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Textiles 2030
UK Sustainable
Textiles Action Plan

Textiles 2030
Circular Design Toolkit

An introduction to design for circularity

Design to make a difference

To reduce the impacts of fashion and textile products, and create a more sustainable future for the industry, circularity will be key and designing for circularity will be at the core of this.

Product development teams have a crucial role to play, and this toolkit has been developed to support you to consider circularity in every aspect of your work.

The purpose of this toolkit

You are probably reading this toolkit because you have a part to play in getting products to market.

The decisions made by design and product development teams have huge impacts on a product's environmental footprint – from the raw materials used, to how it is manufactured, the length of time it is kept in use and what happens to it when it is no longer desired by its owner or cannot be used any more.

As much as

80%

of the environmental impacts of a product are determined at its design stage[1].

This toolkit aims to simplify the theory of circular design and break it down into more manageable actions and strategies, helping you to understand your role in the process and who needs to be involved at each stage.

By compiling much of the research and resources that already exist, along with industry expertise and new findings from WRAP's recent citizen insights, this toolkit will provide you with all the information you need, in one place, to help you make well-founded circular design decisions.

It has been created to establish a consistent set of circular design principles that the fashion and textile industry can align on, adapting them to suit their individual business needs and enabling the industry to accelerate progress towards circularity.

> "This toolkit will empower you with new knowledge."

Designing for circularity might not always be the easy option and there are no promises that it will be free from disruption, but this toolkit will empower you with new knowledge and encourage you to be curious, think about your processes, ask questions and get creative.

There is a lot to think about, so work through the following chapters at your own pace and keep the toolkit handy so you can refer back to it when you are developing your product ranges.

This is the beginning of the journey and the industry does not have all the answers yet. Remember that designing for circularity is not something you can do alone, this will be a team effort that will require collaboration within your internal team, strong relationships with your suppliers and new partnerships across the industry.

The role of Textiles 2030

The power of collaboration

Textiles 2030 is WRAP's ground-breaking initiative, harnessing the knowledge and expertise of UK leaders in sustainability, to accelerate the fashion and textile industry's move towards circularity and support the sector to make rapid, science-based progress on climate change.

Textiles 2030 has set some ambitious targets that brands and retailers need to achieve if the industry is to play its part in tackling the climate emergency.

If the fashion and textile industry, both in the UK and globally, is to hit these targets, designing for circularity must become the norm.

The Textiles 2030 Circular Design Toolkit has been developed through collaboration with Textiles 2030 signatories, with special thanks to the Design for Circularity Working Group, to provide brands, retailers and manufacturers with a consistent framework of Circular Design Principles to accelerate the industry's progress towards circularity.

Find out who is signed up to Textiles 2030 here.

Textiles 2030 targets:

50%

reduction in the overall carbon footprint of new products – in line with the Paris Agreement on climate change

30%

reduction in the overall water footprint of new products

Industry collaboration

to achieve the Textiles 2030 Circularity Roadmap ambitions

Contents

This is an interactive PDF
Use the top bar and buttons below to navigate to each section

Understanding the industry's impacts

The fashion and textile industry is the third highest emitter of greenhouse gases globally, accounting for around 5% of emissions[2]. The industry consumes 98 million tonnes of non-renewable resources every year and uses 93 billion cubic metres of water annually[3].

A similar picture can be seen in the UK, where clothing is the eighth largest sector in terms of household spending[4] and is ranked fourth in terms of its impacts on the environment. Only housing, transport and food have greater environmental impacts[5].

The linear fashion model

To really understand how to reduce the impact of the products we create, we need to understand why the industry has such a huge environmental impact in the first place.

The fashion and textile industry typically follows a linear 'take, make, use, dispose' model.

This means that we 'take' raw materials from the environment (such as the extraction of oil to create synthetic fibres or the agriculture of cotton), we 'make' them into new clothing and textile products, then buy, wear and 'use' those products before we finally 'dispose' of them when they are no longer needed. Each of these phases along a product's lifecycle, can put pressure on our planet, have negative social impacts and result in economic loss due to poor management of resources.

The linear fashion model creates negative environmental impacts across all stages of a product's lifecycle. Figure 1 shows where the biggest carbon, water and waste impacts occur based on the fibre compositions reported by Textiles 2030 signatories in 2021[6].

Figure 1. The environmental impacts of the linear fashion model

Lifecycle phase	Take → Raw materials	Make → Production	In use → In use	Dispose → After use
Carbon impacts associated with each lifecycle phase	30.7%	51.8%	23.8%	-6.3%
Water impacts associated with each lifecycle phase	92.4%	6.7%	0.9%	0%
Waste impacts associated with each lifecycle phase	4.5%	38.5%	0.1%	56.9%

Globally the production and consumption of clothing doubled between 2000 and 2015, but the number of times these products were worn before they were thrown away decreased by 36%[3].

Combining these trends of increased consumption and decreased utilisation with fashion's linear model, means we have created an extremely resource intensive industry, with huge carbon, water and waste footprints. This fuels climate change and a number of other environmental issues, such as water scarcity, water pollution, biodiversity loss, microfibre pollution and increasing amounts of textile waste ending up in landfill around the world.

These negative environmental impacts can also be felt by communities across the globe, particularly in manufacturing regions, with extreme climate events becoming more frequent and severe.

But it is possible to do things differently...

> The linear fashion model creates negative environmental impacts across all stages of a product's lifecycle.

This section of the toolkit will move away from the negative impacts of the industry and on to the positive changes design can make to create a circular economy for the fashion and textile industry.

The circular economy

What is the circular economy?

A circular economy is an alternative to a linear economy.

In a circular economy, resources are kept in use, and circulated, for as long as possible. Products and materials are given new life through reuse, repair, remanufacture and finally recycling, never becoming waste. This means we extract maximum value from them, while reducing their negative environmental impacts.

Circularity also offers economic and social benefits, allowing new and existing industries to future proof their businesses, become more resilient, create new jobs, healthy lifestyles and green growth.

Spotlight on
Sustainability and the circular economy

What is the difference between sustainability and circularity?

The United Nations (UN) defines sustainability as: "meeting the needs of the present without compromising the ability of future generations to meet their own needs".[7]

A sustainable fashion and textile industry, would be one where people, planet and profits can all exist and prosper harmoniously. If we neglect any of these aspects the fashion and textile industry will not be able to sustain itself in the future.

A circular economy is one concept that we can use to support sustainability. It focuses on how we can create thriving industries where products and services use resources efficiently, keep them in use for as long as possible and create no waste. Essentially, decoupling business growth from the production and consumption of new products made from resource intensive, finite raw materials.

Circularity will play an important role in creating a more sustainable future for the fashion and textile industry.

What does a circular economy look like for the fashion and textile industry?

The Ellen MacArthur Foundation has defined a vision of a circular economy for the fashion and textile industry as one where we design products to be:

- Made from safe and recycled or renewable inputs
- Used more
- Made to be made again[8]

In practice, this means we need to:

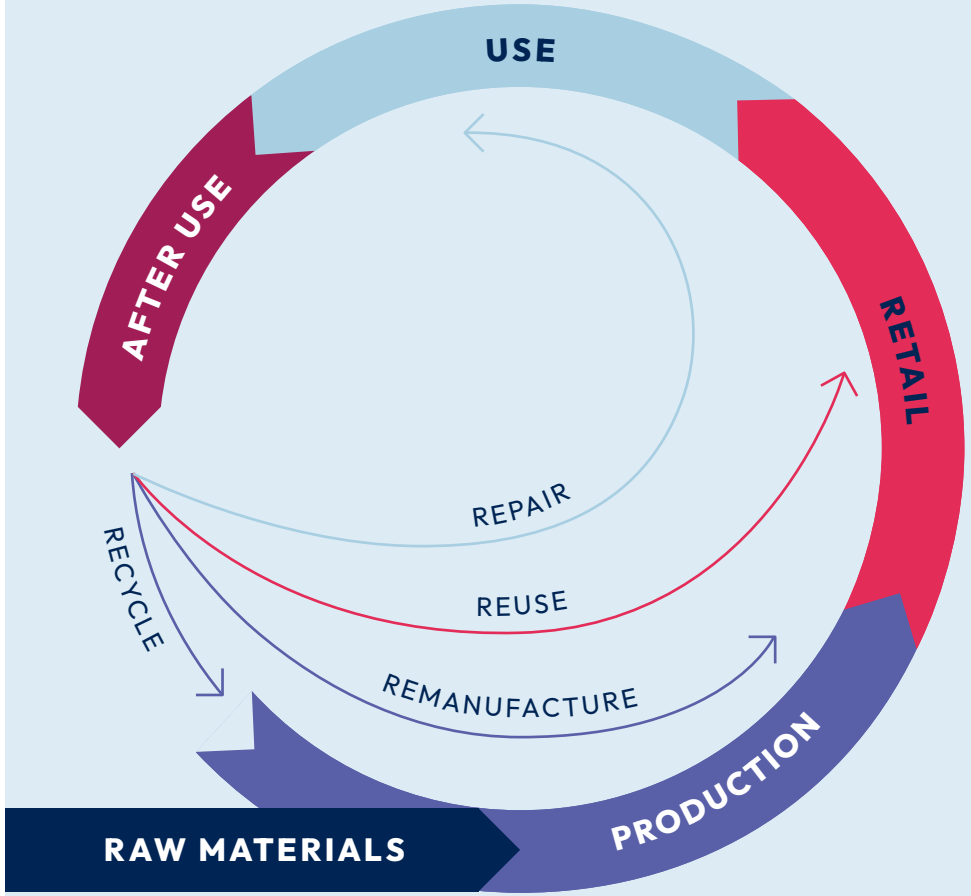
Make products using **safe and lower impact materials**

Design products to be **durable so they can be used for as long as possible** – by their original owner as well as by multiple owners through reuse, rental and repair services

Design products to **allow the materials to be recovered**, so they can be remanufactured and recycled back into new products and textile materials at the end of their usable life

Following this vision (Figure 2) will allow the industry to use resources more efficiently, minimise waste and pollution, and significantly reduce its impacts on the environment.

Figure 2. The circular economy model



Designing for circularity

This section of the toolkit aims to demystify the concept of what it means to 'design for circularity' and why it will play an important role in reducing the industry's impacts.

What is a 'circular product'?

There is currently no industry standard that defines a 'circular product'.

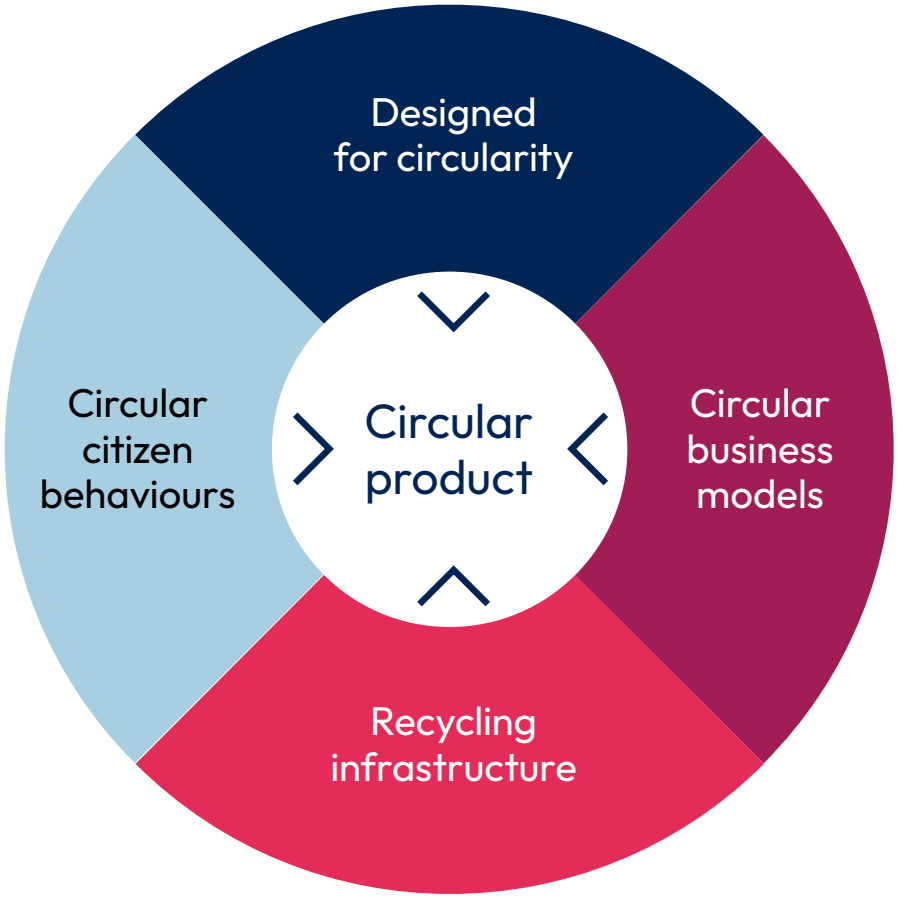
This is because for a product to be truly 'circular', it also relies on the systems and infrastructure around it, as well as how the customer uses and disposes of it, not just the design of the product itself.

The possibilities and opportunities for circularity to create a more sustainable industry are constantly evolving, and a lot of changes need to happen to be able to make a circular future for the fashion and textile industry a reality.

Design will play an important role, but we also need businesses to provide alternative ways for customers to acquire and/or use clothing, and we need the infrastructure in place to scale up textile recycling.

Engaging our customers in how they can play their part in circularity will also be key to allow products that have been designed for circularity to move through a circular system and never become waste.

For example, a T-shirt that is made from lower impact and recycled materials, and has been designed to last longer and be recyclable, can only be truly circular if the customer/s keeps it in use for longer and the systems and technologies are in place for them to dispose of it in a way that can ensure it is recycled back into new textile materials.



"Design will play an important role, but we also need businesses to provide alternative ways for customers to acquire and/or use clothing, and we need the infrastructure in place to scale up textile recycling."

The importance of design

So, what can designers do to help the industry become more circular?

By designing products for circularity now, designers play a key role in catalysing the development, commercialisation and scaling up of alternative business models, new infrastructure and innovation that we need to make creating a 'circular product' achievable in the future.

This means a circular economy for the fashion and textile industry will be driven by design.

Although this may feel like a huge responsibility, it also means you have the biggest opportunity to make a positive impact.

Use design to make a difference.

A new way to design

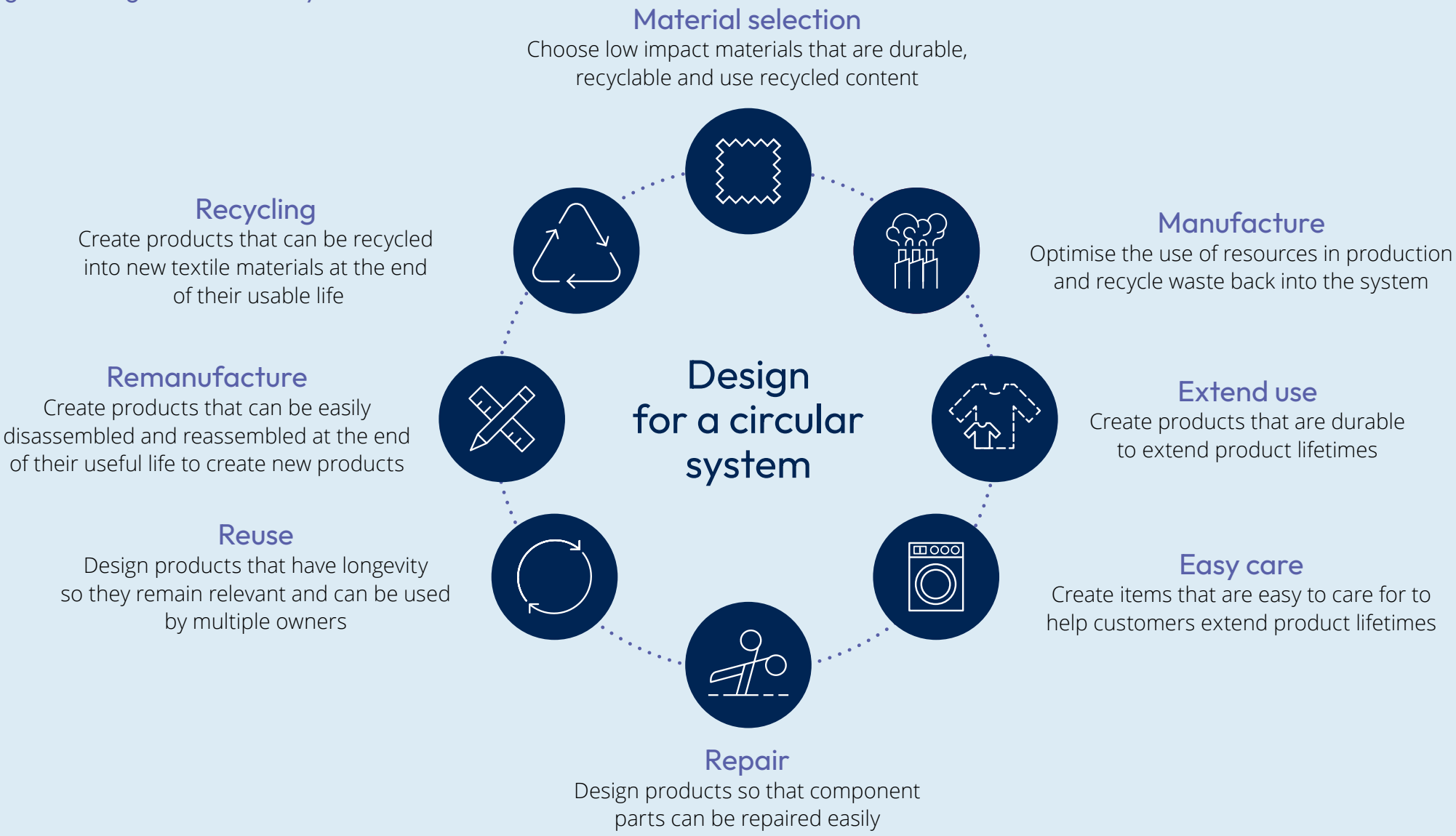
Designing for circularity will require a shift in mindset:

- It will require systems thinking. You will need to consider every phase of the product's lifecycle at the design stage, and how your design can enable that product to move through a circular system (see Figure 3).
- It will also require you to try to strike a balance between considering environmental impacts whilst also meeting commercial obligations like price and trend.

In the short term this may feel challenging, however this should become easier if the industry progresses on this journey together.

> "A circular economy begins with good design."[9]

Figure 3. Design for a circular system



Understanding your product's lifecycle

Understanding your product's lifecycle will be key to designing for circularity.

A product will go through four lifecycle stages:

- Raw materials
- Production
- In use
- After use

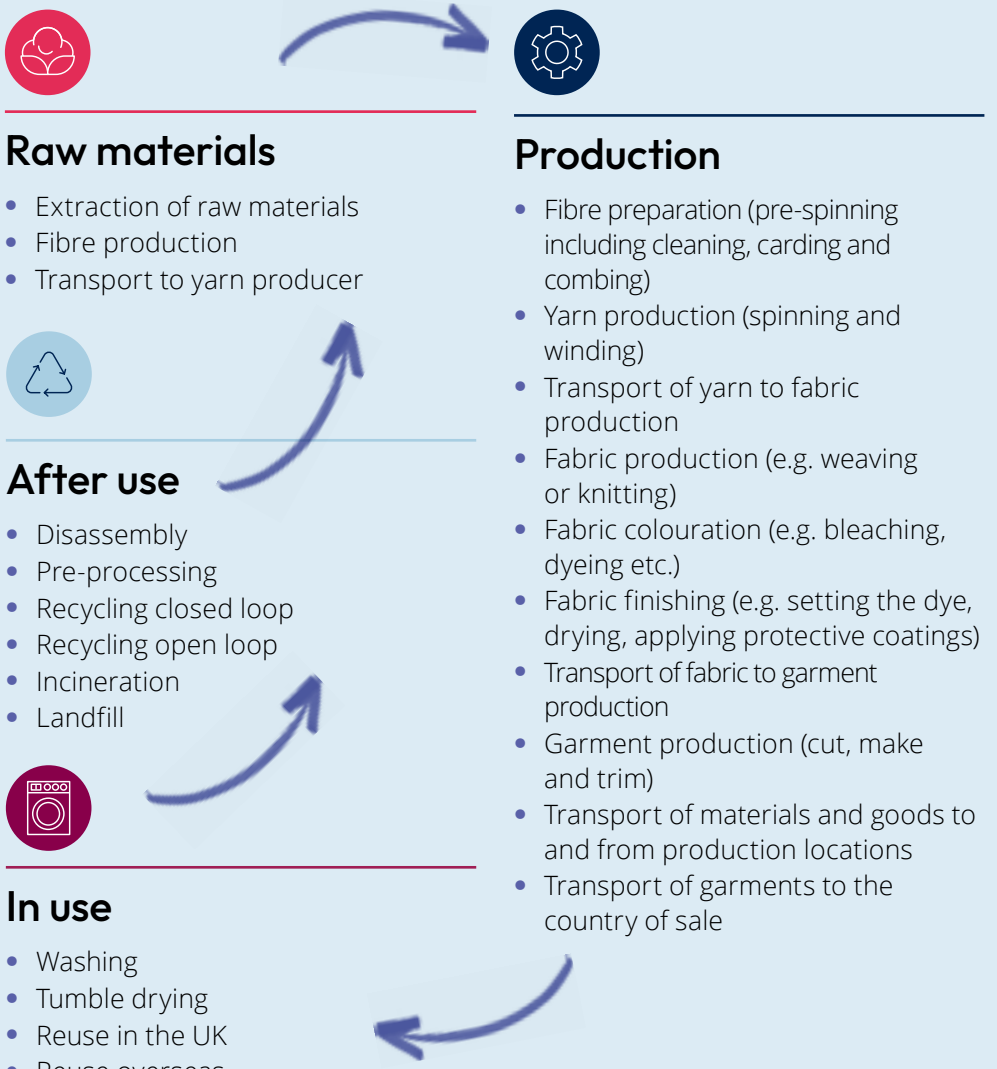
When designing for circularity you will need to think about each lifecycle stage, the processes that happen at each stage and how they interconnect and influence each other.

You will need to consider:

- How to reduce the impact of the raw materials you select
- How you optimise the use of resources and materials in production to eliminate waste and pollution
- How you create durable products that can be used for as long as possible
- How you can make products recyclable, so they never end up in landfill

Designing for circularity goes beyond a product's initial use. Consideration also needs to be given to how items can be reused by multiple owners (i.e. can it go through a circular business model such as resale, rental, redistribution or repair?)

Figure 4. Understanding the processes that happen within each lifecycle stage



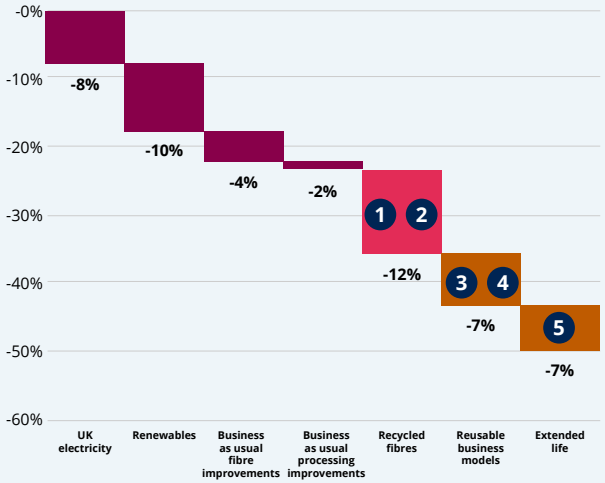
Using design to reduce the industry's environmental impacts

The decisions you make as part of a product development team will determine what impact a product has on the environment at every stage of its lifecycle.

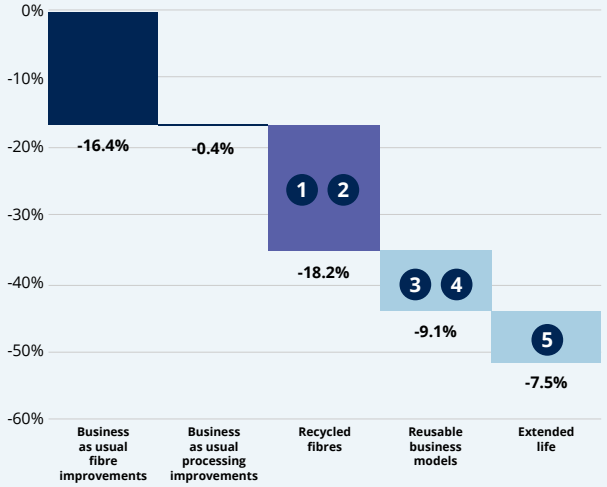
To demonstrate the magnitude of the impact savings that could be enabled through circular design, Textiles 2030 has modelled possible scenarios for UK textile businesses to reduce their carbon and water footprints by 50% by 2030, in line with the Paris Agreement goals and reducing water stress in manufacturing regions.

This scenario shows that designing for circularity could enable over half the impact reductions we need to reduce the industry's carbon and water footprints by 50% by 2030, which is pretty impressive.

Carbon reductions



Water reductions



1

Using recycled materials displaces the impacts associated with producing virgin raw materials.

Significantly scaling up the use of recycled fibres will bring considerable environmental impact savings.

2

Designing products to be recyclable will mean more textile products can be recycled back into textiles.

This will be key to scaling up the use of recycled fibres in new products.

3

Designing products to be more durable will increase the opportunities for reuse through circular business models, such as resale and rental. This will allow businesses and customers to sell the same product multiple times, instead of having to constantly create or buy new ones, decoupling business growth from virgin resources.

4

Designing products that can be repaired easily will allow products to stay in use for longer, decreasing the demand for the production of new products and the impacts associated with them.

5

Increasing the lifetime of 36% of products by 12 months through improved design creates significant impact reductions as this displaces the need to produce as many new items.

This section of the toolkit provides you with a framework to support you to start building Circular Design Principles into your product development process, walking you through practical strategies and actions to support designing for circularity.

The Circular Design Framework

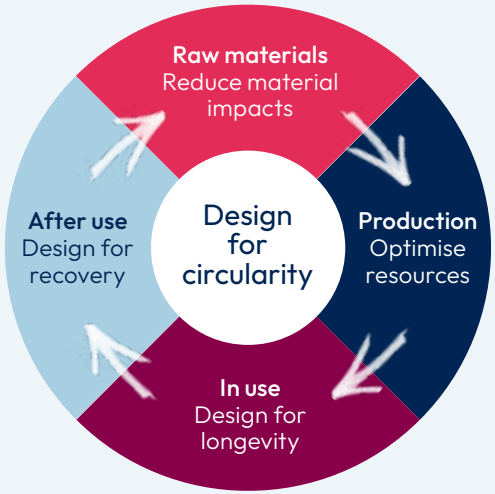
The Circular Design Pillars and Principles

Designing for circularity can be broken down into four Circular Design Pillars that each address the impacts that occur at the four stages of the product lifecycle.

Each pillar can then be broken down further into multiple **Circular Design Principles**, and more detailed **Design Strategies**, which you can use in your design process to reduce your product's impacts within that pillar. The most appropriate principles will vary depending on the product you are designing.

This section of the toolkit will give you a foundational knowledge of all the Circular Design Pillars and Principles and you should use this as a reference as you begin to design circularity into your product ranges.

We will go into more detail on how to select the most suitable principles for your products later in this toolkit (Putting the Circular Design Framework into Action).



Lifecycle phase	Circular Design Pillars	Circular Design Principles
Raw materials	Reduce material impacts	1. Recycled materials 2. Existing materials 3. Next generation materials 4. Preferred renewable materials
Production	Optimise resources	5. Lower impact processes 6. Minimise material waste 7. Remake
In use	Design for longevity	8. Design for durability 9. Design for versatility
After use	Design for recovery	10. Design for recyclability 11. Design for disassembly

Raw materials

Circular Design Pillar:

Reduce material impacts

Circular Design Principles:

1. Recycled materials
2. Existing materials
3. Next generation materials
4. Preferred renewable materials

Why is this important?

The production of virgin raw materials is a significant contributor to a product's carbon and water footprint. This is due to the agricultural processes linked to natural fibres, the extraction of oil for synthetic fibres and the wood harvest and pulping processes linked to the production of man-made cellulosic fibres, such as viscose. To reduce the environmental footprint of a product, the first step is to reduce the impacts of the raw materials.

How to take action

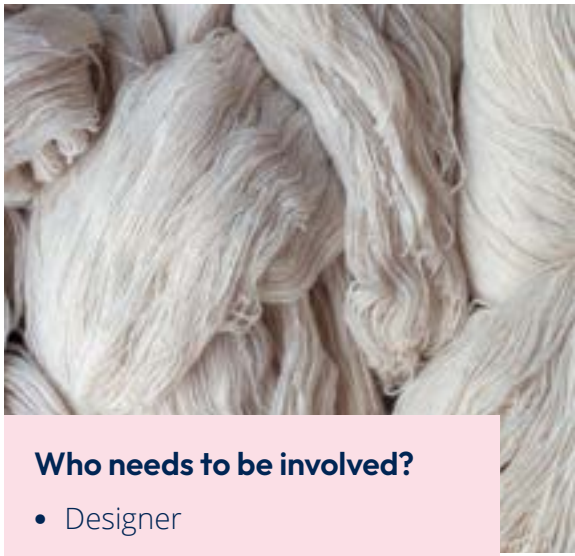
This Circular Design Pillar focuses on selecting materials with reduced environmental footprints that are made from safe, reused, recycled and renewable inputs.

When selecting materials, you should also consider how they support the other three Circular Design Pillars – do the materials optimise use of resources? And are they durable and/or recyclable?

This pillar looks beyond conventional fibre production methods that are currently the industry norm, and pushes you to choose preferred fibres, with lower impacts:

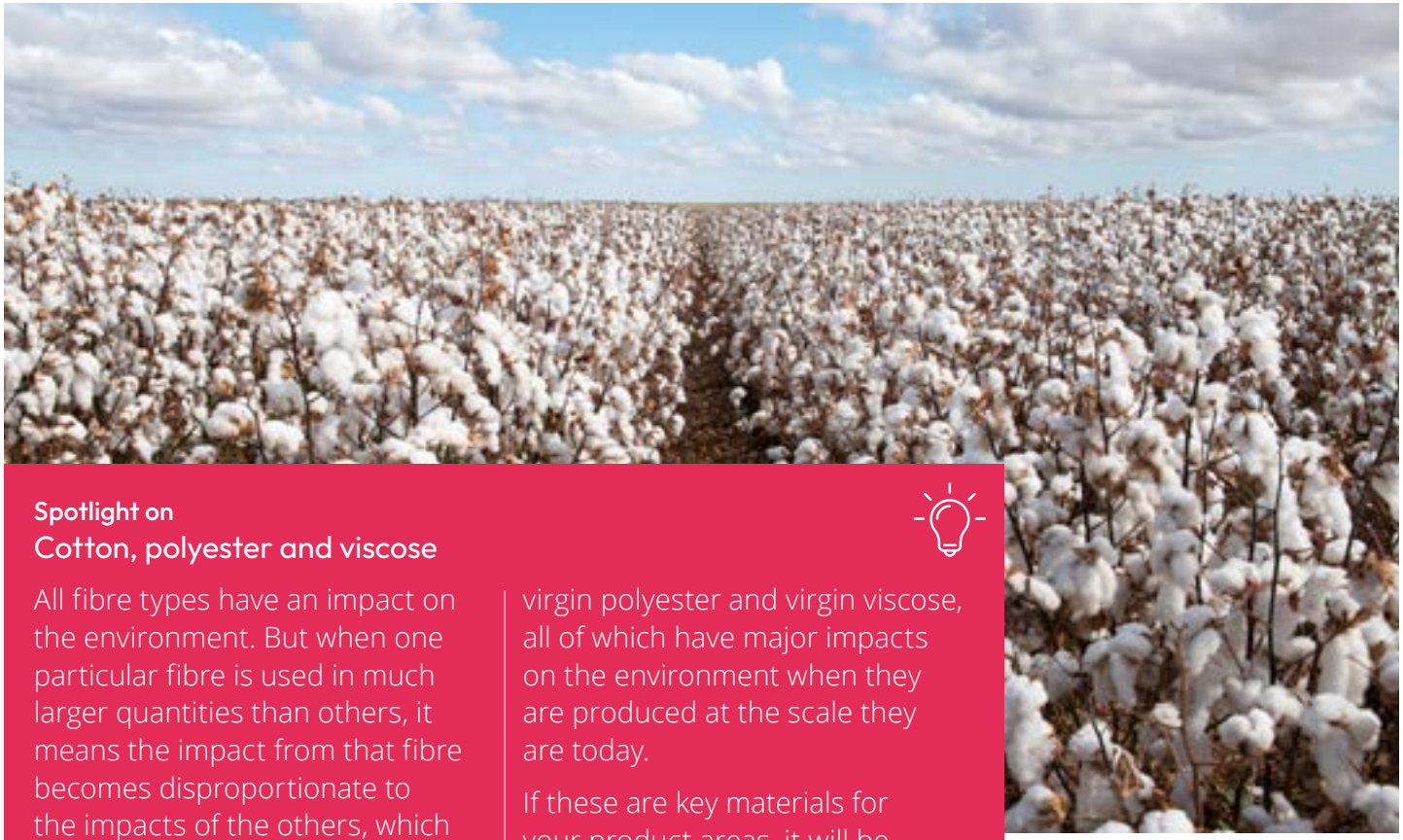
- **Conventional:** a fibre or material that is not produced to the specifications of a sustainability programme (standard, certification, regulation, initiative, or process).[10]
- **Preferred:** a fibre or material which results in improved environmental and/or social sustainability outcomes and impacts in comparison to conventional production.[10]

You could also choose to use materials that already exist, such as surplus materials and faulty or vintage fabric yardage, as this removes the impacts of producing new fibres all together.



Who needs to be involved?

- Designer
- Buyer
- Sustainability Team
- Fabric Sourcing/Material Development
- Fabric Technologist
- Your suppliers
- Senior Management
- Merchandiser



Spotlight on

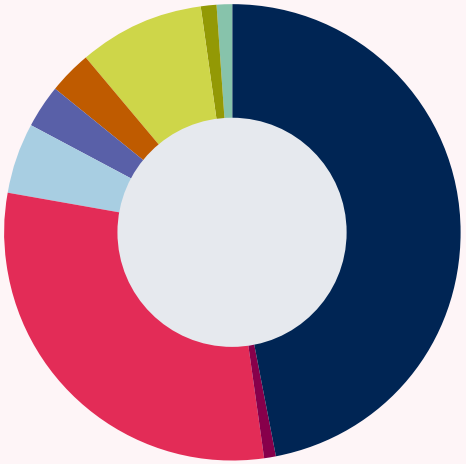
Cotton, polyester and viscose

All fibre types have an impact on the environment. But when one particular fibre is used in much larger quantities than others, it means the impact from that fibre becomes disproportionate to the impacts of the others, which can lead to severe environmental impacts in the production locations associated with that fibre.

Currently, the UK fashion and textile industry relies on three main fibre types: virgin cotton, virgin polyester and virgin viscose, all of which have major impacts on the environment when they are produced at the scale they are today.

If these are key materials for your product areas, it will be particularly important for you to increase the use of preferred materials in these fibre categories, to help you significantly reduce the environmental footprint of your product range.

Composition of fibres placed on the market in the UK



Cotton	47%
Flax/linen	1%
Polyester	30%
Polyamide/nylon	5%
Polyurethane/polypropylene/ elastane	3%
Acrylic	3%
MMCFs (e.g. Viscose)	9%
Other	1%
Wool	1%
Silk	0%

Data based on Textiles 2030 reported base fibre composition in 2019.

Circular Design Principle:

1. Recycled materials

The ultimate aim of this design principle is to increase the use of recycled content derived from unusable textile products and materials.

Only

1%

of materials used to produce clothing is recycled into new clothing[3].

Using recycled materials will help you eliminate the amount of waste your business produces and will significantly reduce the carbon and water footprints' of the products you create by reducing the need to use virgin raw materials.

Technical considerations

When sourcing recycled content, there are a few considerations you need to take into account to help you better understand what your recycled content is made from, where it has come from and its suitability for your product.

Is the recycled material made from open loop or closed loop material inputs?

- **Closed loop**: made by recycling textile materials back into textiles, commonly known as fibre-to-fibre recycling.
- **Open loop**: made by recycling non-textile materials into textiles, such as plastic bottles, fishing nets and carpets.

To enable a circular textiles system, you should work with your suppliers to source and develop recycled materials from closed loop inputs. This will be harder initially but will show there is increasing industry demand for these materials and push suppliers and investors to scale up fibre-to-fibre recycling capacities. Pre-competitive industry collaboration through initiatives such as Textiles 2030 and Accelerating Circularity can also support brands and retailers to increase their use of closed loop recycled materials.

It is also worth noting that the EU Strategy for Sustainable and Circular Textiles, that will be implemented by 2024, states that 'bottles should be used for bottles only (and not textiles)' and frowns upon green claims made by brands and retailers using recycled content from plastic bottles, encouraging businesses to prioritise their efforts on fibre-to-fibre recycling[11].

Is the recycled material made from post-industrial or post-consumer feedstock?

- **Post-industrial:** materials left over from manufacturing and production processes that enter the waste stream, such as fabric off-cuts on the factory floor.
- **Post-consumer**: materials that have entered the waste stream after they have been acquired by a customer, such as used clothing or discarded plastic bottles.

Using both types of feedstock materials have environmental benefits and keep the materials at their highest value and out of landfill. Currently recycled materials made from post-industrial waste are more readily available and can often be higher quality as this waste is usually more uniform and easier to recycle. However, to keep textiles out of landfill, it is important to work with your supplier to start sourcing post-consumer recycled content.

Has the recycled material been produced through a mechanical, dissolution or chemical recycling process?

- **Mechanical recycling**: technologies that recycle materials without the use of chemicals, either by breaking them down mechanically through a shredding process or by using heat to melt the fibres (synthetics only), and then spinning them into new yarns.
- **Dissolution recycling**: Textiles are shredded and dissolved using solvents to create polymers. The polymer chains are separated from any contaminants, creating virgin like purified material that can be spun into new fibres.
- **Chemical recycling**: Chemicals are used to break the polymer chains down into their monomers. These are then purified and repolymerised into a new virgin like material that can be spun into fibre.

All recycling processes have environmental benefits when compared to using virgin fibres.

There is more detail on the different types of recycling technologies later in this guide.

Quality and durability

The process (mechanical or chemical) that has been used to create the recycled material can affect its quality, as some methods can damage the fibres more than others.

Often, recycled content will need to be blended with virgin fibres to maintain the quality, durability and performance required, meaning it is currently difficult to source 100% recycled materials. However, technologies are constantly improving so it is always worth talking to your sustainability, fabric sourcing or material development teams, and your suppliers to understand what is available.

It is also worth noting that when blending recycled content with other fibres you should always try to blend with another preferred fibre, and where possible, the same fibre type, so that the materials can be recycled again at the end of their usable life. See the 'Design for recovery' pillar to find out more about designing for recyclability.

Commercial considerations

Currently recycled materials can commonly carry an upcharge when compared to virgin materials. This is often due to limited availability and the costs of gaining certifications. This upcharge can vary depending on the fibre and its quality. However, increasing demand from the industry will help to scale up recycling capacities which may lead to reduced costs through economies of scale.

Certifications and traceability

To know that the materials in your product are recycled, they must be certified through the GRS, RCS, RCS Blended or SCS standards.

Minimum requirement recommendations

There are currently no industry minimum requirements for the amount of recycled content that must be used in clothing and textile products. However, as a guide, to hit the Textiles 2030 carbon reduction targets by 2030, our current scenario modelling suggests that, as a minimum, we need to switch:

40%
of cotton to mechanically recycled cotton

100%
of polyester to recycled polyester

100%
of nylon to recycled nylon

50%
of viscose to recycled and secondary sources

80%
of wool to recycled and secondary sources [13]

Achieving these levels of recycled content may not always be possible right now, but we would recommend that you always use as much recycled content as you can, without compromising on physical durability. Brands and retailers play a key role in pushing for the continued development of higher quality recycled materials, and driving demand for the investment and innovation in recycling technologies to make hitting these targets a reality.

Use the table on the following page to understand the environmental and commercial impacts of recycled fibres compared to their conventional counterparts[12].

Note: impacts listed in the table are based on comparison to conventional counterparts (e.g. recycled cotton compared to conventional cotton, and recycled polyester compared to conventional polyester).

Fibre		Environmental		Commercial			Examples
		Carbon	Water	Availability	Cost	Traceability	
Cotton	Conventional cotton	C	D	🧺🧺🧺	£	✗	
	Mechanically recycled cotton (closed loop)	A	A	🧺	£ £	✓ ✓	Recover™, Texloop™, Wolkat, European Spinning Group, IKSO™, Marchi & Fildi, Pure Waste, The Billie System (by Novetex), CYCLO®
Polyester	Conventional polyester	D	A	🧺🧺🧺	£	✗	
	Mechanically recycled polyester (open loop)	A	A	🧺🧺	£ £	✓ ✓	Unifi® REPREVE Polyester, Seaqual®, Advansa
	Mechanically recycled polyester (closed loop)	No data available	No data available	🧺	£ £	✓ ✓	Project Plan B, Antex, European Spinning Group, Saya
	Chemically recycled polyester (closed loop)	No data available	No data available	🧺	£ £	✓ ✓	Ambercycle, CuRe, Jeplan, Ioniqa, Loop Industries, Worn Again Technologies
Nylon	Conventional nylon	D	D	🧺🧺🧺	£	✗	
	Chemically recycled nylon	B	D	🧺🧺	£ £	✓ ✓	Aquafil Econyl®, Unifi® REPREVE® Nylon, Chain Yarn GREENLON®, Fulgar® Q-NOVA®
MMCFs	Conventional viscose	B	B	🧺🧺🧺	£	✗	
	Chemically recycled MMCF (made from cotton)	No data available	No data available	🧺	–	✓ ✓	Re:newcell, Lenzing ™ Refibra ™, SaXcell, Infinite'd Fiber, Södra, Evrnu ®
Wool	Conventional wool	D	C	🧺🧺🧺	£	✗	
	Mechanically recycled wool	No data available	No data available	–	–	✓ ✓	Iinouiio, Manteco, Marchi & Fildi, Tesma Cashmere, My Will

Key

Environmental ranking indicators

Sustainability

More — Less

A B C D

* Very high impact, outlier from A–D range

Availability

- 🧺 Niche
- 🧺🧺 Growing availability
- 🧺🧺🧺 At scale

Cost

- £ Same price as conventional
- £ £ More expensive
- £ £ £ Significantly more expensive

Claims traceability

- ✗ No traceability
- ✓ Mass balance or incomplete traceability
- ✓ ✓ Fully traceable

Here are some further resources to support brands, retailers, and manufacturers to source recycled materials:

- Textiles 2030 Sustainable Fibre Guides (available to Textiles 2030 signatories only)
- Fashion for Good's Recyclers Database
- Accelerating Circularity Recycler List
- Cotton Works™ Recycled Cotton Supplier List
- Canopy's Next Generation Solution Providers
- International Wool Textile Organisation's (IWTO) Recycled Wool Database
- Material Innovation Initiative Innovator Profiles
- Textile Exchange – list of GRS and RCS certified companies

Recycled materials: examples

Primark × Recover™

Primark Cares collaborated with Recover™ to create a range of everyday leisurewear with a minimum of 15% recycled cotton along with recycled polyester. Recover mechanically processes post-industrial and post-consumer cotton into recycled cotton fibre for new clothing. Recover's RColourBlend fibres require no dyeing treatments or chemicals to create a range of colours with reduced environmental impacts. Primark has used these fibres to create a range of T-shirts, sweatshirts, essential leggings and tracksuits in multiple colour options across 14 markets in Europe and the USA.

Ganni × Lenzing™ Refibra™

Ganni worked with Lenzing to create a range of denim products using its Refibra™ fibre.

Refibra™ use a chemical process to recycle post-industrial cotton scraps into a cellulosic pulp. One third of this recycled cotton pulp is blended with virgin cellulosic pulp from sustainably managed forests and spun into new fibres.

Finisterre × Circular Textile Foundation × Project Plan B

Finisterre has worked with Project Plan B and the Circular Textile Foundation to create branded buttons from recycled post-consumer polyester textiles.

Project Plan B has completed several recycling trials and produced rPET pellets of various quality grades. The highest grades will be spun into new fibres and the lower grade pellets have been made into buttons using Finisterre's molds and other hard trims.

Fortela × Manteco

Fortela collaborated with Manteco to recreate their iconic wool military coat in Manteco's MWool®.

MWool® use a mechanical process to recycle post-industrial and post-consumer textiles into low-impact and high-end recycled wool. It uses Manteco's Recype® process to eliminate the need for dyeing processes by masterfully blending the recycled fibres to create a range of colours.

Circular Design Principle:

2. Existing materials

This principle focuses on using existing fabrics and components that have been produced but never used for their intended purpose. Using existing materials helps to use fabric that would have otherwise gone to waste.

These materials have been created but never used and therefore become part of the industry's waste footprint. However, seeing these materials as a valuable resource and using them to create new items can significantly reduce your product's impact as it eliminates the need to extract virgin raw materials and the production processes needed to create new fabrics.

Commercial considerations

When sourcing existing materials, there are a few routes you could take. Working closely with your suppliers and fabric sourcing teams to understand what is available to you will be key. A service provider that specialises in sourcing existing textile 'waste' materials could also support you with this design principle.

You will also need to consider your order quantities, as it is likely there will be limited yardage available.

Using existing materials can have cost savings as new materials do not need to be produced.

Note: Using existing materials to create new products **should not** be described or marketed as 'upcycling' or 'remanufacturing' as the fabrics have not been used previously.

Remanufacturing relates to using post-industrial textiles or existing products to create new items and is covered under the 'remake' design principle.

"Using existing materials can have cost savings as new materials do not need to be produced."

Certifications and traceability

When using existing materials, it is important to understand where the material came from, what it is made from, and that it is not a stock fabric. There are no certifications for existing materials specifically, so currently using your own brand's surplus materials is the most traceable option.

Design strategies

Post-industrial surplus materials

Before ordering new fabrics, consider if your suppliers are holding any of your own brand's or another brand's surplus that you could use.

Post-industrial surplus materials are fabric yardage and trims that have been produced for an intended product but have never been used to create that product. This could be for a variety of reasons, such as order changes, cancelled orders or overproduction to meet order minimums. This does not include faulty and/or damaged materials.

You could also try to source vintage surplus materials. You may need to find a specialist supplier and work closely with your fabric sourcing team to do this.

Post-industrial by-products

Often fabric yardage may not be used due to it being damaged, having a defect or not meeting a brand's technical or quality standards.

Work with your suppliers to understand if they are holding any damaged or faulty stock that you could use. You may need to get creative with these materials, for example, can you use it in a patchwork? Could you overdye the fabric to give it a new lease of life or reinforce any defect as part of your design?

You will gain extra kudos for creating a product out of faulty fabrics that would have most likely gone to waste.

Existing materials: examples

Urban Outfitters
Made from Remnants

To keep valuable textiles in circulation, limit the production of virgin raw materials and reduce waste, Urban Outfitter's Made From Remnants styles are crafted from unsold, unused and surplus fabrics to create small-batch, bespoke, limited edition styles for its Urban Renewal range.

Raeburn
Raemade

Raeburn is an eponymous British brand with responsible and intelligent fashion design at its core.

The ethos of its Raemade line has pioneered the reworking of surplus fabrics and garments into distinctive and functional pieces.

Raemade pieces are limited edition and made in the UK. Previous collections have included an upcycled range of clothing, accessories and home textile products made from 1950`s silk Royal Air Force navigation maps.

Christy Dawn
Deadstock Collection

Photo by Christy Dawn

Utilising surplus fabric is where Christy Dawn began. The US-based brand's Deadstock Collection creates vintage-inspired dresses by repurposing surplus fabric from larger fashion houses to produce unique pieces of clothing. This creates a cost-effective business model that reduces the need for virgin materials, in turn limiting its product's environmental impacts. The brand also promises to create products that are made to last using high skilled production techniques and classic silhouettes.

Service providers

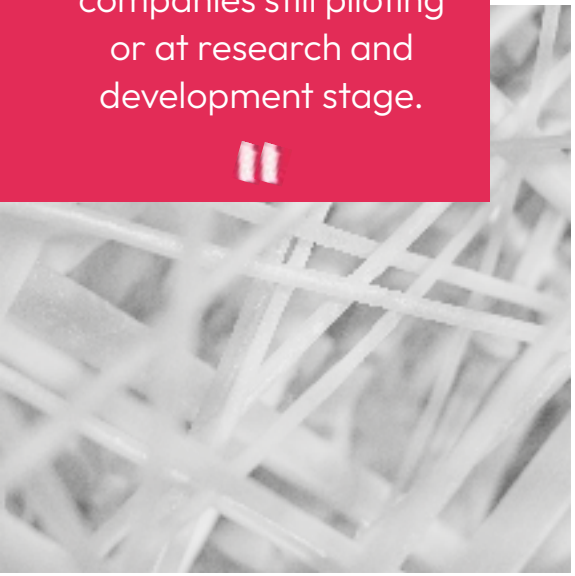
Specialist service providers can support brands to source existing surplus materials, as well as support businesses to manage their excess materials and connect them to potential buyers:

- Ambio-N
- Queen of Raw
- Recovo
- AmoThreads

Circular Design Principle:

3. Next generation materials (Next Gen)

> Material innovation is a fast-moving landscape with many companies still piloting or at research and development stage.



Next generation materials can play a crucial role in curbing the industry's reliance on conventional, resource intensive raw materials.

Textiles 2030 uses the term next generation (Next Gen) to describe materials that are designed to replace conventional materials, and use a variety of innovative approaches to replicate the aesthetics and performance of their conventional counterparts.

Next Gen materials can include bio-synthetic fibres made from renewable sources that replace petroleum-based synthetics, fibres made from cellulosic agricultural waste that could replace conventional MMCF's (like viscose) and materials that replicate animal-based protein fibres, including leather, exotic skins, silk, wool, fur and down.

Next Gen materials primarily fall into four main categories: plant-derived, mycelium, microbe-derived or cultivated animal cells.

Brands and retailers play a key role in driving the demand for Next Gen materials, by influencing investors to support the scaling up of innovation and production to increase availability and make these materials a viable and affordable option for the wider industry.

Technical considerations

Currently, some Next Gen materials are blended with petroleum-based fibres to allow them to meet performance standards and compete in the market. When sourcing Next Gen materials, product teams need to make sure the materials have an improved environmental impact compared to the conventional material they are replacing and that they support the other Circular Design Pillars, for example, are they durable/recyclable?

Commercial considerations

Material innovation is a fast-moving landscape with many companies still piloting or at research and development stage. This means there may be limited availability and cost implications to using Next Gen materials. You will need to think about how to work with these companies and when it is most suitable to use these materials, for example, on higher price-point or limited-edition products. It is best to consult with your sustainability team if you are considering using these materials. The Materials Innovation Initiative (MII) also provides information on the various strategies early adopters are using to work with Next Gen material companies.

Customers are becoming interested in these new materials. A study in the US has shown that nearly half of its participants (45%) were highly likely to purchase Next Gen materials and nearly all (94%) were somewhat likely to purchase, with most participants (83%) stating they were also somewhat likely to pay a higher price for products made from these materials[14].

Certifications and traceability

Again, you should get your sustainability team involved to check claims made by Next Gen materials are backed up by certifications or lifecycle analysis (LCA) that can prove what is in the materials and that they have a lower impact across all lifecycle phases when compared to their conventional counterparts. The MII has launched the Environmental Data Coalition (EDC) to bring together key stakeholders to improve the environmental impact analysis within the Next Gen material industry.

Next Gen material classifications

Plant-derived

This applies to Next Gen materials that are derived from waste or by-product plant matter, for example, agricultural or food waste, or virgin plant matter, such as corn, sugar beet, sugar cane and wheat. For simplicity, fungi and algae inputs are also included in this category, even though they are not plants[15].

These are the most prevalent Next Gen materials on the market.

Examples include:

- Sorona® by Dupont – bio-synthetic polymer alternative to elastane
- Agra Loop™ by Circular Systems™ – transforms left-overs from crops into natural fibres
- Infinna™ by Infinited Fibre – transforms cellulosic-rich waste into premium cellulose fibres
- Bananatex® – durable, cellulose fibres made from banana agriculture by-products
- Orange Fiber – a silky cellulose fibre made from citrus fruit agriculture by-products
- Pinatex® – a leather alternative made from pineapple agriculture by-products
- Treekind® by Biophilica – a leather alternative made from urban plant, agricultural and forestry waste
- Mirum® by Natural Fiber Welding – a plant-based leather alternative

Mycelium

This applies to Next Gen materials that utilise the root-like structure of some fungal species called mycelium. This category is distinctive from the plant-derived category due to the rich activity of Next Gen innovation involving mycelium[15]. These solutions are the second most prevalent in the market due to aesthetic capabilities that have been achieved, specifically in the tanning, texture and feel of leather alternatives.

- Mylo™ by Bolt Threads – leather alternative
- Reishi™ by MycoWorks – leather alternative

Microbe-derived

This applies to Next Gen materials that utilise cellular engineering approaches such as cell culture or fermentation processes to produce products such as proteins and biopolymers for Next Gen material formulations[15].

- Celium™ by Polybion – leather alternative developed from fruit waste
- Shorai™ by Bucha Bio – leather alternative developed from plants
- AirCarbon by Newlight – leather alternative sourced from the sea
- Microsilk™ by Bolt Threads – silk alternative

Cultivated animal cells

This applies to Next Gen materials that utilise tissue engineering approaches to grow animal cell constructs (e.g. skin) from small biopsy in a laboratory[15] to create end-products indistinguishable to that of their conventional counterparts.

- Leather alternative examples are Vitro Labs, Faircraft and Qorium all of which are in research and development (R&D) and piloting stages.

Next generation materials: examples

H&M Foundation Global Change Awards

The non-profit H&M Foundation launched the Global Change Awards in 2015. This platform helps support disruptive ideas that can transform the textile industry. This award gives winners a platform to scale their ideas and collaborate with global businesses. Past winners have included Next Gen materials, including Vegea™ (grape leather), Agraloop™BioFibre™ and Orange Fiber. H&M has created product ranges using these groundbreaking materials.

Tommy Hilfiger × Infinna™

Infinna™ is a premium cellulose fibre made purely from cellulosic-rich waste, including discarded textiles, used cardboard and even straw. Cellulosic waste is broken down to a molecular level and converted into new fibres.

Tommy Hilfiger made the first ever T-shirt with 50% Infinna™ and 50% recycled cotton in three classic colours – red, navy blue and white. PVH Corp's Tommy Hilfiger and Calvin Klein teams continue to test, trial and scale several innovative textile projects, including turning leftover grapes from the wine industry into leather alternatives and experimenting with new materials such as mushroom leather.

Live! × Sorona®

Live! uses the bio-based fibre Sorona® in its activewear ranges in place of elastane. Sorona® provides great breathability, reduced pilling and sagging, is wrinkle resistant and has comfort stretch recovery that helps maintain shape and enhances the garment longevity, making it a perfect fit for activewear, as well as reducing the need for fibres derived from fossil fuels.

Sorona® can be recycled in a mechanical polyester recycling system, so greatly increases the possibilities for garments using this fibre to be recycled.

Further Next Gen resources

Canopy's Next Gen Pathway sets out a plan to support the wide scale uptake of MMCF products made from low impact alternatives that utilise waste textiles, microbial cellulose or agricultural residues, by 2030. The pathway aims to end the sourcing of MMCF's from Ancient and Endangered Forests, while helping the fashion sector meet its sustainability goals.

Textile Exchange's Biosynthetic Roundtable was set up in 2016 to develop a framework to assess the sustainability of biosynthetics and to define preferred biosynthetics in order to support the industry to make informed decisions.

The Material Innovation Initiative is a non-profit that accelerates the development of sustainable, animal-free Next Gen materials for the fashion, automotive and home goods industries.

Circular Design Principle:

4. Preferred renewable materials

A renewable material is made from a natural resource that can be replenished.

When designing for circularity, the use of recycled materials should always be prioritised, but sometimes you may need to use a renewable material to ensure the quality of your product is not compromised and it meets performance requirements.

A renewable material is made from a natural resource that can be replenished. Examples include natural cellulosic fibres, such as cotton and linen, and animal-based protein materials, such as wool and leather.

Conventional renewable materials can still have big environmental impacts, so when designing for circularity you must always use a preferred renewable material, where possible produced using regenerative methods, to reduce your product's footprint to ensure that the soil quality and biodiversity of the land is being protected.

Commercial considerations

Some preferred renewable materials have comparable costs to their conventional counterparts (e.g. BCI and CMiA cotton) but others can carry a premium price due to higher production costs, limited availability and certification (e.g. organic).

Certifications and traceability

All preferred renewable materials must be verified through a certification scheme or industry recognised initiative to ensure they have improved environmental impacts in comparison to conventional production.

Minimum requirements recommendations

There are currently no industry minimum requirements for the amount of preferred renewable fibres that must be used in clothing and textile products.

However, to communicate that a product contains a preferred renewable fibre it must meet the minimum content requirements for the certification you are using. This should be seen as a starting point and it is recommended that you always use as much preferred fibre content as possible to reduce the impacts of your products.

Use the table on the following page to understand the environmental and commercial impacts of preferred renewable fibres compared to their conventional counterparts[16].

Note: impacts listed in the table are based on comparison to conventional counterparts (e.g. recycled cotton compared to conventional cotton, and recycled polyester compared to conventional polyester).

Fibre		Environmental		Commercial			Certification	Minimum content
		Carbon	Water	Availability	Cost	Traceability		
Cotton	Conventional	C	D	🧺🧺🧺	£	✗		
	BCI	C	C	🧺🧺	£	✓	BCI On-Product Mark	Initially 10% of all cotton, increasing to 50% within 5 years
	CMiA	B	C	🧺🧺	£	✓		
	Organic	B	B	🧺🧺	£ £ £	✓ ✓	GOTS OCS OCS 100	70% 5% 100%
Linen/ Flax	Conventional	D	B	🧺🧺🧺	£	✗		
	Organic	No data available	No data available			✓ ✓	GOTS OCS OCS 100	70% 5% 100%
Wool	Conventional	D*	C	🧺🧺🧺	£	✗		
	Organic	No data available	No data available			✓ ✓	GOTS OCS OCS 100	70% 5% 100%
	Responsible Wool Standard	No data available	No data available			✓ ✓		
Silk	Conventional	C	D*	🧺🧺	£	✗		
	Organic	No data available	No data available			✓ ✓	GOTS OCS OCS 100	70% 5% 100%

Key

Environmental ranking indicators

Sustainability

More — Less

A B C D

* Very high impact, outlier from A–D range

Availability

- 🧺 Niche
- 🧺🧺 Growing availability
- 🧺🧺🧺 At scale

Cost

- £ Same price as conventional
- £ £ More expensive
- £ £ £ Significantly more expensive

Claims traceability

- ✗ No traceability
- ✓ Mass balance or incomplete traceability
- ✓ ✓ Fully traceable

Preferred renewable materials: examples

Arket × Texloop™ RCOT™

Produced for ARKET, Texloop™ RCOT™ Primo Recycled Cotton is blended with organic cotton.

RCOT™ is an innovative solution which enables the knitting or weaving of premium quality materials from mechanically recycled cotton. Blend compositions are typically 50%-75% organic cotton with 25%–50% recycled cotton. By using a combination of organic cotton and recycled fibre, these materials provide the quality required but use considerably less water and energy to produce than conventional cottons.

Nobody's Child × Lenzing™ Ecovero™

Nobody's Child is dedicated to reducing the environmental impact of its product ranges by using lower impact and responsibly sourced materials, including Lenzing's™ Ecovero™ as an alternative to conventional viscose.

Ecovero™ is made using wood pulp from certified sustainably managed forests and generates up to 50% less carbon emissions and uses up to 50% less water in production than conventional viscose methods.

Primark × CottonConnect

Primark has partnered with CottonConnect and SEWA to develop the Primark Sustainable Cotton Programme. Female farmers in India take part in the three-year training programme on more sustainable farming techniques, based on CottonConnect's REEL Cotton Code.

The training has helped smallholders to improve their livelihoods, with 6% higher yield and 247% higher profits in year three. The farmers have also seen lower fertiliser, pesticide and water usage; they used 40% less fertiliser, 44% less pesticide and 10% less water in year three. Primark is also now collaborating with CottonConnect to develop a regenerative cotton pilot programme.

HD Wool Apparel Insulation

HD Wool create Apparel Insulation from hand-selected, traceable British wool, that can be used to replace virgin synthetic insulation in outerwear. HD Wool work with farmers using regenerative agriculture and support them to verify their land, making the insulation fully traceable back to farm level.

HD Wool's Apparel Insulation has great physical durability as well as the ability to trap air to generate warmth and great breathability, odour-inhibiting, anti-bacterial and moisture management properties, as well as being naturally elastic. It is available in a variety of machine washable weights from 75gsm to 200gsm. HD Wool has partnered with brands such as Finisterre and North Face.

Production

Circular Design Pillar:

Optimise resources

Circular Design Principles:

5. Low impact processes
6. Minimise material waste
7. Remake

Why is this important?

To transform raw materials into final products they need to go through a variety of production processes, and currently, these processes are heavily resource intensive and inefficient. This is due to the use of fossil fuels for energy to power manufacturing facilities, water used in dyeing and finishing processes, and the large amounts of waste and pollution created.

The production stage of a product's lifecycle can contribute up to 50% of a product's carbon footprint[17], and around 20% of wastewater worldwide is attributed to the production of textiles[18].

It is also estimated that roughly 25% of materials end up as waste during the design and production stage before a product even reaches the customer.[19]

How to take action

This Circular Design Pillar focuses on optimising the use of resources to lower the environmental impacts of how textile products are made. It focuses on the impacts created by production processes, and how these can become more efficient.

Product development teams play a key role in how products are manufactured through the decisions made during the design phase. You will need to consider if you can choose lower impact production processes, how you can use materials more efficiently to reduce the amount needed to make new products in the first place, as well as reducing, reusing, or recycling any waste that is created during production.

Alongside the environmental benefits, optimising the use of resources can also bring potential cost savings to you and your suppliers by using less energy and water in production processes and using materials more efficiently.

Who needs to be involved?

- Designers
- Print Designers
- Pattern Cutters
- Garment Technologists
- Fabric Sourcing/Material Development
- Sustainability Team
- Buyers
- Suppliers
- Sourcing/Ethical Trade

Spotlight on

Understanding your supply chain

Understanding your supply chain and working closely with your suppliers will be key to this Circular Design Pillar. The textiles supply chain can be broken down into tiers. Each tier includes suppliers and manufacturers that carry out specific processes that result in the final product.

Production processes include spinning fibres into yarns (Tier 3 suppliers), weaving or knitting yarns into fabric, dyeing, printing, finishing and laundering fabrics and manufacturing components (Tier 2 suppliers), and finally making those fabrics and components into the final product (Tier 1 suppliers). Products can also go through laundering and finishing processes after they have been constructed (e.g. the distressing processes used on denim).

Tier 4

Raw material extraction

The cultivation and extraction of raw materials:

- Agriculture for natural fibres
- Extraction of oil for synthetics
- Wood harvest for MMCF's (e.g. viscose)

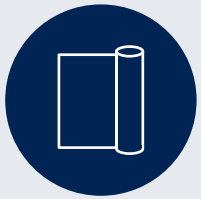
Tier 3

Raw material processing

Processing of raw materials into yarns and other intermediate products:

- Ginners
- Spinners

Tier 2

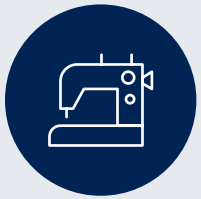


Material and component production

Production and finishing of the fabrics and components that will make up the final product:

- Fabric mills
- Dye houses
- Printing mills
- Laundries
- Component manufacturers

Tier 1



Finished product assembly

Assembly of materials and components into the final product:

- Cut, Make, Trim (CMT) manufacturers

Tier 0

Brand, retailer, wholesaler

Customer

Circular Design Principle:

5. Low impact processes

This principle focuses on how you can reduce the impacts of the production processes used to make your products through the decisions you make at the design stage.

Specifying lower impact processes when briefing designs to your suppliers is an area where product development teams can make a big difference to a product's impacts.

Around 20% of a product's carbon footprint comes from wet processing and the finishing of materials, so this is a good place to start when trying to reduce the impacts of production. This is because many conventional wet processes and finishing techniques use considerable amounts of energy to create heat. They also use vast amounts of water to rinse fabrics multiple times to get rid of excess dyes and chemicals.

Remember to also keep the other Circular Design Pillars in mind when selecting your production processes to ensure products have longevity, for example choose longer lasting dyeing, printing and finishing methods, and processes that do not hinder recyclability.

Technical considerations

Different materials will require different processing techniques, so it will be important to work with your suppliers to understand what processes they are using on specific fabrics and products, so you can specify the correct lower impact techniques for your product.

Commercial considerations

In theory, lower impact processes use less resources and energy so should be more cost effective in the long term. However, the supply chain may need to invest in new machinery which could be costly for them. Talk to your sustainability and sourcing teams about how you can support your suppliers to transition to new processes.

Certifications and traceability

Lower impact wet processes are often certified by non-toxic chemical certifications such as Oeko-Tex®, bluesign® and GOTS.

Design strategies

When designing, you should consider if your product will go through any of the following wet processes and explore lower impact alternatives with your sustainability team and your suppliers.

Pre-processing

Natural fibres such as cotton, linen and wool contain impurities such as oils and waxes which affect the fibres' ability to absorb dyes. This means they need to go through a series of pre-treatments to prepare them for dyeing and finishing. These processes can vary but commonly include scouring and bleaching, which can be energy and chemical-intensive processes. Ask suppliers if they can use lower impact alternatives such as enzyme scouring and enzyme bleaching. More information on pre-processing can be found here.

Dyeing

Dyeing requires significant amounts of energy and water due to the use of heated dye and rinsing baths, and can take place at multiple stages throughout the supply chain, from dyeing fibres and yarns through to fabrics and garments. Many chemicals used in the dyeing process also present a concern. Lower impact dyeing methods include:

- Cold pad batch (CPB) dyeing for cottons and cellulosics
- Dope dyeing for synthetics
- Spin dyeing MMCF's like viscose

More information on dyeing can be found here.

The Society of Dyers and Colourists can also provide brands, retailers and manufacturers with information and educational courses on reducing the impact of dyeing processes.

Printing

Printing can occur at either the fabric or garment level and uses surprising amounts of water, energy and chemicals. Carbon impacts are linked to the energy needed to run machinery and the high temperatures needed to set prints. Chemical issues can occur in the types of printing inks used and water pollution issues arise if wastewater is not properly treated. To reduce the impacts of printing, look into printing inks that reduce hazardous chemical use and require less energy and water usage. Some low impact printing techniques to consider include:

- Digital printing
- Bio-discharge printing

More information on printing can be found here.

Finishing

Finishing is a series of processing operations applied to textile materials to improve their appearance, handle and/or functional properties. Consider if your product requires any finishes, such as crease resistance, stain resistance, water repellent or anti-pilling, and what the environmental impacts of these are. Consider lower impact and less chemically intensive alternatives, such as:

- PFC-free water repellent treatments
- Enzyme finishes

More information on finishing can be found here.

Laundry/washing

To reduce shrinkage during home laundering, some natural materials need to go through a pre-wash treatment. Some products, particularly casualwear and denim, will also go through a laundering process after the product is constructed to soften the materials and give them a worn aesthetic.

- To reduce the impacts of laundering, consider lower water application processes that use bubbles or sprays to apply softeners rather than a water bath, which minimises the amounts of softener and water used.
- You can also consider waterless processes such as Jeanologia technologies and ozone washing.

Distressing

For products that require distressing, such as denim, consider replacing conventional techniques such as bleaching, stone washing and sandblasting with lower impact techniques, such as:

- Enzyme finishing
- Laser finishing
- Ozone finishing

Low impact processes: examples

Marks & Spencer denim

Marks & Spencer (M&S) denim has style, quality and value – with sustainability built in as standard. The entire range is made using 100% responsibly sourced cotton and 80% less water in the finishing process through its partnership with Jeanologia – a leader in sustainable finishing technologies. M&S also joined The Jeans Redesign project, led by the Ellen MacArthur Foundation, in 2021 to launch its first collection designed into circularity. This is all part of M&S's wider commitment to becoming a net zero scope 3 business across its entire supply chain and products by 2040.

Urban Outfitters × cold pad batch dyeing

Urban Outfitters has started to use techniques such as cold pad batch dyeing, as well as integrating alternative dyestuffs into its production processes as one of many initiatives under its UO Impact programme.

Cold pad batch dyeing is a process where fabrics are dyed at lower temperatures and can be applied to natural fibres. The process uses less energy and water, as well as producing less chemical waste which all helps reduce costs. It also produces materials with excellent colourfastness to increase the durability of products.

Gymshark × dope dyeing

Gymshark launched its Vital Seamless workout collection using dope dyeing technology to dye the nylon yarns used in the product range.

Dope dyeing is a process that can be applied to synthetic materials, where the colouration and spinning of fibres is done in one single step. The dyes are mixed with polymer pellets prior to extrusion, and the extruded fibres come out of the process coloured. This reduces energy and eliminates the need for water.

We aRe SpinDye® produces coloured synthetic fibres using the dope dye method.

Alchemie Technology

Alchemie Technology is a UK innovator of low energy, waterless textile dyeing and finishing technologies. Its 'digital spray' technologies apply just the right amount of dye substance to a fabric to achieve the desired colour, not dissimilar to the workings of an inkjet printer. Alchemie's proprietary jetting technology enables nano-droplets of dye to penetrate deep into fabric fibres. Infra-red energy is used to activate dye fixation, eliminating the water requirement and high energy fabric washing relied on by conventional dyeing.

Alchemie also offers Novara™ – a precision digital finishing technology that applies properties such as anti-odour, anti-bacterial and water repellence to fabrics across outerwear, workwear and sportswear.

Circular Design Principle:

6. Minimise material waste

This principle focuses on what product teams need to consider to optimise the use of materials in the production process – to minimise, and where possible, avoid the creation of material waste.

Material waste is created at every stage of the supply chain, with 17.5% of material loss attributed to the product assembly (Tier 1) phase of production[17]. Surplus products, as well as damaged and/or faulty products, also contribute to the material waste that occurs before a product ever reaches the customer.

Creating waste means we are using materials inefficiently, which is not good for the environment or a business' profits.

Use these design strategies to create products using fewer material inputs (materials, trims, components) to reduce the environmental impacts associated with the inefficient use and overproduction of materials and products.

Commercial considerations

In theory, using this principle to reduce the amount of materials you need in the first place and getting as much value out of them as you can, should bring you and your suppliers cost savings in the long term. However, the supply chain may need to invest in new machinery, innovation and skills which could increase costs initially. Work with your suppliers and merchandisers to manage these costs.

"Creating waste means we are using materials inefficiently, which is not good for the environment or a business' profits."

Design strategies

Zero-waste pattern cutting

This strategy challenges you to create a product that uses 99–100% of the fabric, avoiding material waste altogether. There are two main types of zero-waste patterns: square cut or tailored. Square cut creates products from rectangular or triangular pattern pieces. Tailored uses curved pieces to create a more form-fitting or tailored garment, with the pattern pieces nested into each other[20].

This is a technical process and will require designers to work collaboratively with pattern cutters, garment technologists and your suppliers to develop lay plans and grading ratios that create zero-waste for all sizes.

This strategy can be harder to achieve and will not be suitable for all product categories. Consider using it for cut and sew products, particularly ones which include larger, simple pattern pieces which are draped, gathered or tucked.

Minimise pattern cutting waste

Minimising cutting waste will optimise your use of materials. Work with your pattern cutters and suppliers to create lay plans that utilise materials more efficiently. Aim to create lay plans that use more than 85% of the material.

It is likely your suppliers will be monitoring the efficiency of their lay plans and product ratings already. Ask them to calculate the amount of cutting waste created at the product development phase and how you could improve product ratings.

Consider this strategy for all cut and sew product categories.

Optimise the use of cutting waste

Work with your suppliers to understand the post-industrial cutting waste that has been created by the production of your products to ensure it is kept at its highest value.

Consider if you, or another department, could use these offcuts in a new product to eliminate the need to create new materials – see the 'Remake' principle.

Alternatively, work with your supplier and your sustainability team to see if cutting waste can be sent to a fibre-to-fibre recycler to be recycled back into new textiles. Service providers, such as Reverse Resources and Refashion's Recycle platform, can help connect recyclers with your manufacturers' cutting waste.

Fully fashioned knits

This technique can be used for knitted products, where each pattern piece is knitted into the correct shape which eliminates the need for lay plans and cutting waste.

Consider this strategy for knitwear and jersey.

3D knitting

This technique can be used to create fully fashioned knitted products in one seamless piece, eliminating the need for pattern pieces and cutting waste.

This strategy can be used for knitted products, particularly lingerie and activewear.

3D printing

3D printing can be used to create hard trims and components, eliminating the waste that is created through conventional techniques, such as molding.

Consider sourcing trims and components using this strategy.

Your business could also consider other strategies to reduce material waste, but involve wider teams, including:

- On demand manufacturing
- Virtual garments
- Excess stock control

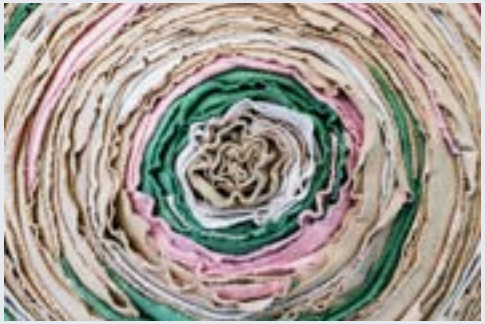
Minimise material waste: examples

ASOS
Zero-waste pattern cutting

ASOS has brought zero-waste pattern cutting to the mass market through its Circular Design Collection. The brand created a smock top and maxi dress both made from 100% recycled polyester from a base pattern of square pieces that gather to create shape. It has also produced a zero-waste pattern cutting satin midi skirt based on a full rectangle and used panels, pleats and a tie-waist feature to create a flowing style.

More detailed examples can be found in the ASOS Circular Design Guidebook.

Reverse Resources
Optimising cutting waste



Reverse Resources is a digital platform that allows fashion brands and manufacturers to connect to waste handlers and recyclers to ensure post industrial textiles are captured and kept at their highest value. The platform digitises data on textile resource flows to enable the entire supply chain to track, trace and make the most out of their textiles to support the scaling up of circular supply chains.

Reverse Resources is a partner in the GFA's Global Fashion Partnership initiative, which aims to support the development of the textile recycling industry in Bangladesh by capturing and directing post-industrial textiles back into the production of new materials for the fashion industry.

Soft Revolt
3D knitted lingerie

Soft Revolt uses SoftTech 3D technology to knit a range of comfortable and breathable patented lingerie. With knitting and assembly all in one location in the EU, it reduces Soft Revolt's waste and carbon footprint. Its ways of working help save up to 90% of carbon emissions per bra compared to traditional production methods.

Alchem Uniqlo
3D knitwear technology

Uniqlo has used 3D knitting technology to produce a range of entirely seamless knitted products, created using one continuous yarn. This technique allows the garments to flow over the lines, curves and shapes of the body with ease, resulting in a beautiful drape and eliminating bulky seams.

In line with Uniqlo's global commitment to minimise waste and reduce excess materials, this 3D knitting technique helps to reduce the carbon footprint of its garments and volume of surplus materials.

Spotlight on

Minimising microfibres

Microfibre shedding, or fibre fragmentation, from clothing and textile products and its potential as a serious polluter in aquatic and atmospheric environments is becoming an increasingly prominent issue for the fashion industry. As well as polluting our ecosystems, microfibre shedding is a form of material loss and contributes to the textile industry's waste footprint. The extent of the impact of microfibres has not yet been quantified, but research has shown that fibre fragmentation can occur throughout all stages of a product's lifecycle during textile manufacturing, garment wearing and washing, and end-of-life disposal, and are dispersed into the water, air and soil[23].

If we are going to create a truly circular system, where no valuable resources are lost, it will be important for the industry to drastically reduce fibre fragementation. The Microfibre Consortium (TMC) is working with the industry towards zero impact from fibre fragementation from textiles to the natural environment by 2030, focusing on eliminating microfibre loss during manufacturing.

Brands, retailers and manufacturers can support the TMC's work to eliminate microfibre release through the Microfibre 2030 Commitment.

Circular Design Principle:

7. Remake

This principle focuses on design strategies you can use to create new products from existing products and components that are either unusable, unwanted or unsaleable in their current form.

Remaking can often be referred to as remanufacturing or upcycling, but essentially, they all mean the same: taking constituent parts of products that already exist to create other product(s) of higher value, quality, or functionality than the original constituent parts.

Whilst the fibre-to-fibre recycling industry is still developing, brands must prioritise using the remake design strategies if the industry is to tackle its increasing post-consumer footprint.

Remaking also has multiple environmental benefits: it reduces the need for virgin raw materials to be created, cuts out the need for recycling which can be energy intensive, as well as diverting textile products away from landfill.

Note that this principle relates to the remaking of existing products, rather than using unused fabric yardage – this is covered in the 'Existing Materials' principle.

Technical considerations

You will need to get creative with this principle, as you will always be working with different products as your starting point. You will need to consider different techniques to create your product, for example, you could disassemble and reconstruct the product in a different way, or combine two or more different products together, or consider overdyeing, overprinting or adding embellishment to update an existing product. The opportunities are endless.

You may also need to work with a specialist supplier or manufacturer to create a remanufactured textiles product range at scale. Work with your sustainability team to find suitable suppliers or to support your existing manufacturers to transition to working with used textiles.

Commercial considerations

You will need to look for new sourcing routes to provide you with products and materials to remanufacture. The process is likely to be more time consuming at first, so make sure you consider lead times when developing these products. There may also be limited availability of the products you need, so take this into consideration when planning your range.

Using the remake design strategies can create a unique product range which can attract a higher selling price.

Design strategies

Post-industrial textiles

Post-industrial by-products, also known as post-production waste, are the material offcuts created during the production process. These can range from tiny fabric cuttings to bigger cut pieces and roll ends.

Work with your suppliers to understand if there are any cut pieces that are big enough and uniform enough to create new products. Or, can you get creative with panelling and patchworking? Can you use post-industrial surplus materials from another product category, for example, could the accessories team create a range of bags from the clothing team's offcuts?

Pre-consumer Surplus and By-Products

Pre-consumer surplus and by-products are products that have been produced, but have never been used or sold, meaning they have never reached the customer. This could be for many reasons, including over ordering or damaged/faulty stock. These products can often be classified as waste by the industry, but we need to see them as valuable resources and materials.

The benefit of working with surplus or by-products is that you are likely to have a large volume of the same item which will allow you to produce a range of identical products. The quality is also likely to be of a higher and more uniform standard as the items will not have been used previously.

To source pre-consumer textiles, firstly work with your suppliers to understand if your own brand has any stock that could be remanufactured. Alternatively, you could collaborate with another brand, retailer or designer to use their pre-consumer textile products.

Note: For this design strategy, brands and retailers should prioritise the use of damaged/faulty products over surplus products. As a first priority, surplus products should be minimised where possible through improved stock management and secondly redistributed or sold through stock exit routes for sale, to allow the products to be used for their original intended purpose first, as this will have the lowest environmental impacts.

Post-consumer textile products

Post-consumer products are items that have reached the customer. Like surplus and by-products, these are often classified as waste once they have been disposed of, but we need to see them as a valuable source of materials. In order to tackle the growing volumes of post-consumer textile waste, brands and retailers need to take this strategy seriously to help the industry reduce its waste footprint.

It may be more challenging to create a consistent product range at scale using post-consumer products, as the consistency and quality of the materials will vary. However, it is not impossible, it just requires a different way of thinking.

You will likely need to work with a reuse and recycling business or a specialist supplier to source suitable post-consumer products, briefing them on the type of products or materials you need as well as the volumes required. Speak to your sustainability team to help you with this.

You could also consider working with your own brand's damaged/faulty returns.

Up to

25%

of production offcuts can be remanufactured into other products[19].

Remake: examples

kapdaa
Remanufacturing post-industrial offcuts

kapdaa works closely with fashion and interior designers, textile manufacturers, fabric weavers and mills to make sure its fabric offcuts are not going to waste by using them to make new products. Some of the upcycled product categories include notebooks, hair accessories, scarves, eye masks, luggage tags, purses, passport holders and coffee cup sleeves. It is working to assist brands to utilise their offcuts in their own product offerings as well as selling directly to consumers.

kapdaa has partnered with 300+ brands like Maison Kitsune, DAKS, Christopher Raeburn and Mary Katrantzou.

Renewal Workshop
Giving pre and post-consumer products new life

The Renewal Workshop takes brand's unsellable apparel and home textile products and refurbishes them to give them a longer life. These items could have manufacturing defects or been damaged during shipping or at retail stores. Products also come from trade-in programmes, customer returns and warranty schemes. Items that come into the system are cleaned using advanced waterless cleaning technology and then professionally repaired and certified as new.

BVH
Remanufacturing post-consumer products

BVH established its component and remanufacturing service in 2018 and are showing the industry that remanufacturing at scale is possible.

BVH has partnered with Urban Outfitters, Converse, Gina Tricot and Selfridges to produce upcycled and innovative product offerings.

BVH has also launched its own apparel brand, Beyond Remade, that focuses on timeless styles and high-quality designs made from 100% remanufactured post-consumer textiles.

E.L.V Denim × Reskinned
Remanufacturing post-consumer denim

E.L.V Denim transforms old, discarded denim into modern and sophisticated jeans. It has partnered with Reskinned to offer a denim takeback programme to ensure it has a continuous supply of denim materials to create its upcycled denim ranges.

Reskinned will accept jeans of any kind, 100% cotton or stretch, and condition making sure nothing ends up in landfill.

The post-consumer denim is washed and sorted before making its way to Blackhorse Lane Atelier, where the new jeans are produced. Any additional hardware and leather patches are also sustainable and sourced locally.

Spotlight on

Minimising waste in the product development process

When we quantify a product's impact (through an LCA), it does not take into account the waste that is created at the design and product development stage. However, this part of the process can be very wasteful and is also an area where you can make a conscious effort to make changes to the way you work to reduce waste.

Sampling at the design phase creates a large number of samples that are often never used due to fit, styling and fabric issues, or maybe they just never make the cut when it comes to sign off.

To cut down on sampling waste and the impacts of transporting samples across the globe to and from your suppliers, consider using 3D design, fit and range building software. Using 3D technologies can also improve time efficiencies and reduce lead times.

3D design and fitting programmes have been advancing rapidly in recent years and the previous issues with replicating real textiles have greatly improved. Your business should consider:

- **3D design software** – by using 3D design software you can decrease the impacts and costs of physical sampling.
- **3D fit software** – 3D technologies can also be used to fit garments without the need for physical samples.
- **Digital range build and showrooms** – consider range building virtually by using 3D programmes to avoid sampling the same product in multiple prints and colourways for sign offs.

If your business does not already use 3D design programmes, speak to your senior management about trialing this and upskilling the team.

Suppliers are also increasingly using 3D design programmes, speak to your suppliers to see who is already using 3D software.

Transitioning to 3D design software will also help brands to more easily transition to opportunities in the digital fashion space as this sector continues to grow.

3D software providers include: Clo3D, Gerber AccuMark 3D, Browzwear and Swatchbook.

Spotlight on

Supply chain emissions, water and chemical management

To minimise the pollution caused by the production of textile products, brands and retailers should be working with their suppliers to ensure they have processes in place to manage energy efficiency, prevent hazardous discharge into waterways, use less water and use safe chemicals.

These are issues you should be aware of when you are working with your suppliers, but they are not part of the circular design principles, as they relate to your supplier's facilities, rather than the product and production processes themselves.

If you want to understand what your business is doing to support these issues, or you have any concerns about your supply base, talk to your sourcing, sustainability and technical teams. They should be working with your supply base to make improvements in these areas.

The below is a quick guide of issues to look out for and be aware of:

Energy efficiency

Decarbonising the textile supply chain will be crucial if the industry is to reduce GHG emissions by 50% by 2030. Brands and retailers must work with their suppliers to reduce their energy consumption, through specifying improved, lower impact processes and supporting manufacturers to move to renewable energy sources. Suppliers can monitor, track and report their facility's energy use and GHG emissions through the Higg FEM.

Water management

To eliminate chemical discharge into waterways around production facilities, brands and retailers should support and work with suppliers to monitor and manage the wastewater created by their facilities, ensuring water treatment processes are in place. Suppliers should be able to provide evidence that they are working towards this by meeting ZDHC Wastewater Guidelines, participating in the Clean by Design (CBD) initiative, through the Higg FEM or other third-party audits.

Water management is particularly important in Tier 2 suppliers, which is where wet processing happens. Ensure you have visibility of these suppliers and knowledge of the processes they have in place.

Safe chemical inputs and management

Brands and retailers should aim to eliminate hazardous chemicals used in fibre production and processing, and increase the use of safer chemicals[21]. Retailers should have chemical compliance requirements, restricted substance lists (RSL) and manufacturing restricted substance lists (MRSL) in place for suppliers to adhere to, to ensure safe chemical management. Certifications such as Oeko-Tex®, bluesign® and GOTS can also be used to ensure safe chemical management.

In use

Circular Design Pillar:

Design for longevity

Circular Design Principles:

8 Design for durability

9 Design for versatility

Why is this important?

Extending the active life of 50% of UK clothing by nine months would reduce carbon, water and waste footprints by 4-10%[22] and is the most effective intervention that can be made to reduce the environmental impact of textiles – slowing down the need to produce and consume new products, decoupling growth from the use of virgin raw materials.

Around 25% of clothing's carbon impact happens once an item is in use, from high washing temperatures and tumble drying[23]. Home laundries can also impact on a product's longevity, so creating low maintenance products will also help reduce the environmental footprint of the 'in use' phase of a product's lifecycle.

How to take action

This Circular Design Pillar focuses on how we can design products that will last longer and be used more.

Designing for longevity also opens up opportunities for businesses to create profits from circular business models (CBMs) such as repair, resale, rental and subscription. A durable product can be used to gain additional revenue throughout the 'in use' phase, cutting down production volumes of new products and the environmental impacts associated with them.

For your customers, the longevity of a product is measured by how long the product provides a useful service for them. Expectations will vary depending on factors such as, your customer, the purpose of the item, the cost of the item, the perceived quality of the item, its physical durability, and the emotional attachment the customer has with the item.

When designing for longevity, there may be trade-offs to consider with the 'optimising resources' and 'design for recovery' pillars.

Worldwide, clothing utilisation – the average number of times a garment is worn before it ceases to be used – has decreased by

36%

compared to 15 years ago[3].

Who needs to be involved?

- Designers
- Garment Technologist
- Fabric Technologist
- Suppliers
- Sustainability Team
- Testing houses

Circular Design Principle:

8. Design for durability

This principle focuses on strategies that will keep a product in continual use for longer. This will depend on the durability of the product, how easy it is for your customers to care for and maintain the product, and finally, making sure the product can be repaired when its physical durability fails.

Durability can be looked at in two ways: the physical properties of the product and the emotional attachment a customer has with the product. Both will affect how long a product is kept in use by the original customer, or by multiple users through a circular business model.

As trends and tastes change, it is a good idea to consider physical and emotional durability alongside each other to ensure a product that lasts longer also has long term appeal. WRAP's research has shown that more people stop using an item for reasons linked to their emotional attachment to the product[24].

For many of the design strategies under this principle, it will be key to work closely with your garment technologists and suppliers.

Commercial considerations

Some of the measures you can take to increase the durability of your products may incur an increased cost, such as increasing fabric weights. But other techniques, such as changing a seam construction, may not. Work with your suppliers and garment technologists to understand the cost implications related to increasing the durability of your products.

Designing for, and investing in, durability will increase the quality of your products which, as well as safeguarding against product failure, can also strengthen your brand reputation and cement customer satisfaction and loyalty.

Certifications and traceability

Currently there is no industry minimum standard for durability, however WRAP's Clothing Longevity Protocol can be referenced as a framework for industry best practice to increase the physical durability of textile products.

> "Work with your suppliers and garment tech to understand the cost implications related to increasing the durability of your products."

Design strategies

Physical durability

Physical durability relates to the technical properties of a product which will allow it to be physically used more by resisting wear, tear and damage.

When designing for physical durability, consider the durability of the materials and components, and the construction and fit of the product.

Also consider the testing protocols (for example, wash testing and wearer trials) that will ensure your products meet a high standard of durability.

For more detail on physical durability go to 'Closer Look: physical durability'.

Emotional durability

Emotional durability relates to the relevance and desirability of the product to the customer over time.

You should consider design strategies that will increase a customer's emotional attachment to that product, this could be through making it feel unique, special, or individual to them, or by creating effortless and timeless designs that do not lose their appeal as tastes and trends change.

Emotional durability can be subjective, and it is hard to measure its success, however, it cannot be overlooked as it will play an important role in extending the lifetime of clothing.

For more detail on emotional durability go to 'Closer Look: Emotional Durability'

Design for easy care

As well as having a significant carbon footprint, washing our clothes too often or incorrectly can shorten their expected lifetime due to issues such as, an item shrinking or losing its shape, colours fading or fabrics pilling. WRAP's research has shown that a significant proportion of UK citizens wash all items after a single wear[26].

Designing products for easy care, by using finishes that reduce shrinkage and pilling during home laundries (e.g. wool and jersey garments) and making sure the dyes used do not run or fade, will help to extend the life of clothes.

Finishes are another important element that can help the customer cut down the need to wash and iron products as often, for example, finishes to reduce creasing (e.g. shirting) and stain resistance.

Brands and retailers should also consider how they communicate care guidelines to their customers to support them to reduce the impact of their laundry habits as well as making their clothes last longer.

Design for repair

You should consider if any components or areas of a product may need to be replaced, repaired or reinforced before the product fails as a whole. By using this foresight and designing for repair, it will help the customer get increased use out of the product and ensure it is not disposed of early.

Choose materials that are easy to repair and reinforce, and think about designing products so that components and parts can be easily detached and replaced, such as zips, pockets and elbow patches.

The design for repair strategy is also supported by the disassembly and modularity design strategies. These techniques can be used to allow cosmetic changes to be made to a product to update its appearance, as trends and the customer's tastes change over time.

Closer look

Physical durability

WRAP's Clothing Longevity Protocol can be used as a best practice framework for brands and retailers to increase the physical durability of their product ranges.

Think about building the below into your design process and product specifications to increase the quality and physical durability of your products:

Material durability

Using materials that are physically durable, that can withstand wear and tear and can be repaired easily, is the first step to creating a product that can be used for longer.

Quality frameworks ensure materials meet minimum technical standards for tests relating to dimensional stability, wear through and colourfastness. These will vary based on the fibre type, yarn type, fabric structure, fabric weight and any treatments or finishes that have been applied. When sourcing materials, make sure they meet your companies' quality frameworks before sampling.

If your company does not have a quality framework, speak to your technical team and make use of WRAP's Longevity Protocol as a starting point to create minimum technical standards for materials.

Consider using materials that use longer fibres and high yarn twists to improve durability.

Sometimes it may be necessary to use a fibre blend to improve a product's durability and allow it to meet its intended function. However, this could hinder the recyclability of the product. You can find out more about material recyclability here.

Adding finishes such as bio-polishing to materials can also reduce abrasion resistance and pilling. However, thought needs to be given to the finishes being added to fabrics as this could increase the overall impact of the materials and also hinder recycling.

Colourfastness

Dye selection and dyeing methods all have a huge impact on colourfastness and colour fading. Work with your technical team and suppliers to understand the best colouration techniques and dyes for your product and the materials you are using.

Component durability

Ensure components and trims such as zips, buttons and garment linings are durable and securely attached to the product so that it decreases the risk of component failure.

Fit and construction

Consider garment construction techniques closely to ensure your product is both physically durable, comfortable to wear (no tension points) and aesthetically correct.

Think about enhancing the durability of areas liable to failure such as seams, necklines, hems and stress points like elbows and pockets.

The use of reinforcement stitches and bar tacks at stress points is recommended.

Also think about which stitch density is most appropriate for seams and hems based on the materials you are using. High density stitches should preferably be used in heavier, tightly woven fabrics.

Wash test requirements

Products should be able to stand a minimum of 30 home laundries with little change to their appearance based on core performance tests.[25]

This should be increased for different product categories, based on the hours of wear and number of washes expected to meet their target lifetime. WRAP's Clothing Longevity Protocol can be used as a framework and suggests T-shirts and shirts should be tested beyond 30 washes.

Wearer trials

Wearer trials test your product under real life conditions and can provide customer feedback. Currently, standard industry practice requires wearer trials to be carried out for 50 hours[27].

Closer look

Emotional durability

Think about the below when considering how to design emotional durability into your product ranges:

Trendless design

Create timeless designs that use quality materials, simple silhouettes, colours and prints that will not go out of fashion quickly, to keep your customers looking effortlessly stylish for many years and across multiple seasons.

When creating next season's ranges, can you consider building on last season's trends and colour palettes to allow items to stay relevant, extend their trend lifecycle and allow the products to stay desirable to the customer for longer?

Quality and craftsmanship

Creating products with high quality materials or high levels of craftsmanship, such as artisanal fabrics, embroideries, embellishment, dyeing and printing techniques, interesting construction techniques or well-tailored items, can make a product feel extra special and increase its perceived value to the customer, which can help to build the emotional bond they have with the item.

Customised and co-created

Creating customised products by involving the customer in the design process or offering them the opportunity to customise the product themselves can allow customers to create a product that is unique to them. This can build their engagement with the item and create a stronger emotional attachment.

Exclusivity/limited editions

Exclusive collections and limited production runs can increase the desirability of a product and the customer's emotional attachment, making them want to keep it and wear it for longer as well as increasing the potential for resale. However, brands need to be careful that they do not use this technique to drive the consumption of fast fashion items.

Comfort

An item 'no longer being a good or comfortable fit' is one of the top three reasons for a customer to stop wearing an item of clothing[26].

Carefully consider the materials and silhouettes that will keep your customers feeling comfortable and unrestricted, eliminating any potential tension points. This will change depending on the product's purpose, whether that is feeling comfortable in a tailored suit all day at work, keeping them cool during exercise or feeling relaxed at home.

Design for durability: examples

F&F
Improving colourfastness of black denim jeans

F&F worked with its supply chain to improve durability and quality across its product range. From engaging with customers and colleagues, F&F saw that there was a need to make its black jeans retain their colour for longer. To resolve this issue, it worked with its suppliers Kipas and Huntsman. Using Huntsman's special black dye, F&F were able to develop a fabric that stays black even after 20 home laundry washes. Importantly for customers, the original price point for the jeans has been retained, and wearer trials showed that the fabric performed exceptionally well. Not only that, but all F&F's jeans are now made with 100% organic or more sustainably farmed cotton.

ASOS × Hemseal

ASOS identified an opportunity to increase the product durability of blind felled hems on tailored trousers (i.e. falling after washing or wearing). WRAP worked with ASOS to trial a bonding seal on both menswear and womenswear tailored trousers. Coats, a thread manufacturer, was identified to work on this pilot. Coats produces a fusible low-melt thread that creates a reliable, secure hem called Hemseal. Durability trials indicated that the Coats Hemseal bonded hems construction performed well on lightweight garments. A key insight is to use the correct amount of Coats Hemseal thread, and to bond it at the correct temperature to ensure that the application does not feel scratchy or heavy.

New Look
Improving component durability

Regular analysis of its returns data enabled New Look to identify a button attachment issue on its womenswear stretch jeans.

WRAP worked with New Look to review the testing process of womenswear stretch jeans to help improve their performance and extend the life of the product. By reviewing the faulty products along with the testing data, New Look was able to standardise the shank button attachment's testing process and help reduce the risk of failures. This process allowed New Look to also implement a simple fabric specification document to identify future causes of product failure.

COS
Optimising care instructions for customers

WRAP worked with COS to run extended wash test trials on four different menswear merino wool jumpers to optimise care instructions and maximise the garment's life. Some of the parameters of assessments were pilling, shrinkage and colourfastness. The trial helped COS test the quality and performance of the product over time and verify the care instructions. COS also realised the importance of consumer engagement through this pilot.

Design for durability: examples

Tom Cridland
30 year guarantee

Designer Tom Cridland is known for making garments with a 30-year guarantee. Staple unisex pieces are made from loopback polycotton (ring spun to prevent pilling), with reinforced seams and an anti-shrinkage silicone treatment. The brand also has a clothing maintenance programme which allows the customer to send the garment back for repair free-of-charge for three decades, encouraging the consumer to buy less but buy good quality.

ASKET
Designed for longevity

ASKET has created an affordable range of T-shirts from long and extra-long combed cotton, based on 15 different body types. The range is kept affordable by cutting out agents, higher-end retail spaces and marketing. The garment is 20–30% heavier than a market equivalent with a focus on durability. ASKET wishes to encourage customers to repair their garments independently – to facilitate that the brand hosts three garment care guides on its website: repair care, general garment care and stain care.

Patagonia
Designed for repair

To extend the life of its products, Patagonia offers its customers a repair service. It also empowers individuals to repair their Patagonia items themselves, by providing a series of repair guides and videos on its website, as well as a service that lets customers request spare trims and parts.

Unmade × Opening Ceremony
Customisable designs

Unmade offers software to brands that enables their customers to design their own products, creating a unique brand and customer experience with interactive design and customisation tools, which can increase the emotional durability of the products.

Unmade collaborated with Opening Ceremony to create a customisable capsule collection, which was sold exclusively via e-commerce platform, Farfetch.

Unmade also offers an on-demand apparel design and manufacturing software.

Circular Design Principle:

9. Design for versatility

This principle focuses on design strategies that increase the versatility of a product so it can be used more and remain suitable for the customer for longer.

After all, there is no point creating a durable product if most of the time it is sitting in someone's wardrobe unworn.

WRAP's research into clothing longevity has shown that the three main reasons for people not wearing clothes that are currently in their wardrobes are[26]:

- 'The item is for occasions only'.
- 'The item is no longer a good/ comfortable fit'.
- 'I like the item, but it is not a priority'.

These reasons all relate to the items no longer being suitable for the customer, rather than their durability failing.

Product teams need to consider how the design of a product can allow the customer to transform it, so it can be used for different occasions and functions or by multiple users, it can be updated as trends and tastes evolve, or it can be adapted as body shapes change.

> "Product teams need to consider how the design of a product can allow the customer to transform it."

Design strategies

Modularity

Create a product so that parts (or modules) of it can be independently replaced, making it easy to upgrade or update as the customer's needs or tastes change. This could also allow individual sections of the product to be used independently.

This strategy can also support the repair, remanufacture and recycling of textile products.

> "Consider if you can create inclusive products that have the potential to be worn by all genders."

Multi-functionality

Create a product that can be adapted to allow it to be worn or styled in multiple ways, for different occasions or functions. This could be a dress that can be draped or tied in different ways to allow the customer to create different looks for different occasions. You could also combine several styles into one by using detachable layers or making it reversible, such as a jacket that could be worn for different weather conditions throughout the year.

The adaptability must be a feature of the physical design of the product, rather than how it can be styled with different accessories.

Adjustability

Customers do not come in standard sizes or have the same preferences in terms of comfort and fit. One way to embrace these differences is to offer built-in size adjustments or alterations. This might involve generous seams or the use of strategic fastenings, such as ties or buttons, elastic and drawstring details to allow garments to be adjusted easily, or a fabric that can adjust to multiple sizes. These strategies can also allow the customer to adjust an item easily as their body shape changes over time.

Gender fluid

Consider if you can create inclusive products that have the potential to be worn by all genders. Make sure you are intentionally designing the product to fit and be comfortable for all body types.

Design for durability: examples

Vetta
Modular and multi-functional capsule collections

Vetta creates five-piece capsule collections made up of multi-functional and modular/ convertible pieces that can be mixed and matched to create 30 different outfits. Customers have the option of buying the entire capsule or shopping individual pieces.

Convertible pieces include dresses that can also be worn as a separate top or skirt, as well as jackets with removable sleeves.

Marks & Spencer
Multi-functional outerwear for all seasons

The M&S 3 in 1 hooded parka has a multifunctional design, allowing it to be styled differently and used throughout the seasons. It is comprised of two layers, a water-repellent Stormwear™ shell and a padded jacket beneath which can be worn together or separately. The hood is also detachable allowing the customer to create different looks for different weather conditions.

Hunza G
One size fits all swimsuits

Hunza G is a London-based brand which uses its signature crinkle fabric to create one size fits all products. The stretch fabric allows its styles to adjust to fit all body shapes and sizes, as well as giving products longevity, as they do not need to be replaced as body shapes change over time. Producing one size only also reduces the risk of over-purchasing sizing on a commercial level.

Beyond Nine
Adaptable designs for all stages of womanhood

Beyond Nine spotted a gap in the market for quality, stylish and responsible maternity wear, that could be worn by women through all stages of womanhood. Its contemporary and relaxed styles prioritise comfort and are designed to adjust and adapt to accommodate the changes women's bodies go through during pregnancy and beyond.

After use

Circular Design Pillar:

Design for recovery

Circular Design Strategies:

10 Design for recyclability

11 Design for disassembly

Why is this important?

In the UK alone, over 1.5 million tonnes of clothing and textiles are disposed of annually, with 920,000 tonnes ending up in landfill and incineration.[26] It is also estimated that globally, only 1% of clothing is recycled back into textiles for clothing.[3]

Textile products ending up in landfill is not just bad for the environment, it is also bad for the economy as we are losing resources that could be kept at a higher value through either reuse or recycling.

How to take action

This Circular Design Pillar focuses on designing with consideration to what will happen to a product at the end of its useful life. It uses design principles that allow us to recover the materials and components from a product so that they can be remade into new products through remanufacturing or recycled and diverted from landfill.

Designing products so that the materials they are made from can be recovered for recycling is key to this pillar – to provide feedstocks for the fibre-to-fibre recycling sector to allow it to supply the fashion and textile industry with the volume of recycled fibres needed to reduce its dependence on virgin materials. Designing for recyclability is also vital to support the 'recycled materials' principle under the 'reduce material impacts' pillar.

Designing for recovery, should also be used to increase opportunities to scale up circular business models, such as remanufacture and recyling, by purposely designing products to ensure the materials can be recovered and remade into new products once they have come to the end of their useable life.

When considering this pillar, we must understand that we cannot recycle our way out of the problems that are caused by overconsumption and the decreased utilisation of clothing and textile products. This pillar needs to be considered alongside the other three Circular Design Pillars to address circularity in its truest form.

Who needs to be involved?

- Designers
- Garment Technologists
- Fabric Technologists
- Sustainability Team
- Suppliers

Circular Design Principle:

10. Design for recyclability

This principle focuses on how we can design fashion and textile products so they can be recycled back into textiles when they can no longer be used for their original purpose, diverting them from landfill.

If we want to hit our climate targets and create a circular economy for the textile industry, we need this principle to focus on how we design for closed loop mechanical and chemical fibre-to-fibre recycling technologies, which we discussed back in the 'reduce material impacts' pillar.

Technical considerations

The ability to recycle a product through fibre-to-fibre recycling technologies will depend on the fibre composition, dyeing and finishing processes used, the trims and components and the construction of the product. To ensure the products that we create today can be recycled when they come to the end of their usable life, product development teams will need to have an understanding of what can be recycled by current and emerging recycling technologies, as different technologies have different specifications for the materials they can process.

To help you decide what recycling technologies will be most suitable for your products, consider the product's purpose and trend lifecycle:

New recycling technologies are constantly evolving and as technologies develop, recyclers' specifications will change so it is always worth talking to your sustainability team for help to understand this. As a rule of thumb, the purer the fibre content and the simpler the product, the more likely it is to be recyclable. An overview of different recycling technologies can be found here.

Current recyclability

For now, designing for current recycling technologies means sticking to mono-materials. You should consider what products in your range can easily be converted to mono-materials. If the lifecycle of your product is expected to be short (under four years), you will need to make extra effort to ensure you design these based on current recycling technology parameters.

Emerging recyclability

If your product has been designed for longevity and is expected to have a longer lifetime (over four years), you can begin to consider emerging recycling technologies that may accept more complex products and certain blended materials such as polycotton.

Use this table as a quick reference to understand what materials can be recycled by current and emerging fibre-to-fibre recycling technologies:

Fibre type	Fibre mix	Mechanical	Dissolution	Chemical
Cotton	100% cotton	♻	♻	-
	98% cotton/2% other	♻	♻	-
	95% cotton/5% other	♻	♻	-
	85% cotton/10% MMCF/5% other	♻	♻	-
	80% cotton 20% other	-	◷	-
	60% cotton/40% polyester	-	◷	-
	60% cotton/40% other	-	-	-
Polyester	100% polyester	♻	◷	◷
	98% polyester/2% other	◷	◷	◷
	95% polyester 5% other	-	◷	◷
	70% polyester 30% other	-	◷	◷
	60% polyester/40% cotton	-	◷	◷
	60% polyester/40% other	-	◷	◷
Nylon	100% nylon	♻	-	-
MMCF	100% MMCF	-	◷	-
	50% MMCF 50% polyester	-	◷	-
	50% MMCF 50% Cotton	-	◷	-
Wool	100% wool	♻	-	-
	95% Wool 5% other	♻	-	-
	85% wool/15% other	◷	-	-

Key

♻ Current recyclability

◷ Emerging recyclability

Design strategies

When designing for recyclability, you must consider the product and all its elements. Use the strategies below to consider your design decisions and ensure your product is free from disruptors, so it will have the best chance of being recycled.

Disruptors are elements which can hinder the recycling process (e.g. fastenings, buttons, zips, fabric patches etc). By minimising disruptors, you can reduce cost, time and waste at the manufacture, pre-processing and recycling stages.

Eliminate

Some elements cannot be recycled and must be eliminated if the product is to be recycled at end of life using current technologies. This could include non-recyclable materials that are woven into the main fabric of a product, for example a metallic thread which cannot be disassembled, rendering the product unrecyclable.

Reduce

Some elements may be able to go through the recycling process but must be minimised to meet the recyclers parameters, for example elastane.

Substitute

Where some elements cannot go through the recycling process, look to see if you can substitute them for something that can. For example, change a nylon button to polyester button on a polyester product.

You will also need to consider if any dyes, prints or finishes need to be substituted.

Disassembly

If you cannot design your product to fit with recyclers requirements, you will need to consider if the 'Design for disassembly' principle can be applied to your product.

Certifications and traceability

There are currently no recognised industry standards to verify that a textile product is recyclable. However, to ensure products that have been designed for recyclability will reach the correct recycling technology at the end of their usable life, traceability and complete transparency of what the product is made from will be vital. Putting the wrong material through the wrong recycling technology could be a costly mistake!

To allow the fibre-to-fibre recycling of post-consumer textile products to be a reality, brands and retailers must ensure all product information is provided and easily accessible to the reuse and recycling sector. This should include:

A detailed Bill of Materials (BOM) – fibre and component compositions must be accurate so recyclers can be sure the products meet their feedstock specifications. Providing product and component weights will also help recyclers calculate fibre percentages accurately.

Accurate care labels – Care labels can often be inaccurate. It will be crucial that retailers ensure fibre content is accurate on care labels and that all materials and components are listed.

Digital product passports – Care labels do not include information on all the components of a product and can often be removed by customers. Digital product passports are an innovative solution to track products through their entire lifecycles, from the materials, processes and components that went into making them, to the disposal of the product. This will help to create the transparency and efficiency that the reuse and recycling sector need to scale up fibre-to-fibre recycling. Product passports can also be used to provide transparency, product care and disposal information for the customer.

Product passports can come in a variety of forms, from QR codes to blockchain. The Circular Textile Foundation's Infinitee Mark, Circular Product Data Protocol and Circularity.ID® can all be used to help identify recyclable products using a digital product passport. Speak to your sustainability teams to see how you could incorporate product passports into your design and buying process, and how to get your suppliers on board.

Use this matrix to understand potential disruptors to the recycling technology you are designing for:

	Mechanical recycling	**Dissolution and Chemical recycling**
Mono-fibre	Yes	Yes , with up to 5% allowance for other fibres
Blends	No	Yes – mainly poly cotton blends. Generally, compositions must be at least 60% of one fibre, e.g. 60% polyester/ 40% cotton or 60% cotton/40% polyester[27].
Elastane	Up to 5% of garment weight for cotton and wool, however this must be included in overall allowance for 'other' materials. 0% for polyester	Up to 5% of garment weight, however this must be included in overall allowance for 'other' materials.
Colours	Dyes are not removed in the process. Feedstock will be sorted and recycled by colour so there is no need to consider colour.	Dyes can be filtered out so there is no need to consider colours, however you may need to consider the dyes that are used.
Plain white	Yes	Yes
Dyes	Feedstock will be sorted and recycled by colour, so dye types will not affect the recycling process. Dyes are not removed.	Vat or reactive dyes can be challenging to remove[34] for some technologies.
Prints/finishes	As feedstock is recycled by colour, prints can affect the colour of the output, so are less advisable. However, the output yarns can be bleached or overdyed if necessary. In general, water based prints are preferred. Coated or laminated prints and finishes are not suitable for this technology.	Can tolerate 'light' contamination of prints and certain finishes[2] depending on technology. In general, water based prints are preferred.
Threads	Where possible, threads should be the same fibre as the product. Generally, sewing threads are polyester due to their durable quality. If your product is a different fibre, this can be included in the 2% allowance. Metallised and lurex threads are not suitable for this technology.	Threads should be in the same mono-fibre as the product. If they are a different fibre, they can be included in the 2% allowance. Metallised and lurex threads are not suitable for this technology
Trims (including tapes, bindings, interfacings etc.)	Keep trims to a minimum, and match to main fibre where possible. Some thermo-mechanical technologies may be able to handle mono-fibre trims only.	Keep trims to a minimum, and match to main fibre where possible.
Care labels	Try to include mono-material care labels or use a printing technique on the garment so there is no need for a label. If you cannot use a mono-material care label, it must be included in the 2% allowance.	Try to include mono-material care labels or a printing technique on the garment so there is no need for a label.

Design for recyclability: examples

BAM Clothing × Project Plan B

Photo credit BAM Clothing

BAM Clothing have designed and created a high-performance jacket that can be recycled through Project Plan B's mechanical recycling technology.

To allow the jacket to be recyclable it had to be made from a mono-material. BAM also wanted to use a recycled material, so finding a material that was made from recycled content, that could also be recycled, and that would work for the fabric, zips, trims and threads was a challenge. BAM used a high quality recycled polyester for its jacket and had to source polyester zips, Velcro and lightweight insulation. The jacket also has a water repellent, PFC-free, Teflon EcoElite™ coating.

Teemill
Remill

Photo by Remill

Teemill has created a range of organic cotton T-shirts that are designed to be returned to it when they are worn out so the materials can be recycled and spun into new organic yarns to make brand new products. It calls this process Remill and provides customers with freepost returns.

Teemill also lets you customise your own T-shirts which are printed on demand, which helps to reduce waste created from overproduction.

Napapijri
Circular Series

All styles in Napapijri Circular Series have been designed completely from mono-material, to be 100% recyclable. The fillings and trims are made of Nylon 6, while the fabric is made of Econyl ®.

Econyl® is regenerative nylon, which is a recycled yarn made from discarded fishing nets and other waste materials which can be recycled indefinitely.

Napapijri has also developed a unique digital take-back scheme which encourages the customer to register their garments through a unique identifier with the option of returning the garment after two years of purchase.

Ellen MacArthur Foundation
Jeans Redesign

The Ellen MacArthur Foundation's (EMF) Jeans Redesign project is on a mission to create a circular economy for denim. EMF has set guidelines that brands can follow to create jeans that will stand the test of time, can be recycled easily, and are made to have less impact on the environment. The guidelines state that jeans must include a minimum of 98% cellulose-based fibres, ensure any components added are easily disassembled and ensure the jeans can be easily identified as recyclable by used textile collectors and sorters.

Many Textiles 2030 signatories have already participated in this project to create recyclable jeans, including Primark, M&S, ASOS, BAM Clothing, George (ASDA) and Urban Outfitters.

Circular Design Principle:

11. Design for disassembly

This principle focuses on design strategies you can use if you cannot design an entire product to meet the criteria for a current or future recycling technology.

Designing for disassembly will enable sections of a product to be easily taken apart and recycled separately. This principle is also really important to support the repair and remanufacture design strategies, and will be crucial if we are to keep materials at their highest value and out of landfill whilst many recycling technologies are still in their infancy.

Commercial considerations

Currently there are not many technologies that can disassemble garments quickly at a commercial scale, meaning disassembly can be a time consuming and expensive process. Creating simpler products, that minimise the number of trims and components, will make disassembly more viable.

Design strategies

Minimise inputs

Currently, the more complex a product is, the less likely it is to be recycled. Keep this in mind when 'designing for recovery' and try to reduce the complexity of your product by prioritising simple designs that use minimal inputs.

Even colour blocking materials together that are made from the same mono-material can be problematic for some mechanical recycling technologies which often recycle by colour.

Where possible, it is also best to avoid the use of trims and components altogether if you can. Think about where you can replace a trim with an alternative construction technique, for example replacing rivets on denim with bar tacks.

Detachability

When creating a product with detachable components, you should make sure that they are all individually recyclable.

If your product is more complex, designing a product with detachable materials and components can, in theory, allow you to use different materials within the product which can be separated from each other to allow them to be recycled through different technologies.

Use construction techniques that will allow materials to be separated from each other easily, for example, polyester lining from a wool blazer. This is an area that needs further exploration, and you may need to work closely with your garment technologist and suppliers.

You could consider using this technique to replace the use of fusible interlinings as some types of glue makes the product hard to disassemble and often unrecyclable.

Using detachable trims can optimise the amount of material that can be recycled, as material is often lost when trims and seams need to be cut off. You could think about working with your supplier to develop trims that can be screwed on and off.

To make detachability a commercially feasible strategy, materials and trims need to be removable quickly.

> When creating a product with detachable components, you should make sure that they are all individually recyclable.

Design for disassembly: examples

Bershka × Resortecs®

Bershka and Resortecs® have launched a collection of jeans designed to be easily disassembled for recycling.

Resortecs® has an innovative microwavable thread that can be dissolved by heat, making the removal of buttons and trimmings easier. Bershka is exploring the full recyclability potential of the garment by making the product easy to recycle, disassemble and providing a take-back scheme for its customers in addition to the Resortecs® yarns.

Unspun – detachable trims

Unspun's Genesis circular denim collection follows the EMF Jeans Redesign guidelines – the collection features removable buttons and heat labile sewing threads making it easy to disassemble for recycling. Each product can be tracked and verified for resale and recycling via a simple QR code unique to each garment. Other features of the collection include personalisation and on-demand manufacturing which helped reduce overall waste.

Fibre-to-fibre recycling technologies

This section will give you a quick introduction into the different types of fibre-to-fibre recycling processes, to support you to design for recyclability and understand the processes recycled fibres have been through when sourcing recycled content for your products.

Mechanical recycling

Process overview

Mechanical recycling technologies recycle materials by physically breaking them down without the use of chemicals to be spun into new yarns. There are two main technologies for mechanical recycling:

- **Mechanical fibre recycling**

  This uses a shredding process to break down materials into fibres, which are spun into new yarns.

- **Thermo-mechanical recycling**

  Synthetic materials are shredded into small pieces and heat is used to melt the pieces down into polymers. They then go through extrusion, vaporisation, filtration and pelletisation to create pellets. These pellets are then melted and extruded into a new filament fibre.

Material inputs

This process can be used to recycle a wide variety of fibres, including cotton, polyester, nylon and wool. Materials should be sorted by colour.

Output quality

The output fibres often need to be blended with a percentage of virgin fibre (or rPET from bottle chip) to create a material that meets the durability standards expected of their virgin equivalents.

However, as recycling and spinning technologies advance, the quality of these fibres are constantly improving.

Environmental footprint

This process is relatively low energy and requires no chemicals.

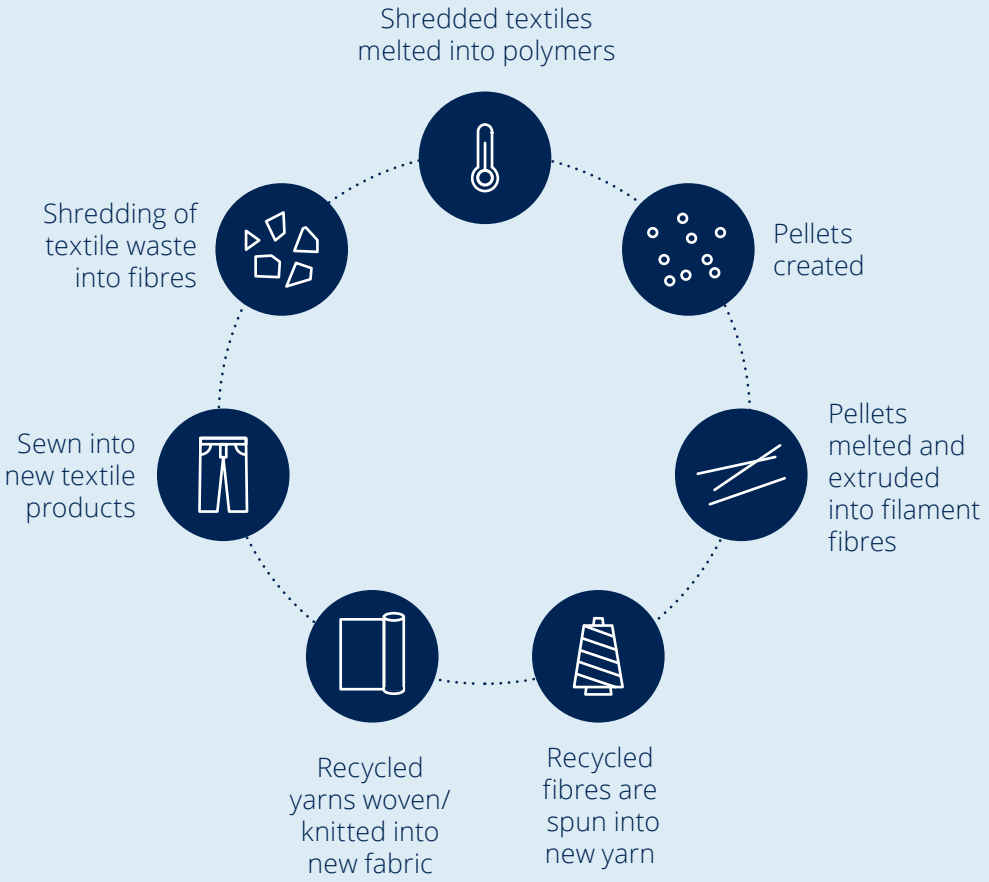
Availability

Mechanical recycling is a well-established market.

Mechanical recycling technologies

Mechanical fibre recycling

Thermo-mechanical recycling



Dissolution and Chemical recycling

Process overview

Current dissolution and chemical recycling technologies both recycle materials using processes that break down fibres into polymers or monomers using solvents, chemicals or enzymes, which can then be extracted into new fibres.

- **Dissolution recycling:**

  Textiles are shredded and dissolved using solvents. The desired fibre polymers are physically separated from contaminants, resulting in 'virgin like' purified polymers that can be re-spun into fibre.

- **Chemical recycling:**

  In this process, chemicals are used to break the textiles polymer chains down into their monomers. These are purified and then repolymerised into a new virgin like material that can be spun into fibre.

- **Enzyme recycling:**

  In this process, biological enzymes are used to catalyse the breaking down of the polymer chains into their monomers. These can be recovered and re-polymerised, and used in place of virgin polymers.

Material inputs

These technologies can recycle cottons, cellulosics fibres and synthetics. Some of these recycling technologies can also recycle blended fibres.

Output quality

The output fibres are the same quality as virgin fibres, so there is no need to blend with virgin fibres. These recycling methods can also remove dyes and other contaminants from the fibres to create un-dyed, griege outputs.

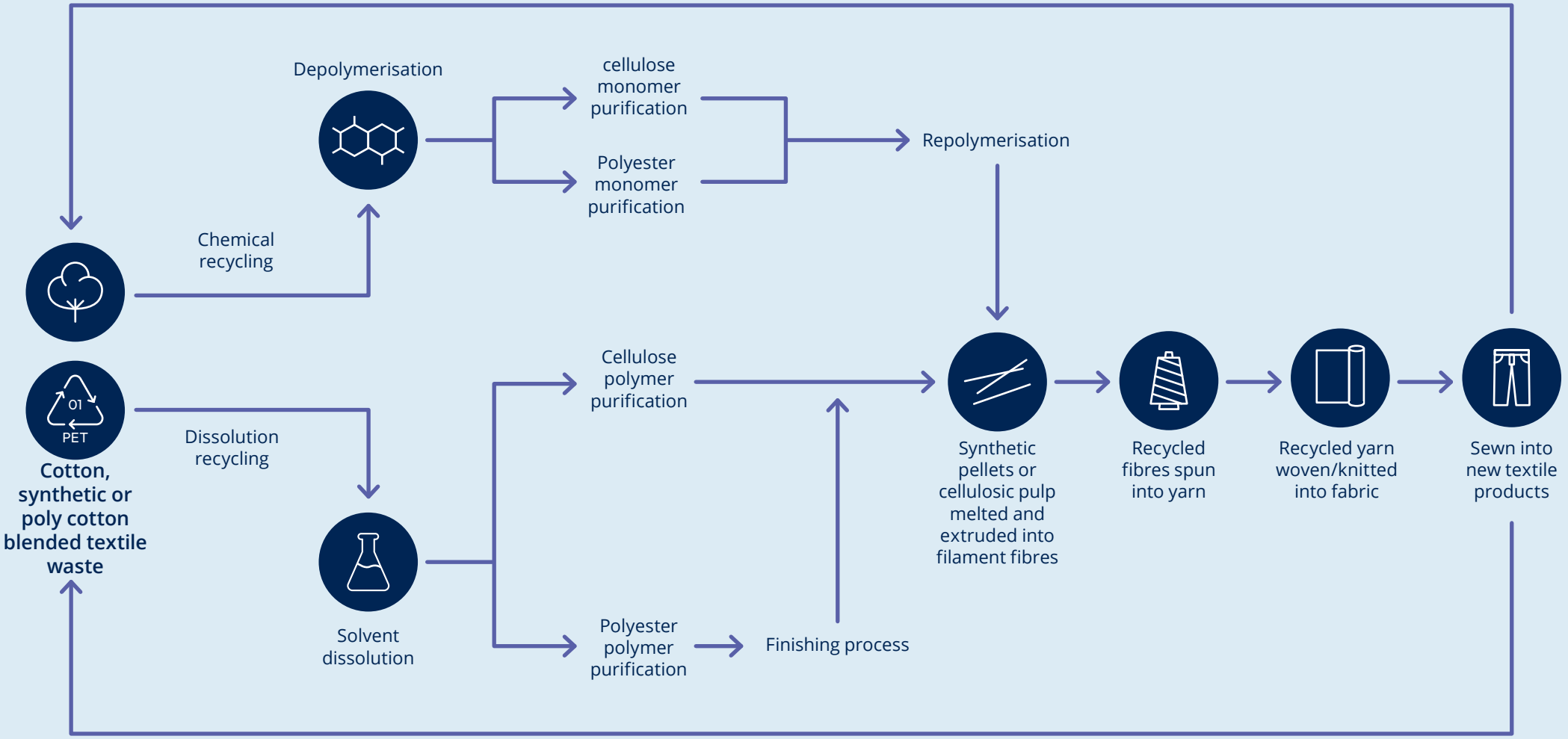
Environmental footprint

These processes vary in impact depending on their use of solvents, chemicals, or biological enzymes. A Life Cycle Assessment is the best way to compare recycling technologies in terms of their impacts.

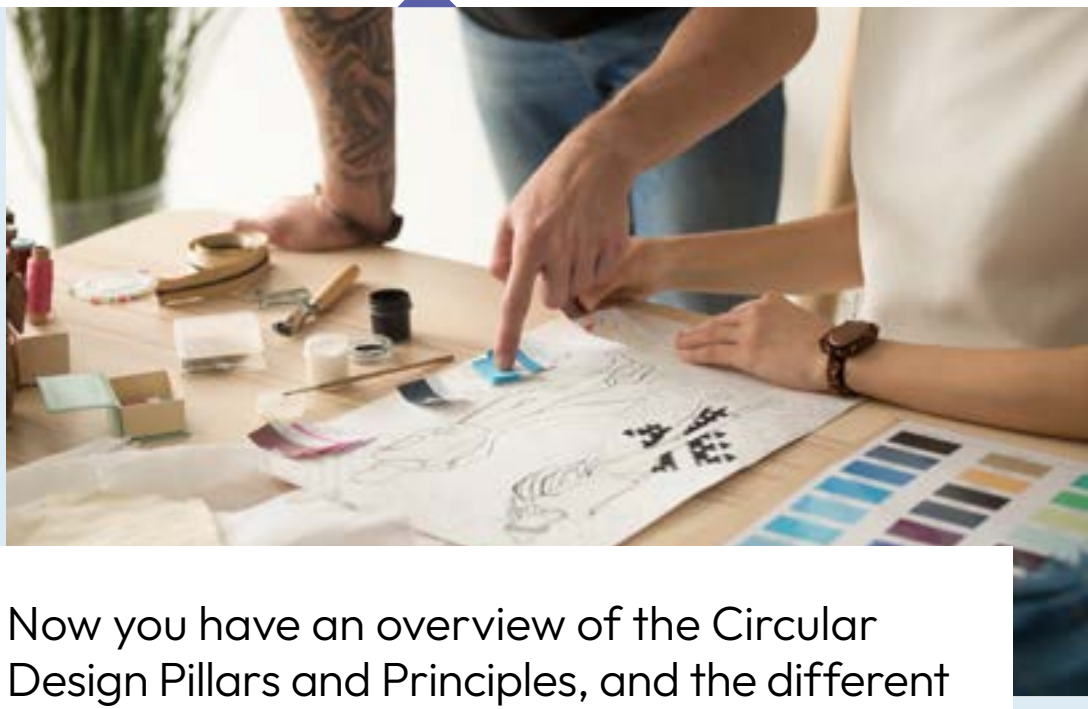
Established

Dissolution processes that target only cellulosic fibres (pure cotton and high cotton content poly/cotton blends) have been developed over the last 10 years and are well-established. The recycling of nylon has also been commercial for the past decade. Technologies for polyester are relatively new.

Dissolution and chemical recycling processes



Putting the Circular Design Framework into action



Now you have an overview of the Circular Design Pillars and Principles, and the different strategies you could use to put them into action, you might be feeling a little overwhelmed.

This section of the toolkit will help you think about which strategies are right for your products, give you some practical considerations to think about and help you understand who you need to get involved to deliver products that have been designed for circularity to market.

Choosing your Circular Design Principles

A product that is designed to be circular should use a combination of the Circular Design Principles to address all four of the Circular Design Pillars, with the intention of achieving the biggest environmental impact reductions over the product's whole lifecycle.

Choosing which Circular Design Principles to use to achieve this will depend on the product you are designing as one solution will not fit all product types.

To help you decide which Circular Design Principles will be most effective in reducing your product's impacts, you need to think about:

- The **product's purpose**.
- The **potential impact reductions** the different design principles could achieve for that specific item.

You will also need to take some practical considerations into account.

Choosing your
Circular Design Principles:

Practical considerations

Cost implications

There is likely to be cost implications associated with the Circular Design Principles – some might increase the cost price of the product, others might actually make cost savings if you are using materials and resources more efficiently. Product teams need to think about how this may affect product margins and if you are able to balance them out across your range.

You will need to consider the retail price of the product – do you think your customer will pay more?

Customer considerations

Keep your customer in mind throughout the product development process to make sure you do not forget about your customer's needs. If your product does not sell, it will be harder to convince your teams, suppliers and senior management to commit to switching to more circular products in the future.

Availability

What is the availability of the materials and/or services you want to use? And are they readily available in your manufacturing locations?

Lead times

If you are developing and sourcing new materials, or using new manufacturing processes or new suppliers, will this affect your lead times?

Supply suitability

Does your current supply base have the capacity, technology, machinery and skill set to manufacture your product? Are they willing to make the changes you need them to create your product? Think about how to communicate with your supplier and how you can support them to manufacture for circularity. If you are using principles such as remanufacture, you may need to look for specialist suppliers.

Unintended consequences and trade-offs

Always consider if there are any unintended consequences to your decisions, and that you are happy you have made the best choices, e.g. durability versus recyclability, durability versus resource efficiency.

Verification and certifications

Make sure you can get evidence to verify the use of the Circular Design Principles. Traceability and visibility of your supply chain will be important for this, as well as the use of certifications where possible.

Minimum requirements

There is no industry standard for a circular product, which makes setting minimum requirements hard. Certifications for preferred fibres will require your products to meet minimum content requirements, consider if you think these are enough and whether you could go further. If there are no minimum requirements currently for the principles you want to use, talk to your sustainability team to decide what is acceptable for your business. This will be important if your company wants to communicate the Circular Design Principles to your customers.

Choosing your
Circular Design Principles:

Product purpose

To understand your product's purpose, you should consider the following questions:

- **Who is your customer/who are you designing the product for?**
- **Why do they need/want the product?**
- **What occasion or function will they use it for?**
- **How will they care for the product?**
- **How long will they keep it?**
- **Why do you think they will dispose of it?**

These questions will help you to understand how often the customer will use the product and how long they will use it for. This information can guide your circular design choices. For example:

For products that will be worn regularly, you should focus on physical durability to extend their lifetime, making sure the product does not fail before it has lost its appeal to the customer.

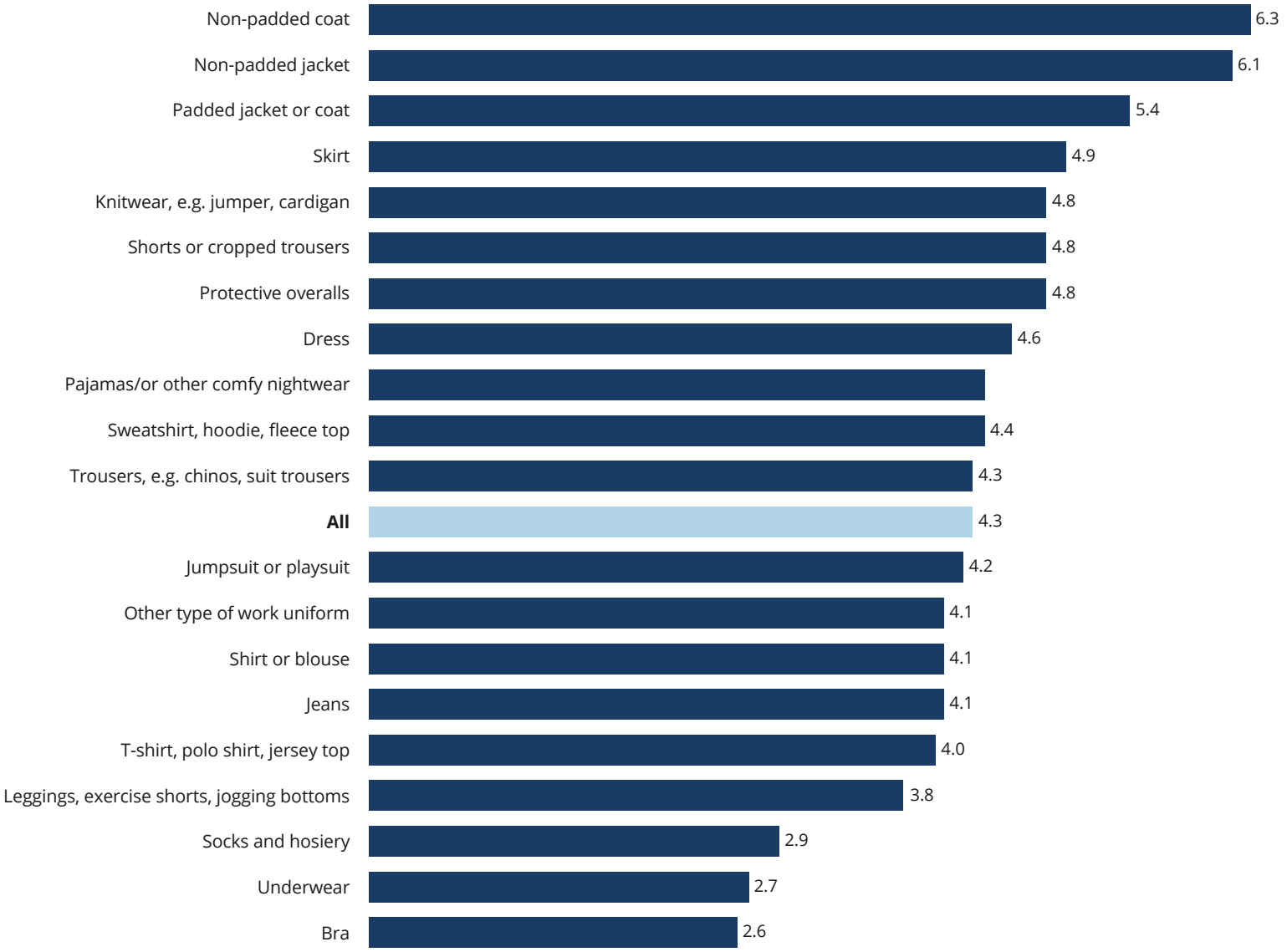
For products that are predicted to have a shorter lifetime due to them losing their appeal to the customer quickly, you could focus on optimising the use of resources and should make sure they are designed with an end-of-life solution in mind.

As a guide, WRAP's research has shown that the overall predicted longevity of clothing in the UK is 4.3 years, although this an average and variation exists across individual product types – from 6.3 years for coats and jackets through to 2.7 years for underwear[26].

This research also takes into consideration key factors that can affect a product's predicted longevity, such as consumer demographics, where a product was purchased, the product category and end use (e.g. casualwear, smart wear, sportswear), how regularly and intensely a product is used and why a customer stops using it. A full summary of this research can be found here.

WRAP has also developed an interactive tool that can be used by product development teams to help you understand the predicted longevity of different items of clothing and support you to make decisions on which Circular Design Principles should be prioritised based on the product category and your customer.

Figure 5. Estimated clothing longevity in years



Q. How long ago did you acquire this item that you wore most recently? Your best estimate is fine.

Q. And how much longer do you think you will continue to wear this item? Your best estimate is fine.

Base: 44,807 items of clothing, among 6,000 UK adults who purchase clothing at least once a year. Oct-Nov 2021

Choosing your
Circular Design Principles:

Impact reductions

When it comes to the impact reductions the circular design principles could achieve across your product range, you should, where possible, use data to support your decisions.

Data on the materials and processes that go into making a product, as well as how the product is used and how it is disposed of, can help businesses and their product teams understand the overall footprint of their ranges, as well as showing where there are impact hotspots. This information can be used to make strategic decisions on which of the design principles will achieve the biggest reductions in carbon, water and waste across your product ranges.

Circular design data gaps

However, current data can only tell us about the impact reductions of some of the Circular Design Principles. This is because only a handful of the principles have been used at scale by the industry. To develop methodologies and allow us to gather more data to measure the impacts of all the Circular Design Principles, we need brands and retailers to start putting the design principles into work now, so we can collect the data we need to build a better understanding of the impact reductions they can achieve. The more robust data we can collect, the more tools we can develop to help designers and product development teams make the most impactful design decisions.

Textiles 2030 Footprint Tool

If you are a signatory of Textiles 2030, you can use the Textiles 2030 Footprint Tool to scenario model the reductions that could be achieved by using some of the Circular Design Principles. Speak to your sustainability team about how you can use the Textiles 2030 Footprint Tool to help you understand the impacts of your product range and how to build the Circular Design Principles into your product strategies to make design decisions that will have big impacts.

Getting the right people involved

Making products circular requires buy-in and support from different roles around the business and the supply chain. Delivering circular products to customers will be a team effort and everyone has a role to play.

> Delivering circular products to customers will be a team effort and everyone has a role to play.

Design Team

- **Designers** – designers will need to embed the Circular Design Pillars into their seasonal trend development and product strategies, as well as their design process, using their creativity to translate the Circular Design Principles into commercial products that customers will love.
- **Print/Graphic Designers** – print and pattern will play a big part in the circularity of a product. Print and graphic designers should keep the Circular Design Pillars in mind when creating new artwork and specifying printing techniques, so that they are low impact and do not restrict the longevity or the recyclability of your product.
- **Fabric Sourcing/Material Development** – material selection plays an important role when designing for circularity. Fabric sourcing teams should support the development of innovative materials that go beyond more sustainable alternatives, and that improve product durability and recyclability.

Buying/Merchandising

- **Buyers** – buyers will need to understand the Circular Design Principles and work with the design team to plan them into seasonal strategies and product ranges. They will play an important role in making the design principles commercial and will be key to getting suppliers on board and signing off products with senior management.
- **Merchandisers** – merchandising teams should provide buyers and designers with previous seasons' sales analysis to help the team build product strategies that target areas of your range where you can have the biggest impacts, e.g. your bestselling volume lines. They should help buyers balance margins and manage the critical path to make sure products that are designed to be circular can be delivered to the customer for the right price and at the right time.

Technical Team/Product Compliance

- **Pattern Cutters** – pattern cutters can help to create efficient lay plans and reduce cutting waste. They can also help designers create product interest through creative pattern cutting techniques instead of using trims and embellishment, to enable recyclability, as well as creating extra special pieces that can increase product longevity.

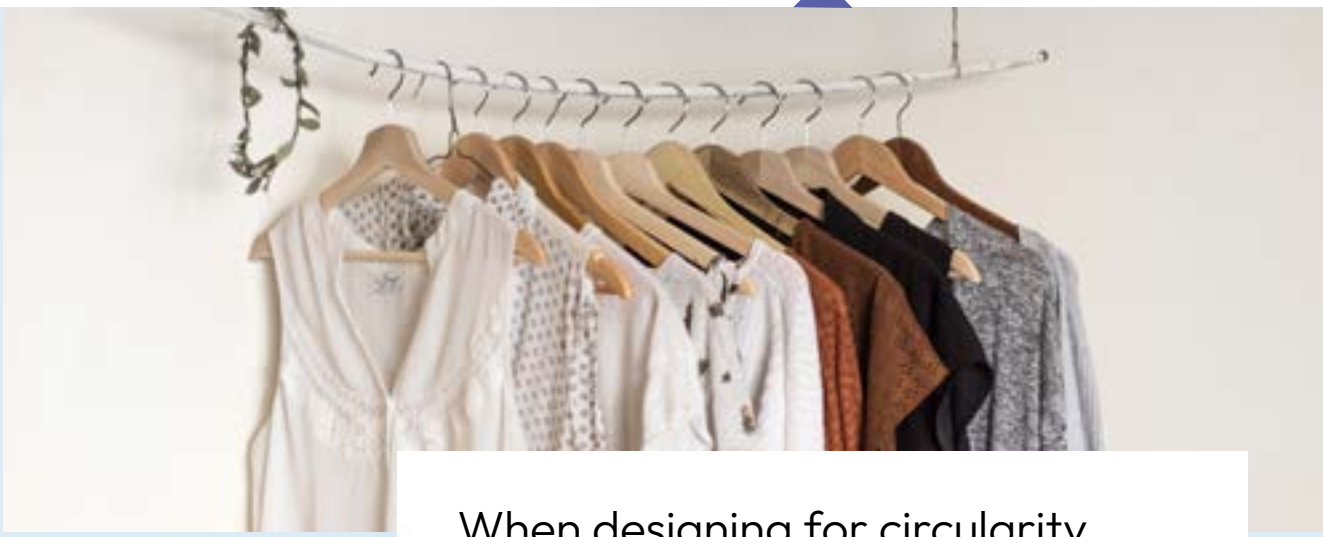
- **Garment Technologists** – garment technologists are the experts in garment durability and product testing. They can support designers to create detailed design briefs that specify construction techniques that will improve durability and help to communicate this to suppliers. Garment technologists will also be key to creating recyclable products – think about potential alternatives to tapes, bindings and interfacings that can restrict recycling.
- **Fabric Technologists** – fabric technologists are the fabric quality experts and should support the product teams to ensure all materials meet quality and performance standards, as well as managing certification compliance. You should check with your fabric technologists that the materials you want to use will meet minimum durability and performance standards, especially as you start to use more recycled content.

Corporate Social Responsibility (CSR)

- **Sustainability Team** – the sustainability team are the experts in circularity and all things environmental. They will be key to supporting product teams to develop circularity strategies for your product ranges that will have the biggest impacts, as well as supporting you to put it into action.
- **Sourcing/Ethical Trade** – the sourcing team will make sure your suppliers meet codes of conduct for ethical trade and responsible sourcing. They can support your suppliers to transition to lower impact production techniques that support circularity. This team will also be key to ensuring you have visibility of your supply chain.

Marketing

- **Marketing Teams** – to make designing for circularity commercial, your customers will need to be on board. Marketing teams will need to understand what it means to 'Design for Circularity' and have visibility of the Circular Design Principles that have been used so they can communicate this honestly to customers, to allow them to make informed choices about the products they buy. When marketing products, always make sure your labelling and messaging meets the Competition and Market Authorities' Green Claim's Code and if you are unsure consult your legal team.



The complexities of circular design

When designing for circularity, you should always try to address all four Circular Design Pillars. However currently this may not always be technically possible. When this is not possible you will need to prioritise the design principles that deliver the highest impact reductions for your product. As measurement is not established across all principles yet, this can also be challenging, so agility and adaptability is key.

Despite the complexities, we need to prioritise progress over perfection if we want to create a circular future for the fashion and textile industry.

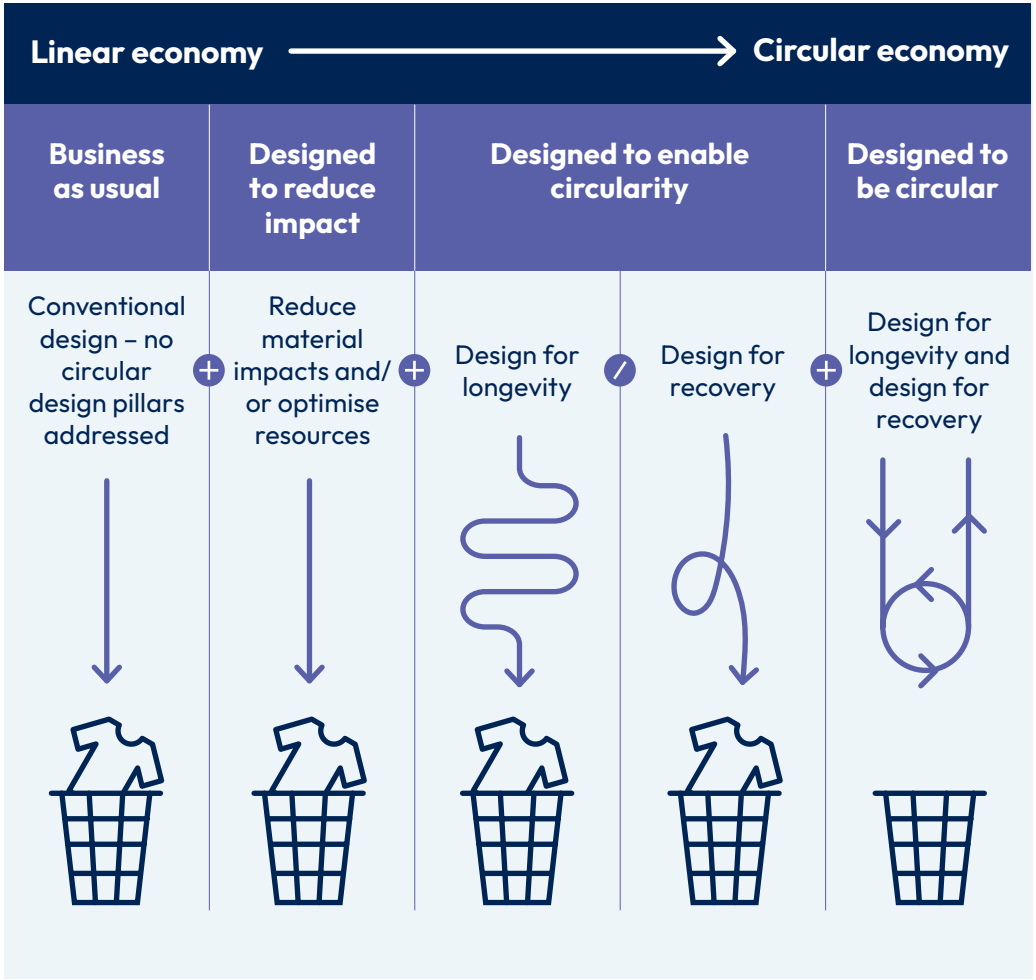
It will be important to push the boundaries further than the use of more sustainable materials to enable the transition to a circular economy.

To begin this transition, **products should aim to address at least one principle from three of the Circular Design Pillars as a starting point**, but you should always try to go further than this if you can!

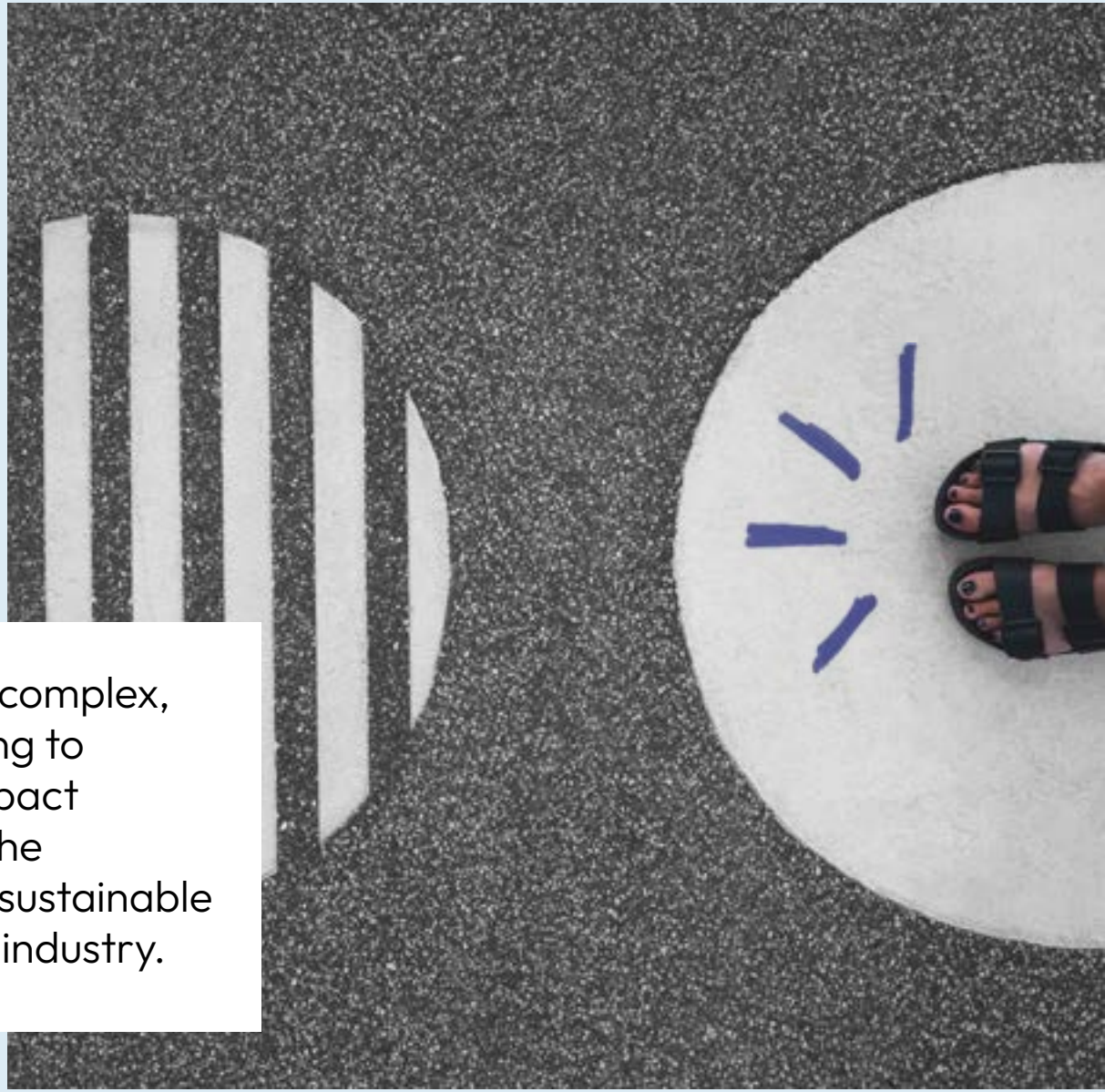
This should always include the 'reduce material impacts' pillar, plus two others.

Trade-offs are most commonly required to be made between the 'design for longevity' and 'design for recovery' pillars and WRAP's research (unpublished) has shown that Circular Design Principles targeting clothing durability can often hinder recyclability and vice versa, for example:

- Adding synthetic fibres to natural fibres in fabrics can help increase durability but may cause problems for recycling as the resulting material has a blended fibre composition which is currently harder to recycle.
- Designing for durability may require more resources to be used to create the product which could increase its overall material and production impacts. Finishes applied to enhance durability might also affect its recyclability.



Conclusion and next steps



Designing for circularity is complex, but essential, if we are going to significantly reduce the impact of fashion and textiles on the environment and create a sustainable and resilient future for the industry.

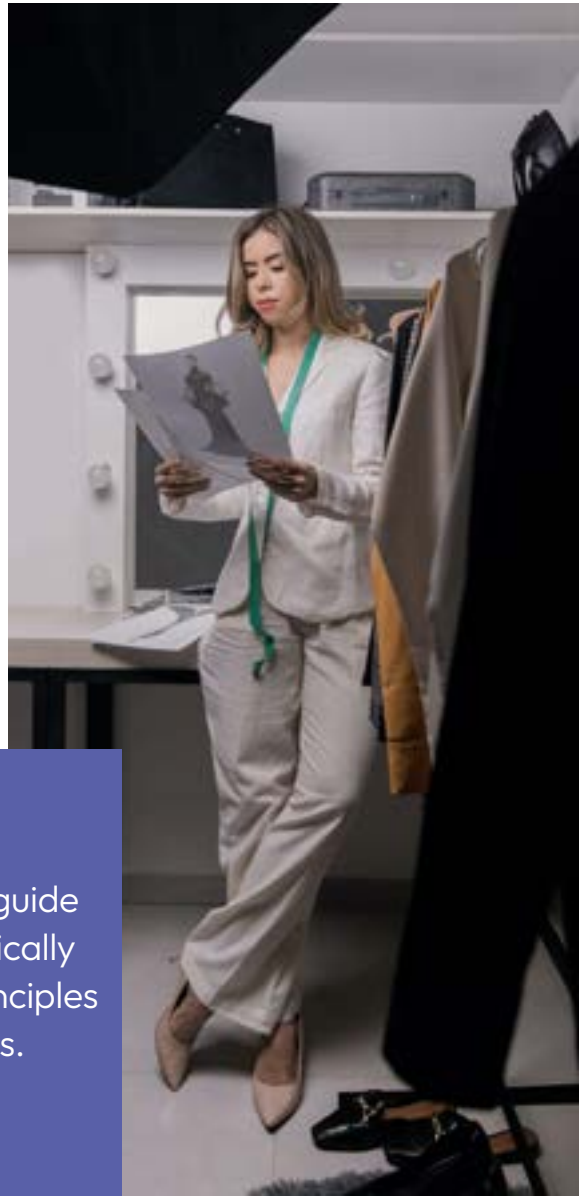
A circular economy is driven by design[28], and setting this Circular Design Framework, is the first step in creating a consistent approach to designing for circularity for the fashion and textile industry.

By using the Circular Design Pillars, Principles and Strategies laid out in this guide as a framework, designers and product development teams have an exciting opportunity to make a positive impact and use design to tackle the climate crisis.

Use the information in this guide to empower you to strategically build the Circular Design Principles into your product ranges where you can have the biggest impacts and inform your design decision making processes. And remember, it's a team effort, so make sure the right people are involved from your internal teams and your supply base, as well as collaborating with the wider industry, to help you achieve designing for circularity at scale.

We are at the beginning of the journey towards a sustainable and circular textile industry and there are still a lot of unknowns and nuances to navigate.

Textiles 2030 will work with the industry to quantify the impacts of the Circular Design Principles set out in this guide, develop further tools and resources to support brands, retailers and manufacturers to make informed design decisions, address potential barriers and navigate intricacies, so that together we can make a circular future for the fashion and textile industry a reality.



"Use the information in this guide to empower you to strategically build the Circular Design Principles into your product ranges."

Glossary

Term	Definition
Carbon footprint	Quantity of greenhouse gas emissions expressed in tons of carbon dioxide (CO_2).
Circular economy	An alternative to the traditional linear economy (make, use and dispose). Under a circular economy, products, components and materials are kept in use for as long as possible to extract the maximum value, after their usable life, they are reused, repaired or recycled.
Closed loop	Usually referring to recycling (e.g. closed loop recycling), this means keeping material within its product cycle. In its purest form this would mean turning a product back into the same product, for example, turning a branded T-shirt into another T-shirt from that brand. However, closed loop recycling can be flexible enough to allow for fibre created from recycling one brand's textiles to make another brand's textiles; the sentiment is retaining material within the industry/product type. Contrast: open loop.
Cold pad batch (CPB)	Cold pad batch (CPB) is an alternative continuous dyeing technique for natural fibres. Natural fibres commonly use reactive dyes which require vast amounts of salt, water and energy to heat the rinse water. In the CPB dyeing process no heat is required and the reactive dyes have a much higher fixation rate, meaning less rinses are needed and no salt is used.
Colourfastness	Colourfastness is used as a key performance indicator to test the efficiency of dyes. It is defined as the ability of a dye to preserve the original colour throughout the manufacturing process and subsequent customer use.

Term	Definition
Conventional material	A fibre or material that is not produced to the specifications of a sustainability program (standard, certification, regulation, initiative, or process).
Pos Industrial surplus materials	Fibres, yarns, fabrics and trims that have been produced, but that have never been used to create a final product, meaning they have never reached the consumer. This is most seen in the manufacturing stage of the value chain due to order changes, cancelled orders or overproduction. This does not include faulty and/or damaged textiles and trims.
Decarbonising	The process of stopping or reducing carbon gases, especially carbon dioxide, being released into the atmosphere as the result of a process.
Dimensional stability	Dimensional stability (in fabric) is the change of dimensions in textile products when they are washed or relaxed. The change is always expressed relative to the dimensions before the exposure of washing or relaxing.
Disassembly	Enables a product to be taken apart in such a way that allows components and materials to be reused, remade, or recycled.
Disruptor	An element or hard point present on a textile product (e.g. fastener, button, zipper, fabric patch etc.) that may be a disruptor to the recycling process and will need to be removed before the product is suitable as feedstock for recycling.
Dope dyeing	Dope dyeing is a dyeing process where the colouring and spinning of the synthetic polymer is done in one single step. The polymer pellets are mixed with the dyes prior to extrusion, and the extruded filaments come out of the process coloured.

Term	Definition
Durable/Durability	The ability of a physical product to remain functional and relevant over time when faced with the challenges of normal operation. This can relate to physical properties or emotional characteristics to do with appearance. It applies to a product over multiple owners and acknowledges repair and other services as a means to increase overall durability.
Dyeing	Dyeing is the application of dyestuff on textile materials such as fibres, yarns and fabrics.
Fibre-to-fibre recycling	Fibre-to-fibre recycling refers to the closed loop reprocessing of non-reusable textiles back into fibres to produce new textile materials.
Greenhouse gases	Greenhouse gases refer to carbon dioxide, nitrous oxide, methane, ozone and chloro-fluorocarbons occurring naturally and resulting from human (production and consumption) activities and contributing to the greenhouse effect (global warming).
Lay plans	Lay planning is a process that positions pattern templates onto fabric in the most economical way preventing excess wastage of fabric.
Lifecycle analysis (LCA)	A systematic set of procedures for evaluating the environmental impact of products throughout its life cycle.
Longevity	See Durability.
Man-made cellulosic fibres (MMCFs)	MMCF's, such as viscose and modal are manufactured by dissolving cellulosic raw materials, such as wood pulp, in chemicals and extruding them through a spinneret to produce continuous filaments of pure regenerated cellulose fibres.

Term	Definition
Manufacturing Restricted Substance List (MRSL)	In some production processes, hazardous and harmful chemicals may be used but must not remain on the final product. A MRSL ensures these chemicals are also eliminated from the manufacturing process, preventing them from being used in the first place – minimising the possible impact they could have on production workers, local communities, and the environment[29]. The ZDHC MRSL can support retailers and suppliers to manage all chemical inputs.
Mono-material	A material that is created from a single fibre type. For a product to be classed as a mono-material, it must include a minimum of 98% of a single fibre type, by weight, in the total product composition.
Next generation materials	Materials that are designed to replace conventional materials, and use a variety of innovative approaches to replicate the aesthetics and performance of their conventional counterparts.
Non-renewable (material)	Material that is made from sources that will run out or will not be replenished in our lifetimes – or even in many, many lifetimes. Most non-renewable materials are made from fossil fuels: coal, petroleum, and natural gas. Carbon is the main element in fossil fuels.
Open loop	Usually referring to recycling (e.g. open loop recycling), this means taking or giving inputs from/to another industry or product. For example, taking the plastic packaging from garment bags and turning it into new garments would count as open loop recycling. Contrast: closed loop.
Post-consumer textiles	Textiles that have been purchased, used, and then discarded for reuse or disposal. It refers to textiles generated by households or by commercial, industrial, and institutional facilities in their role as end-users. This excludes unused returned items.
Post-industrial textiles	Fibres, yarns, fabrics and products from the textile manufacturing process. These can either be finished materials/products that are suitable for use/sale, or unusable materials.

Term	Definition
Post-Industrial Surplus Materials	Fibres, yarns, fabrics and trims that have been produced, but that have never been used to create a final product, meaning they have never reached the consumer. This could occur due to order changes, cancelled orders or overproduction. This does not include faulty and/or damaged textiles and trims.
Post-Industrial Surplus Products	Products that have been produced but never reached the retailer for whatever reason. This could occur due to order changes, cancelled orders or overproduction. This does not include faulty and/or damaged products.
Pre-consumer By-Products	Pre-consumer textile products that are not usable for their intended purpose e.g. products received from the manufacturer or returned by the customer that are damaged, faulty or soiled etc.
Pre-consumer textiles	Textile stock that has been manufactured for and transferred to a retailer but is yet to be used by a consumer. This can include include unsold products, returns and damaged or faulty goods.
Preferred materials	A fibre or material which results in improved environmental and/or social sustainability outcomes and impacts in comparison to conventional production.
Pre-Consumer Surplus Products	Pre-consumer textile products that have been manufactured and transferred to a retailer and can be used for their intended purpose. This may arise due to over-ordering or where unused products are returned and not resold.
Recycling	The process of reducing a product back to its basic material level, reprocessing those materials, and using them in new products, components, or materials.
Remanufacture	The operation by which a product is created from existing products or components to create something new by disassembling and repurposing. It can also include the refurbishment of a product to 'as new' condition, including updates through re-dyeing and alterations.

Term	Definition
Renewable (material)	Material that is composed of biomass from a living source and that can be continually replenished. When claims of renewability are made for virgin materials, those materials shall come from sources that are replenished at a rate equal to or greater than the rate of depletion.
Rental	A business model where each garment or collection of garments can be hired/rented for a limited time. The ownership of the garment remains with the rental/subscription company (B2C) or the owner (P2P), not the consumer whose purchase provides access to the garment for a set period of time.
Repair	Replacing or repairing components of a garment that are faulty or close to failure back to a useable state, or altering a garment for a better fit/style.
Resale	Mechanism to generate revenue from additional sales of a garment after the first sale, with ownership changing hands at each sale. Recovering own-brand products through a takeback scheme to be resold through the brand or via a partner, alongside only their product or a multi-brand offering. Or selling secondhand garments of any brand/origin.
Restricted Substance List (RSL)	A RSL is a list of harmful or illegal chemical substances often found in the textiles supply chain that are either prohibited or limited and must not remain on a product once they are sold to customers. Existing RSL's include those from ZDHC, GOTS and bluesign®.

Term	Definition
Reuse	Operation by which a product or component is used repeatedly and for long periods of time, for its original purpose, without being significantly modified, remade, or recycled. Products might need to be 'prepared for reuse', which often involves cleaning, repairs, or small modifications so that they can continue to be used throughout time and multiple users.
Spin dyeing	Spin dyeing is a dyeing process where the colouring and spinning of fibres are done in one single step. Spin dyeing can be used on manmade cellulosic fibres where the cellulosic pulp is mixed with the dyes prior to extrusion and the filament is dyed directly at the spinning stage.
Stock fabric	Stock fabrics are materials that are produced in volume without a buyer, in anticipation that it will be purchased.
Subscription	A type of rental model where a commitment by a consumer to pay a regular fixed amount of money in return for a set amount of product (e.g. number of garments) or a service (e.g. provision of a clothing style).
Vintage	Clothing (or materials) that is between 20 and 100 years old that recognisably follows the style of the era in which it was produced.
Virgin raw materials	Virgin materials are natural resources that are extracted in their raw form that are traditionally used in industrial or manufacturing processes. Examples of raw materials include steel, oil, corn, grain, gasoline, lumber, forest resources, plastic, natural gas, coal, and minerals.
Water footprint	A measure of the total volume of freshwater used to produce goods or services produced by a business or consumed by an individual or community.
Wet processes	Liquid-based pre-treatments, dyeing, post-dyeing, finishing, laundry and printing – particularly piece-printing.

Endnotes

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