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Waste less, grow more

Why the circular economy matters

As environmental concerns rise and resources deplete…

…we need to shift towards a new model of consumption…

…which can support the economy and help the planet

Did you know?

The circular economy is an alternative economic model to the linear one of manufacture, use and dispose. It promotes sustainable development by designing products, systems and processes that focus on recycling and reuse, ultimately minimising waste, conserving natural resources and providing efficiency gains.

- Humanity requires 1.75 Earths to sustain current demand for raw materials (Global Footprint Network)
- OECD economies produce 21bn tonnes of materials that never enter the economic system each year (SERI)
- The extraction, processing and manufacture of goods for society accounts for a staggering 62% of total global greenhouse gas emissions
- 31% of food is wasted, the average European car is parked 92% of the time, offices are used 35-50% of the time in working hours
- 60% of all materials globally are landfilled or incinerated vs 40% reused or recycled
- Currently only five countries in the EU28 have recycling rates of over 50%
- We are currently only 9% 'circular'
- Switching to a circular economy could unlock an additional USD4.5trn of global GDP by 2030 (World Economic Forum)
- Cities including Amsterdam, Ljubljana, New York are working towards circularity and zero waste
- The circular economy is in mainland China's five-year plan for economic and social development
- Airbnb, Zipcar, Spotify, Netflix form part of the 'sharing economy' which is key to circularity

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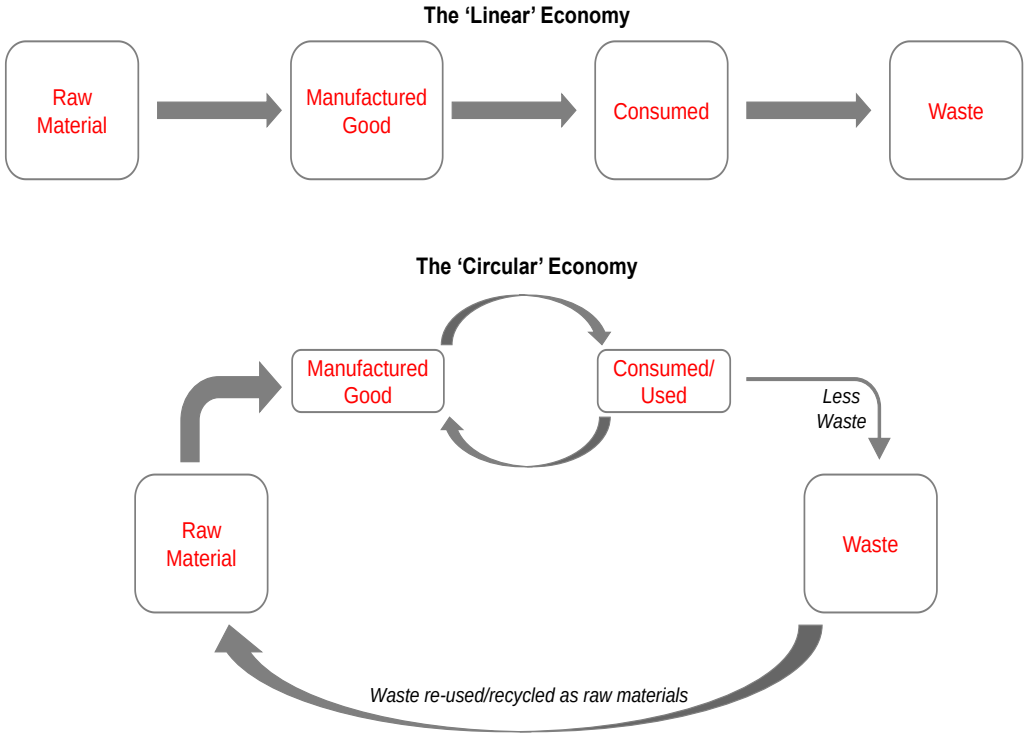
1. A simple model of the circular economy



Source: HSBC, all detailed sources are within the report.

Executive summary

We consume a lot. And we waste a lot.

Think about the resources you consumed in the past week – the clothes you bought, the food you ate and the packaging it came in, the miles travelled in your car. And think about everything you threw away, the single use plastic, the glass bottles, books and all of your unwanted items. How much energy is required to replace that product that could be spent in a more effective way? Do we really need to extract from the natural environment at the rate we currently do?

Things would be different in a circular economy. The concept of circularity is that we move from a world where we make-consume-dispose to one where there is less leakage, where waste can be fed back into the system as raw materials, where products and systems are designed to be easier to recycle, and where we 'use' much more than just 'consume and dispose'.

And to what benefit? A switch to a circular economic model provides the opportunity for efficiency gains that preserve scarce resources, protect our environment, unlock sustainable economic development potential and improve our quality of life.

There are many definitions available on what the circular economy is, and taking these into consideration we provide our own, considering the shift from the linear economic model:

> **"The circular economy is an alternative economic model to the linear one of manufacture, use and dispose. It promotes sustainable development by designing products, systems and processes that focus on recycling and reuse, ultimately minimising waste, conserving natural resources and providing efficiency gains**

Why we need circularity...

As Oxford University lecturer Kate Raworth explains with her theory of 'doughnut economics', there is a sweet spot in terms of growth and development between providing a social foundation and overshooting. And, under today's linear model, natural resources are under strain. According to Global Footprint Network, humanity is using the Earth's supply of natural resources at 1.75 times the rate that ecosystems can naturally regenerate. This is unsustainable.

Under a linear model we generate vast amounts of waste, polluting waterways, the air around us, our soil and natural spaces. Pollution at the levels we are currently responsible for destroys ecosystems and potentially puts human health at risk. Minimising waste generation through a more circular model is environmentally beneficial and a positive externality for both current and future generations.

Technology is a key facilitator...

We've written much about how the smartphone is the trigger for so much fundamental change in the shape of the global economy: in regards to inflation and price information, potential EM growth and how to measure GDP growth because apps take away physical production. Smartphones also enable the instant knowledge of availability of products and services, allowing the sharing economy to exist and thrive, a key component of the circular economy concept. Technology that allows better reusing and recycling can help to grow the circular economy too – as we steadily see the new paradigm come to fruition.

...and people's tastes

Consumer change can happen very quickly and often without any political influence. Consumers play a role in the switch to a 'using economy', an important part of the circular economy. We use Spotify rather than CDs and Kindles instead of books. It is far less resource intensive and arguably offers a better choice for consumers. Airbnb is now a bigger company than any hotel chain. Short-term car hire, ride-hailing, scooters and bikes across cities are booming; they provide consumers with options and can significantly reduce humanity's strain on natural resources.

This shift, pushed even harder by a consumer wary of the environmental consequences of their lives, means that the circular economy may arrive faster than we'd

even have expected. Companies, investors and economists all need to be ready for this new world – and we will explain why.

What's happening already?

The road to "closing the loop" is long and indirect. There are pockets of the market that are seeking to adopt better supply chain management and product design practices, ultimately lessening the overall impact on natural resources. Waste management investments in recycling and waste-to-energy are becoming more widespread.

Despite this, the world is still only 9% circular. There is much more still to be done. Many of the efforts we describe are underinvested in and many processes are simply just underused or present their own economic and environmental challenges too.

A huge economic impact (and for economists)

There is a broader discussion within the economics community around rethinking the goals of economic progress. As the linear economic model splutters under growing demands on our planet, policymakers and economists will start to rethink the goals of economic development – is it just about endless GDP growth or will the focus shift to wellbeing or other measures?

But, against this, the move towards a more circular economy can unlock a lot of economic potential. Estimates from the World Economic Forum suggest that the transition to a circular economy could unlock USD4.5trn of global GDP by 2030, as a result of resources being better utilised and more jobs being created in higher-skilled industries away from resource extraction and waste disposal.

Governments will have to play a role in the transition. Policy can nudge consumers but ultimately, if there isn't adequate infrastructure, policies may be meaningless.

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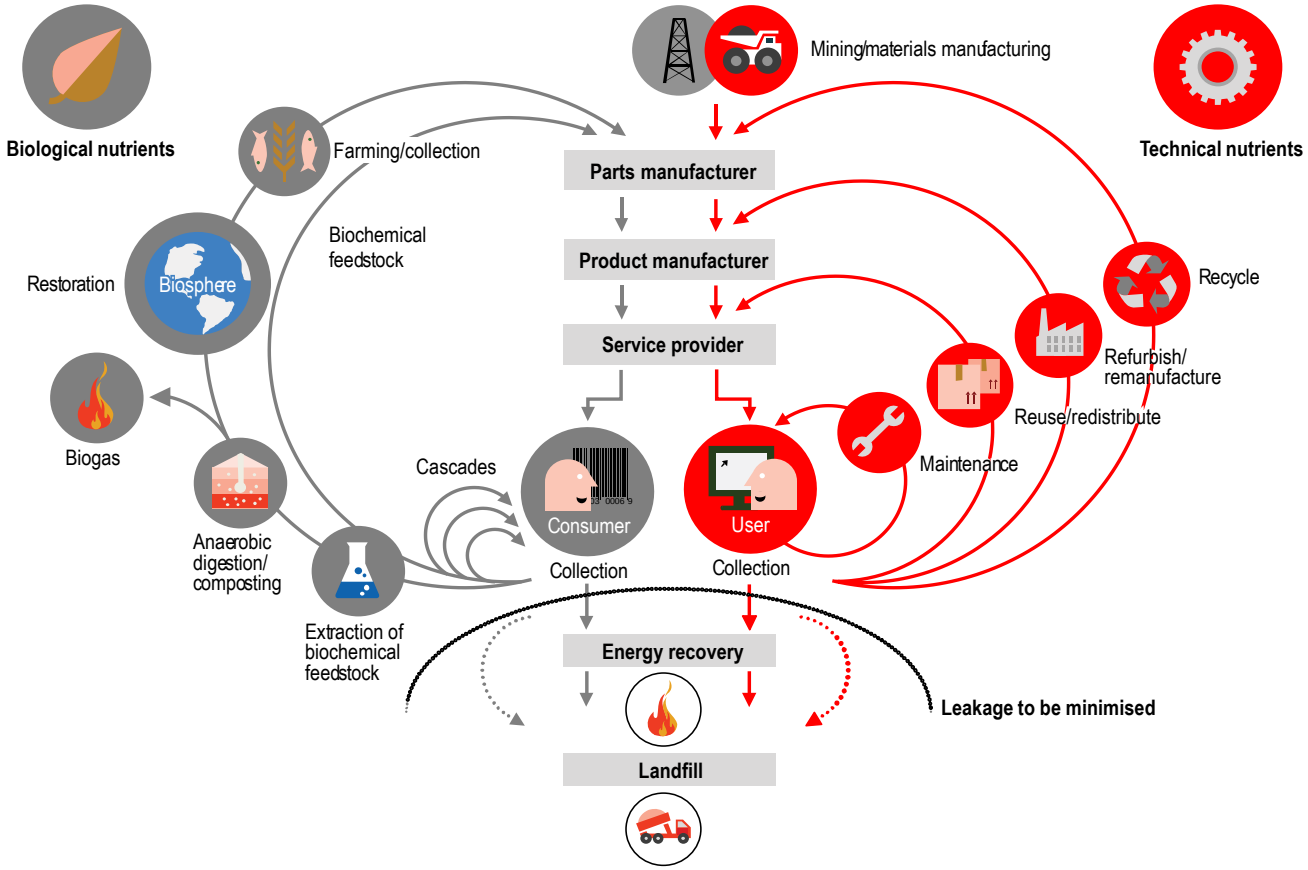
2. The circular economy emphasises recycling, refurbishing and reusing to cut wastage



Source: World Economic Forum & Ellen MacArthur Foundation circular economy team drawing from Braungart & McDonough and Cradle to Cradle

What is the circular economy?

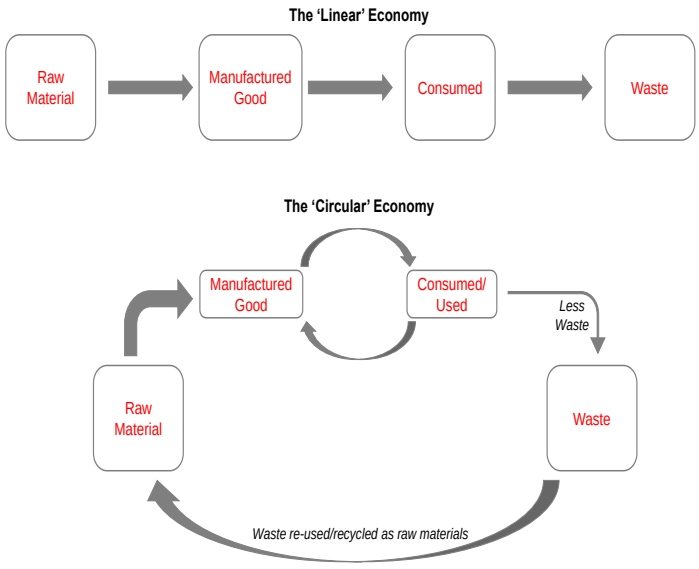
- The circular economy is an alternative economic framework to the current, linear model…
- …as products are fed back into the system rather than just wasted…
- …which becomes more important against resource constraints

We define the circular economy as an alternative economic model to the linear one of manufacture, use and dispose. It promotes sustainable development by designing products, systems and processes that focus on recycling and reuse, ultimately minimising waste, conserving natural resources and providing efficiency gains.

Global power trends

The circular economy is a simple concept that requires a radical paradigm shift in how we live our lives, design, manufacture and dispose of goods across our economies. The need to achieve circularity is significant, for both environmental and economic reasons.

3. A simple model of the circular economy

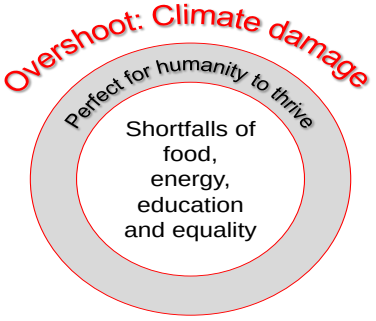


Source: HSBC

The circular economy is a simple concept that requires a radical paradigm shift in how we live our lives, design, manufacture and dispose of goods across our economies. The need to achieve circularity is significant, for both environmental and economic reasons.

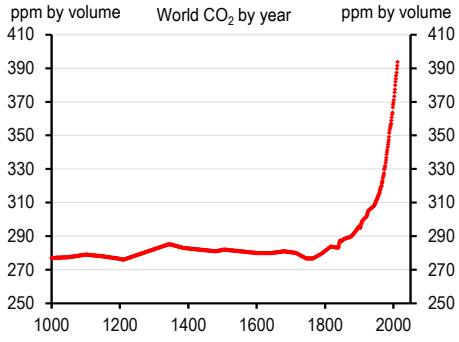
Within the economics community, the most notable voice on the topic is Oxford University lecturer Kate Raworth, whose work (and book) on the topic is discussed under the umbrella of 'doughnut economics' – the idea that there's a sweet spot in terms of our lives between providing a social foundation and overshooting. As Kate Raworth says, "In other words, to ensure that no one falls short on life's essentials (from food and housing to healthcare and political voice), while ensuring that collectively we do not overshoot our pressure on Earth's life-supporting systems, on which we fundamentally depend – such as a stable climate, fertile soils, and a protective ozone layer."

4. A simple doughnut economic model



Source: HSBC, based on www.katraworth.com/doughnut

5. Global growth has come at a cost



Source: Earth Policy Institute, World Bank

The sharing economy

A shift from consumption to usage is an important part of our shift away from today's linear economic model. This involves using assets more efficiently, ultimately allowing materially lower overall resource demand. This is often referred to as the 'sharing economy'.

So many of the goods and services that we consume every day have already shifted to the sharing economy with assets being used rather than consumed. So far, our shifts towards a sharing economy have come through better use of physical assets such as homes (or bedrooms) and cars. The success of the likes of Airbnb, car hire and ride-hailing apps suggests that there is a clear consumer appetite for these sorts of means of consumption.

Some developments revolve around physical products turning virtual. Think Kindles, Spotify, Netflix and Google Maps. We no longer own our books, music, films or maps, we simply access them. In all cases, a huge consumer surplus is unlocked through paying less for more.

But things can go much further. YCloset, in mainland China, is a service that allows you to order a wardrobe of clothes to wear once and then send back, to be replaced for a monthly fee.

Such sharing ideas could feasibly be applied to so much of what we consume. We actually consume only a few things to the point where they cannot be used by someone else. And this is a key principle of the shift away from the linear economy: we can share so much more. If the sharing economy continues to boom, and we can also reform many other aspects of our way of life and economies – from product design to waste management – we can hope to progress towards circularity in future.

Why we need circularity

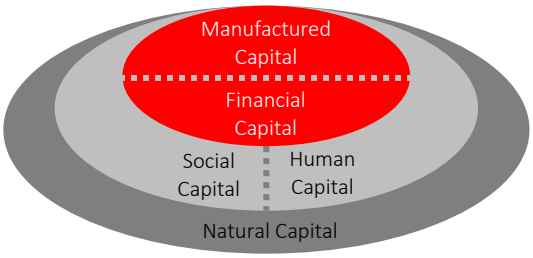
The circular economy is forming part of the developing narrative of recent decades on 'sustainable development'. Despite the considerable extent to which sustainable development has been adopted as a policy objective, it has been widely interpreted as concept and as policy prescription. We use the Five Capitals model to explore one way of viewing sustainable development.

Five Capitals model for sustainable development

The Five Capitals model for sustainable development can be used as a lens through which to view the benefits of a circular economy. The model explains economies in terms of five key capitals that form the development of cities, economies and societies: these are natural, social, human, financial and manufactured capital (Figure 6).

Most economies rarely add to all five types of capital simultaneously as they develop. Less developed economies start off with a lack of manufactured/financial/human or social capital but greater abundance of natural capital. As economies develop, social, human, manufactured and financial capital are built upon, but typically at the cost of natural capital, which is depleted.

6. The Five Capitals model



Source: forumforthefuture.org, HSBC

This relates closely to the academic distinction between the ideas of weak and strong sustainability[1]. Weak sustainability is a substitutability paradigm, where different capital forms can be substituted for one another, and a project is deemed sustainable if the overall total level of capital stocks (economy, natural and society) are maintained.

Strong sustainability is a non-substitutability paradigm, which calls for the maintaining of levels of all individual capital stocks, including natural, man-made and human capital. The idea of a circular economy fits closely into a strong sustainability paradigm, with natural capital recycled continuously such that it is not depleted in the growth of other capital stocks.

Thus, a circular economy model can in theory allow us to consume/develop/experience economic growth (social, human, manufactured and financial), at a reduced cost to the natural environment.

[1] Discussion on this debate can be found in numerous texts, including Neumayer, E. (2003). Weak versus Strong Sustainability: Exploring the Limits of two Opposing Paradigms, Pearce, D., et al. (1989). Blueprint for a Green Economy, and Bowers, J. (1997). Sustainability and Environmental Economics - an Alternative Text.

The limits of linear development

Over the coming decade, millions more people all over the world are expected to become 'middle-class' consumers, pushing global consumption ever higher. Given the finite resources we have at our disposal, a new model for economic prosperity is becoming even more necessary; the linear model is no longer sustainable, in our view.

Natural resources

Under today's linear model, resource extraction is rising by nearly 2% per year with roughly 82bn tonnes of raw materials expected to be extracted in 2020, more than double that required in 1980. And that's only the stuff that we want: the Sustainable Europe Research Institute (SERI) estimates that OECD countries produce 21bn tonnes of materials that never enter the economic system, such as harvesting losses, dredged materials and other by-products.

Another way of viewing humanity's strain on natural resources, is through "Earth Overshoot Day". According to the Global Footprint Network (GFN), on 29 July, we used all of the world's natural resources budget for 2019. The GFN analyses our demand for resources such as food, forestry and marine products, plus our demands on nature, such as carbon emissions in excess of sequestration potential, and aggregates them to determine when we have used up what the Earth can replenish. This year, "Earth Overshoot day" arrived three days earlier than in 2018 (Chart 7), the largest jump forward since 2010.

Another way to conceptualise our unsustainable use of the Earth's resources is through the number of 'Earths' we need. At current usage rates, we require 1.75 Earths to meet our natural resources demand each year, but some countries are more responsible than others. If the world's population lived like the US, we would require five Earths, which contrasts with 0.7 Earths if we lived as India does (today, at least).

1.75 Earths

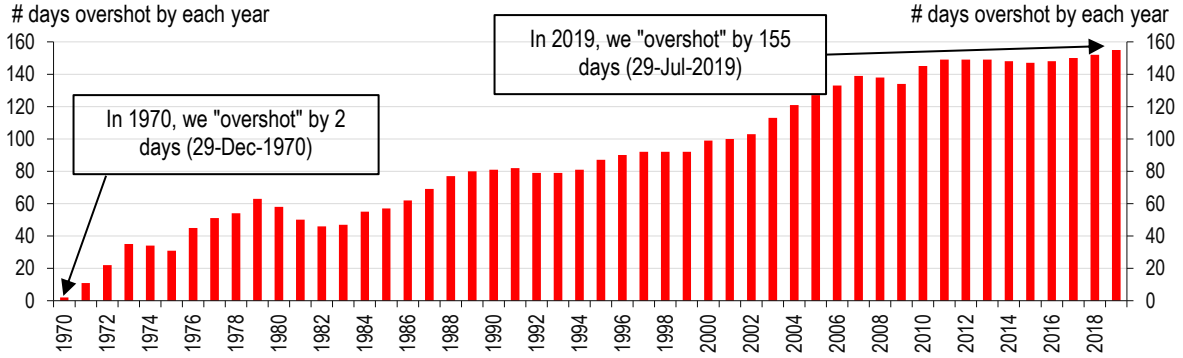
Required in order to meet all of humanity's raw material needs this year

These concepts are useful, in our view, in offering a simple quantitative illustration of the idea of sustainable development and how far we are from balancing our ecological deficit. A circular economy model minimizes the strain on natural resources, by curbing demand for products as we reuse products we have and the waste we generate more efficiently. Secondary effects of a more circular model includes emissions and pollution benefits.

Emissions

The current linear economy model of manufacturing goods and materials generates emissions. According to the Circle Economy organisation, 62% of total global GHGs (ex LUCF) are released from extraction/ processing/ manufacture of goods for society, and just 38% come from the delivery and use of these products and services. The circular economy therefore has the potential to create significant emissions savings.

7. The date at which the world uses up its natural resources for the year is arriving earlier and earlier



Source: Global Footprint Network National Footprint Accounts 2019

Pollution

The current linear model of development generates significant amounts of waste and pollution. This has devastating environmental and human effects by contaminating water sources and soil, and creating air pollution. Human health can be at risk and entire ecosystems are disrupted. Leading to weak sustainable development (see Five Capitals models).

Under a more circular model, waste would be minimised and better managed, leading to less pollution. Currently, 60% of discarded materials are either sent to landfill or incinerated, damaging the natural environment and disposing of materials which have residual value. But extracting this value is challenging and can often be uneconomical. This is why catalysts need to be put in place to create scale and achieve lower costs for creating circular solutions for waste. Or in the language of sustainability – create financial capital without depleting natural capital.

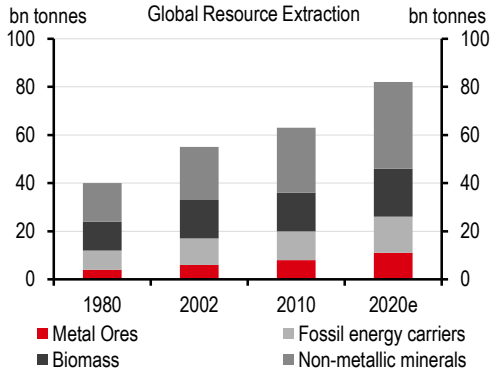
Wastage and product underuse

Wastage can also be in terms of assets not being fully utilised: For example, the average European car remains parked 92% of the time, 31% of food is wasted along the value chain, and the average European office is used only 35% to 50% of the time, even during working hours. With short-use cycles, the average manufactured asset lasts only nine years (excluding buildings), according to estimates from The Ellen MacArthur Foundation[2].

The current methods of producing and using products and resources is a costly business. Ellen MacArthur Foundation estimates suggest this could come down by roughly 25% in Europe by 2030 as a result of a transition into a circular economy. Estimates suggest that roughly 60% of discarded materials are either put in a landfill or incinerated, while only 40% are recycled or reused. Europe loses roughly 95% of the material and energy, in value terms, while material recycling and waste-based energy recovery capture only 5% of the original raw-material value. Even recycling success stories such as steel, polyethylene, and paper lose up to 75% of the material value in the first-use cycle. On average, much of the developed and developing world uses products only once, leaving it disposed of (properly or not), wasting a huge proportion of its value.

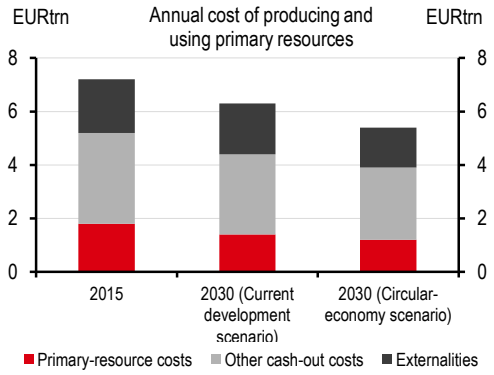
In the next section, we explore how both consumers and technology have a key role to play in reducing wastage and product underuse.

8. More and more resources are coming out of the ground each year…



Source: Ellen MacArthur Foundation

9. …and the circular economy can help to lower the amount need and the costs



Source: Ellen MacArthur Foundation

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[2] The Ellen MacArthur Foundation: Growth within: A circular economy vision for a competitive Europe, July 2015

What's happening in the move towards circularity?

- Sustainable resource and waste management are key for circularity
- Supply chains, product design, recycling and waste-to-energy are considerations across all sectors
- We explore progress at a national and a company level

As it stands, we are only 9% "circular"[3]. There is a huge amount still to be done in order to transition a notable share of the world away from a linear model. This section explores the progress that has been made to date, and the key next steps required.

The requirements are twofold. The first pillar involves sustainable resource management:

- *Supply chains* – depleting natural resources unsustainably caps the rate at, and level to, which economies and societies can grow and develop. Sourcing from sustainable supply chains alleviates this.
- *Product quality and design* – low quality products are manufactured, used and disposed of quickly, generating waste and requiring more resources to generate replacements. High quality, well designed products would mitigate this.

The second pillar requires efficient waste management for any waste that is generated. This is, perhaps perversely, the pillar that is at a more advanced stage of development despite it being the second order effect. We examine this through:

- *Recycling* – higher recycling rates which is increasingly leading to waste reprocessing.
- *Waste-to-energy processes* – deriving energy from waste products that are not recycled is one way of reaping returns and closing the loop.
- *Alternative means of disposal* – generating products from waste that do not fall under conventional recycling or waste to energy options is an avenue that is being explored.

10. Pillars for circularity

Source: HSBC

Sustainable resource management

Supply chains

Good supply chain management that ensures sustainable use of natural resources is important for a circular economy model. But how to define, and regulate claims of, "good" supply chain management?

Some standards/stewardship codes have been introduced to allow some streamlining of this. The FSC (Forest Stewardship Council), the MSC (Marine Stewardship Council), the BCI (Better Cotton Initiative) and Fair Trade accreditation are global certification systems now commonly seen on products that allow businesses and consumers to identify products that meet certain sustainability standards.

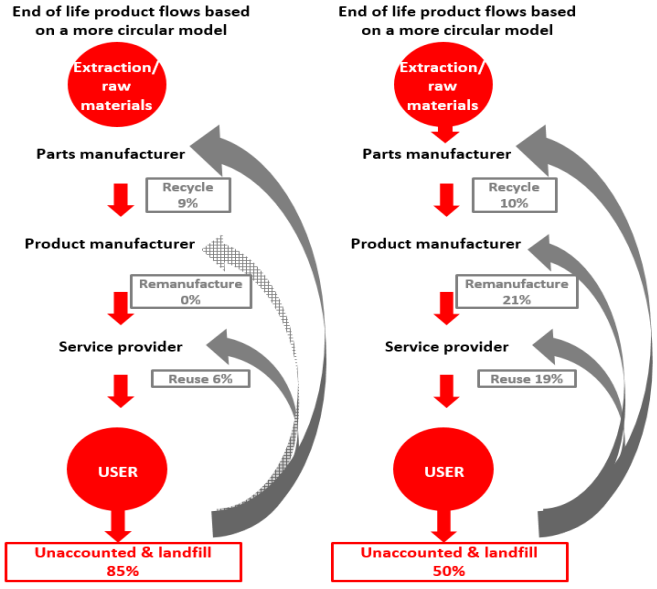
These are just some examples of initiatives/standards that are promoting better quality of extraction from natural resources. If it becomes mainstream that companies operate supply chains in accordance with these, and similar, initiatives, it will be an important pathway towards circularity.

Not only should the quality of supply chains be monitored, but they have the potential to be rethought in a positive manner. Take mobile phones for example: based on 2010 Eurostat figures, 85% of mobile phones produced are unaccounted for/sent to landfill after use. 6% are reused and 9% are recycled. No phones were remanufactured. As mobile phone usage continues to

[3] The Circularity Gap report, published 22 January 2019 at the 2019 World Economic Forum in Davos by the Circle Economy Organisation.

increase across the world, increasing how many handsets are re-used and recycled will be important.

11. End of life product flows for mobile phones



Source: HSBC design. Using: Gartner, EPA, Eurostat, UNEP, Ellen MacArthur Foundation circular economy team.
Note: Remanufacturing here refers to the reuse of certain components and the recycling of residual materials

Product quality and design

In order to transition to a circular model, initial products will need to be longer lasting and higher quality, and designed in a manner that facilitates reuse or recycling.

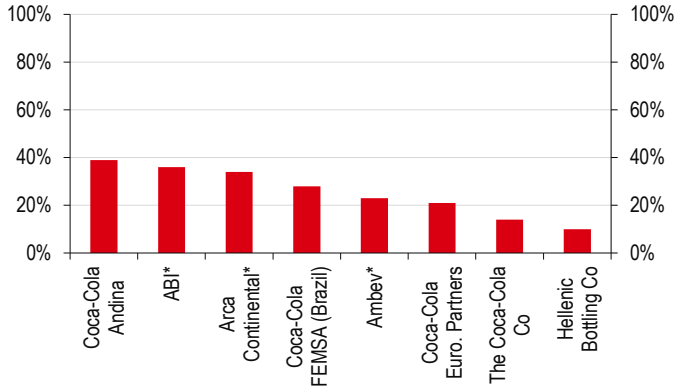
One good example of this is with the production of drinks bottles. Currently, vast amounts of plastic packaging are used for this; Coca Cola alone used three million tonnes of plastic packaging in one year – this is the equivalent weight to approximately 15,000 blue whales.

While recycled content is used in drinks bottles, virgin plastic is added to most recycled bottles – currently only Highland Spring uses 100% recycled material in its drinks bottles. Only 9% of PepsiCo's US portfolio uses some recycled content in its bottles. Higher quality plastic materials are more likely to be recycled compared to low quality plastic which is less durable and more likely to be landfilled.

The UK government has set out plans for a tax on plastic bottles that do not contain at least 30% of recycled material. This may be the beginning of a wider trend to use fiscal drivers to change behaviours. Already in the UK there has been progress on recycled content in plastic milk bottles. Biffa has been producing food-grade HPDE for milk bottles in the UK for some 10 years.

One good example of this is with the production of drinks bottles. Despite recent focus on plastic pollution, we are yet to see statistics to suggest plastic bottle use is falling in aggregate. One new idea for promoting more circularity with bottles, is through the use of refillables bottles, made either from heavy duty plastic or from glass, something that is of growing popularity in Latin America and in the Coke system. Adoption of such designs will have benefits at the end of life waste management stage.

12. Some bottlers and brewers are committed to refillable bottles (% volumes)



*2016 figures, all other numbers 2017
Source: Company data from sustainability reports

The potential with a refillables model goes beyond drinks bottles. UK food retailer Waitrose is latching on to this idea by starting a trial for the use of refillables in supermarkets for a range of products such as cereals, rice, pasta and even washing up liquids and alcohols. This new scheme significantly reduces packaging waste, closes the loop to be less damaging on the environment, and makes economic sense too; as most of the refillables products carry a lower price given a lack of packaging costs (up to 15% discount). Generating consumer surplus and benefitting the environment highlights the benefits that the circular economy can have for consumers.

Improved product design is also beneficial. Products that are more durable and long lasting lower the overall demand on natural resources. Clothing is a good example here. Higher quality clothing items last longer and should therefore mean less demand for replacements (ignoring demand for ever changing fashion items). Clothing company Patagonia has introduced a repair system for their clothing; Renault, the French car maker has design specifications allow functional recycling of many car parts, allowing for a tighter control of their raw material usage. IKEA, the Swedish furniture seller, has started trials for leasing furniture and launched its 'Live Lagom' community, which provides advice and products for members to learn how to reduce waste and live more sustainably

Improved waste management

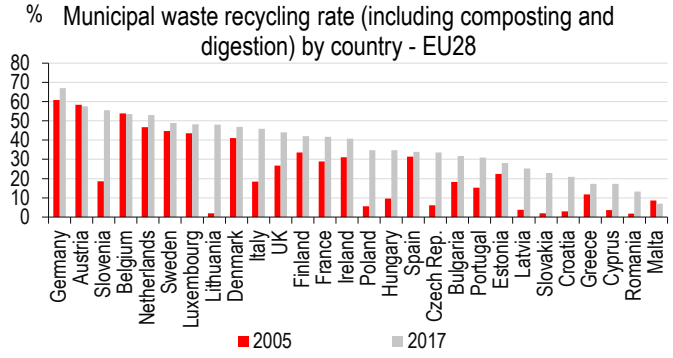
Recycling

Recycling products allows for less virgin material demand. An important step towards circularity, in our view, as it would allow us to continue to manufacture and use the products we all love and enjoy, but mitigates the cost to our finite stock of natural resources.

Current rates of recycling vary hugely by country and product. 70-90% of iron and steel is recycled, vs. 58% of paper and 10-15% of plastic, globally. However, circularity is coming quickly in some areas of the plastic recycling market. Complete recycling of polyethylene terephthalate (PET) and high density polyethylene (HPDE) is already economically viable and being rolled out both in Europe and some EMs.

At a country level, rates for more material types is possible given investment and formalised processes, as proven by Sweden, where 99% of all household waste is recycled in some capacity, up 160% since 1975. The dramatic increase in recycling came about as a result of new regulations and technologies. Sweden sets a positive example of a country that is closing the loop in some form, but much needs to be done elsewhere (Chart 13).

13. Only 5 of the EU28 have recycling rates of over 50%



Source: Eurostat

Textiles is another area where recycling has huge potential. Brands including H&M, Marks & Spencer and Asics have launched programmes that involve exchanging used clothes or trainers for discount vouchers.

One key message to take from all these examples is this: humans are lazy and the easy option is typically the route that will be taken, even if this is environmentally damaging. With that in mind, the easier companies make it for consumers to recycle (be that by simple processes or through incentives), the more circular we can hope to become. Companies can benefit from this too, extracting valuable component parts or raw materials from waste products, lowering costs.

Waste-to-energy

Waste-to-energy processes involve capturing the energy generated through waste incineration to be used for fuel and power production, taking us one closer to a more circular economy.

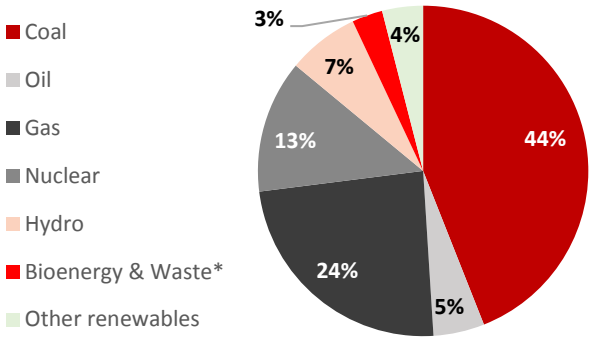
Waste-to-energy has the potential to reduce emissions vs the linear model of manufacture, use, landfill – burning waste to produce electricity allows for displacement of fossil fuels, particularly coal. Additionally, landfilling can generate methane (CH4), a potent greenhouse gas. The World Energy Council cites a 2015 study that found that incineration led to approximately 40% lower emissions than from sending waste to landfill and has lower NOx and SOx pollutants.

14. Some examples of policies promoting the use of waste-to-energy processes

Country	Policy
EU	Guidance from the European Commission (EC) under the EU's Action Plan for a Circular Economy "Waste-to-energy can maximise the circular economy's contribution to decarbonisation, in line with the EU and the Paris Agreement" - EC 2030 goals include: 65% recycling for municipal waste, 75% for packaging waste and reducing landfill to a maximum of 10%
UK	Imposition of landfill tax in 1996, which successfully diverted waste from landfill. Since the landfill tax imposition, approximately 30 energy-from-waste plants have been introduced, and several more are in the pipeline.
Mainland China	Dispose of 1/3 of the country's waste with waste-to-energy plants by 2030 300 new plants scheduled to be built to meet the 2030 goal
Thailand	Gov't subsidies and tax incentives for various waste-to-energy plants, including incineration, gasification, fermentation and landfill gas capture Power Development Plan 2018-27 may include plans to expand licenses granted for waste-to-energy plants which would expand capacity
Indonesia	Significant government support for waste-to-energy build out, with target capacity of 810 megawatts by 2025 Notable pushback from the public on this
India	Tipping fees, tax incentives and financial de-risking measures for waste-to-energy processes in the country Government planning a waste-to-energy plant in New Delhi given landfill needs estimated to be 7% of the city's land. This plant should process one-third of the city's waste (link: https://thinkglobalgreen.org/waste-to-energy/)
Ethiopia	Africa's first waste-to-energy plant being built in Ethiopia, operation estimated from January 2020 Should incinerate approximately 80% of Addis Ababa's waste generation on a daily basis, providing 30% of power needs to locals

Source: various government sources, eco-business.com, thinkglobalgreen.org

15. Global power generation mix



Source: World Energy Outlook 2017, IEA, data for 2016.
*Note: Bioenergy and waste includes solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste

There are some criticisms of waste-to-energy processes. The process does still generate air pollution, despite lower greenhouse gas emissions. This is particularly the case in less developed economies where the process is not as regulated. Stricter regulations and more modern pollution control equipment would mitigate this and should be pursued, in our view.

Lastly, some would argue that waste-to-energy does *not* form part of a fully closed loop economy model, as it does not transform waste back to component parts and ultimately does result in lower demand for raw materials to make goods.

Nevertheless, we think that raw material recovery and waste-to-energy can complement each other, and should be developed in tandem, given that we do not expect a fully closed loop system to be achieved in the near future. Waste-to-energy is a useful stepping stone that will reap near term returns, in our view.

Alternative means of disposal

Establishing a completely new system of manufacture, use and reuse for societies will not come quickly and will require new and previously unexplored approaches, technologies and ideas. There are many new projects being established by waste management companies with access to the HPDE and PET recyclate.

We note some other interesting experiments and trials that have the potential to positively transform how we produce, consume and reuse as a society.

Some companies (Ioniqa and Agilyx) are exploring technologies to break down PET and polystyrene waste (and any contaminants) to return them to their original form, for complete reuse. These are small stage projects but would allow for a fully closed loop system.

Other projects include Yoshida et al (2016), who have discovered bacteria that generate enzymes capable of breaking down PET in a matter of weeks turning it into terephthalic acid and ethylene glycol, both of which are environmentally benign (Yoshida et al, 2016). In 2018, scientists discovered a way to further speed up the breakdown process, creating potential for more scale (University of Portsmouth). The scale and viability of this to address plastic pollution at large remains to be seen. If successful, however, we believe this could be a promising step towards closing the loop.

Private company Ecovative is a US-based biotechnology company making products from mycelium (mushroom based) materials. Ecovative is partnering with a number of companies, including IKEA and Dell to create these mushroom based products, including alternative meat products, biodegradable packaging and even footwear and animal free leather.

The fungi can be grown within nine days and is entirely biodegradable when thrown away as waste. Products such as these open new possibilities for companies and individuals, lowering packaging costs and environmental impacts simultaneously.

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Circling back – the road ahead

- There's a long way to go towards circularity
- Governments and companies can accelerate progress, potentially lifting economic activity…
- …but not in ways our current data find easy to capture

Challenges: The road to circularity isn't direct

There are many avenues through which we can develop circularity, offering much scope for progress. However, many challenges lie ahead as we seek to reform entire aspects of the value chain. Many of these challenges will not be easily, or quickly, solved.

Costs

Investments in new technologies, efficient waste processing centres and green technologies with which to run operations are all key to allow economies to take the next steps. To do something we have never done before, we need tools we have never used before. Many millions of dollars of investment and research is needed for this, and ideally this needs to be carried out on as much of a global level as possible, across all economies.

Government policy

Policy tools are vital. As we discuss in the following section, a select few cities are taking the lead on a move to more circularity. But most other cities and entire regions lag far behind, particularly in emerging markets. Europe is the main region where we see significant progress at this stage. However, adoption in one region should eventually spread, allowing policies to become more mainstream.

Organisation

In truth, the circular economy requires a lot of organisation. It requires an overarching plan for how to manufacture products that are efficient in their use stage and minimal in their waste generation stage. This is a mammoth task that requires active participation and cooperation across all aspects of the value chain. Not only that, but given widespread international trade in products *and* waste materials, there needs to be some form of cooperation internationally, too.

Government policy and investment will be key, and without some form of coordinated sector and global wide policy in place for tackling the circular economy, progress can only go so far, in our view.

Lastly, any new products, processes and alternatives need to be designed in a manner that is more sustainable overall; it is important to ensure that we do not cause further environmental or social issues beyond anything that is being mitigated.

Governments: Key to the next steps

We believe that government policy has a vital role to play in encouraging the progression of the circular economy. A select few countries' policies are far advanced with respect to a circular economy, such as the Netherlands, which is targeting to be 50% circular by 2030, and 100% by 2050.

In the UK, Defra (Department for Environment Food and Rural Affairs) is continuing work on the UK Government's Resources and Waste Strategy announced in November 2018, whereas in mainland China, the circular economy has been incorporated into the country's current five year plan[4]. The European Commission announced a "Circular Economy Action Plan", which included measures to stimulate Europe's transition towards a circular economy, raise competitiveness, generate new jobs and make growth more sustainable. This action plan was completed in 2019, with the commission suggesting that this has created a platform for further growth in the space[5].

Cities take the lead

As we highlighted in the section about the drivers of the circular economy, cities will play a big role. The best case study in the world today is Amsterdam, where the city government's partnership with Kate Raworth and the Circle Economy group has set a new plan for the "Amsterdam Circular" between 2020 and 2025[6]. The city aims to follow the national government target of using 50% fewer raw materials by 2030 and to be 100% circular by 2050 at the latest, with CO2 emissions aiming to be 95% lower than in 1990 by the time we get to 2050.

[4] Chapter 43, Section 5 of the 13th Five Year Plan (2016-2020), available here: http://en.ndrc.gov.cn/newsrelease/201612/P020161207645765233498.pdf
[5] http://ec.europa.eu/environment/circular-economy/index_en.htm
[6] See: *https://www.iamsterdam.com/en/business/news-and-insights/circular-economy* for more details

16. The city of Amsterdam's toolkit to move towards a circular economy

Levers for a circular city	Policy Instruments
Digitalisation	Regulation: eg Planning, environmental assessments
True and fair pricing	Legislation: eg Performance and technology standards
Innovation	Fiscal frameworks: eg Positive & negative price instruments
Systems thinking	Direct financial support: eg Grants, debt financing
Experimentation	Economic frameworks: eg Tradable permits, Public-private partnerships
Logistics	Knowledge, advice and information: eg Conducting research, education and information campaigns
Jobs & Skills	Collaboration platforms & infrastructure: eg Data sharing, living labs and matchmaking platforms
	Governance: eg Institutional design, public-private partnerships

Source: City of Amsterdam Government

But a new way to measure it?

While the circular economy may unlock some economic potential, picking it up may be hard. Economists and financial markets enjoy looking at monthly activity data to measure the goings on within the economy, while others look at commodity prices, such as those who insist that the Copper price is a leading indicator for the global economy.

But many of these indicators are useful in a linear economy but not a more circular one. Earlier, we discussed how more usage and less wastage is vital to a more circular model, and how technological and digital developments will facilitate this. We have highlighted how certain parts of consumption simply disappear within a digital framework, such as CDs, DVDs and software which simply aren't shipped anywhere anymore (Chart 17).

17. Global goods exports of products that can be digitised have collapsed

Source: WITS and HSBC. Based on HS codes defined in https://www.unescap.org/sites/default/files/aptir-2016-ch7.pdf

Now, imagine if many of our products simply aren't consumed, but are 'used' in a similar way. What happens to industrial production of many products? Or retail sales of clothes, tools or other products that may shift to a 'sharing' model? If fewer resources are needed from the ground, what happens to commodity prices, the companies that extract them and the economic activity that this creates? While we may consume other products, certain flagship bellwethers of economic growth such as car sales or certain companies' earnings may be far less relevant.

The answer to all of these questions is that they fall. And quite substantially too. If we start sharing drills and cars, the number of these products in society will collapse, meaning that total retail sales will be much lower. If we need fewer cars, fewer will be produced, at a great loss to the manufacturing data. And if less copper, oil or any other raw material is needed out of the ground then prices will be lower and industrial production data much weaker.

So, despite huge leaps in human development we could see enormous drags to key economic data. It may look like (on traditional metrics) economic welfare is weighed down when actually it is fine, if these resources are diverted to more fruitful endeavours or services that benefit society. As a society we may be thriving, even if we're not growing in the traditional sense.

Statistics offices may have to rethink which data carry merit in this environment and economists and market participants may have to focus on other data for the full picture, such as income growth, consumer and business surveys and not focus on some of the narrower data that gets distorted.

This adds the debate surrounding what governments should be targeting. Nobel Prize winning economist Simon Kuznets was famously quoted (in his book, National Income, 1929-1932) as saying "the welfare of a nation can scarcely be inferred from a measure of national income". One of his areas of focus was on the factors that determine GDP growth that go beyond simple measures of national income. This led to the birth of the "Kuznets curve", the relationship between income inequality and economic growth.

Beyond this, Kuznets had a broader message about economic growth. That quality of growth matters as much as quantity. Long run trumps short run, and the climate, social factors, ecosystems, social and human capital are all vital for this. This opens a broader discussion of whether wellbeing, human development indicators and levels of savings are indicators that should be incorporated into economic data analysis, and this fits with the shift of some governments towards wellbeing – such as New Zealand's wellbeing budget launched in May 2019. The challenge for governments is to manage the shift to new types of jobs without any damaging economic and social consequences – which will require investment in training and re-skilling programmes. Without this, we may see a rise in unemployment in certain sectors and regions.

Squaring the circle

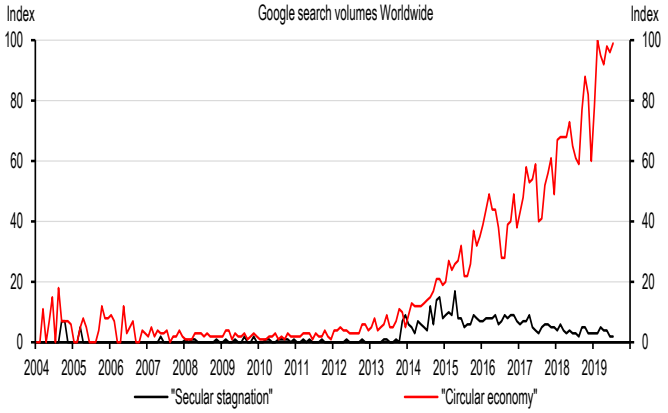
- The circular economy is gaining prominence as a new way of thinking about growth and wellbeing
- International organisations are raising the profile of the ideas…
- which are to set to feature more in government policy

The circular economy: going mainstream

While the circular economy is gaining awareness as a concept, as we have mentioned throughout, we are still more linear than circular. As more international organisations such as the World Economic Forum continue to partner with circular economy specialists to bring the message to the mainstream, this voice will continue to spread. Encouragingly, in 2018, Japan hosted the second World Circular Economy Forum. The Circular Economy was also discussed at this year's G20 summit. The Ellen MacArthur Foundation is one of the biggest proponents of the subject and greater awareness of concepts within the economics and political community will no doubt see these ideas spread more quickly.

Although the world's population is growing more slowly now than at any point in recent history, the number of middle-class consumers is expected to double in many emerging market countries over the coming decade. This new consumer will mean even greater strains on the linear economy model, meaning that a more sustainable growth model will be needed, even in those countries at an early stage of their development. Spreading of awareness and pressure on governments from international organisations will therefore be key for the world's transition over the coming years.

18. The new economic framework is coming…



Source: Google Trends. Note: Both searches are to same scale where 100 = maximum search volume for either term. So, in 2019, the term "Circular Economy" gets roughly 10x more Google Searches than "Secular Stagnation"

It matters for everyone

As more consumers in the world become aware of the environmental impacts of their consumption, we expect the world to move towards more circular economy practices. Governments, at both a national and city level, will have to react to provide platforms for this model to thrive, both in terms of infrastructure, policy and information.

And if the two can come together, the world could move away from being 'linear' in nature and towards a more 'circular' economy, where we waste less and we use our resources more efficiently. Such a move will play a key role in tackling climate change.

For the economics community, this shift plays havoc with traditional models. New data will have to be analysed and the aims of policy may have to be re-thought. We may see new jobs away from waste management and resource extraction, with a greater emphasis on service sector and high-tech jobs, and we could see an improvement in the quality of life for many people.

Governments will have to help to manage these shifts in the economy. Akin to how we have looked at the impact of technology on the labour market, government policy will have to focus on retraining, up-skilling and allowing the geographical mobility of workforces to smooth this transition.

So, however you look at the concept of the circular economy, the idea is one that is growing in prominence. It will matter for companies reliant on linear models and those looking to grow in a more circular way. It will matter for investors trying to understand the data that they look at on a day to day basis and it will matter for governments, who need to play their part too.

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