AXA Investment Managers

Investment Institute *Sustainability*

The circular economy: A potential value driver across industries

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Highlights

- The concept of a circular economy has gained traction as the world considers the threats created by the linear economy's 'take-make-dispose' approach to production and consumption
- In 2019, more than 90 billion tonnes of materials were extracted and processed, contributing to about half of global CO_2 emissions, and are implicated in around 90% of the incidence of biodiversity loss and water stress
- Concerns over resource security and safety have contributed to the trend, shifting our perception of materials as assets to be preserved, rather than continually consumed
- The circular economy is based on three principles: Eliminate waste and pollution, circulate products and materials, and regenerate nature
- This paper provides a high-level view of related policies and of the macroeconomic issues at play – and highlights the key sectors concerned at European level
- We also look more closely at three important sectors – construction, food and textiles – and highlight drivers for increased circularity, as well as opportunities arising for companies and investors.

Our 'take-make-dispose' approach to production and consumption has become a threat to the planet and to well-functioning economies. Over the last 50 years, natural resource extraction has tripled, and the rate of extraction has been accelerating since the year 2000. In 2019, more than 90 billion tonnes of materials were extracted and processed, contributing to about half of global CO_2 emissions and responsible for about 90% of biodiversity loss and water stress.[1] [2]

The outlook is just as concerning. Should our ever-increasing world population (10 billion people by 2050) rely on the systems of production and services that we operate with today, then as much as 180 billion tonnes of materials will be required, twice that used now.[3] It is unclear whether such quantities of materials will be available and just as importantly, whether companies and countries will be able to limit and manage the associated waste generated.[4]

This challenge explains the gathering momentum behind the circular economy. The concept is evolving from an initial focus on waste generated in production processes that was driven by governments as stewards of public health and environmental protection. We can then identify a second

[1] The World Economic Forum
[2] 2019 Global Resources Outlook from the International Resource Panel
[3] Global Material Flows and Resource Productivity: Assessment Report for the UNEP International Resource Panel. H Schandl et al. UNEP, 2016
[4] Annual global waste generation is expected to increase by 70% to 2050. World Bank (2018), What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050

phase of the circular economy, from 1990 to 2010, as the focus moved towards connecting inputs and outputs to drive eco-efficiency. This led to the development of waste output metrics and implementation of more focused waste-reduction strategies. More recently, from about 2010 onwards, concerns over resource depletion have taken centre stage. The approach has shifted from managing waste to maximising the utilisation of raw materials in a context of high demand for resources.

Visualising the Circular Economy

Source: European Parliament

There remains a lack of consensus on the exact definition of the circular economy in the scientific community, as well as on the terminology around it. The concept sits at the intersection of climate, natural resources and environment, extending to other areas of sustainability such as green economy, clean production or industrial ecology. Unlike climate issues, which put high-emitting sectors on the transition radar, the circular economy spans all sectors, accompanied by a series of risks and opportunities for responsible investors.

A crucial part of the transition, renewable energy is creating new challenges as we pursue this circularity. The large-scale development of solar panels, wind turbines and batteries for storage or electric vehicles will materially increase the rate of extraction and transformation of specific materials. For batteries, notably, this will include lithium, cobalt and nickel and inevitably result in significant environmental damage related to extraction as well as scarcity effects and social challenges around the rights of affected communities. It will be crucial to anticipate and adapt the circular economy in renewable energy as the sector expands – targeting resources preservation, and recycling/re-use, as well as waste limitation and treatment.

And if we look to perhaps the most direct and immediate effect on the investment landscape, it is clear that resource scarcity causes significant fluctuations in market prices which, unchecked, can trigger instability in the world economic system. Commodity price volatility, also due to geopolitical and economic factors, is now higher than at any other time in the last 100 years. Supply risks are emerging across resource categories, from rare metals to fish stocks, with clear implications for businesses and investors.[5]

Linear versus circular

The prospect of a global population of 10 billion might feel like the heart of the issue, but in fact, it is consumption patterns that really drive resources use. The point is made by the observation that high-income countries use more than 10 times the resources per capita as low-income countries.[6] In that context, it has become evident that a wholesale shift is required, decoupling natural resources use from economic activity as much as possible.

Our globalised economy is still defiantly linear. We extract resources, manufacture products, use them and then throw them away. It is based on mass production and consumerist lifestyles that demand short-life, disposable products. The linear economy has thrived by offering high profits for manufacturers around the world, and cheap prices for consumers in developed nations.[7]

This is only possible because the model does not factor in the cost of the enormous volumes of waste, pollution and carbon emissions that are built into the system. Only very slowly are we evolving an effective response through widespread carbon pricing, or more focused measures such as the UK's tax on non-recycled plastic packaging.[8] Such policies are aligned with the principle of a circular economy, largely by incentivising businesses to maximise the lifetime of products and materials, while waste is captured and turned into secondary raw materials.

[5] Decoupling 2 technologies, opportunities and policy options, UNEP, Working Group on Decoupling to the International Resource Panel, 2014.
[6] United Nations Environment Programme (UNEP), International Resource Panel, Global Resources Outlook 2019: Natural Resources for the Future We Want, 2019
[7] What is the circular economy? P. Schroeder et al. Chatham House 2021
[8] Introduction of Plastic Packaging Tax from April 2022. UK government website, 2021

The central goal is to reduce our demand for raw materials and the associated environmental impact, making the 'reduce, re-use and recycle' approach the backbone of circularity.

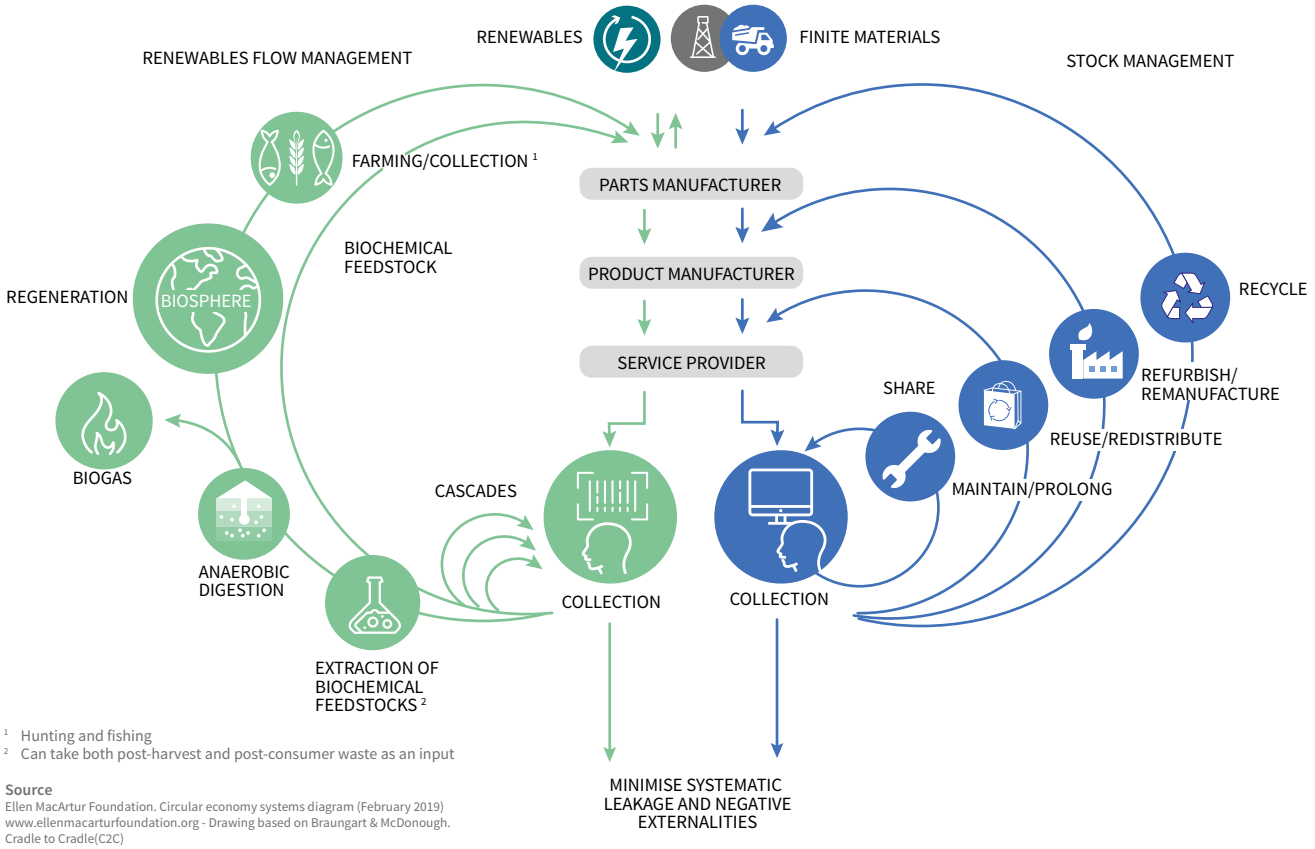
The diagram below illustrates the continuous flow of materials in a circular economy, as well as the division between biological and technical materials. The biological cycle sees nutrients from biodegradable materials returned to nature through processes such as composting, which enable the land to regenerate. By contrast, technical 'nutrients' are materials that either do not degrade easily or cause contamination within the biological nutrient flows. The technical cycle aims to keep those products in circulation through re-use, repair, re-manufacture and recycling, thereby drastically limiting the amount of waste generated by industrial processes.

This transition to a circular economy requires new models of business and trade, as well as cultural change. In this respect, the ability to alter consumer behaviour will be crucial. Repair and re-use must become far larger and more highly prized parts of the economy and society, as must the sharing of resources. A key point is that the circular economy relies more on the services sector and the rental of goods, while the linear economy is much more based on the ownership of goods. In that respect, it could contribute to shifting the balance of responsibilities from consumers to producers of goods, with effects reaching into the early stages of the design phase. This shift would greatly help to accelerate the transition to a more circular economy.

However, transitioning to a circular economy is not only aimed at reducing the negative impacts of the linear economy. It also represents a systemic shift that we think can build long-term resilience, generate business and economic opportunities, and provide environmental and societal benefits.

We are a fair way off that ideal. The 2021 Circularity Gap Report, produced by non-profit organisation Circle Economy, estimates that the global economy is only 8.6% circular and proposes an ambitious target of 17% by 2030, targeting sectors with the greatest potential for change. [9] To do that, government policy will need to ensure that actions are taken and implemented in a coordinated way across sectors,

Biological and Technical: Two sides of the same coin



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

Source
Ellen MacArtur Foundation. Circular economy systems diagram (February 2019) www.ellenmacarturfoundation.org - Drawing based on Braungart & McDonough. Cradle to Cradle(C2C)

9 The Circularity Gap Report 2021

through public-private partnerships and based on science. This is a crucial starting point. Up to 80% of products' environmental impacts are determined in the design phase.[10] And yet, the linear pattern of 'take-make-use-dispose' does not provide producers with any incentives to make their products more circular.

Policies gaining traction

Implementing a more circular economy requires interactions and collaboration between government agencies, policymakers, stakeholder communities and manufacturing industries, as well as the consent – even enthusiasm – of wider society.

The potential benefits of a circular economy are perhaps best understood in the context of China. As the world's largest manufacturer and processor of natural resources, China experiences some of the worst effects of unchecked resource extraction, waste and pollution while struggling to achieve its growth targets. In 2009, China became the first country to implement official policy, its Circular Economy Promotion Law, mandating local and provincial governments to consider circular economy targets in the coal, steel and petrochemical industries. This has become more comprehensive over time, upgraded to a national development strategy in the 2011-2015 Five Year Plan. Objectives include reusing 72% of industrial solid waste by 2015 and raising resource productivity (economic output per unit resources used) by 15%.[11]

Outside China, initiatives began to emerge in 2008 with an Organisation for Economic Co-operation and Development (OECD) Council Recommendation that encouraged member countries to "take appropriate actions to improve resource productivity and reduce negative environmental impacts of materials and product use".[12] In the same year, G8 environment ministers signed the Kobe 3R Action Plan (reduce, re-use, recycle), in which countries agreed to prioritise the implementation of such principles in order to improve resource productivity. The concept of resource efficiency was integrated into the 17 Sustainable Development Goals (SDGs) defined by the United Nations in 2015. And in the same year, the creation of the G7 Alliance on Resource Efficiency highlighted a more concrete approach. It set up a voluntary forum gathering key bodies including the International Resource Panel, the OECD and the United Nations Environment Programme (UNEP). The purpose of the alliance is to advance policy discussions

[10] Ibid
[11] Circular economy: Lessons from China, John Mathews and Hao Tan
[12] Recommendation of the Council on Resource Productivity. OECD 2022

and bring together experts from around the globe. Part of its work has been to create a circular economy model for plastic, and more recently to reduce food loss and waste. In Europe specifically, work on the means of implementation, as well as precise milestones, were laid out in the European Commission's 2020 Circular Economy Action Plan, which established a framework for designing sustainable products, empowering consumers and public buyers and promoting circularity in production processes.[13]

In that context, European Union (EU) initiatives and legislation have been put in place to address to a certain extent the sustainability aspects of products, notably the Ecodesign Directive which regulates energy efficiency and some circularity features of energy-related products.[14] A legislative initiative has also been established to extend the Ecodesign Directive and make the framework applicable to the broadest possible range of products.

The main aims of this directive are in line with the "Reduce, Re-use and Recycle" levers of circularity:

- Improve product durability, re-usability, upgradability and reparability
- Address the presence of hazardous chemicals
- Increase recycled content in products, enabling high-quality recycling
- Restrict single-use items and counter premature obsolescence
- Ban the destruction of unsold durable goods
- Incentivise the products-as-a-service model, or others where producers keep ownership of the product.

Those measures indirectly contribute to address the issue of waste. Echoing the responsibilities that the public sector shares in that field, the EU has set the target of recycling 65% of municipal waste by 2030, as cities represent almost two thirds of global energy demand, produce up to 80% of greenhouse gas (GHG) emissions and account for 50% of global waste.[15]

For responsible investors, waste remains a key topic to address. Millions of tonnes of European waste have been exported to non-European countries over the past decade, in many cases without proper waste treatment consideration. Actions on product design, on the quality and safety of secondary raw materials, are therefore crucial, as well as fostering recycling in the EU. Ultimately, the EU must ensure it does not export its waste

challenges to third-party countries with its accompanying series of environmental and health impacts.

The EU's Circular Economy Action Plan has defined some sectors as priorities in the context of their whole value chain: Electronics and ICT (Information and Communication Technology); batteries and vehicles; packaging; plastics; textiles; construction and buildings; and food, water and nutrients. Later in this paper we will deep dive into three of those sectors to see what is at stake and explore how investors might start to focus on material circularity factors in different industries.

[13] Circular economy action plan. EU, 2020
[14] Ecodesign and Energy Labelling. EU, 2017
[15] The Circular Economy in Cities and Regions. OECD, 2019

The macroeconomics of the circular economy

The transition to a more circular economy, with better efficiency in the use of material resources, will bring layered macroeconomic effects, requiring economists and analysts to understand not only the impact on industries directly affected, but also the multiple interactions and spill-over effects between sectors and countries. It will also take place in parallel with other trends such as digitalisation and automation, triggering additional complexities. Assessments are based on Multi Regional Input-Output analysis, which track the transformation of products at each step along the supply chain and capture the material flows across increasingly fragmented international supply chains.

One conclusion that emerged from a 2018 OECD working paper examining 24 assessments of a circular economy transition was that most economic models, however different they might be – and however precise and granular they might be – find that this will have an insignificant or even positive impact on aggregate macroeconomic outcomes such as economic growth or overall employment.[16] Only two of the assessments reviewed found that a circular economy transition could have a material detrimental effect on economic growth. Intuitively, the competitiveness of material-intensive sectors – natural resource extraction and certain types of manufacturing perhaps – would decline while sectors such as waste management and recycling, remanufacturing and repair might be likely to expand as their offering becomes more affordable.

The OECD working paper highlights the considerable uncertainty of some underlying assumptions, and therefore the difficulties at play when quantifying the potential benefits of such a transition. The key determinant in models can vary greatly, whether that is the expected pace of technological change or future efficiency improvements, assumptions about substitutability between primary and secondary materials, or changes in the future structure of the economy and associated consumption patterns. Looking specifically at the effect of policy measures to disincentivise natural resource extraction (i.e. taxes), the studies reviewed put the impact on global GDP at anywhere from -5% to +6% by 2050 versus a business-as-usual (BAU) baseline. The discrepancies seemed to centre on how/whether the model incorporated the likely endogenous incentivisation of material-saving technologies. Modelling may be an inexact science sometimes, but it still produces useful findings.

In this case there is an important takeaway for investors. It seems likely that policy intervention will need to combine disincentives with incentives, targeting resources use through punitive measures while simultaneously encouraging research and development in the field of material use or 'dematerialised' service models. This is something that companies across sectors should consider and prepare for, and will be a key objective to push for in our engagement with companies on the topic.

For any responsible investor seeking to focus in more detail on material extraction and anticipate the impact that government policy could have, we would highlight a Norwegian study which concludes that the adoption of the circular economy leads to significantly lower global material extraction when compared to the BAU scenario, but still with high discrepancies according to the different materials at stake.[17] Data vary from a decrease of about -27% in metal extraction to -8% in fossil fuel extraction and use, -8% in forestry products and about -7% in non-metallic minerals.

This may be a useful guide for investors seeking to understand which sectors will face the sharpest turnaround given an emphatic move towards a circular economy model.

[16] The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches, Andrew McCarthy et al. OECD Environment Working Papers 2018

[17] Global Circular Economy Scenario in a Multiregional Input–Output Framework. Kirsten S. Wiebe et al. American Chemical Society, 2019

The sectors at stake

The EU Circular Economy Action Plan focuses on sectors that use the most resources and where the potential for integrating a circular economy approach is greatest. Among them are construction, food and textiles, on which we will focus here for different reasons. Construction because it remains a sector where demand will keep increasing as developing countries catch up with urbanisation. Food because it remains the most basic human need, and textiles because of its emblematic position in our 'take-make-dispose' consumption model.

Investors will have to acknowledge, however, that the circular economy is relevant to all sectors, with challenges and opportunities differing in nature and degree. Investors focusing on waste will have to increase their scrutiny of the ICT sector, as it represents the fastest growing waste stream in the EU, with current annual growth of 2%. It is currently estimated that less than 40% of electronic waste is recycled in the EU. It's a similar story for packaging, for which the associated waste reached a record 173kg per inhabitant in 2017, its highest level ever.[18]

Buildings and Construction

The sector's contribution to global GHG emissions is widely acknowledged, standing at around 40%, with a third from the construction phase and the remainder from buildings in use, according to the World Economic Forum (WEF). New buildings equivalent to a city the size of Paris are constructed every week. Fired bricks and concrete, the most common materials used in the construction process, have a major emissions impact. Both materials require high temperatures – over 1,000° C for firing bricks and 1,450° C for the production of cement. Cement production alone accounts for between 5-10% of global GHGs.[20]

The sector is also important when we consider its relationship to the circular economy. It accounts for about 50% of all extracted material in the EU and is responsible for more than 35% of the EU's total waste generation, with a significant share ending up in landfill.[21] In Europe, it is estimated that greater material efficiency could save up to 80% of those emissions.[22]

A separate study has estimated that applying circular economy principles in the European built environment could save €300bn annually in primary resources (virgin construction materials, direct use of fossil fuel for heating, land use and non-renewable electricity) by 2030.[23]

[18] Circular economy action plan. EU, 2020
[19] How construction innovations are enabling the transition to a circular economy, WEF 2021
[20] These 'supermud' bricks could tackle construction's carbon emissions, WEF 2018
[21] Eurostat data for 2016
[22] Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future. E. Hertwich et al. UNEP, 2020
[23] Ellen MacArthur Foundation, Growth Within: A Circular Economy Vision for a Competitive Europe., Ellen MacArthur Foundation, 2015.)

Looking at the global picture, and in a context where the WEF estimates 50% of the urban environment needed by 2050 is not yet built, the sector has attracted the attention of a number of initiatives, with cities on the front line. The difficulties inherent in a shift to a circular economy model requires concerted action from public authorities, who can change buildings norms to make material recycling mandatory, from buildings owners and infrastructure developers who can adapt procurement specifications, and from companies, to develop new technologies that assist with recycling and materials management.

Energy efficiency in existing buildings is already widely researched, but tackling the construction phase is a more recent theme demanding circular solutions for cement, steel and aluminium. Co-led initiatives between governments and businesses have been instrumental in moving forward and achieving clear examples of innovation.

We can highlight one example from Switzerland-based Holcim, which in 2021 launched a green cement range. This cement enables a claimed average 30% lower carbon footprint compared to ordinary cement. One version of the product contains 20% recycled construction and demolition waste, allowing the use of 20% fewer resources drawn from nature and delivering a claimed 38% lower carbon footprint. Other companies have developed their own low-carbon cement and concrete, including HeidelbergCement.[24]

Public-private partnerships have also emerged, including a 2019 project in the Netherlands to develop circular techniques for the construction of bridges and viaducts. This has a claimed potential to reduce CO_2 emissions by up to 63%, and virgin steel consumption by up to 60% simply through the re-use of steel elements.[25] In the same vein, the use of recycled asphalt at Tobalaba airport near Santiago de Chile in 2020 led to a claimed 70% decrease in the virgin gravel used, a 74% decrease in waste generation and 45% decrease in overall costs.[26] Both examples highlight the critical role that waste collection plays in circularity, and the potential opportunities that innovative players may represent for responsible investors.

Food

Food production accounts for a quarter of global GHG emissions and yet almost 30% of all food produced is wasted.[27] The primary driver (15% of food emissions) comes from losses in the supply chain due to poor storage, lack of refrigeration or spoilage in transport and processing. A secondary factor (10% of food emissions) reflects food thrown away by retailers and consumers. All told, food waste is responsible for around 6% of global GHGs, or around three times the global emissions from aviation.[28]

Implementing a circular economy model in the food sector, therefore, stands out as a powerful lever to tackle climate change and biodiversity loss. It encompasses various aspects: Ensuring that food production improves rather than degrades the environment; preventing food waste from the design phase of the product onwards; promoting innovations that minimise losses in the supply chain; and transforming organic waste into compost, fertiliser or bio-energy.

Although consumers retain an important role in developed markets, we think that companies remain best positioned to tackle this issue given their influence on the food system. In the EU and UK, 40% of agriculture land is tied up with the supply chains of the top 10 fast-moving consumer goods (FMCG) companies and major retailers, according to research organisation the Ellen MacArthur Foundation. As it stands, just four crops provide 60% of the world's calories, while many ingredients that could be used instead – and have a lower impact – are rarely used. Major FMCGs and retailers can catalyse this shift in the mix of crops and livestock at scale by helping to create the demand.

We think that a reimagining of food production and distribution could follow a model put forward by the Ellen MacArthur Foundation:

- **Diverse,** incorporating a broader range of ingredients to increase the genetic diversity of crops and their resilience
- **Lower impact ingredients,** shifting from animal products to plant products (proteins, for instance)
- **Upcycled,** promoting innovations to upcycle food and by-products into high value ingredients, alleviating pressure on land and maximising return on invested land
- **Regenerative production,** including a new collaborative dynamic with farmers to promote agroecology or agroforestry

[24] References to companies are for illustrative purposes only and should not be viewed as investment recommendations.
[25] How construction innovations are enabling the transition to a circular economy. C Schmidt et al. WEF, 2021
[26] Ibid
[27] Reducing food's environmental impacts through producers and consumers. J. Poore, T. Nemecek, 2018
[28] CAIT Climate Data Explorer. World Resource Institute, 2015

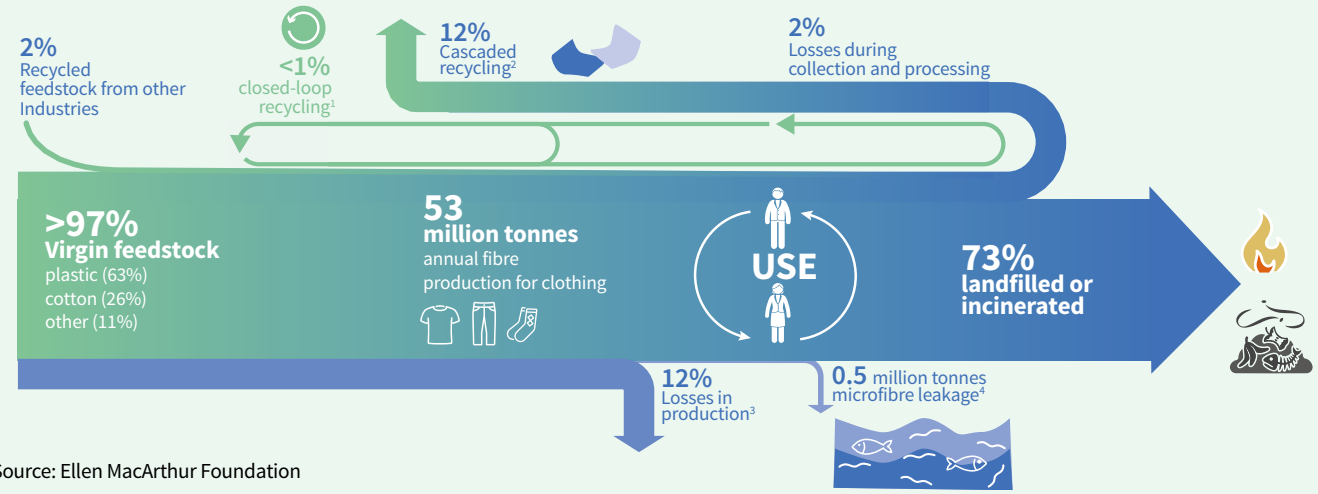
Textiles

The textile industry is the fourth highest-pressure category for the use of primary raw materials and water (after food, housing and transport) and the fifth for GHG emissions.[29] It relies largely on non-renewable resources: Some 98 million tonnes in total per year, including oil to produce synthetic fibres, fertilisers to grow cotton, and chemicals to produce, dye, and finish fibres and textiles. Textiles production (including cotton farming) also uses around 93 billion cubic metres of water annually, contributing to problems in some water-scarce regions.[30]

These non-renewables resources are extracted to produce clothes that are often used for only a short time, after which the materials are mostly sent to landfill or incinerated. It is estimated that less than 1% of all textiles worldwide are recycled into new textiles.[31]

The below graphic illustrates some key environmental issues that the sector represents, driven by the material flows it encompasses.

Clothing pathways



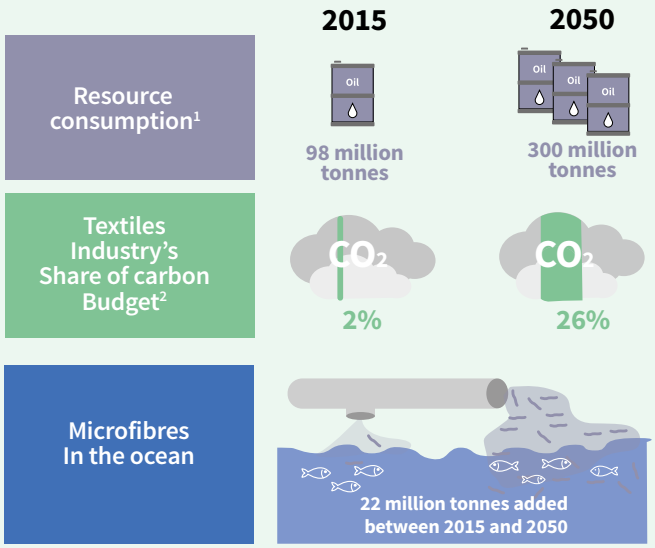
Source: Ellen MacArthur Foundation

[29] Textiles in Europe's Circular Economy. EEA Briefing report Nov 2019.
[30] A New Textiles Economy: Redesigning Fashion's Future. Ellen MacArthur Foundation, 2017
[31] Ibid

Beyond raw materials use, pollution remains an important source of collateral damage, with textile production reported to discharge high volumes of water containing hazardous chemicals into the environment. One source estimates that 20% of industrial water pollution globally is attributable to the dyeing and treatment of textiles.[32] In the same vein, the sector stands out as a major contributor to marine plastic, with around half a million tonnes of microfibres ending up in the oceans every year after being shed during the washing of textiles such as polyester, nylon or acrylic.[33]

However, demand for clothing is continuing to grow quickly, driven by emerging markets, while in developed markets the rise of 'fast fashion' has greatly accelerated the cycle of production and consumption.[34] Unless tackled seriously we think the trajectory of the sector points to significant environmental damage, that without intervention could drastically increase by 2050, as highlighted by the Ellen MacArthur Foundation's work on the sector:

On course for problems



Source: Ellen MacArthur Foundation

Enhancing circularity in textiles would reduce waste and pollution, keep products and materials in use and regenerate natural systems. It would entail:

- Making effective use of resources and moving to renewable inputs, using renewable feedstock for plastic-based fibres and using regenerative agriculture for cotton and other cellulose-based fibres
- Phasing out substances of concern, including microplastics
- Promoting textile re-use, including through brand commitments to design garments that last
- Radically improve recycling by transforming clothing design, collection and reprocessing

Policymakers have a role to play here, encouraging companies to set up their own returns schemes, as well as increasing the uptake of recycling by removing regulatory barriers. The EU, for example, defines used textiles as waste, and its strict rules on the transport, storage, and treatment of waste pose challenges for collection and recycling efforts.

Along with recycling, innovation to encourage industrial applications for textile recycling would also offer an avenue for increased circularity.

The textile industry may not be a giant cornerstone of many investors' portfolios, but it does act as an emblem of our detrimental consumption patterns – one that reaches from the field, to the factory, to the shopping mall. We can favour the companies that make the kind of headway discussed above, we can support initiatives to drive useful policy changes, and we can deliver research that communicates just how important these themes have become – but as responsible investors, we also have the opportunity to set an example, both professionally and personally.

[32] Textile dyeing industry: An environmental hazard. R. Kant. Natural Science, Vol. 4, No.1 2012,
[33] Primary microplastics in the oceans: A global evaluation of sources. International Union for Conservation of Nature, 2017
[34] Global Clothing and Apparel Markets, 2014-2018 & 2018-2022, Research and Markets, 2019

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