



BASICS OF CIRCULAR DESIGN

The Basics of Circular Design manual was developed within the project «Ukrainian-British School of Design for Circular Economy» for awareness-raising of designers from Ukraine and the UK about circular design.

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Site: ucf.in.ua, facebook: www.facebook.com/ucf.ua



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Site: <https://www.britishcouncil.org.ua/>

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FROM LINEAR TO CIRCULAR ECONOMY

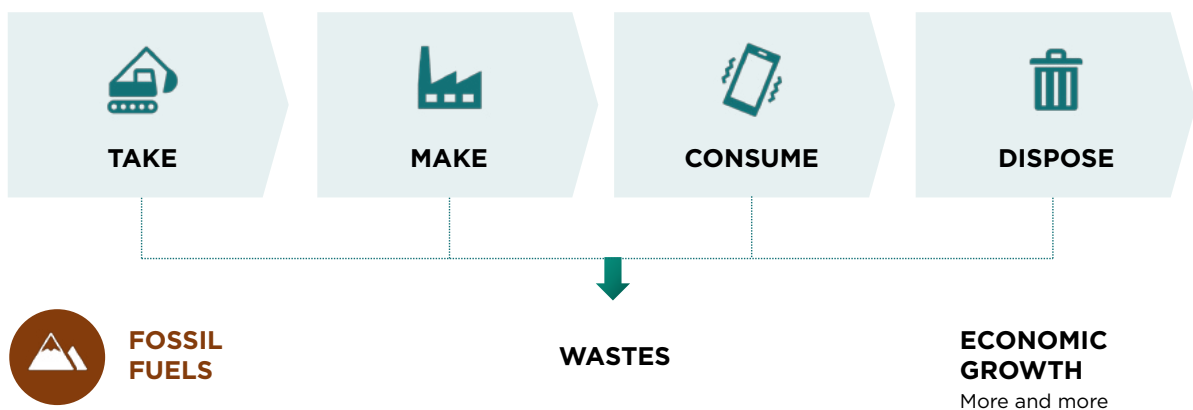
Linear economy and an overview of the issues that it creates

For a long time, our economy has been “linear”. What does that mean?

We **TAKE** raw materials from nature, such as mining, cutting down trees, usually from limited resources and in unsustainable ways. We **MAKE** products and their packaging with planned obsolescence designed to be broken and disposed of, using lots of chemicals and production practices that are polluting the environment.

We **USE** them, usually for a very short period of time and when we no longer want them, we throw them away. When we **DISPOSE** of the products they go to landfills, our environment or get incinerated creating pollution and health hazards.

Linear economy. Degenerative economy



SOURCE:
<https://www.youtube.com/watch?v=aVb4hvA3jY4&list=LL&index=22>

Today's linear 'take, make, dispose' economy relies on large quantities of cheap, easily accessible materials and energy. But we cannot live in a linear system on a planet with finite resources forever. This model is wasteful and polluting on all the stages.

- We extract around 90 billion tons of natural resources every year, which is more than 12 tons for every person on the planet
- 1/3 of all the food we grow is wasted worldwide
- Every second around the world, the equivalent of one garbage truck full of textiles is landfilled or burned¹
- Worldwide, over 400 million tonnes of plastics are produced each year and packaging accounts for more than 1/3 of all plastics produced
- 40% of plastic products are garbage after less than a month²
- Only 14% of plastic packaging is being collected for recycling globally and only 9% is effectively recycled³
- Every year we create over 40 million tonnes of electronic waste worldwide
- In Europe, the average car sits unused 92% of time⁴

1. A New Textiles Economy: Redesigning Fashion's Future, 2017. <https://ellenmacarthurfoundation.org/a-new-textiles-economy>

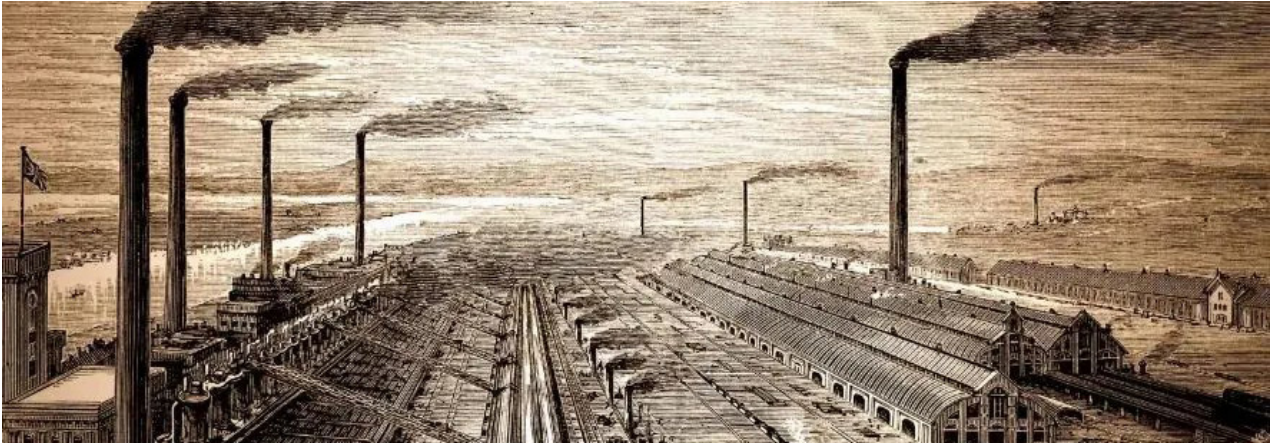
2. Plastic Atlas, Heinrich Böll Foundation, Break Free From Plastic. 2019. <https://www.boell.de/en/plasticatlas>

3. The New Plastics Economy, 2016. <https://www.newplasticseconomy.org/>

4. Growth within: a circular economy vision for a competitive Europe, 2015. <https://ellenmacarthurfoundation.org/>

How did we get here?

The invention of the steam engine back in 1684 transformed our ability to make things and changed our society. This invention kick-started the industrial revolution, which transformed our ability to make things. Raw materials and energy seemed infinite and labour was readily available. For the first time in history, goods were mass produced. The Industrial revolution laid the foundation for how the economy of today operates.



Source: <https://www.washingtonpost.com/news/wonk/wp/2016/10/28/why-the-industrial-revolution-didnt-happen-in-china/>

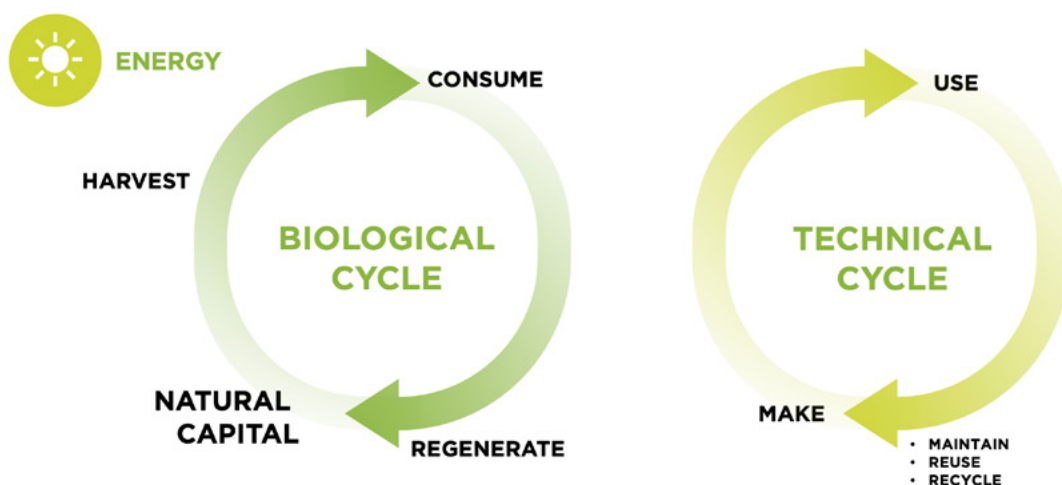
Since then, the rapid pace of technological progress has continued. The resulting innovations mean that many now have access to products from all over the world at affordable prices. These products have brought many of us levels of material comfort unimaginable to previous generations.

What is a circular economy?

The current system is no longer working for businesses, people or the environment. We now have the knowledge and tools to build an economy that is fit for the 21st Century.

We must transform all the elements of the take-make-waste system: how we manage resources, how we make and use products, and what we do with the materials afterwards. Only then can we create a thriving economy that can benefit everyone within the limits of our planet.

Circular economy. Regenerative economy



SOURCE:
<https://www.youtube.com/watch?v=aVb4hvA3jY4&list=LL&index=22>

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The circular economy is a new way of doing things that brings real business benefits, as well as positive social and environmental impacts. The circular economy offers opportunities for better growth, through an economic model that is resilient, distributed, diverse and inclusive. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural and social capital.

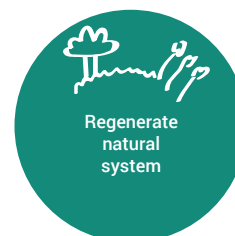
The circular economy is an attractive and viable alternative that businesses have already started exploring today. According to Ellen Macarthur Foundation, shifting to circular economy can:

- save 700 million USD annual material cost in the fast-moving consumer goods industry
- create a net benefit of 1.8 trillion EUR in Europe by 2030
- reduce 48% of CO2 emissions by 2030.⁵

The three main principles of Circular Economy

Shifting the system involves everyone and everything: businesses, governments, and individuals; our cities, our products, and our jobs. A circular economy is based on three principles that can help us redesign everything:

1. Designing out waste and pollution,
2. Keeping products and materials in use,
3. Regenerating natural systems.



1. Designing out waste and pollution

Did you know that waste and pollution are largely a result of the way we design things? Around 80% of environmental impacts are determined at the design stage. So waste and pollution are not accidents, but the consequences of decisions made at the design stage. When we start seeing waste and pollution as a design flaw we can prevent it's creation in the first place.



Source: [facebook.com/sustainablelaboratory](https://www.facebook.com/sustainablelaboratory)

➔ Case: S.Lab, Ukraine

The Issue

Waste and pollution from single-use or low-quality plastic and other materials.

The solution

This innovative biomaterials company creates products from mushroom mycelium and technical hemp to replace plastic. The company has numerous collaborations with Ukrainian businesses creating consumer products from alternative to plastic materials. E.g. home and horeca decor, clothes hangers for dry cleaning, Christmas toys etc..

5. <https://archive.ellenmacarthurfoundation.org/explore/make-a-circular-economy-pitch-in-your-organisation>

Why it's an example of the circular economy

In a circular economy, products can be designed to break down naturally after use as they would in the natural world. S.Lab's products and packaging doesn't contribute to the 8 millions tonnes of plastic that enter our oceans every year. It can be safely composted and will break down in soil within 30-45 days.

2. Keep products and materials in use

We can't keep wasting resources. Products and materials must be kept in the economy. We can design products and components so that they can be reused, repaired and remanufactured. As for biological materials - we should be able to be returned back to the biological cycle (see the Butterfly diagram below).



Source: <https://bundles.nl/en/about-us/>

➔ Case: **Bundles, The Netherlands**

The Issue

Most appliances use more energy, water and detergent than required, wasting money and creating a huge impact on the environment. Most appliances break down within 6 years and only can be down-cycled afterwards.

The solution

The company provides sustainable and efficient appliances - washing machines, tumble dryers, dishwashers and coffee machines - that can be rented and are accessible to everyone, helping their customers to lower their energy, water and

detergent use. The company takes the responsibility for maintenance in order to increase the lifetime of the appliances as well as for upcycling and repairs of broken appliances aiming to capture the value of the applied materials.

Why it's an example of the circular economy

Customers pay for performance instead of ownership. This will stimulate manufacturers to make appliances that last longer and can be repaired. The company also connects the appliances to the internet to collect data that enables them to learn how to use the appliances in a smarter way aiming to increase the lifetime and reduce consumption of energy, water and detergent. Bundles create partnerships in the value chain – with Miele producer, detergent producers, energy utilities, water service providers – aiming for smart production, use and reuse. The company plans to provide a circular subscription system for fridges, solar panels and heat pumps soon as well.⁶

3. Regenerate natural systems

What if we could not only protect, but actively improve the environment?

In nature, there is no concept of waste. Everything is food for something else - a leaf falls from a tree and feeds the forest. Simply trying to do less harm is not about circular economy. We should aim to do good by returning valuable nutrients to the soil and other ecosystems to enhance our natural resources.

6. <https://bundles.nl/en/about-us/>



Source: <http://emmanaluyima.com/>

➔ Case: **One-acre farm, Uganda**

Circular agriculture

One-acre farm is a highly profitable, mixed-farm near Lake Victoria in Uganda, East Africa designed by farmer and veterinarian Dr. Emma Naluyima. By emulating nature's cyclical and regenerative processes, the farm generates multiple revenue streams and significantly reduces running costs and waste. This leads to much higher profits.

Why it's an example of the circular economy

Emma's approach is to create a mixed-farming system that integrates livestock and plant crops into a symbiotic relationship.

The farm is divided into 4 zones with interconnected resource flows. For example, maggots are grown on pig waste to feed to chickens and fish. The waste is further broken down by worms, then combined with cattle and pig urine to provide fertiliser for perennial crops such as matoke (green-banana). Beneficial exchanges of resources are repeated all over the farm, so that just like in nature nothing goes to waste, and instead is cycled to another part of the farm.

Business and environmental benefits

- Increased profitability. The revenue generated is estimated at \$100,000 per year
- 80% reduction in feed and other inputs costs
- an abundant supply of renewable biogas, reducing pressure on forests and avoiding particulate pollution
- local biodiversity is protected as the farm's high productivity reduces the need for expansion into virgin wilderness areas
- high quality nutritious food contributes to healthy animals and humans⁷

Misconceptions about circular economy

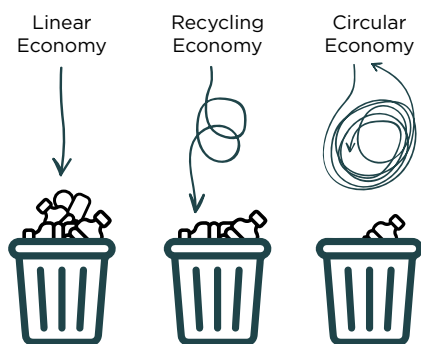
The circular economy is often interpreted in a variety of ways, renaming some familiar activities, like recycling or making something useful from waste. This could lead to various misconceptions:

Misconception 1: It's all about making better use of waste

In a circular economy, waste is eliminated through better design, rather than developing some ways to utilise waste that has already been created. It puts the emphasis on upstream innovation, rather than better waste management – although this is needed as well. There is a clear distinction between designing from waste and designing out waste.

7. <http://emmanaluyima.com/>

Misconception 2: It's a better form of Recycling



Recycling begins at the last stage of a product's lifecycle. The circular economy, however, goes right back to the beginning to prevent waste and pollution from being created in the first place. In the face of our current environmental challenges, recycling won't be enough to overcome the sheer amount of waste we produce.

Recycling is a fight with consequences, while a circular economy's 'upstream' solutions address potential problems right at the source.⁸

The circular economy is about seeing the way the world works; it's a dynamic, complex system, it's full of feedback, exchange, building up, and breaking down. It has stocks and flows of resources that are interdependent. In it, materials cycle around while energy flows through and can be lost as heat to space. And of course, it is interesting economically.⁹

Misconception 3: Waste-to-energy is the best solution

In many countries, incineration – the burning of waste like plastics to produce energy – is viewed as a valuable and safe waste management method. Setting aside questions about toxicity in burning waste, resulting in air pollution and health hazards, this solution isn't viewed as part of a well-designed system. For example, in the case of plastics, taking an energy source (oil), turning it into an important material using more energy, which is then used for a very short period of time, only to then use more energy to turn it back into another form of energy, is not an example of a high value process. There's also increasing evidence that waste-to-energy plants can lock cities, regions, and even countries into needing a steady flow of waste to make these plants economically viable – essentially creating a demand for it rather than designing out waste altogether.

Misconception 4: It's another term for Sustainability

Traditional sustainability efforts have focused on efficiency tactics – reducing the amount of material and energy used in production processes, and aiming to lower environmental impacts. So it's a strategy focused on reducing the negative impacts of our activities. A circular economy is about creating a new system, rather than tweaking the wasteful linear system in place today.¹⁰

The circular economy needs more than sustainability – it is about finding ways of protecting the systems that sustain life on earth while also being regenerative and making a positive impact.

8. <https://ellenmacarthurfoundation.org/articles/recycling-and-the-circular-economy-whats-the-difference>

9. <https://ellenmacarthurfoundation.org/articles/recycling-and-the-circular-economy-whats-the-difference>

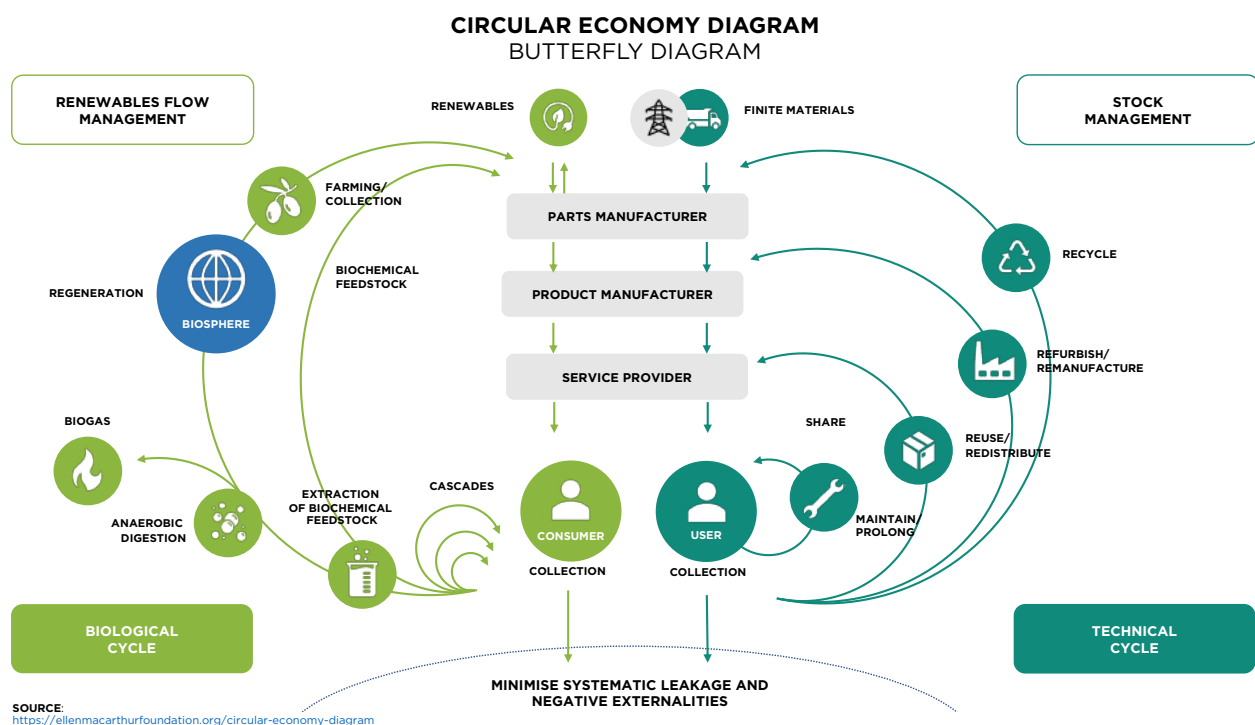
10. <https://www.greenbiz.com/article/why-storytelling-important-circular-economy>

Butterfly Diagram

The Circular Economy concept is illustrated by the “butterfly diagram”. The diagram illustrates the continuous flow of technical and biological materials through the ‘value circle’.

Both sides of the diagram are relevant to the built environment: the right side illustrates the technical cycle and closing the loops of resources facilitated by circularity strategies such as reuse, refurbish and recycling; the left side of the diagram shows the biological cycle and the loops and cascades assuring the sustainable management of biological resources and creating renewable flows and stocks. The ultimate aim of this economic model is to minimize the extraction of raw materials and waste generation.¹¹

In the circular economy system diagram, approaches such as reuse, sharing, remanufacturing, and refurbishment sit closer to the centre of the multiple material loops, while recycling sits farthest away. As a rule of thumb, the closer the loop is to the centre of the diagram, the more valuable the approach. It is no surprise then that many of the most successful examples of circular design are those that prioritise these inner loops of the circular economy. By designing products to be easily repaired or remanufactured, or creating new business models to easily facilitate sharing, these businesses are unlocking new value for themselves and their customers.¹²



11. <https://ocw.tudelft.nl/course-readings/1-3-2-the-butterfly-diagram/>

12. <https://www.youtube.com/watch?v=NBExJwTxs4w>

SYSTEMS THINKING FOR THE CIRCULAR ECONOMY



The world is made up of complex interconnected systems of which we human beings are a part.

We have to breathe, eat food and drink fresh water to survive and thrive on this planet. Thus, it is really important that we figure out how to meet our human needs in ways that let the earth continue to be able to provide vital systems for us all.

For transition to the circular economy it is crucial to understand how the different ecosystems intersect with the industrial and social systems that we are all part of.

Everything around us requires something else to survive. And as we look at nature what we discover is that all of these nutrients are cycling through adding value. But when we look at the industrial system that humans created, we often see where things just don't have purpose at the end of their life. Circular design lets us not just take away from nature, but use this power of nutrient cycling to add value when we create things we need in our lives.

Absolutely everything is interconnected which means when you take one thing out of the system it can have a negative impact. And nature has this kind of problem too. If we keep extracting things then we can have a negative impact on the way those systems work. Anything that is made from nature can go back quickly and easily into it. On the other hand we have these technical products and processes that humans have made. Such as plastic and different chemicals. If they are designed in a particular way they can easily come back to the system. The problem begins when we have a combination of different materials.¹³

Zooming out to see a bigger picture

Traditional design approaches place a particular focus on considering and meeting the needs of the end user. If we are to design for the circular economy, we need to look much wider than this, considering not only the user but the system within which the design will exist. This means understanding the impact of our design on stakeholders and building in feedback loops to help identify and address the unintended consequences of our design decisions.

At every stage of the design process we need to both Zoom in on the user needs and Zoom out to consider the systemic implications, oscillating continuously between these two equally critical perspectives.¹⁴

🔗 Find out more: Article [6 fundamental Concepts of Systems Thinking](#), Video [A Flow of Wealth or a Wealth of Flows?](#), Video [Adopting a systems mindset](#)

13. <https://circularclassroom.com/educators/>

14. <https://archive.ellenmacarthurfoundation.org/explore/systems-and-the-circular-economy>

CIRCULAR DESIGN: A POWERFUL TOOL AND A KEY TO THE CIRCULAR ECONOMY

The impact of Design

All of the objects around you were designed by someone: from the chair that you sit on to the city you live in. Design is in everything we interact with from the moment we are born until the moment we die.

DESIGN - is a way of creating products, services and systems, as well as a mechanism by which we shape the material environment to meet our needs and desires.

Important choices are made in the design stage: the definition of business models, material choices, and the 2D or 3D aesthetics and functionality of elements, but also the way designs will interact with people and systems along their journey, such as with logistics, collection, and infrastructure systems. How different materials are combined and how easily they can be reused, repaired, refurbished, or disassembled is also decided at the design stage.

These crucial choices affect the entire system, sourcing, production, and how we use things and what happens after we no longer need it. Does it become waste or can it be part of a circular economy, where waste is designed out and materials are kept in use? It's hard to reverse the impacts of design decisions once they are implemented. We can't unscramble an omelette

Circular design

Everything that's created is achieving a function. So circular economy and design are about using creativity to close the loops on production. To find ways of delivering that functionality, so that we meet our needs in sustainable ways but not in ways that create waste and pollution.¹⁵

The reality is that most things today are still designed for the linear model. This means that almost everything needs to be redesigned in accordance with the principles of the circular economy.

If you could redesign everything, what would you do differently? The reality is that most things today are still designed for the linear model. This means that almost everything needs to be redesigned in accordance with the principles of the circular economy. The key lies in rethinking the process from the beginning, so that matter, like biological processes themselves, have a regenerative life cycle for the sustainability of the planet, i.e. it becomes useful repeatedly by being repaired, reused, recycled or transformed.

Design in the linear world happens in the beginning, when you design a thing, send it to the world and you're done. But in the circular world **design is never done**, so designers can come at almost any point. The role of design throughout the cycle of products and services remains relevant.

15. <https://circularclassroom.com/educators/>

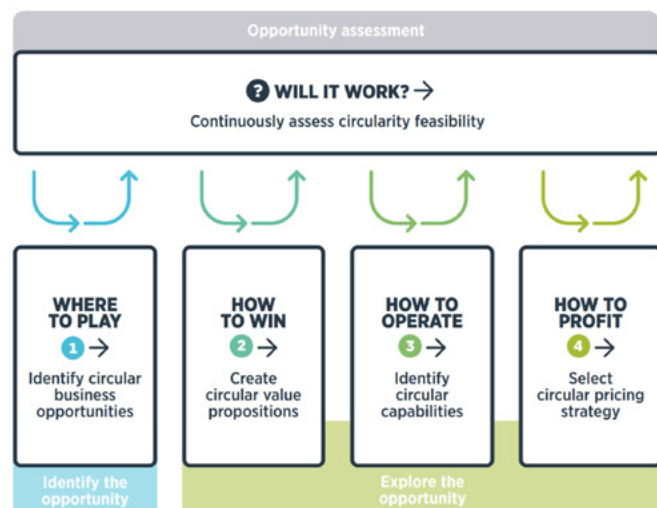
Circular Business models

A circular business model articulates the logic of **how to create, offer, and deliver value** to a broader range of stakeholders while **minimising ecological and social costs**.

Circular businesses no longer focus mainly on profit maximisation or pursue cost-cutting through greater efficiency in supply chains, factories, and operations as the primary corporate objective. Rather, they concentrate on redesigning and restructuring Product-Service-Systems from the bottom up to ensure future viability of business activities and market competitiveness.

Circular businesses:

- are deeply involved in the product usage phase;
- they generate revenues through provisioning services instead of selling physical products;
- they rethink the conventional producer-consumer-relationships, value creation activities and the structure of value chains;
- ecological and social factors complement the overall business culture and philosophy.



The move to a circular business model is an example of a fundamental change, which requires a new way of thinking and doing business. Some of the business models are:

- Creating Sharing Platform,
- Product as a Service,
- Product Life Extension,
- Resource Recovery,
- Circular Supplies.

They can be used singly or in combination to support companies achieve massive natural resource productivity.

🔗 Find out more: [Circular Business Model](#) and [Circular Business Design Guide](#)

The main Strategies of Circular design

There is no single way to design a product or service that creates no waste and pollution or a business model that keeps products in use for years and years. The three principles of the circular economy do not dictate the methods by which they need to be achieved, instead, they leave the door open to countless strategies and innovations, some of which have not been invented yet.

That said, analysing successful case studies of circular design in practice illuminates certain strategies that appear to be more regularly successful than others. Here are some of these strategies and cases that usually apply a few strategies at the same time:

1. Designing for Inner loops

In the circular economy system diagram, approaches such as reuse, sharing, remanufacturing, and refurbishment sit closer to the centre of the multiple material loops, while recycling sits farthest away. As a rule of thumb, the closer the loop is to the centre of the diagram, the more valuable the approach.

It is no surprise then that many of the most successful examples of circular design are those that prioritise these inner loops of the circular economy. By designing products to be easily repaired or remanufactured, or creating new business models to easily facilitate sharing, these businesses are unlocking new value for themselves and their customers.



Source: <https://www.greenqueen.com.hk/>

➡ Case: **Loop, USA**

The Issue

Single-use packaging and product waste is one of the most pervasive and rapidly growing issues facing our planet today. We consume an increasing amount of disposable items, a very small percentage of which can be recycled and even less is being recycled.

The solution

Loop offers popular products in reusable containers that customers order online or purchase in stores and return to the

company when finished. Loop is now partnered with 200 consumer product companies (CPGs) and 12 retailers. Under the Loop scheme, customers can make online orders for goods, such as shampoo, washing powder, and ice-cream, that normally come in single-use plastic packaging. They will be delivered instead in durable, refillable containers that can be collected from the doorstep and cleaned for reuse. UPS will pick up the empties for no additional charge.

Why it's an example of the circular economy

Reusing an object saves time, energy, and resources and does away with the need for waste disposal or recycling. While disposable design focuses on making packaging as cheap as possible, durable design focuses on making containers as long lasting as possible, allowing us to access unparalleled materials, design, and function.

Loop launched in the United States and is in the process of expanding across the United States and internationally, including France, the United Kingdom, Canada, Germany, Japan and Australia

2. Product as a Service

Central to the concept of circular economy is a shift from ownership to access; understanding that customers often only require access to a product for a short period of time after which they can return it to the service provider or pass it on to a new user.

A host of new businesses, built on this notion, have emerged in recent years offering all manner of products to their customers on a short term basis (through rental, subscription, sharing or leasing) rather than selling it to them forever.



Source: <https://gerrardstreet.nl/>

➔ Case: **Gerrard Street, The Netherlands**

The Issue

Globally, we throw away 15,000 tonnes of headphones every year, either due to simple mechanical faults or because of technology advances.

The solution

Gerrard Street Customers get affordable, high quality products and a high level of service and support. Included in the monthly subscription fee, is a guarantee that if the product is damaged or an upgrade is available then the customer returns the old headphones and is sent a replacement.

Why it's an example of the circular economy

Headphones are modular and easily disassembled to facilitate easy repair, refurbishment or upgrade. The use of a subscription business model allows them to recover headphones at the end of their use and 85% of components are ultimately reused.

Benefits for business

Combining durable design with a subscription business model means that Gerrard Street can increase its revenue through maximising the use cycles for every pair of headphones produced. The focus on standardised parts, repairability, and reuse reduces costs as fewer virgin materials are required. At the same time, the company can form a closer relationship with its customers, and has a more reliable and predictable material supply chain.

3. Dematerialization

This strategy is all about finding solutions to deliver utility using the minimum amount of material possible. This could mean finding ways to virtualise your offering, creating a digital rather than a physical product - services such as Spotify and Netflix being prime examples of this approach. It could also mean designing your product or service in such a way that it requires only a minimal amount of physical material to create.

The case study below presents a business that has drastically dematerialised its packaging materials, by employing durable, reusable containers rather than single-use packaging.

➔ Case: **MIWA**, Czech Republic

The Issue:

Today supermarkets are full of single-use plastic packaging that is too complex to be recycled or are not economically recyclable. This packaging often finds a way to our environment, creating pollution, and its toxic content harms people's health.

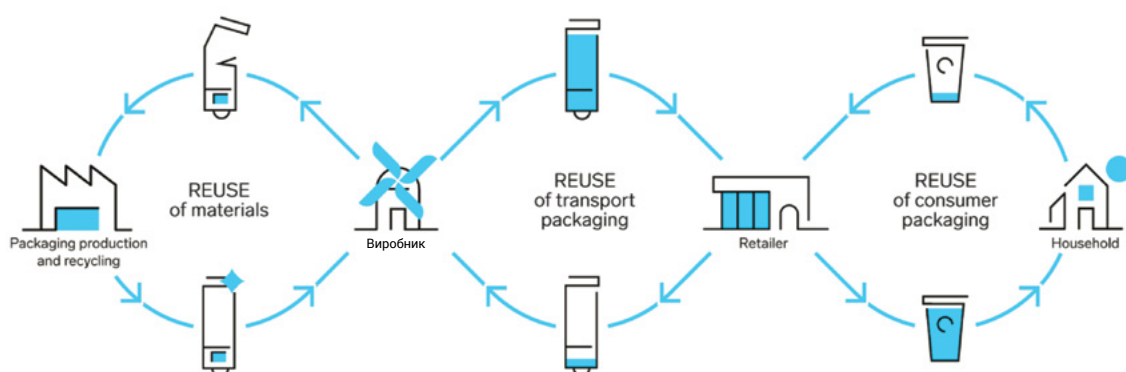


The solution:

Miwa, which is short for 'minimum waste', is developing a system to remove packaging from shops entirely. It introduced a digital solution that lets shoppers order the exact quantities of the groceries they need, which are then delivered in reusable packaging from the producer to their closest store or their home. Suppliers deliver goods from producers to stores, packed into Miwa's reusable capsules. The capsules make up modular racks in shops. The empty capsule is collected and washed by Miwa, then sent back to the supplier to be refilled.

Why it's an example of the circular economy:

Connecting the producer with the consumer it eliminates single-use packaging along the product's value chain but also the usual transportation of products by trucks or ships. The system can be scaled to work in supermarkets as well as local stores and farmers markets. This solution does not only avoid non-recyclable plastic packaging, but also minimises food waste.



Source: <https://www.miwa.eu/>

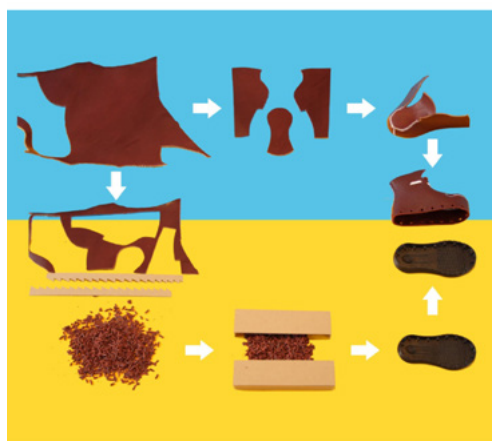
Retailers are interested in pioneering new ways of shopping, suppliers like the idea of saving on logistics-packaging, and shoppers like the reduced costs by buying only the necessary amounts they need.

4. Product Life extension

Extending the life of a product allows it to remain in use for as long as possible, one of the three core

principles of circular economy. This may involve designing products to be both physically and emotionally durable or it may require innovative approaches that allow the product to adapt to a user's changing needs as time passes - as is the case in the two examples below.

Products that resist damage and wear, or retain their emotional appeal are able to be used and reused multiple times, potentially by many different users. In some cases, objects may become even more valuable through repair.



Source: <http://thomasleech.co.uk/shoey-shoes>

➔ Case: **Shoey Shoes, The UK**

The Issue:

It is estimated that every year 20 billion pairs of shoes are produced and 300 million pairs are landfilled, creating pollution, waste and social issues..

The solution:

Shoey Shoes produces children's shoes entirely from waste materials, and engineered to be disassembled, reused, and recycled. They are the invention of Thomas Leech, an industrial designer in London.

Why it's an example of the circular economy:

A modular shoe, which creates an opportunity for a new service model. The wearer leases the shoes, while the manufacturer retains ownership of the valuable materials and takes responsibility for keeping them in use.¹⁶

5. Modularity

Modular design is a useful strategy for making products easier to repair, remanufacture, and upgrade. By making it easy to remove only part of a product, you make it easier to disassemble, lowering the cost and effort to swap out components when they are damaged. Additionally, modular systems are easier to customise and therefore adapt to the variable and forever needs of users, preventing products from becoming obsolete and ensuring they are kept in use for long periods of time.

➔ Case: **Fairphone, The Netherlands**

The issue:

Every year, millions of mobile phones are thrown away. This is largely because most phones aren't built to last (so called "planned obsolescence"), paired with our desire to constantly upgrade our devices ("perceived obsolescence"). Fairphone is fighting against a market trend where the average phone is replaced every 18 months.

16. <https://www.circulardesignguide.com/story/a-systemic-approach-to-designing-with-resources>

The solution:

Fairphone develops smartphones that are designed and produced with minimal environmental impact. Their product does not contain conflict minerals (typically gold, tin, tantalum, and tungsten), has fair labour conditions for the workforce along the supply chain and helps people to use their phone longer. The Fairphone 4 released in October 2021 has 5 years of warranty.



Source: <https://www.fairphone.com/en/>

Why it's an example of the circular economy:

The modular design allows the screen and other parts to be quickly and cheaply replaced if it is damaged. The company is moving one step closer to a circular economy by encouraging the reuse and repair of mobile phones, researching electronics recycling options, and reducing electronic waste worldwide. The purpose is to make the most of the materials used in consumer electronics and support recycling programmes to ensure valuable materials can be used again and again.

6. Safe and circular material choices

Not all materials are fit for a circular economy. Some contain chemicals that are hazardous to humans or the environment. Additives are often used unintentionally or for performance reasons - such as improving flexibility or durability - but there are ways to design them out. By choosing materials that are safe and circular, you can build a better offering for your users, while ensuring that the products and services you create fit within a circular economy.

🔗 Find out more: [Instrument for Material choices](#), [The Circular design guide](#)

7. Biomimicry

Nature has already solved many problems and global challenges that we face and has the secret of survival, in particular, in extremely difficult conditions. Biomimicry is a practice that learns from and mimics the strategies found in nature to solve human challenges. This design strategy mimics solutions developed by nature over 3.8 billion years. By imitating nature, you can find the optimal form, functions, process, systems, strategies for solving global



Source: <https://www.treehugger.com>

problems of mankind. For example, tiny hooks on burdock fruit prompted the idea of creating «Velcro», which we now actively use as an element of clothing, shoes, backpacks and more.

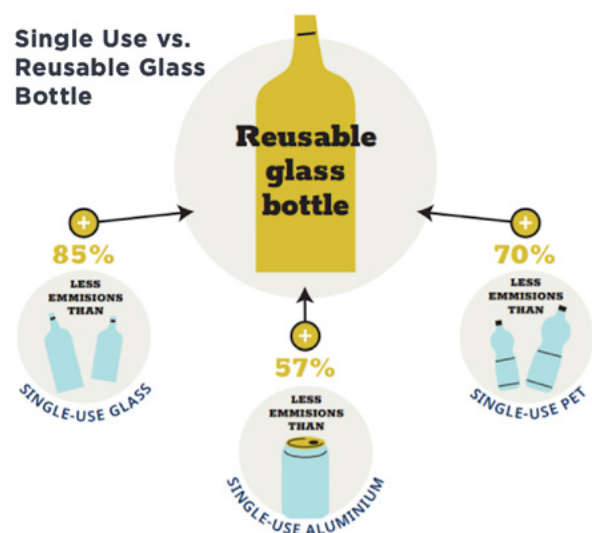
Find out more: asknature.org and [UNDP Biomimicry online-course](https://www.unep.org/education/learning/online-courses)

8. Life Cycle Thinking

Life Cycle thinking means accounting for economic, environmental and social impacts across all stages of a product or process life cycle (i.e. greenhouse gas emissions, jobs created, health impacts, etc.).

The current way of thinking about product life cycles is fundamentally linear because there is a raw material extraction phase, a production phase, a use phase and an end-of-life phase. The typical life cycle stages companies consider when evaluating the impacts of a product or service are listed below. The number of stages to include in your life cycle thinking depends on the product or process.

- Raw material extraction
- Material processing
- Manufacturing
- Use
- End-of-Life



E.g. Life-cycle assessment of a plastic bottle, glass bottle and aluminium can, helped to find out that reusable glass bottle has the lowest environmental impact of all.

More: [Executive summary: Reusable VS Single-use packaging – A review of environmental impact.](#)

Find out more: Article [Life-Cycle Thinking](#), Video [The Story of Stuff](#), Video [Life-cycle of a T-shirt](#), Instrument [Life Cycle model Organization](#)

The Stages of Circular design

The circular design process comprises four stages and is informed by approaches such as design thinking and human-centred design. According to The Circular Design Guide, an initiative from the Ellen MacArthur Foundation in collaboration with IDEO, the four stages of circular design are:

Understand

Learn about different circular design solutions and gain a deeper understanding of how to move from linear to circular thinking.

Define

Articulate a challenge, find opportunities for circularity, whether you are starting a project or revising an existing one, and set goals.

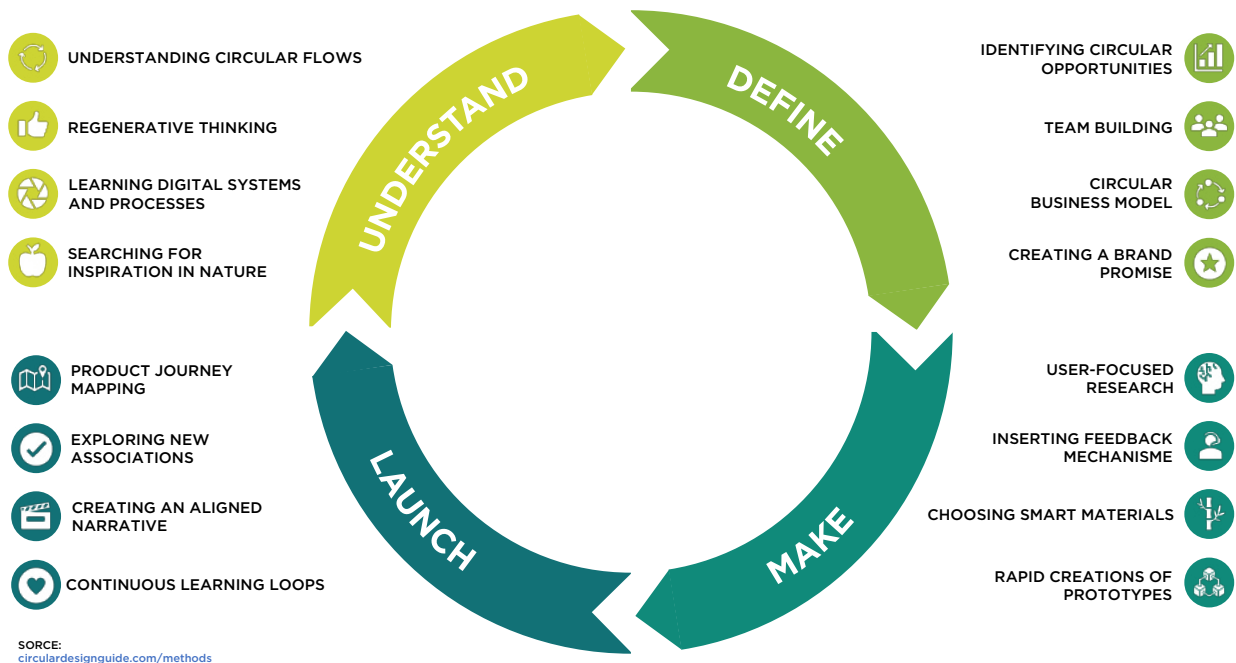
Make

Understand user needs, exchange ideas, develop concepts, make them tangible by building prototypes and test them in order to learn.

Launch

Put the concept on the market in order to gather feedback that will allow the product or service to evolve and generate the necessary change.

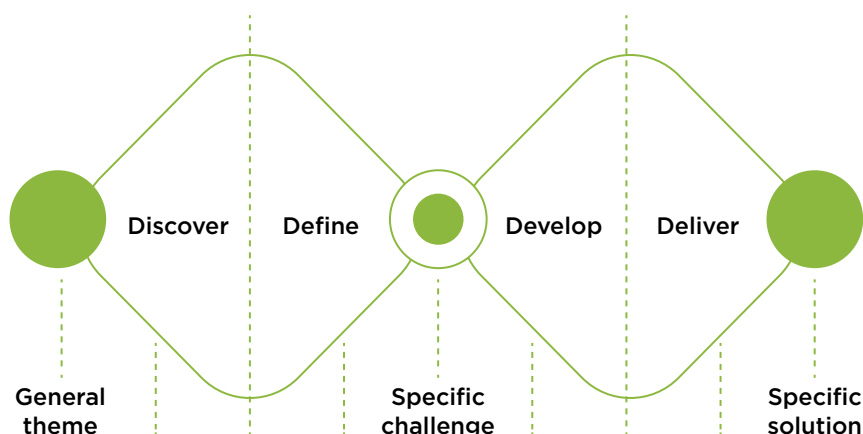
Circular Design Methods



Designing is an iterative process that never finishes. You should constantly be testing and refining as you understand how your users interact with your design, and how it fits within the wider system..

Find out more: [The Stages of Circular Design](#)

We have prepared step-by-step recommendations for designers on how to develop circular solutions. Pay attention to the process of Zooming in and Zooming out, while following the scheme:



1. First, **choose a General Theme**. E.g. "Plastic pollution". Conduct a research and try to answer these questions:
 - What opportunities can we see for interventions/problem solving?
 - What obstacles can we see?
2. **Zoom out** to see the system in which the challenge exists.
 - Define the main stakeholders that can influence the system, using the [Instrument for identifying stakeholders](#)
 - Define opportunities and obstacles for solving the problem, conducting SWOT-analysis.
3. **Zoom in** and **define a Specific challenge** that you want to solve (not too narrow, not too wide). E.g.:
 - "How can we solve the plastic pollution problem?" - is too broad.
 - "How can we set a separate collection and recycling of waste?" - is too narrow.
 - "How can we reduce the quantity of waste from single-use plastic packaging" - is a specific clear challenge.
4. **Zoom out** again and go through the Ideation process to **Develop** as many ideas and solutions as possible. You can use [Ideation cards](#).

Try to answer the questions "How can we...?", "What if...?", e.g.:

 - How might we design in a way that addresses 'user needs' AND that can work in the long term?
 - How might we create products and services that fit into our (eco)-systems, and become 'food' rather than waste and pollution?
5. Zoom in again to Deliver one solution. Move to Prototyping. Fill in [«Circular Canvas»](#). Make sure to assess negative and positive impacts of your product or service.
6. Think about what partnerships can help you maintain the value.

Remember, there is no single perfect solution, whether you are a beginner or an advanced practitioner you can iteratively improve your practice. We can learn from each other and gain inspiration from pioneers in other organisations and geographies. Together we can raise the bar in designing for a circular economy.

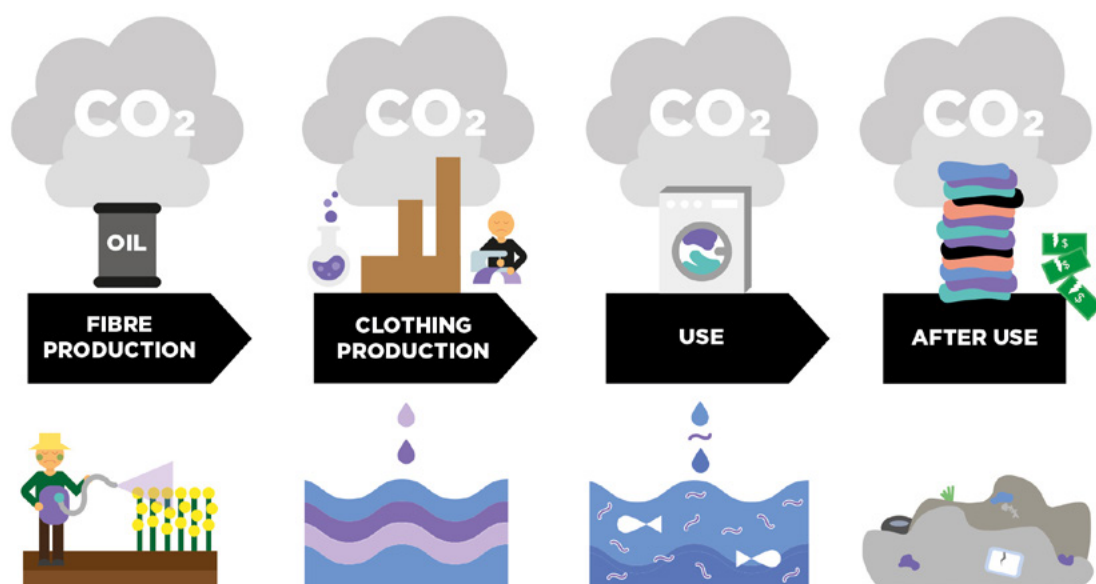
 **Useful resources:** [Circular Design Guide](#), [Use2Use Circular Design Tools](#)

CIRCULAR CASE-STUDIES IN VARIOUS INDUSTRIES

Fashion and the Circular economy

Globally, an estimated 92 million tonnes of textiles waste is created each year and the equivalent to a rubbish truck full of clothes ends up on landfill sites or gets incinerated every second.¹⁷ Large amounts of nonrenewable resources are extracted to produce clothes that are often only used for a short period. The textile industry is a major polluter of groundwater, rivers and the sea. Between 20,000 and 40,000 different chemicals are used to process and dye clothing.¹⁸ Also the fashion industry is one of the major contributors of plastic microfibres entering our oceans.

The current system for producing, distributing, and using clothing operates in a linear way, polluting our environment, depleting resources and creating significant negative societal impacts and health risks. The current clothing systems pressures on resources, environment, social impacts.¹⁹



Source: <https://archive.ellenmacarthurfoundation.org/explore/fashion-and-the-circular-economy>

Circular economy for fashion is restorative and regenerative by design and provides benefits for business, society, and the environment. In such a system, clothes, textiles, and fibres are kept at their highest value during use and re-enter the economy after use, never ending up as waste. A circular economy for fashion prioritises the rights and equity of everyone involved in the fashion industry, including textile workers.

17. <https://www.bbc.com/future/article/20200710-why-clothes-are-so-hard-to-recycle>

18. Plastic Atlas 2019: <https://www.boell.de/sites/default/files/2020-01/Plastic%20Atlas%202019%202nd%20Edition.pdf>

19. <https://archive.ellenmacarthurfoundation.org/explore/fashion-and-the-circular-economy>

Realising this vision of a new global textiles system relies on three focus areas:

- **New business models that increase clothing use**

Designing and producing clothes of higher quality and providing access to them via new business models would help shift the perception of clothing from a disposable item to a durable product. There are numerous opportunities for innovative business models to be employed by the fashion industry, including subscription services, clothing rental etc.

Cases: [MUD jeans](#), [Circos](#).

- **Safe and renewable materials**

A new textiles economy will enable the shift to renewables, decreasing resource dependence and increasing system resilience. E.g. no fossil fuel-based fertilizers or pesticides should be used in the farming of biologically-based input, like cotton.

Harmful substances should not leak into the environment or risk the health of textile workers and clothing users. Other pollutants and greenhouse gases should be designed out. Our clothes should not release microfibres and making of these clothes should be a safe process, that doesn't destroy the ecosystems and doesn't harm people's health.



- **Solutions so used clothes are turned into new**

Accessible services and widespread support for users to maintain their clothes for longer (e.g. through repair, restyle, washing, and storing) could help to keep clothes at their highest perceived and actual value. Some brands already offer in-store repair and incentivise users to keep their garments well maintained, in particular, outdoor clothing brands such as Bergans, Jack Wolfskin and Patagonia, all offer repair services for their used products. [Patagonia](#), is repairing about 50,000 pieces per year.

Once clothes cannot be used anymore, recycling them into new clothes will allow the value of the materials to be captured at different levels. To be able to capture the value of all materials once garments are no longer worn, it is necessary to ensure that design aligns with recycling processes that are available today.²⁰

Plastics and the Circular economy

Plastics are versatile materials, but the way we use them is incredibly wasteful. We take oil and gas from the earth to make plastic products that are often designed to be used only once, and then we throw them away, creating **pollution at all the life-cycle stages**. 8 million tonnes of plastic waste leaks into the ocean every year. As for today, only 9% of plastic has been recycled, 12% incinerated, creating toxic ash and emissions, and nearly 79% stays in landfills and in the environment.²¹

20. <https://archive.ellenmacarthurfoundation.org/explore/fashion-and-the-circular-economy>

21. Plastic Atlas 2019: <https://www.boell.de/sites/default/files/2020-01/Plastic%20Atlas%202019%202nd%20Edition.pdf>

The majority of plastic packaging items on the market today are designed in a way that means they are not recyclable in practice and at scale. Recyclability also depends on global infrastructure, and the current recycling system can't keep up with growth in plastic usage.

Today, plastic packaging materials flows are largely linear



1 – CLOSED-LOOP RECYCLING: RECYCLING OF PLASTICS INTO THE SAME OR SIMILAR-QUALITY APPLICATION
2 – CASCADED RECYCLING: RECYCLING OF PLASTICS INTO OTHER, LOWER-VALUE APPLICATIONS

Source: <https://emf.thirdlife.com/link/cmy2sfpast1d-bid6vx/@/#id=4>

95% of the value of plastic packaging material, worth USD 80-120 billion annually, is lost to the economy.²²

In a circular economy for plastic, it never becomes waste or pollution. Three actions are required to achieve this vision and create a circular economy for plastic:

- **Eliminate** all problematic and unnecessary plastic items.
Without elimination, achieving a circular economy for plastic will not be possible. With the demand for plastic packaging set to double over the coming two decades, it will be impossible to keep this ever-growing flow of plastics in the economy and out of the environment. To achieve a circular economy we need to reduce the amount of material that needs to be circulated
- **Innovate** to ensure that the plastics we do need are reusable, recyclable, or compostable.
Until recently, reuse models were broadly considered to be burdensome or a thing of the past. In the last year, there has been a significant increase in business and government interest, commitments and action on reuse in the form of pilots, research initiatives, and reuse-focused startups. Globally, replacing just 20% of single-use plastic packaging with reusable alternatives is conservatively estimated to be an opportunity worth at least USD 10 billion.

Reusable packaging is designed to be used multiple times, for its originally intended purpose. The packaging is brought back into the economy through washing, retaining its original form throughout its entire life of multiple uses. There are four different business-to-consumer (B2C) reuse models, differing

22. Report The New Plastics Economy: Rethinking the future of plastics: <https://ellenmacarthurfoundation.org/>

in terms of packaging 'ownership'. Refill users retain ownership as in they keep the packaging, while Return users return the packaging and the ownership either moves between business and user or stays with the business.



The four reuse models

Business-to-consumer reuse models differ in terms of packaging 'ownership' and the requirement for the user to leave home to refill/return the packaging.

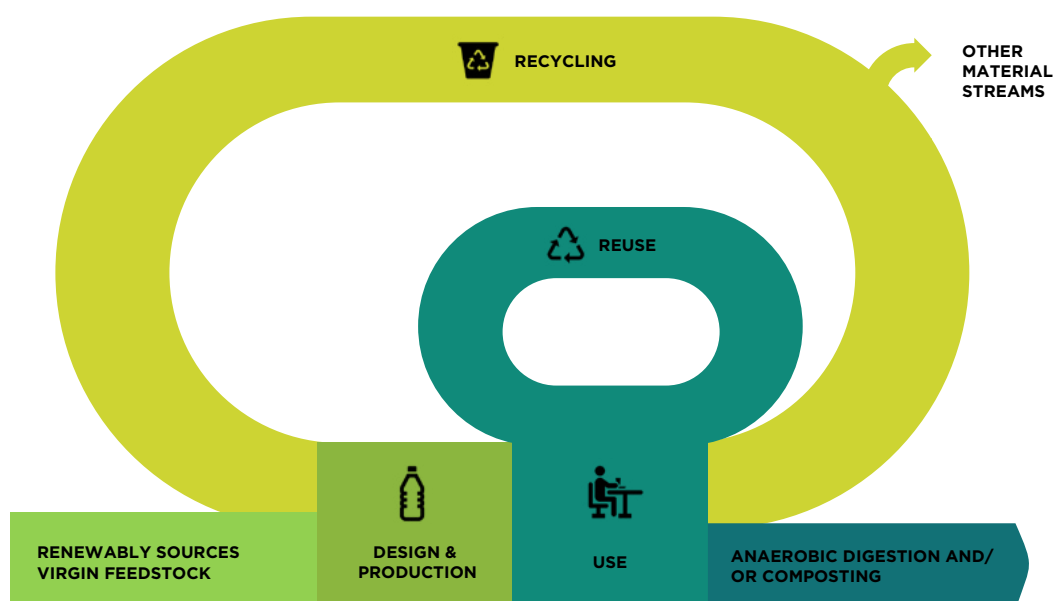


Moving from single-use to reuse not only helps eliminate plastic waste and pollution but also, if done well, offers significant reductions in greenhouse gas (GHG) emissions and other negative externalities.²³ Also, innovation means that plastic packaging should be free of hazardous chemicals, and the health, safety, and rights of all people involved are respected.

- **Circulate** all the plastic items we use to keep them in the economy and out of the environment. Material circulation refers to keeping the material that packaging is made from in circulation in the economy. This is achieved through the development of a dedicated system which includes collecting and sorting, a physical chemical or biological breakdown process, and then the rebuilding of a material that is reintroduced. Packaging materials re-entering the economy in packaging applications is material circulation, while converting packaging materials into roads is not. Material circulation differs from reuse in that reuse circulates the in tact packaging (i.e. packaging shape is maintained and circulation occurs through washing) whereas material circulation circulates the packaging material (i.e. packaging shape is not maintained and circulation occurs through a breakdown process).

23. Reuse - Rethinking packaging. Ellen Macarthur Foundation: <https://ellenmacarthurfoundation.org/reuse-rethinking-packaging>

A Circular Economy For Plastic



SOURCE:
<https://emf.thirdlight.com/link/cmy2sfpast1d-bid6vx/@/#id=0>

Find out more: [Infosheet about Bioplastics](#)

Circular Economy for Cities

Cities play a central role in the global economy. Home to more than half of the world's population, they are creative, innovative centres of growth.

Cities account for 85% of global GDP generation and 75% of natural resource consumption. Cities also produce 50% of global waste and 60-80% of greenhouse gas emissions.²⁴

With their high concentration of resources, capital, data, and talent spread over a relatively small geographic area, cities are uniquely positioned to drive a global transition towards a circular economy.

It's important to consider cities like living systems. Same as a human body, cities are made up of many interdependent, dynamic subsystems, such as buildings, mobility, products and services, and food. Each of these systems has opportunities for design innovations, new business models and use of digital technology.

In buildings it's important to source renewable, non-toxic materials, that will increase reusability/recyclability, and ultimately allow for materials to be safely returned to the biosphere at end of life, thereby acting as 'nutrients' to grow new materials. In this model, buildings will have fully closed water, nutrition, material, and energy loops.

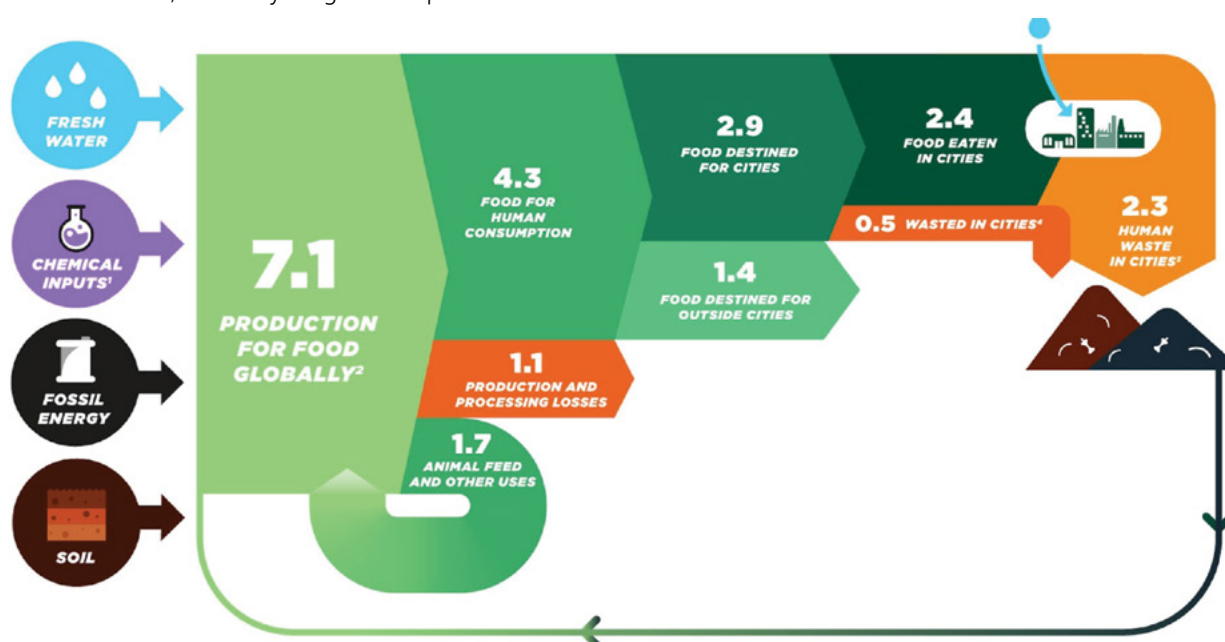
Much progress can be made by integrating 'smart' technology such as responsive heating, ventilation, and air conditioning (HVAC) systems, and smart meters that provide greater transparency on energy

24. <https://archive.ellenmacarthurfoundation.org/explore/cities-and-the-circular-economy>

consumption and cost. The last one can reduce energy consumption in Europe by 20-30%. New business models are emerging to take full advantage of underutilised or idle space in cities, allowing people to share anything from office space and equipment, to parking spaces and spare rooms.

More established technologies such as solar PV are dropping considerably in price, and help buildings to produce energy. Green roofs are able to filter and capture rainwater. Recirculation of water within homes (e.g. using shower water to flush the toilet) is another way to reduce a home's resource consumption.

A circular mobility system would let citizens access affordable and effective transportation. Multi-modal system would offer a diverse range of mobility options to reflect the diverse needs of cities and their citizens - shared cars, buses, trams, trains, and shared bikes etc. Among the most effective forms of transport in cities is active mobility such as walking and cycling, because they are low impact, low cost, and have many associated health and economic benefits. Vehicles are designed so that we can easily repair, reuse, remanufacture, and recycling of components and materials at the end of use.²⁵



Changing our **food system** is one of the most impactful things we can do to address climate change, create healthy cities, and rebuild biodiversity.

1/3 of food produced globally - worth USD 1 trillion - is wasted each year, yet more than 10% of the world's population goes hungry²⁶

By 2050, around 5 million lives a year could be lost as a result of current food production processes. Among the harmful impacts of such methods are diseases caused by air pollution and water contamination, health consequences of pesticide use, and increased antimicrobial resistance. Some of the principal causes are overuse of fertilisers, excessive reliance on antibiotics in animals, and untreated human waste.

25. <https://archive.ellenmacarthurfoundation.org/explore/cities-and-the-circular-economy>

26. <https://archive.ellenmacarthurfoundation.org/explore/cities-and-the-circular-economy>

The circular economy offers a vision for a food system fit for the future. Cities are equipped with technology and have dense networks of highly skilled workers creating ideal conditions for innovation. Their citizens, retailers, and service providers are all in close proximity, making new types of business models possible. This combination of factors means that cities, businesses, and governments, have a unique opportunity to spark a transformation towards a circular economy for food.



Source <https://www.urbangreenbluegrids.com/projects/hammarby-sjostad-stockholm-sweden/>

Hammarby Sjöstad in Sweden is one of the examples of cities implementing circular economy principles. It was designed as a comprehensive infrastructure project. The heating, transport, and waste collection systems were intended to work in conjunction to reduce their long term use of energy and resources. The Hammarby Model consists of using resources in a cyclical loop, ensuring that the system is based on a life-cycle assessment and maximizing renewable resources use.²⁷

🔗 Find out more: [here](#) and [here](#)

Conclusion

The linear economy has already proved its short life and a large number of shortcomings. We have a long way to go, and interest in the circular economy is already growing among many different actors, from business to politicians. It is time to take full advantage of the many opportunities to create a system that can work in the long run for the economy, society and the environment.

Designers play a very important role in the transition to a circular economy, as the design phase determines about 80% of the environmental and human health impact.

Design for the circular economy or Circular design is one of the biggest creative challenges of our time. It's an exciting journey, and we are only at the beginning of it.

27. <https://circle-lab.com/knowledge-hub/3644/hammarby-sjostad>