



# THE VIRTUOUS CIRCLE

*Ellen MacArthur*

BIG IDEAS III



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**The virtuous circle**

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pdf: QH-03-19-397-EN-N ISBN 978-92-861-4303-8 doi: 10.2867/016569

eBook: QH-03-19-397-EN-E ISBN 978-92-861-4307-6 doi: 10.2867/667980

## BIG IDEAS

Imagine an economy in which today's goods become tomorrow's resources and nothing is discarded.

Ellen MacArthur, the founder of her eponymous foundation, which works to accelerate the transition to a regenerative economy, writes that we need to stop living a "take, make, dispose" lifestyle. We need to think about a circular economy where waste and pollution are prevented, products are reused and natural systems such as agricultural land are regenerated.

The benefits to cities and countries are huge, as sustainability brings big savings for the environment, mobility, nutrition, textiles, electronics, etc. Businesses, governments, NGOs, and investors have started taking action to make the circular economy happen, and the number of countries and cities drawing up circular economy strategies is multiplying.

We now need people with the ability to do so to grasp with both hands the opportunities to design a world that works in the long term.

This is the seventh essay in the *Big Ideas* series created by the European Investment Bank.

The EIB has invited international thought leaders to write about the most important issues of the day. These essays are a reminder that we need new thinking to protect the environment, promote equality and improve people's lives around the globe.





**TIME TO RETHINK  
OUR APPROACH**

# TIME TO RETHINK OUR APPROACH

Unseen levels of material wealth reached the most advanced economies from 1900 to 2000: global GDP rose by a factor of 20. This meant increased availability of affordable and reliable consumer goods. In emerging economies, growth has played a vital role in reducing extreme poverty and improving the lives of millions. However, the system at the core of this historic progress relies on a “take, make, dispose” approach. Resources are extracted from the earth and converted into products that are discarded after use – the linear economy.

The environmental impacts of this approach become clearer by the day. Take some of our ubiquitous products: for every dollar spent on food, two dollars of health costs, environmental damage, and economic waste are generated in the form of degraded soil, pollution, harmful food, and food waste. The production of plastic relies almost entirely on fossil fuels, and eight million tonnes of plastic a year find their way into the world’s oceans. Without action, the prospect of there being, by weight, more plastic than fish in the ocean by 2050 is real.<sup>1</sup>

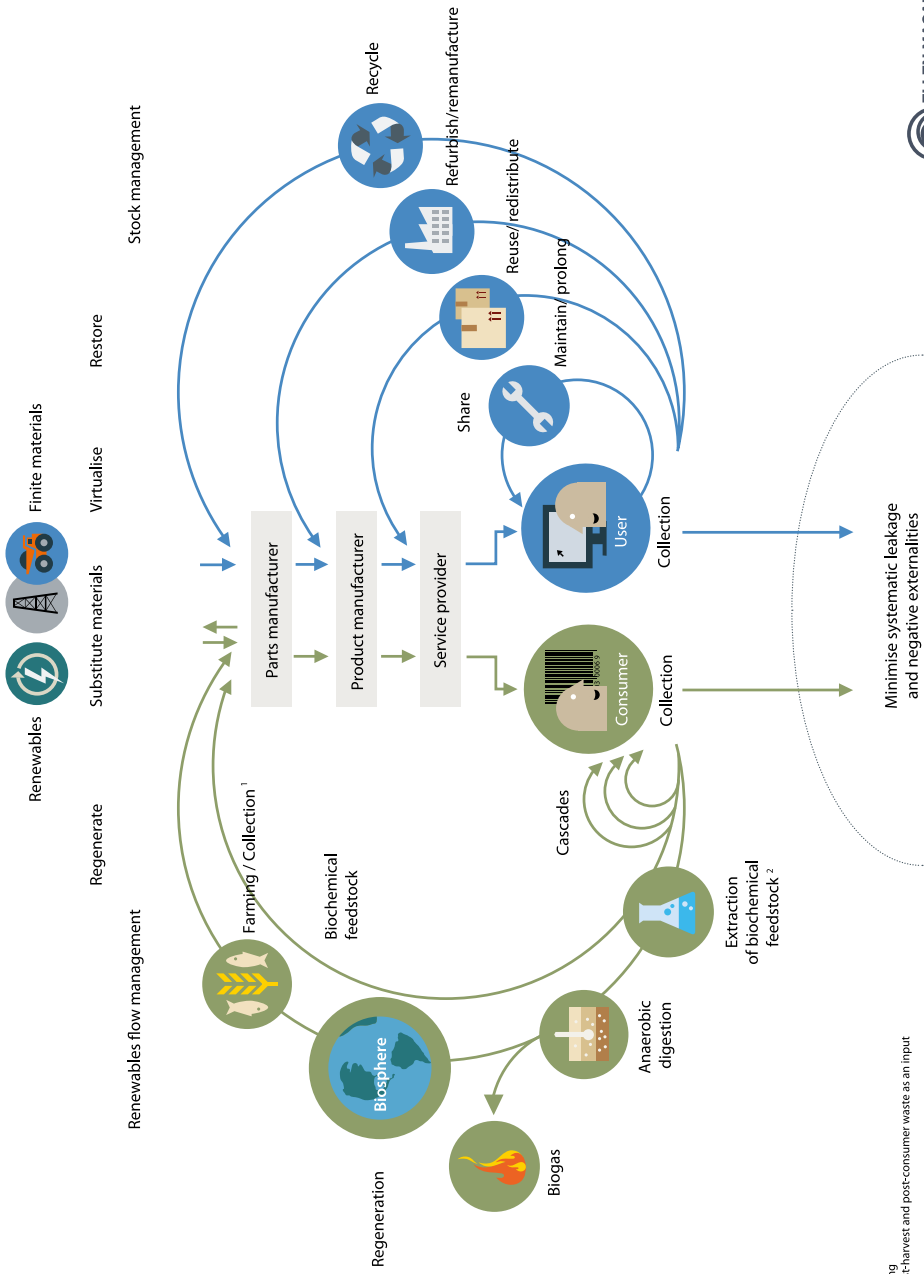
No less tangible are direct losses to the economy. In the fashion industry, of the 53 million tonnes of fibres used to produce clothes every year, only 1% is recycled back into new clothes, with 38 million tonnes landfilled or incinerated. In all, more than \$500 billion of value is lost every year due to clothing being under-used and not recycled. The picture is similar for other materials. In Europe, the average citizen uses 16 tonnes of materials annually, of which 60% by weight is landfilled or incinerated. When it comes to their value, and the energy used to make them, the loss is 95%.<sup>2</sup>

The fundamental drawbacks of the linear approach leave little doubt that it has reached its expiry date. The prospect of a growing population and rapidly expanding global middle class, with most planetary boundaries at or approaching their limits, underlines the need for a serious rethink.

<sup>1</sup> Ellen MacArthur Foundation, *The New Plastics Economy: Rethinking the Future of Plastics*, 2016

<sup>2</sup> Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment, *Growth Within: A Circular Economy Vision for a Competitive Europe*, 2015

# CIRCULAR ECONOMY SYSTEM DIAGRAM



1. Hunting and fishing  
 2. Can take both pre-harvest and post-consumer waste as an input  
 SOURCE: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment  
 Drawing from Braungart & McDonough, Cradle to Cradle.



## **A SYSTEM FIT FOR THE FUTURE**

In response to the wasteful linear system, the circular economy has gained significant momentum in recent years. Underpinned by a transition to renewable energy sources, it is an approach to economic development that aims to benefit business, society, and the environment. In a circular economy, creating value is gradually decoupled from consuming finite resources. It presents new opportunities for organisations small and large, local and global, private and public, representing the potential to create an economy that is distributed, diverse, and inclusive.

The circular economy is based on three principles. First, waste and pollution are designed out. This means the negative impacts of economic activity that cause damage to human health and natural systems are eliminated. This includes factors such as the release of greenhouse gases, the use of toxic and hazardous substances, the pollution of air, land, and water, and the landfilling and incineration of waste. Second, products and materials are kept in use. This means favouring activities that preserve the most embedded energy, labour, and materials. Examples include designing for durability, reuse, remanufacturing, and in the last resort recycling. Third, natural systems are regenerated. This entails, for instance, deploying agricultural practices that not only avoid degrading soil, but actually rebuild soil health over time.



The model distinguishes between technical and biological cycles. In biological cycles food and biological materials (e.g. cotton or wood) feed back into the system through processes such as composting and anaerobic digestion. These cycles regenerate living systems such as soil, which provide renewable resources for the economy. Technical cycles recover and restore products, components, and materials through strategies including reuse, repair, remanufacture or recycling.

Importantly, the transition to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy. Rather, it reflects a systemic shift that builds long-term resilience to economic shocks, generates business opportunities, and provides environmental and societal benefits.





**CONCENTRATORS  
OF RESOURCES**

## CITIES: CONCENTRATORS OF RESOURCES

Global urbanisation trends mean that cities – with their concentrations of resources, capital, data, and talent – will increasingly be the main creators of economic wealth and will therefore play a pivotal role in the transition towards a circular economy.

Urban planners and city-level policymakers can embed circular principles across the city's functions to create an urban system that is regenerative. In the built environment, off-site manufacturing techniques and new technologies such as 3D printing can be deployed to substantially reduce construction waste. Using digital platforms, buildings can have several users over a day or a year, increasing use-rates (even during working hours European offices are on average only 40% occupied). Since they can be designed to be modular and easily disassembled, buildings can readily be repurposed or used as material banks. When looking at mobility, cities can move towards a transport system that is on-demand and zero-emission, and in which shared vehicles are integrated with public transport. This reduces dependence on private cars that are very under-utilised (in Europe the average car is parked 92% of the time).

As for food, citizens can have access to products grown using regenerative agriculture, which does not use fossil-based fertilisers and pesticides and builds soil health. Where possible this food can be grown locally in peri-urban and urban settings, using techniques such as vertical farming, which can cultivate crops indoors without pesticides and using 70-90% less water than conventional farming. Food waste and wastewater can become valuable sources of energy and of organic materials to refine into chemicals and organic fertilisers.







Some of these ideas have already been put into practice. The Broad Group, a Chinese construction company has applied modular construction methods to factories and high-rise buildings. In so doing it has achieved increases in efficiency of production, installation, and logistics of between six and ten times, a reduction in materials waste to almost zero, and a reduction in construction costs of 40%.

In Finland, the city of Helsinki is transforming its transport system by implementing a digitally enabled, point-to-point, mobility-on-demand network. The scheme will integrate all transport options, including buses, taxis, car pools, and shared bikes, on a single payment platform. The user will access the platform via a smartphone app, which will function as a journey planner.

The anaerobic digestion facility in Montpellier, France is able to treat 173,000 tonnes of municipal solid waste a year and is the largest in the country. The plant generates 19 gigawatt hours (GWh) of electricity and 7 GWh of heat for neighbouring households and a clinic. It also produces 25,800 tonnes of compost, which is applied to local public green spaces and agricultural fields.



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The transition to a circular economy also brings about significant economic benefits at the city and national levels. A recent study focused on China shows that, by 2040, circular economy opportunities in the built environment, mobility, nutrition, textiles, and electronics, could save businesses and households approximately \$11 trillion compared to the current development path, 16% of projected GDP.<sup>3</sup> The same opportunities could also lead to substantial advantages for the environment and society. By 2040, emissions of harmful fine particulate matter could be reduced by 50%, emissions of greenhouse gases by 23%, and traffic congestion by 47%. In Europe, research suggests similar outcomes. By 2030, the benefits for the European economy as a whole could be €900 billion more than those expected in the linear scenario. The disposable income of European households could be 11 percentage points higher and CO<sub>2</sub> emissions 48% lower.

At the heart of these economic and environmental opportunities are business models such as sharing, reuse and repair, and product life extension. They provide new ways of creating value without depleting finite resources.<sup>4</sup>

<sup>3</sup> Ellen MacArthur Foundation, *The Circular Economy Opportunity for Urban and Industrial Innovation in China*, 2018

<sup>4</sup> Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment, *Growth Within: A Circular Economy Vision for a Competitive Europe*, 2015





**A BETTER SERVICE  
AT A LOWER PRICE**

## A BETTER SERVICE AT A LOWER PRICE

Circular economy business models lead to more effective use of resources and the building of stronger customer relationships by offering a better service at a lower price. Prominent products in our cityscapes, like cars and bikes, can be designed to be durable, easily maintained, refurbished, remanufactured and recycled. They can then be shared among many users through digital peer-to-peer platforms.

For instance, in India, car manufacturer Mahindra launched an electric vehicle designed for urban use. The car is available through car-sharing pools, allowing users to pay per hour, day, or week, instead of buying the car, increasing the intensity of its use and placing the onus for durability and upgradeability on its manufacturer.

By retaining responsibility for a product, companies can optimise its use and take care of maintenance, remanufacturing, deployment, and material recovery after use. As a result, more businesses may choose to sell a service rather than a product.

Dutch technology company Philips, for instance, was able to start selling light instead of lightbulbs – the so-called “pay per lux” model. This means lower costs and a better service for the customer, since they do not have to take care of maintenance and overcapacity is designed out. Philips maintains ownership of the lighting systems and uses its expertise to run them most effectively, leading to lower energy use and material costs.





Fundamentally rethinking the way we design products offers a range of opportunities to keep them in use longer, preserving their embedded materials and energy over many consecutive cycles rather than aiming simply for efficiency and low purchase price. This enables manufacturers to use resources more effectively in the long run.

For instance, French car manufacturer Renault remanufactures parts such as engine blocks. Compared to producing new ones, this approach uses 80% less energy, 88% less water and 92% less chemicals, and creates 70% less waste.

Central to the circular economy transition is the shift from activities based on extraction and consumption to those based on regeneration and restoration. Businesses that reimagine the way they create value, in line with the principles of a circular economy have a much better chance of thriving in the cities and societies of tomorrow. A business that is able to decouple its activities from the continual extraction of raw materials by keeping products and materials in circulation, and is powered by renewable energy, is likely to be more resilient to future uncertainty than one dependent on throughput.



# CATALYSING THE TRANSITION

## **CATALYSING THE TRANSITION**

The advantages of moving towards a circular economy are numerous and momentum is building. To catalyse the transition, progress in four areas will be important.

### **DIGITAL INNOVATION**

The rise of new digital technology is an important enabler of the transition towards a circular economy. It allows valuable products and materials to be tracked and recovered more easily and access to them brokered in real time. Circular business models rely increasingly on cloud computing, data mining, machine-to-machine communication, and blockchain.

For example, information technology multinational HP has developed Instant Ink, an application that makes use of the Internet of Things (IoT), a network of devices able to exchange information. Instant Ink has an IoT subscription model for individuals and small businesses that uses connected printers to send customers replacement cartridges, along with pre-paid envelopes for returning used cartridges, before the customer runs out of ink. The model demonstrates a component recovery and recycling programme in the consumer electronics sector, as it enables HP to reuse their cartridges many times.





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**THE ORIGINAL**  
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## ENABLING POLICIES

Governments at all levels can facilitate the transition by providing an enabling environment. Supporting policies, suitable infrastructure, and transparent processes are vital in this regard. From a European perspective, the European Commission has taken the lead with the adoption of the circular economy package in December 2015. The idea is to kickstart a new wave of industrial renewal in line with environmental goals. Since then, several national governments have adopted circular economy policies, and countries such as Finland, France, Slovenia and Italy have recently unveiled national circular economy roadmaps. Cities are also seeking to open up opportunities: Amsterdam, Paris, London, and Brussels have all developed broad-based circular economy strategies with a focus on business innovation. Europe is far from alone in these efforts. China adopted circular economy policies in the early 2000s, and its latest policy portfolio launched in 2017 has placed the emphasis on upstream solutions with measures around design policy and extended producer responsibility.

Overall, these are very encouraging first steps that can offer clarity of direction for businesses and investors, but more can be done. The spectrum of circular economy fiscal and regulatory measures remains broad, from pricing in the negative impacts of the linear economy and discouraging over-extraction of non-renewable resources, to breaking down the barriers of existing regulations that can hinder circular business models, for instance by updating definitions of waste to enable the trade in components and materials destined for reuse.







## UNPRECEDENTED LEVELS OF COLLABORATION

Even with the best intentions, the circular economy efforts of most businesses and governments will be limited if they are pursued in isolation. In order to succeed, organisations will need to rethink the nature and depth of collaboration, and work together to achieve system-level change. For example, designers and manufacturers will need to work closely with waste management providers, urban planners, and governments to ensure that the necessary infrastructure and mechanisms are in place to allow what they produce to be reused. Designing a new system for single-use plastic packaging is a good example. Industry convergence on design (materials and formats) and after-use systems (collection, sorting, and reprocessing) will be crucial to decisively improve the economics of reuse and recycling compared to landfill or incineration.

Pre-competitive collaboration is particularly acutely needed when it comes to global, complex materials streams such as plastics, textiles, and food. Establishing circular flows will only be possible with alignment around a common vision and high levels of commitment from those with a stake in the way materials are used. A positive step in this journey is the Global Commitment to eradicate plastic waste and pollution at source, which was launched in October 2018 and sets its signatories on a path to a circular economy for plastic. It has been signed by more than 250 organisations, including many of the world's largest packaging producers, brands, retailers and recyclers, as well as governments and NGOs. Signatories include companies representing 20% of all plastic packaging produced globally.

## ACCESS TO CAPITAL

Bringing these circular economy solutions to scale will create substantial additional investment opportunities. Analysis has shown that in Europe investing an additional €320 billion across three broad themes could unlock the economic, societal, and environmental benefits of such a transition. In the built environment, €115 billion could be invested in designing modular buildings for multiple uses, ramping up the reuse of construction waste, and integrating circular economy principles into urban planning. For better mobility, €135 billion could be invested in integrating shared vehicles into public transport, producing zero-emission cars that can be remanufactured, and establishing reverse logistics for vehicles. Investing €70 billion in the food system could take the form of shifting to regenerative agricultural practices, circulating organic nutrients, and supporting new technologies such as aquaponics and new protein sources. These investments, which can be facilitated by modest policy reforms or industry actions, would allow circular economy innovations to reach their full potential.

Capital is beginning to flow. In September, the Italian banking group Intesa Sanpaolo announced a credit facility of up to €5 billion for 2018-2021 for businesses that adopt circular economy thinking in innovative ways. Dutch banking group ING publishes analysis on the financial benefits of going circular, develops circular business propositions and transactions with clients, and creates market demand for circular products. Public funding is also available. The EU has allocated €650 million for circular economy research and innovation under

Horizon 2020, and €5.5 billion under Structural and Investment Funds for waste management. At EU Member State level, the European Investment Bank has provided €2.4 billion in co-financing for circular economy projects over the last five years, offering not only loans and other instruments, but also financial and technical advice.

How to channel further capital towards these circular business opportunities and away from linear ones? One avenue could be to measure the circularity of a business. If they are robust and easy enough to use, such measures could become widely adopted by investors and high scores could indicate a likely source of market outperformance. Another route could be to increase the attractiveness of financing assets by designing in circularity from the start. This would increase their value after use and reduce the risk of costly decommissioning. Such an approach could be applied to energy infrastructure, real estate, and shipping to name just a few. A rethink of the shorter-term financing needs of circular business models will also be necessary. Pay-per-use models, for instance, increase working capital requirements since the time is extended, potentially by years, before production costs are recovered. This increases credit risk towards customers, but reduces raw material price risk. Could a leasing model share – between the user, producer and financier – the higher underlying value of reduced future production costs? Finance in a circular economy is still a young field and innovative thinking is needed.



## **THE WAY FORWARD**

The shift towards a circular economy has begun. Businesses, governments, NGOs, and investors have already started taking decisive action to make it happen. Circular economy thinking is increasingly evident across supply chains. The number of countries drawing up national circular economy strategies is multiplying. In cities, networks of maker labs, platform cooperatives, and peer-to-peer exchanges are growing apace. Most tellingly perhaps is the growing recognition in many quarters that a circular economy has the potential to provide a wealth of regenerative business opportunities while acting as a delivery mechanism for the environmental and societal advances outlined in the UN Global Goals. What is needed now is for those with the ability to do so to grasp with both hands the opportunities to design a truly regenerative economy – one that works in the long term.

## Notes

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## BIOGRAPHY

Dame Ellen MacArthur made yachting history in 2005, when she became the fastest solo sailor to circumnavigate the globe. She remains the UK's most successful offshore racer ever, having won the Ostar, the Route du Rhum, and finished second in the Vendée Globe. She received the French Legion of Honour from President Nicolas Sarkozy in 2008, three years after having been knighted by HM Queen Elizabeth II.

Having become acutely aware of the finite nature of the resources on which our linear economy relies, she retired from professional sailing to launch the Ellen MacArthur Foundation in 2010.

The Foundation works to accelerate the transition to a circular economy, and has helped establish the subject on the agenda of decision makers around the world. Since the publication of its first economic report in 2012, the Foundation has launched global initiatives on plastics and textiles, developed innovation networks with educators, businesses, and governments, and released almost 20 further reports and books. Dame Ellen is a World Economic Forum Global Agenda Trustee for Environment and Natural Resource Security and member of its Platform for Accelerating the Circular Economy, and she sat on the European Commission's Resource Efficiency Platform between 2012 and 2014.





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