Co-funded by the European Union

DesignSmart

MODULE 1

Sustainable Fashion Foundations and Lifecycle Thinking



Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project Number: 2025-ES01-KA220-VET-000358027

Contents

What is sustainable fashion? 11
Life Cycle Assessment (LCA) fundamentals in the fashion industry 12
What is Life Cycle Assessment (LCA)? 13
Resource-efficient production 18
Environmental impact and measurement tools in the fashion industry 18
References 20
Best Practice 1 - Rifò 24
Practical Activity 1 25
Practical Activity 2 26

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project Number: 2025-ES01-KA220-VET-000358027

Lesson Plan

Module purpose: This module equips VET providers and trainers to deliver practical learning on sustainable fashion and lifecycle thinking. Trainers will guide learners to map a garment's lifecycle, examine its environmental and social impacts, and identify opportunities to reduce waste, extend product life, and apply circular economy principles to everyday fashion decisions.

- Relevant topics:

1. Introduction to Sustainable Fashion and its Global Relevance
2. Life Cycle Assessment (LCA) fundamentals in the fashion industry
3. Circular economy principles
4. Resource-efficient production
5. Environmental impact and measurement tools in the fashion industry
6. Practices for cleaner production, preventing pollution, and waste reduction

- EQF Level: 5
- Estimated Learning Time: 6.00/7.00 hours

Learning Outcomes

Knowledge

After the completion of this module, learners will:

- Understand sustainable fashion principles and concepts
- Understand lifecycle assessment methodologies and circular economy frameworks.
- Have awareness of the limits of this knowledge and how it connects to related fields (environmental science, production systems, policy).
- Understand the circularity of materials and product reuse strategies.
- Have awareness of environmental impacts (carbon, water footprint).
- Understand the carbon and water footprint calculation methods and their application to fashion products.
- Have knowledge about carbon footprint indicators calculation and water impact analysis
- Understand lifecycle thinking.

Skills

After the completion of this module, learners will be able to:

- Analyse product lifecycles
- Identify and assess environmental impacts
- Interpret environmental impact data and apply lifecycle thinking to design and production decisions.
- Use environmental measurement tools and translate findings into actionable recommendations.

Responsibility & Autonomy

After the completion of this module, learners will be capable of:

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project Number: 2025-ES01-KA220-VET-000358027

- Exercising management and supervision in work contexts where there is unpredictable change.
- Reviewing and developing their own performance and that of others.
- Taking responsibility for integrating sustainability considerations into team or organisational practices, identifying improvement opportunities, and communicating lifecycle impacts to stakeholders.

Practical Activities:
- Lifecycle mapping of a garment
- Carbon & water footprint mini assessment

Outcomes:
Participants can explain sustainability principles and apply lifecycle thinking to fashion design and production.

Methodology (training delivery)
- Blended learning: short theoretical lectures + readings
- LCA Simulation (Workshop Style): students perform a "Live LCA" on a physical item (e.g., a hoodie) and identify every component—from the zipper's metal to the thread's polyester—and track its origin.
- Case-Study Analysis: Analyse a "failed" sustainability claim from a real fashion brand

Assessment
- Short quizzes (multiple choice / short answer)
- Peer-reviewed mini-reports from case-study exercises.
- The "Impact Calculator" Test. A practical exam where students must calculate the CO_2 and water usage for a specific production batch.



Co-funded by the European Union
Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project Number: 2025-ES01-KA220-VET-000358027

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
Ice-breaking activity Garment story guessing Learners receive an item (or image) and guess its lifecycle impact (water, energy, labour).	15 min	Gamification, discussion	Physical samples/images of garments, short prompt cards	**Example:** Trainer asks: "What story does this garment tell?" Learners identify at least 1 environmental and 1 social impact.
Pre evaluation 3–4 questions on fast fashion, circularity, recycling, and LCA basics.	10–15 min	Quiz-based learning, group reflection	Mentimeter / Kahoot / Google Forms	The trainer will administer a short pre-evaluation to assess participants' prior knowledge. The questions may include: **1. Which of the following best describes the fast fashion model?** ❑ Production of high-quality garments designed to last many years ❑ Slow production with limited seasonal collections ❑ Rapid production of low-cost clothing with frequent new collections ❑ Clothing made only from recycled materials

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
				2. What is the main goal of the circular economy in fashion? ❑ Increase global clothing production ❑ Extend the life of products and reduce waste ❑ Promote higher consumption of new garments ❑ Focus only on recycling materials at the end of life **3. What does Life Cycle Assessment (LCA) evaluate?** ❑ The marketing success of a fashion brand ❑ The environmental impacts of a product across its entire life cycle ❑ The price of garments in different countries ❑ Only the production stage of clothing **4. Which statement is correct about textile recycling today?** ❑ Increase global clothing production ❑ Extend the life of products and reduce waste

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
				❑ Promote higher consumption of new garments ❑ Focus only on recycling materials at the end of life
Introduction to module 1: Sustainable Fashion System Overview. Introduction by the facilitator to the concept of sustainability in fashion, including the impact of fast fashion, key environmental and social challenges, and an overview of lifecycle thinking within the fashion system.	30 min	Discussion	Intro slides of the PPT	The facilitator introduces the module through examples from everyday fashion consumption and encourages learners to reflect on their own shopping habits.
Topic 1: Sustainable Fashion Foundations (Module 1.1) Definition, environmental/social impacts, fast fashion critique, circular economy introduction.	30 min	Case-based learning, interactive lecture etc.	PPT slides, UNEP/Fashion Revolution reports, Oxfam case study;	The trainer could introduce the topic through reflective questions and group discussion, such as *"Is buying more clothes always a problem?" "Would you stop buying fast fashion if sustainable options were more expensive?* *"Who is more responsible for sustainable fashion: consumers or brands?"* *"Can individual choices really change the fashion industry?"*

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
				Encourage debate.
Topic 2: Lifecycle Thinking & Introduction to LCA	40 min	Problem-based learning, demonstration-based learning	PPT slides, diagrams, LCA charts	The trainer provided an overview of the stages of Life Cycle Assessment (LCA) in the fashion industry, focusing on the main boundary models—cradle-to-gate and cradle-to-grave—and their applications and insights within the sector, followed by a case study on Mud Jeans and a practical activity designed to encourage participation.
Topic 3: Circular Economy in Fashion	40 min	Collaborative learning, group discussion	PPT slides, Case studies (Patagonia, H&M circular initiatives), videos	The trainer provided an overview of the Circular Economy by using videos and practical examples. Then the trainer introduced a mini case study on Patagonia, an outdoor clothing company known for its strong commitment to environmental sustainability.
Topic 4: Resource-Efficient Production	30 min	demonstration-based learning	PPT slides ,industry best practices (Levi's, Adidas examples), reports	After introducing the topic of the module, the trainer invites learners to identify three ways a factory can reduce resource use in production.
Topic 5: Environmental Impact Tools	40 min	Applied learning, tool demonstration	screenshots of Higg Index, PEF documentation, digital tools	Trainer gives an overview of the main Environmental Impact Tools

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
Topic 6: Practices for clearer production, preventing pollution, waste reduction	40 min		PPT slides	The trainer provides an overview of practices for clearer production, pollution prevention, and waste reduction. He begins by engaging students with questions such as: 'What do you think happens behind the scenes before a piece of clothing reaches a store?' and 'What happens to clothes after we stop wearing them?' He then explains how fashion production is shifting from focusing on cost and efficiency to reducing environmental and social impacts across the entire supply chain, through greater transparency, pollution prevention, and a full life-cycle approach.
Practical activity Fast fashion detective: trace the hidden impact	60 min	Collaborative analysis, simulation-based learning, problem-solving activity, group presentation	Fictional brand scenario cards, PPT slides, clue cards, lifecycle hotspot checklist, case-study examples of greenwashing and sustainable fashion practices	Participants work in small "investigation teams" to analyse a fictional fast fashion brand scenario. Using provided clues about pricing, marketing claims, and supply chain information, learners identify hidden environmental and social impacts, detect possible greenwashing practices, and suggest sustainability improvements. Each team presents their findings before the trainer reveals the "real story" behind the fast

Topics and Sub-topics/Learning activities	Duration	Training methods used	Materials used (PPt, case studies, best practices, activities etc.)	Suggestions for implementation
				fashion business model and facilitates a reflective discussion.
Assessment (post evaluation)	40 min	Quiz and reflective assessment	PPT Slides (**Debrief / Reflection**) + Short Quiz using Mentimeter / Kahoot / Google Forms	Possible assessment questions (What is Life Cycle Assessment (LCA), and how can it help fashion companies make more sustainable decisions? What is the difference between a Cradle-to-Grave and a Cradle-to-Gate approach in LCA, and when might each be used? How does the circular economy differ from the traditional linear model of “take, make, dispose”? What actions can consumers take to support a more sustainable and circular fashion industry?)
Wrap-up	30 min	reflective learning, peer sharing	PPT slide with key takeaways	The trainer asks each learner to share one “actionable recommendation” they will take back from the session related to sustainable fashion (e.g. consumption habits, product choices, awareness actions). Learners can first discuss in pairs and then share in plenary. A short peer feedback moment can be included to reinforce key learning points.

What is sustainable fashion?

Sustainable fashion represents one of the most important shifts in the contemporary fashion industry. This module introduces the fundamental concepts of sustainability in fashion and Lifecycle Thinking, which helps us understand a garment's environmental, social, and economic impacts. The aim is to provide students with a theoretical and practical foundation to analyse the fashion sector from a sustainability perspective.

Sustainable fashion is an approach to designing, producing, distributing, and consuming clothing that aims to reduce negative environmental and social impacts.

Sustainable fashion is a way of designing, producing, distributing, and consuming clothing that considers both environmental impact and social responsibility across the entire lifecycle of a garment. It is not only about producing "greener" clothes, but about rethinking the whole fashion system to make it more fair, transparent, and long-lasting. (Lindenwood University, 2024; UNEP, 2018).

At its core, sustainable fashion aims to reduce harm to the planet and improve conditions for the people involved in making clothing. This includes using fewer natural resources, reducing pollution and waste, and ensuring ethical working conditions throughout the supply chain.

It also emphasises valuing clothing and using it longer, rather than discarding it quickly. (UNEP, 2018; Fashion Revolution, 2019).

A key part of sustainable fashion is reusing and extending product life. Initiatives such as second-hand markets, clothing repair, resale, and donation systems help keep garments in circulation for as long as possible. This approach directly supports the circular economy by reducing the demand for new production and limiting textile waste. For example, organisations like Oxfam have been promoting second-hand clothing since the 1940s and today operate hundreds of shops that give clothes a "second life" while also supporting social causes such as poverty reduction. (Oxfam, 2024; Ellen MacArthur Foundation, 2017).

Sustainable fashion is increasingly seen as a response to the problems created by fast fashion. The fast fashion model relies on rapid production, low prices, and constant consumption, but it creates significant environmental and social costs. Overproduction leads to excessive waste, high carbon emissions, and heavy pressure on natural resources such as water and energy. At the same time, global supply chains often rely on low-paid labour and unsafe working conditions. (UNEP, 2018; Fashion Revolution, 2019).

Recent research highlights the scale of the issue: consumers today buy significantly more clothing than in previous decades, while only a very small percentage of textiles is truly recycled into new garments. The environmental footprint of the fashion industry is also considerable, contributing to greenhouse gas emissions, water pollution, and large volumes of textile waste that often end up in landfills or are incinerated. (Ellen MacArthur Foundation, 2017; UN Alliance for Sustainable Fashion, 2019).

In contrast, sustainable fashion encourages slower consumption patterns and more conscious choices. This can include buying higher-quality garments that last longer, choosing second-hand items, repairing clothes instead of replacing them, or supporting brands that prioritize ethical production and environmentally responsible materials. It also promotes innovative solutions such as clothing rental, upcycling, and circular design strategies.

However, not all sustainability claims in fashion are genuine. A growing concern is greenwashing, where brands present themselves as environmentally responsible without making meaningful changes to their practices. For this reason, transparency, certifications, and reliable data are essential to distinguish real

sustainability efforts from marketing strategies. (Changing Markets Foundation, 2021; UK Competition and Markets Authority, 2024).

Ultimately, sustainable fashion is not a single trend or product category, but a systemic shift in how the fashion industry operates. It connects environmental protection, social justice, and economic responsibility, and it requires action from brands, governments, and consumers alike.

Sustainable fashion in numbers (Key facts)

Sustainable fashion is easier to understand when you look at a few key figures that show the scale of its environmental impact. The fashion industry accounts for a significant share of global greenhouse gas emissions and water pollution, while also contributing large volumes of textile waste and microplastic pollution.

For example, a large percentage of clothing is discarded shortly after purchase, with many garments ending up in landfill within a short time. At the same time, recycling rates remain extremely low, meaning that most textiles are not recovered or reused. In addition, producing clothing often requires high amounts of water and energy, making fashion one of the most resource-intensive industries in the world.

These facts highlight how current consumption and production patterns are unsustainable, but they also show the potential for improvement through circular economy strategies, better materials, and more responsible consumer behaviour.

These facts underline why sustainability in fashion is not just a trend, but a global necessity. The industry's environmental and social impacts affect climate systems, natural resources, and global labour conditions. Changing the way we produce and consume clothing is therefore essential to reduce harm and move towards a more responsible system.

In this article, you can learn more about sustainable fashion and why sustainability matters.

Life Cycle Assessment (LCA) fundamentals in the fashion industry

The Society of Environmental Toxicology and Chemistry (SETAC) defines Life Cycle Assessment (LCA) as "*an objective process of assessing the environmental burdens associated with a process, product or activity by identifying and quantifying the energy and materials used and the waste released into the environment […]. The assessment includes the entire life cycle of the product, process or activity, including extraction and treatment of raw materials, manufacturing, transport, distribution, use, reuse, recycling and final disposal.*" Originating in the 1960s, LCA has become an important tool for companies seeking to rethink and redesign their production systems in a more sustainable way from the very beginning.

Today, Life Cycle Assessment (LCA) is one of the most important scientific tools for measuring and understanding the environmental impact of fashion products. As sustainability challenges in the textile sector grow, LCA provides a structured, data-driven method to evaluate how a garment affects the environment across its entire life cycle—from raw material extraction to disposal or reuse (ISO 14040–14044; European Commission PEF methodology).

The main strength of LCA is that it does not focus on a single stage of production, but instead considers the full system. This makes it possible to identify environmental "hotspots", such as energy-intensive processes,

high water consumption stages, or high-emission supply chain activities (Ellen MacArthur Foundation, 2017; ISO standards).

What is Life Cycle Assessment (LCA)?

Life Cycle Assessment (LCA) is a methodological framework used to evaluate the environmental impact of a product, process, or service throughout its entire life cycle. It follows a "cradle-to-grave" perspective, although it can also be adapted to circular systems such as "cradle-to-cradle" models aligned with circular economy principles.

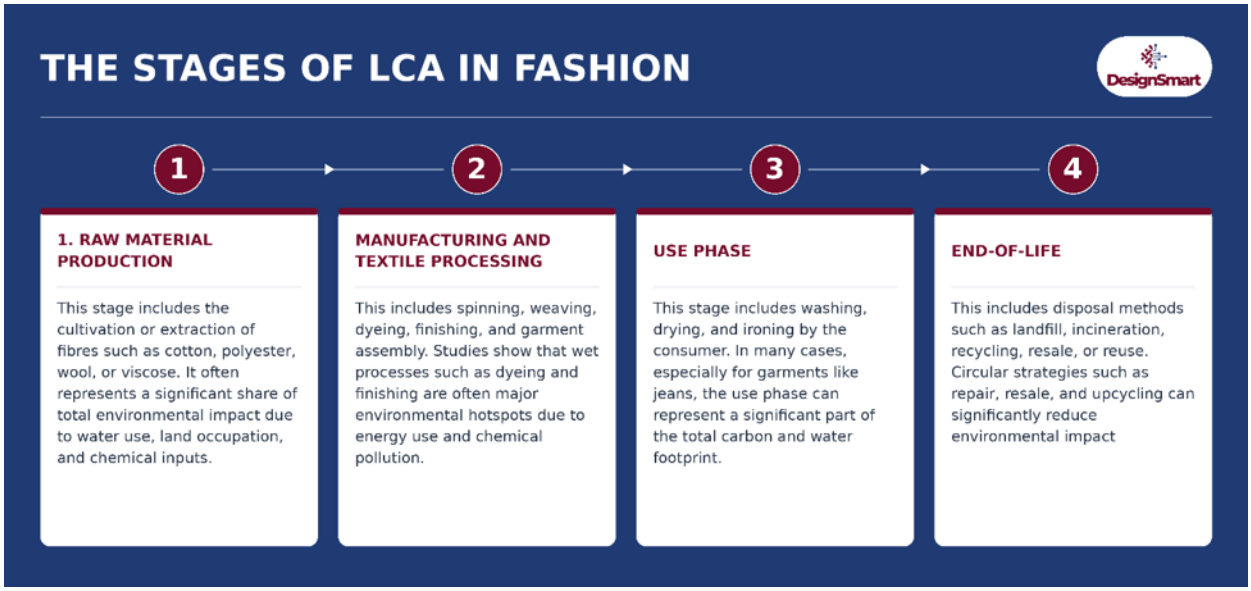
LCA typically analyses environmental indicators such as:

- greenhouse gas emissions
- water consumption
- energy use
- pollution and waste generation

In simple terms, LCA is like a recipe: the method is the structure, the data are the ingredients, and the final result depends on the quality and accuracy of the input information (Fairly Made, 2024).

The stages of LCA in fashion

In the fashion industry, LCA is usually applied to the following phases of a product's life cycle:



Main LCA boundary models

In Life Cycle Assessment (LCA), defining system boundaries is a crucial step, as it determines which stages of a product's life cycle are included in the environmental analysis. In the fashion and textile sector, these boundaries can cover the entire production chain, from raw material extraction to the finished product's end-of-life stage. This decision is particularly important because it sets the scope of the study and directly affects the results obtained. Two main approaches are commonly used: Cradle-to-Grave and Cradle-to-Gate. (CarbonFact.com)

Cradle-to-Grave

This approach considers the **entire life cycle of a product**. It includes all major stages:

- extraction and production of raw materials
- manufacturing and assembly
- transportation and distribution
- product use phase
- end-of-life treatment (reuse, recycling, or disposal)

It is the most comprehensive model because it captures a product's full environmental impact. It is typically used when:

- a complete understanding of environmental impacts is required
- sustainability strategies are being developed
- transparent communication with consumers is needed
- product design decisions are being made

Cradle-to-Gate

This model stops at the point where the product leaves the factory. It includes:

- raw material extraction
- manufacturing and processing
- transportation up to the factory gate

It excludes: the use phase and end-of-life processes.

It is mainly focused on the production stage, where companies have direct control over operations and it is typically used when:

- comparing products at the manufacturing level
- preparing Environmental Product Declarations (EPDs)
- data on use or disposal phases is unavailable or uncertain
- improving production efficiency is the main goal

How to choose the right boundary

The choice between these two models depends on the purpose of the LCA:

- **Cradle-to-Grave** → best for a full, holistic assessment of environmental impact
- **Cradle-to-Gate** → best for analysing and improving manufacturing processes

LCA in the fashion industry: applications and insights

System boundaries have a significant influence on LCA results, which makes it essential to clearly state the chosen boundary model, ensure transparency in reporting, and allow fair and consistent comparisons between products. Selecting appropriate system boundaries is therefore crucial for producing reliable and

meaningful LCA outcomes, as clearly defining the scope of the analysis ensures accuracy and usefulness whether the goal is to improve production processes or communicate environmental impact.

The fashion industry widely uses CA to compare materials, improve production processes, and guide sustainability strategies. Research shows that cotton cultivation, polyester production, and dyeing processes are among the most studied impact areas due to their environmental relevance (Bhardwaj & Fairhurst, 2010).

At the brand level, companies such as Levi Strauss & Co. have used LCA to analyse iconic products like jeans, showing that consumer use (washing and drying) can represent a significant portion of total emissions. This led to behavioural change campaigns encouraging lower washing frequency and cold washing practices (Levi Strauss & Co. LCA studies).

Similarly, brands like H&M, Patagonia, Adidas, and others use LCA to evaluate material choices, increase recycled content, and design more circular products. For example, recycled polyester has been shown in LCA studies to reduce energy use and emissions compared to virgin polyester (Ellen MacArthur Foundation, 2017; brand LCA reports).

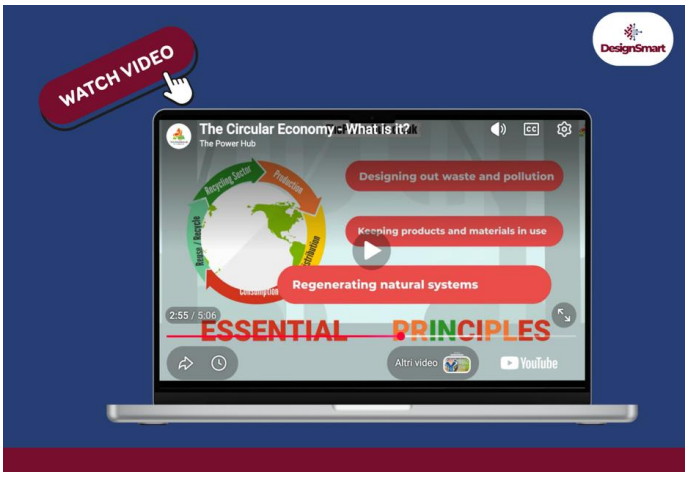
However, research also highlights that results can vary significantly depending on methodological choices such as system boundaries, functional units, and data sources. This makes comparability between studies challenging and highlights the need for standardisation (Sandin et al., 2015; ISO 14040–14044 review literature).

LCA is increasingly important not only as an environmental measurement tool but also as a decision-making and transparency instrument. It is widely used in corporate reporting, eco-design strategies, and emerging regulatory frameworks such as the EU Digital Product Passport (European Commission, ESPR).



At the same time, studies show that methodological inconsistencies remain a major challenge, especially in complex global supply chains such as fashion, where data availability and system boundaries can vary significantly.

What is the Circular Economy?



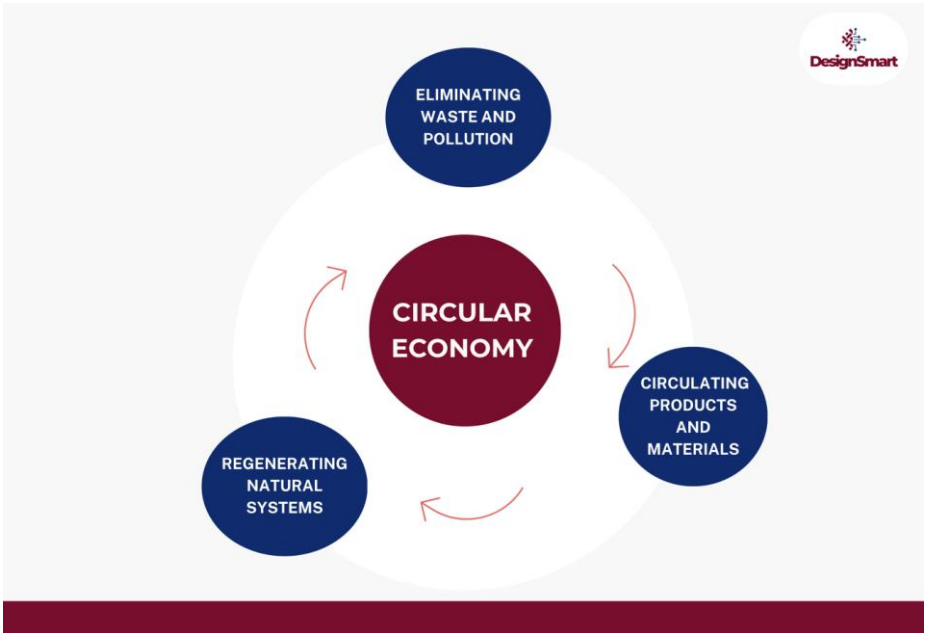
The circular economy is a transformative approach to production and consumption that aims to reduce waste, extend the use of resources, and regenerate natural systems. Unlike the traditional linear model—based on "take, make, dispose"—the circular economy rethinks the entire lifecycle of products so that materials remain in use for as long as possible (Ellen MacArthur Foundation, 2017).

At its core, the circular economy is not only an environmental strategy but a design system. It challenges the way products are created in the first place: instead of designing for disposal, products are designed for continuous reuse, repair, and recovery.

This shift is essential because the linear model is inherently unsustainable. It relies on constant raw material extraction, generates large amounts of waste, and contributes to biodiversity loss, pollution, and climate change. In contrast, the circular model treats waste as a design flaw rather than an inevitable outcome.

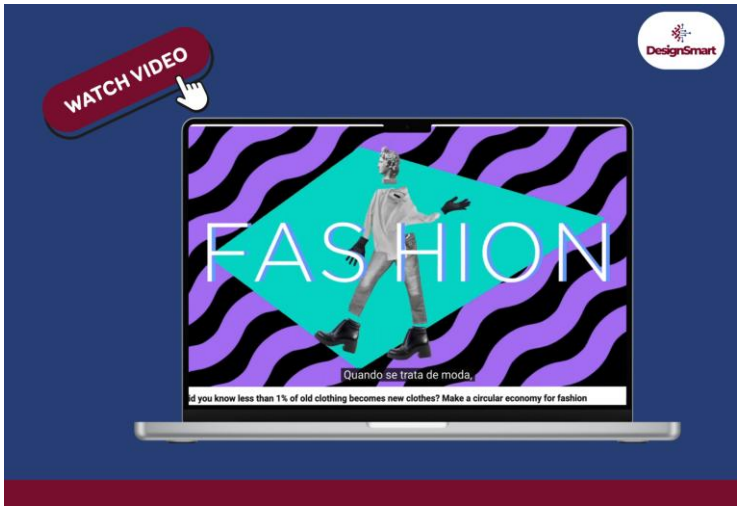
The three principles of circular economy

The circular economy is built on three interconnected principles:



Circular fashion is based on several key strategies:

- Rather than designing clothing for short-term use, brands are encouraged to create durable and repairable garments.
- Longevity becomes a design goal, not an afterthought. Repair and maintenance also play a central role, extending product lifespans through mending, alteration, and restoration. Another important strategy is reuse.
- Clothing can circulate through second-hand markets, rental services, and resale platforms, allowing garments to remain valuable even after their first user. Recycling is also part of the system, but it is considered a last step, not the primary solution.
- Finally, circular fashion includes the idea of material recovery, where textiles are transformed into new fibres or products, reducing dependence on virgin resources.



The transition to a circular fashion system requires action from both industry and consumers.

Brands are increasingly adopting circular strategies such as take-back schemes, resale platforms, and the use of recycled materials. Some are also redesigning products to make them easier to repair or disassemble. Consumers also play a crucial role. More sustainable behaviour includes buying fewer but higher-quality items, repairing clothing, choosing second-hand products, and extending the use phase of garments. These actions help reduce demand for fast fashion production and support circular systems.

The circular economy represents a fundamental shift in how fashion is designed and consumed. It moves the industry away from a waste-driven linear model and toward a system where materials are continuously reused, repaired, and regenerated.

In this sense, circularity is not only a sustainability strategy but a redesign of the entire fashion system—one that aligns economic activity with environmental limits and natural cycles (Ellen MacArthur Foundation, 2017).

Limits and interdisciplinary connections

Although the circular economy offers a powerful framework for reducing environmental impact, it is important to recognise its limitations. Not all materials can be infinitely recycled without quality loss, and some processes still require significant energy and resources. In many cases, “closed-loop” systems remain partially theoretical rather than fully achievable at industrial scale.

For this reason, circular economy thinking must be understood in relation to other disciplines such as environmental science, which studies ecological limits and planetary boundaries, and production systems engineering, which addresses the technical feasibility of recycling and manufacturing processes.

In addition, policy and regulation play a crucial role in enabling circular transitions. Frameworks such as extended producer responsibility (EPR), eco-design regulations, and initiatives like the EU Digital Product Passport are essential to support systemic change and ensure transparency across global supply chains.

Resource-efficient production

In the fashion and textile industry, companies are already implementing resource-efficient production as part of the shift toward more sustainable manufacturing, although adoption varies significantly across companies. It refers to production processes designed to reduce the use of natural resources—such as water, energy, raw materials, and chemicals—while maintaining product quality and production output.

Many brands are now integrating efficiency strategies into their operations. Common examples include optimised fabric-cutting techniques to reduce textile waste, water-saving technologies in dyeing and finishing, and more efficient machinery to lower energy consumption. In some cases, companies also adopt recycled materials, renewable energy sources, and more advanced production systems to further decrease environmental impact. Despite these developments, the implementation of resource-efficient production is still uneven across the industry. While some companies have made significant progress, the fast fashion model continues to drive high levels of resource consumption due to large production volumes and short product life cycles.

As a result, full efficiency across the sector has not yet been achieved. Overall, resource-efficient production is increasingly present in the fashion industry and represents a key direction for its future development, even if it is still an ongoing transition rather than a fully established standard. (Resource Efficiency in Fashion and Furnishings, Rob Weterings, Ton Bastein, Arnold Tukker, Michel Rademaker and Marjolein de Ridder).

Environmental impact and measurement tools in the fashion industry

Life Cycle Assessment

As already discussed in Section 1.2, **Life Cycle Assessment** (LCA) represents the main methodological framework used to evaluate the environmental impacts of products throughout their life cycle. Building on this approach, the fashion industry has developed complementary tools that apply LCA principles in more practical, standardised ways, allowing companies to measure, compare, and improve environmental performance across products and supply chains.

The fashion and textile sector drives significant environmental pressures because it uses large amounts of water, energy, raw materials, and chemicals, and generates emissions across complex global supply chains. As a result, reliable measurement tools are essential for identifying environmental hotspots and supporting more sustainable decision-making.

Higg Index

The **Higg Index** is a widely used suite of sustainability assessment tools developed by the Sustainable Apparel Coalition (Cascale) to measure the environmental and social performance of companies and products within the apparel, footwear, and textile industry. Its main purpose is to provide a standardised framework that

allows brands, retailers, and manufacturers to evaluate their impacts across the entire value chain and identify key areas for improvement.

The system is composed of several modules designed for different actors and stages of the supply chain. The Higg Brand & Retail Module (BRM) assesses the overall sustainability performance of brands and retailers, covering aspects such as product design, logistics, retail operations, labour conditions, and end-of-life considerations. It evaluates both environmental impacts (including greenhouse gas emissions, energy and water use, chemical management, waste generation, and pollution) and social impacts (such as workers' rights, health and safety, fair wages, and ethical practices). This holistic approach allows companies to understand sustainability risks and set improvement targets based on structured indicators.

More info here: Higg Index Brochure.

Product Environmental Footprint

Another key framework is the **Product Environmental Footprint (PEF),** developed by the European Commission. Based on Life Cycle Assessment methodology, the PEF aims to harmonise environmental impact measurement across products, ensuring greater consistency and comparability. This is particularly relevant in the context of European sustainability policies, where standardised environmental reporting is becoming increasingly important. In addition, international standards such as ISO 14040 and ISO 14044 define the principles and requirements for conducting LCA studies. These standards ensure methodological consistency and scientific robustness, forming the basis for most environmental assessment tools used in the industry.

Alongside these established frameworks, a growing number of digital LCA software tools, including platforms such as **SimaPro, GaBi, and Carbonfact**, are being used by companies to model environmental impacts in detail. These tools rely on extensive databases and allow the calculation of indicators such as carbon emissions, water consumption, and resource depletion across complex supply chains. Beyond company-level assessment tools, more recent developments have introduced consumer-focused digital calculators that estimate environmental impacts at the individual level. As mentioned in Section 1.2, LCA provides a product- and system-oriented perspective; however, recent studies also highlight the importance of considering consumer behaviour.

More info here: Product Environmental Footprint method Understanding key concepts and how to implement them

Fast Fashion Footprint tool

A relevant example is the **Fast Fashion Footprint tool**, which estimates both carbon and plastic footprints associated with personal clothing consumption. This web-based calculator integrates behavioural factors such as shopping frequency, transport modes, laundry habits, and garment disposal, offering a more holistic view of environmental impact. Applied in an urban context such as Milan, it also incorporates spatial dimensions, showing how mobility patterns and logistics systems influence individual footprints. In addition to its analytical function, the tool also serves an educational purpose, raising awareness—especially among younger consumers—about the hidden environmental costs of fast fashion.

Overall, environmental impact measurement tools play a crucial role in the fashion industry's transition toward more sustainable practices. By combining scientific methodologies such as LCA with standardized frameworks and innovative digital tools, it becomes possible to better understand environmental impacts, identify inefficiencies, and promote more responsible production and consumption patterns.

More info here: Fast Fashion Footprint: An Online Tool to Measure Environmental Impact and Raise Consumer Awareness

References

- Ellen MacArthur Foundation (2017) – *A New Textiles Economy*
- UNEP (2018) – *Sustainability and Circularity in the Textile Value Chain*
- UN Alliance for Sustainable Fashion (2019) – consumption and industry impact data
- Oxfam (2024) – second-hand fashion and circular economy initiatives
- WRAP (2018) – *Valuing Our Clothes Report*
- Lindenwood University (2024) – definition of sustainable fashion
- Changing Markets Foundation (2021) – greenwashing reports
- European Commission - Product Environmental Footprint method
- European Platform on LCA - Environmental Footprint
- Ecoinvent – LCA
- Report - Resource Efficiency in Fashion and Furnishings
- Higg Index Brochure

Case Study 1 - : Patagonia – Transparency, Repair Culture and Product Life Extension

Case Study Title: Patagonia – Transparency, Repair Culture and Product Life Extension
Country: America
Link:

- https://www.patagonia.com
- https://www.patagonia.com/our-footprint/
- https://eu.patagonia.com/nl/en/worn-wear/?srsltid=AfmBOopXyepMtIl0cbhCAipS1o5MVAFq7bt9gVi0az7_dJiSclhCvuv4

Main Content including the following:

Background

Company/context description

- Patagonia is an outdoor clothing company known for its strong commitment to environmental sustainability. Unlike traditional fast fashion brands, Patagonia promotes long-lasting products, repair services, and reduced consumption as part of its business model.

Initial problem or challenge:

- The outdoor apparel industry is resource-intensive, relying on synthetic materials, energy-heavy production, and global supply chains. Patagonia needed to reduce its environmental footprint while still operating in a consumer market based on product sales.

The Challenge

- **What sustainability/digital issue is addressed?**

The company addresses the challenge of overconsumption and product lifecycle impact, focusing on extending garment life and reducing environmental impact through design, repair, and transparency tools (including LCA-based assessments).

Actions Taken

- Step 1 : Introduced the **"**Worn Wear" program, encouraging customers to repair, reuse, and resell used Patagonia products instead of buying new ones.
- Step 2 : Implemented **Life Cycle Assessment (LCA) studies** to measure product impacts and improve material selection, energy use, and design decisions.
- Tools/methods used:
  - Life Cycle Assessment (LCA) (ISO 14040–14044 framework)
  - Product durability testing
  - Repair and reuse systems (Worn Wear)
  - Supply chain transparency reporting
  - Circular economy principles

Results

Patagonia's approach shows that extending garment lifespans can significantly reduce environmental impact by lowering emissions associated with each use. Through repair, reuse, and resale initiatives, the company has also reduced textile waste and decreased demand for virgin raw materials. From a business perspective, these sustainability strategies have strengthened Patagonia's reputation as a global leader in responsible fashion, while also increasing customer loyalty and engagement. The company has differentiated itself from fast-fashion competitors by building a business model based on durability, transparency, and long-term product value rather than constant consumption. One key lesson from this case is that product durability is one of the most effective sustainability strategies in the fashion sector. The case also shows that encouraging more responsible consumption does not necessarily conflict with business success. In addition, Patagonia's emphasis on transparency has built consumer trust and reinforced brand credibility, showing that behavioural change among consumers is as important as technological or product innovation in achieving sustainability goals.

Key Takeaways

- Extending product life is one of the most effective sustainability strategies
- Repair systems can replace part of new production demand
- LCA helps identify where durability creates the highest impact reduction
- Sustainability can be aligned with business profitability
- Consumers play a key role in circular systems

Discussion Questions

- *Should fashion companies encourage people to buy less?*
- *Is a repair-based business model scalable globally?*
- *What are the limits of durability in fashion design?*
- *How does transparency influence consumer trust?*
- *Could fast fashion brands adopt similar strategies? What would stop them?*

Practical Exercise (optional)

Learners can:

- Choose a fashion product
- Design a repair or resale system for it
- Identify how LCA results would change if the product lasts 2x longer
- Present a circular business model concept

Case Study 2 - Mud Jeans – Lease A Jeans: circular denim business model

Case Study Title: Mud Jeans – Lease A Jeans: circular denim business model
Country: Netherlands
Link:
https://mudjeans.com/
Mud sustainability report
https://mudjeans.com/pages/sustainability-mud-jeans
The Recycle Tour MUD Jeans

Main Content including the following:

Background

Company/context description
Mud Jeans is a Dutch sustainable fashion company specialising in denim products. The brand is widely recognised for pioneering circular business models in the fashion industry, particularly through its innovative "Lease A Jeans" concept. Instead of relying exclusively on traditional product ownership, the company promotes access-based consumption models designed to extend product lifespan and improve material recovery.

Initial problem or challenge:
The traditional denim industry has significant environmental impacts, including high water consumption, intensive cotton production, textile waste, and overreliance on virgin raw materials. In addition, fast fashion consumption patterns encourage short product lifecycles and frequent garment disposal.

The Challenge

What sustainability/digital issue is addressed?
Mud Jeans aimed to address the environmental impact of denim production by developing a circular business model focused on product longevity, reuse, recycling, and reduced dependence on virgin cotton. The company also explored how consumer behaviour could shift from ownership toward product-service systems.

Actions taken

Step 1
Mud Jeans introduced the "Lease A Jeans" model, allowing customers to lease jeans through monthly payments instead of purchasing them outright. After use, customers can return the jeans for recycling or replacement.

Step 2

The company incorporated recycled cotton into new denim production and designed products to facilitate fibre recovery and recycling at the end of the garment's life.

Tools / methods used

- Circular Economy principles
- Product-as-a-Service business model
- Textile recycling systems
- Design for durability and recyclability
- Supply chain transparency practices
- Lifecycle thinking approaches

Results

Mud Jeans demonstrated that circular business models can reduce dependence on virgin raw materials and support longer product lifecycles. By integrating recycled cotton into production and encouraging garment return systems, the company helped reduce textile waste and improve material recovery in the denim sector. The leasing model also encouraged consumers to rethink ownership and engage more consciously with clothing consumption.

From a business perspective, Mud Jeans positioned itself as an innovative leader in circular fashion and gained international recognition for its sustainability-focused approach. The company showed that alternative business models can create market differentiation while aligning environmental goals with commercial activity.

One important lesson learned from this case is that circularity requires not only product redesign but also changes in consumer behaviour and business logic. The case also highlights that service-based fashion models can help extend product value while reducing environmental pressure associated with fast fashion systems.

Key Takeaways

- Circular business models can reduce textile waste and resource consumption.
- Leasing systems encourage longer product use and material recovery.
- Product design is essential for effective recycling and circularity.
- Consumer behaviour plays a critical role in circular fashion systems.
- Sustainability innovation can become a competitive business advantage

Discussion Questions

- *Would consumers accept leasing everyday fashion products on a large scale?*
- *What are the advantages and disadvantages of replacing ownership with access-based models?*
- *Can circular business models work within fast fashion markets?*
- *What barriers could companies face when implementing leasing systems?*
- *How does product design influence recycling efficiency?*

Practical Exercise (optional)

"Design Your Own Circular Fashion Service"

Learners are asked to:

- Choose a fashion product (e.g. jeans, jacket, sneakers)
- Develop a circular business model based on leasing, repair, resale, or take-back systems
- Identify how the product lifecycle could be extended
- Explain which environmental impacts could be reduced using lifecycle thinking principles
- Present the concept as a short sustainability pitch to the group

Best Practice 1 - Rifò

Title: Rifò – Circular Knitwear from Textile Waste (Made in Italy Circular SME Model)
Type:
x Business practice ☐ Technological solution ☐ Educational approach x Policy
Content (Executive Snapshot):

Rifò is an Italian circular fashion brand based in Prato, one of Europe's most important textile districts. The company produces knitwear and garments using **regenerated textile waste, primarily recycled cashmere and wool sourced from post-consumer and industrial scraps**. The production process is entirely local, short-chain, and transparent, combining traditional textile expertise with modern circular economy principles. Rifò is considered a best practice because it demonstrates how small and medium-sized enterprises can build a **fully circular fashion model grounded in local production, material regeneration, and sustainable design**, while maintaining aesthetic quality and commercial viability.

The Challenge Addressed

The fashion industry generates large volumes of textile waste, much of which is not effectively recycled due to technical and economic limitations. At the same time, global supply chains increase emissions, reduce transparency, and disconnect production from local expertise.

Key problems addressed include:

- accumulation of post-consumer textile waste
- dependence on virgin raw materials
- loss of local textile manufacturing know-how
- lack of transparency in global fashion supply chains

If left unaddressed, these issues increase environmental pressure, waste generation, and the decline of European textile districts.

Innovation & Added Value

Rifò's innovation lies in combining **traditional textile craftsmanship with circular economy principles** to create high-quality fashion products from waste materials.
Its added value includes:

- use of recycled fibres (cashmere, wool, cotton blends)
- localised production in the Prato textile district
- short and transparent supply chain
- reduction of textile waste through fibre regeneration
- creation of desirable, design-led circular fashion products

What makes this case particularly engaging is its ability to prove that **circular fashion can be aesthetic, local, scalable, and commercially successful at SME level**, not only within large corporations or experimental labs. Compared to industrial fast fashion systems, Rifò operates on a **slow, regenerative, and traceable production model** that prioritises quality over volume.

Tools / Technologies Used

- Mechanical textile recycling (fibre regeneration systems)
- Re-spinning and re-weaving technologies
- Local supply chain integration (Prato district ecosystem)
- Small-batch production systems
- Sustainable material sourcing (post-consumer textile waste)
- Circular design principles (design for longevity and recyclability)

Practical Activity 1

Activity Title: Fast fashion detective: trace the hidden impact

Type:
☐ Hands-on ☐ AI-based x Analysis ☐ Design x Simulation ☐ Other

Activity Objective:
The aim of this activity is to develop critical thinking skills by investigating the hidden environmental and social impacts behind a fashion product through a "detective-style" analysis.

After the completion of this activity, learners will be able to:

- identify hidden impacts across the fashion supply chain
- link product stages to environmental and social consequences
- recognise greenwashing vs real sustainability actions

Activity outline / Description of the activity:

STEP 1

Learners are divided into "investigation teams". Each team receives a fictional brand scenario (e.g. "UltraFast Denim Co.") with clues:

- low price product (€9–€19 jeans)
- marketing claims ("eco-friendly", "conscious")
- production hints (Asia supply chain, synthetic blend, etc.)

Teams must reconstruct:

- where impacts are hidden (water, CO_2, labour, waste)
- which claims are potentially greenwashing
- which lifecycle stages are most problematic

Tools:

- clue cards / PPT slides
- optional LCA hotspot checklist

STEP 2

Each team presents:

- top 3 hidden impacts
- one “red flag” marketing claim
- one sustainability improvement suggestion

Trainer reveals the “real story” (fast fashion model logic).

Total time: 15-20 minutes

Practical Activity 2

Activity Title: *From waste to value: circular design sprint*

Type:
☐ Hands-on ☐ AI-based x Analysis X Design x Simulation ☐ Other
Activity Objective:

The aim of this activity is to stimulate circular design thinking by transforming textile waste into a new product concept.
After the completion of this activity, learners will be able to:

- apply circular design principles
- rethink waste as a resource
- propose innovative product reuse strategies

Activity outline / Description of the activity:

Step 1 (10–12 minutes)

Each group receives a “waste material scenario”:

- old jeans
- polyester T-shirt waste
- mixed textile scraps

They must design:

- a new product idea (fashion or non-fashion)
- how the material is reused
- what circular strategy is applied (reuse, upcycle, recycle, redesign)

Tools:

- idea canvas template
- sketching paper

Step 2 (8–10 minutes)

Each group pitches their idea in 60 seconds:

- product concept
- circular value created
- environmental benefit

Trainer highlights most innovative circular logic.

Total time: 15–20 minutes