



The circular economy

What is meant by the circular economy and how might this approach provide sustainability?

The circular economy is one possible response to the challenges posed by a growing population and consumer pressure on natural resources. Circular-economy thinking relies on the important geographical concepts of systems, sustainability and interdependence.

Limits to growth

Climate change, along with water, food and energy insecurity, poses a risk to the existence of humanity. The Earth's fixed and sometimes finite stock of natural resources is being depleted in wasteful ways by a global population which continues to grow in size and affluence. The pessimism of the 1970s 'limits to growth' model is grounded in views such as these (Figure 1). It shows population, industrial output and pollution ramping upwards as natural resources dwindle. This catastrophic scenario leads ultimately to a population 'crash'.

Some people fear this projection could still be accurate. Plastic production, for example, is predicted to double worldwide by 2025. Yet only 8% of all plastic is recycled currently (while some sea life chokes on the remainder). Can anything really be done to mitigate against accelerating use of throwaway plastic and other materials? The conventional wisdom of the past suggested that contraception (fewer people) and austerity (buying fewer goods) might limit growth. Neither of these are realistic fixes, however. Increased longevity has meant that world population continues to grow even as fertility falls. Meanwhile, consumption rises in line with successful poverty reduction.

A better solution is clearly needed. Advocates of the circular economy believe they have found it.

Circular thinking

The circular economy aims to nurture both ecological and economic health in order to promote truly sustainable development. It is a far bolder vision than either increased recycling or improved efficiency in using primary resources and fossil fuels (which just delays the inevitable exhaustion of finite reserves). Its philosophy derives from the study of natural systems (such as ecosystems, or the water and carbon cycles).



Alloy car wheels awaiting recycling

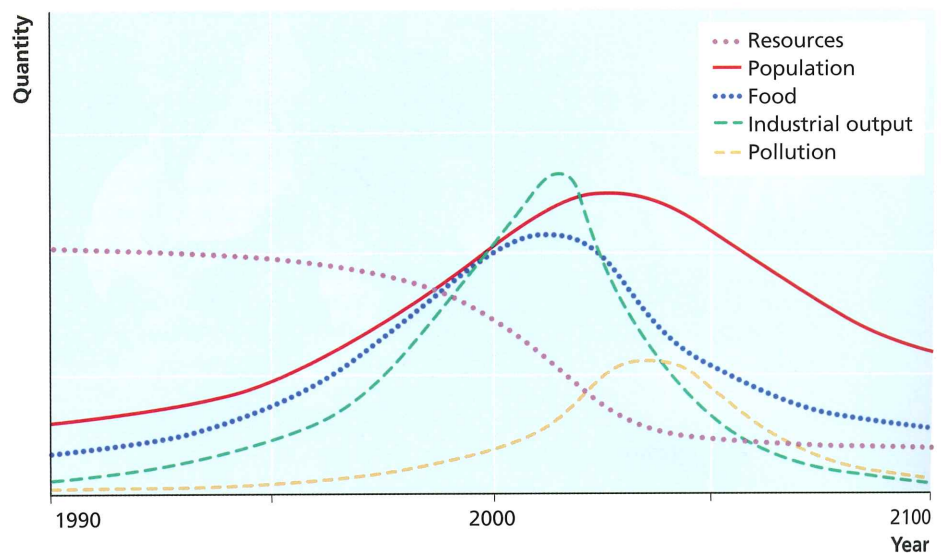


Figure 1 The dire predictions of the limits to growth model

Figure 2 portrays the circular economy as biological and technical cycles operating in tandem. This 'cradle to cradle' framework was designed by architect William McDonough and chemist Michael Braungart. The key aim is to progress beyond current linear, wasteful economic systems and to ultimately 'design out' waste altogether. Box 1 outlines the main elements of contrasting linear and circular systems.

Since 2010, the Ellen MacArthur Foundation has actively promoted the circular economy concept and in 2015 the European Commission submitted a Circular Economy Package to the European Parliament. Circular economy concepts have been successfully applied at a small scale since the 1990s (for instance, in 'industrial ecosystem' parks such as the Kalundborg Symbiosis in Denmark).

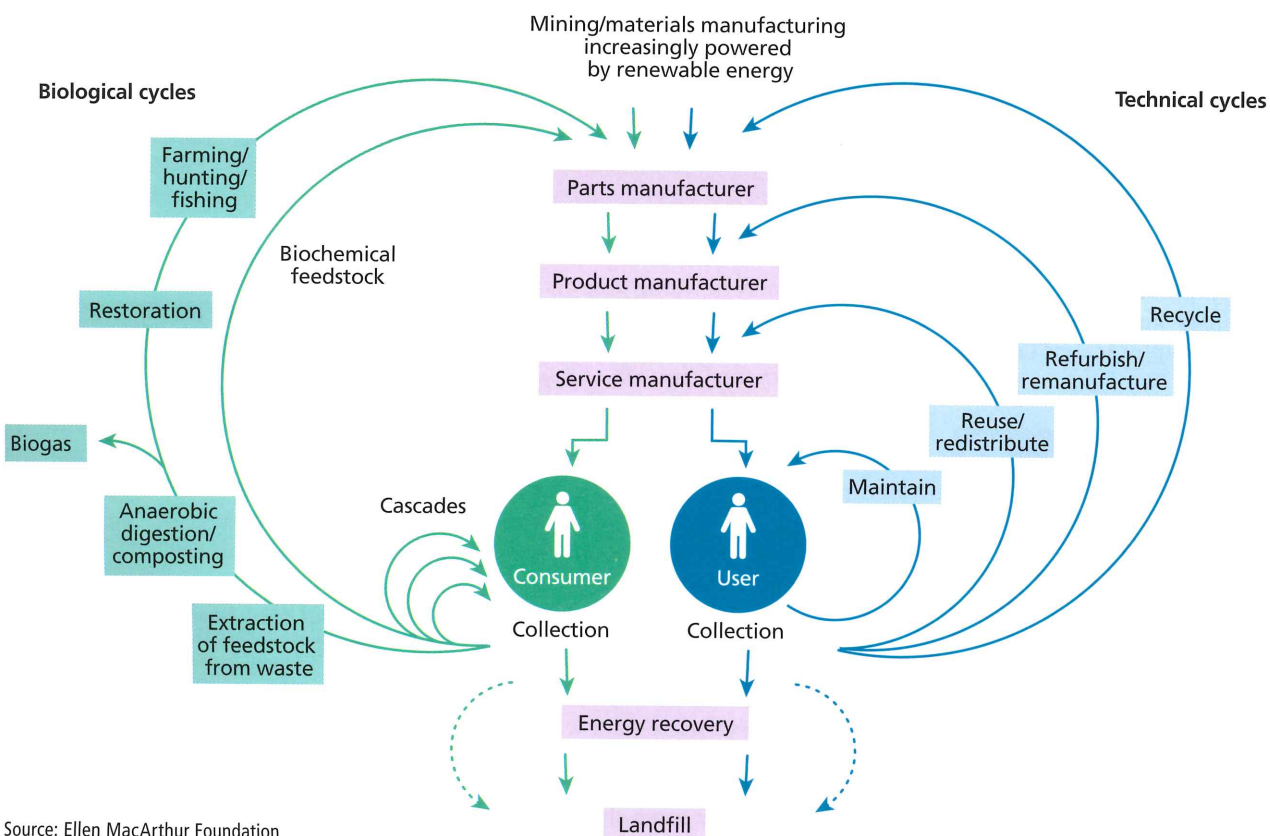


Box 1 Different types of economic system

A **linear economy** flows in a single direction. Natural resources including oil, minerals and food move through the system as they are manufactured into consumer goods. This often involves linked supply-chain stages, with waste created and value added at each step. At the end of this, when goods are sold, ownership passes from producer to consumer. This includes responsibility for waste disposal when the product is used up or breaks. Under capitalism, economies are expected to grow, always moving towards increased output and profit. This is likely to exhaust resources and create a growing amount of waste.

In a **circular economy**, outputs are reprocessed and all waste is viewed as a resource. Reuse may be more efficient than recycling — cleaning and reusing a bottle could be faster and cheaper than recycling the glass or making a new bottle. Vehicles, plastics and buildings are all designed with a view to dismantling them and reusing parts later: this is called closing the loop. Food is managed more carefully at all stages of the supply chain and waste is composted. New jobs are created in developing and implementing technology. Natural-resource stocks are maintained, benefiting both our environment and society.

A circular economy may be easier to reach if people rent or share goods instead of buying them. This way, the manufacturer retains ownership of the product (and the resources it contains) and responsibility for waste. Companies are encouraged to innovate more creative and cost-effective ways of recycling and reusing.



Source: Ellen MacArthur Foundation

Figure 2 The twin biological and technical loops of the circular economy

Table 1 Examples of the application of circular economy principles at varying scales

Scale	Examples
Global governance	The SDG target is to halve food waste worldwide by 2030. The EU has committed to this target The EU already has long-standing 'circular' legislation in place: the 2003 Directive on Waste Electrical and Electronic Equipment (WEEE Directive) led to collection schemes in which consumers return their WEEE, such as fridges, to the manufacturer free of charge
National targets	The US Department of Agriculture and Environmental Protection Agency has set a national food waste reduction goal (matching the UN's global goal) France and Italy have taken steps to make it illegal for supermarkets to throw out unsold food, requiring that they donate it to charities, or animal feed and composting companies
Local initiatives	Suzhou New District, near Shanghai in China, is home to 4,000 manufacturing firms, many of which have interlinked their operations and become interdependent. Manufacturers of printed circuit boards use copper that is recovered from waste generated by other companies in the park (rather than using virgin copper produced by mining firms elsewhere)

For the circular economy to succeed in the future, supermarkets and charities must work together. Can you think of a way in which they could reduce waste while also minimising health risks?

Reasons to be optimistic?

Pessimists might view circular economy thinking as 'too little, too late'. They may point despairingly towards the vast quantities of resources and waste associated with China's production of half the world's aluminium, steel and cement. Yet China increasingly leads the way in promoting renewable energy and in setting targets for reusing waste. Unlike neoliberal governments, Chinese leaders are often quick to impose legislation to accelerate changes. According to the journal *Nature*, China's goal is a circular economy.

Closer to home, we see socio-technical changes which both support and are shaped by circular thinking. Longer-lasting products such as graphene are being used in manufacturing. Nexus thinking is at the forefront of many designers' minds. Some scientists hope to develop edible plastic, for instance. The fast-maturing technology of driverless cars could play a key role in moving us towards product rental rather than ownership. Finally, sociologists have observed that many millennials participate willingly in a 'sharing economy' and are committed to sustainable development goals. This generation is now part of the political decision-making process.

Optimists may therefore conclude that the technological, economic and — perhaps more importantly — political building blocks for a circular economy are already in place.

The 'use by' date poses a challenge for circular food-waste management

The 2015 United Nations Sustainable Development Goals (SDGs) include a commitment to reduce waste in food systems globally.

To achieve circular economy goals, companies everywhere must design products which last longer and/or make greater use of recycled materials. Yet if costs rise and profits fall, where is the incentive? For example, current low oil prices mean that new plastic has become less expensive than recycling used plastic, which takes a lot of water, energy and effort. The circular economy may not succeed if neoliberal beliefs prevent

governments from intervening strategically in markets. It may be a long time before oil prices fall, for instance. If that is the case, then governments will need to take action to promote recycling (instead of assuming that businesses and civil society will adopt circular economy principles voluntarily).

The food supply-chain challenge

Implementing a circular economy for food could be difficult because of the complex way sustainability goals intersect with health and safety requirements. Over time, shoppers have grown accustomed to food labelling showing whether a product remains fresh ('best before' date) or risk free ('use before' date). Supermarket waste food which has passed its 'use by' date cannot be donated legally to food banks (because of risks such as salmonella), while some charities reject food which has passed its 'best before' date for health and ethical reasons.



The challenge ahead

Steps towards implementing circular-economy principles have already been taken at varying geographic scales (Table 1).

Glossary

Graphene An exceptionally light, strong form of carbon which conducts electricity and heat and can be used in structural and electrical devices.

Millennials People who reached young adulthood around the year 2000.

Neoliberal A political/economic ideology that favours free-market capitalism.

Nexus thinking Recognising the link between supplying resources of food, water and energy, and the environmental implications of all three.

Further reading

Nature special report: www.nature.com/news/the-circular-economy-1.19594

The European Union's Circular Economy Package: www.tinyurl.com/mrgoa47

Exploring the 'cradle to cradle' principle: www.cradletocradle.com/

How market forces threaten recycling: www.tinyurl.com/jmoedkb

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