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SUSTAINABILITY

The Impact of Circular Economy on Business

Final Report

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eunomia

Introduction

The business case for adopting a circular economy is clear – evidence shows it can help make business more resilient. But resilience today isn't enough; a circular economy is one that ensures that businesses have future proofed their operations to not just survive but thrive.

Global political momentum has started to gather around key global issues such as climate change and marine plastic pollution. As policies continue to shift to tackle these challenges, with more momentum in some areas of the world than others, adopting the principles of a circular economy will make more business sense than ever. And disruptive technologies, such as AI, big data and 3D printing, have arrived at exactly the right time to assist us in our efforts to solve these problems as we try to ensure our future is sustainable.

It is imperative that we move away from today's disposal-economy which is so reliant on making things that can never be recycled or reused. It is unsustainable and is causing unprecedented and potentially irreversible damage to our planet. Consumers are onto this – and are demanding more ethical businesses practices from their suppliers. And, as this report shows, adopting the circular economy has been proven to increase brand loyalty, which is vital to survival in today's volatile retail environment.

It is clear that 'business as usual' is no longer an option. Businesses are compelled to change and those that don't will get left behind. Circular business models will have to become the norm. That is not to say making this transition will necessarily be easy or straightforward. However, it will be worth it and will ultimately help businesses enhance their profitability, increase their resilience and ensure that they are playing a part in being the solution, rather than the problem.

Dan Botterill, CEO

Ditto Sustainability

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Executive Summary

E.1.1 What is the Circular Economy?

Simply understood, a circular economy is one where businesses design products and services in such a way that:

- the value added in manufactured products is maintained through maintenance, reuse, and remanufacture;
- where the value can no longer be retained in this way, products and packaging are recycled;
- energy inputs are sourced from renewable sources; and
- resource use is consistent with enhancing the stock of natural capital.

One recent report indicates that the potential economic upside for the EU could be of the order €1.8 trillion, annually, by 2030. Whilst one can debate the accuracy of these figures, the potential upside is increasingly recognised: over the last decade, policy makers and businesses have been made increasingly aware of the potential benefits to be derived from changing the way in which resources, packaging and products are managed.

E.1.2 **What is the Imperative?**

The Circular Economy represents part of the response that will be required if a number of critical environmental issues are to be addressed:

1. As the world strives to maintain planetary warming in the next century below '2 degrees centigrade' with regards to pre-industrial levels (let alone a 1.5 degrees centigrade), it is recognised that not only must energy be sourced from renewable sources, but energy use must fall: this implies reducing materials use, and relying increasingly on the use of secondary materials;
2. Addressing the flow of plastics into the world's rivers and oceans demands a more responsible approach to the use of resources, and their management at the end of their (first) life; and
3. Making more responsible use of resources, and seeking to rely more on biogenic materials, will maintain such materials in natural cycles, and enhance the stock of natural capital (also required to increase the capacity of the biosphere to act as a sink for emissions of carbon dioxide).

Consequently, policy makers are already moving to adopt policies that can foster a more circular economy, although the rate of adoption is uneven across countries.

The aforementioned issues are already leading to changes in policy at all levels: international (the Paris Agreement[1]); national (the 25 Year Environment Plan[2] and the Clean Growth Strategy[3]), regional (for example, the Climate Change Strategy in Greater Manchester[4], and the Scottish Government's 'Making Things Last' Circular Economy Strategy[5]); and city (the Circular Economy Roadmap in London[6], and Glasgow's Circular Economy Vision and Action Plan[7]). Whilst it might be argued that policy has not moved sufficiently quickly or aggressively to deal with the above threats, the trajectory of policy which is required to address the challenges being confronted is increasingly clear. Businesses which anticipate these changes can expect to be more resilient in the face of emerging policy changes.

Reinforcing the change in view of businesses and policy makers is an emergent shift in consumer trends and attitudes, facilitated by advances in communications technologies. In an increasingly digital world, mobile communications allow for a decoupling of the benefits of using a product from the need to own the product outright: sharing, and leasing, of products has made physical ownership unnecessary, reducing the overall requirement for products and the associated material use. This is fostering an explosion in the so-called sharing economy. Business to business transactions are also moving in this direction: lighting can now be sold as a service, rather than as a number of discrete fittings. These changes allow businesses to foster relationships with their customers, and support a shift from low quality, short life products to durable, well-designed, high quality products that deliver services reliably to customers.

1 UNFCCC (2015) *The Paris Agreement*, December 2015, https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf
2 Department for Environment Food and Rural Affairs (2018) *A Green Future: Our 25 Year Plan to Improve the Environment*, January 2018, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/673203/25-year-environment-plan.pdf
3 HM Government (2018) The Clean Growth Strategy: Leading the Way to a Low Carbon Future, p.167
4 Zero Carbon Manchester (2018) *Manchester Climate Change Strategy 2017-2050 and Implementation Plan 2017-2022*, July 2018, http://www.manchesterclimate.com/sites/default/files/MCCA_Annual%20Report%202018.pdf
5 Scottish Government (2016) Making Things Last – A Circular Economy Strategy for Scotland, http://www.gov.scot/Resource/0049/00494471.pdf
6 LWARB (2017) London's Circular Economy Routemap, June 2017, https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf
7 Glasgow Chamber of Commerce, and Zero Waste Scotland (2016) *Circular Glasgow: A Vision and Action Plan for the City of Glasgow*, June 2016, https://www.circle-economy.com/wp-content/uploads/2016/06/circular-glasgow-report-web-low-res.pdf

E.1.3 Why Is This Important for Businesses?

A number of high profile case studies are widely reported: Caterpillar's remanufacturing of machinery; Rolls Royce selling 'power by the hour'; and Phillips 'pay per lux' lighting service model.

Our case studies indicate that this trend is not confined to major companies dealing with high-tech items. Circular economy business models are not the exclusive domain of major multinationals: businesses of all sizes can adopt such principles, and in all sectors, there will be opportunities either to adopt more aspects of circular business models, or to support such a transition through enabling the necessary shifts to occur. There is a range of technologies whose transformative potential is only now becoming clear, such as:

- Artificial intelligence and big data;
- Robotics, machine learning and automation;
- Blockchain;
- 3D printing and nanotechnology;
- Networks and sensors; and
- Biotech, bioinformatics and synthetic biology.

How these are deployed will have a profound influence on societies in future, but each presents opportunities in terms of enabling a more circular economy through enhancing business efficiency, new business models and enhancing stewardship.

E.1.4 What Does the Future Hold?

Finally, and recognising the role of other sectors as an enabler for change, the financial sector is beginning to understand that environmental threats translate into business risks: those who are invested in assets that have no role to play in a low-carbon, and sustainable economy are beginning to understand that these assets are likely to be of diminishing value in future. As well as full-scale divestment, actions at a global level taken by the Task Force on Climate-related Financial Disclosures (TCFD), and at the EU level in respect of disclosure of non-financial and diversity information, are already having significant ramifications for investment. The TCFD's recommendations, for example, have been widely supported by industry leaders. As of April 2018, more than 275 companies, with a combined market capitalization of more than $6.6 trillion, have publicly expressed support for the TCFD recommendations. The companies include more than 160 financial firms — responsible for assets of over $86.2 trillion. This experience – in respect of climate-related risks – could fund itself being replicated in other areas: the ratings agency, Moody's, has already issued reports indicating that as governments seek to address the issue of marine plastic pollution, so the credit-worthiness of manufacturers of plastic packaging might fall.

If some of the cases presented for adopting a circular economy may appear overstated, the case for adopting circular economy principles still appears extremely strong. Studies on business resource efficiency have shown, over decades, that business practice varies significantly, even within sectors, and sometimes, across sites within the same business, with plenty of scope for improved practices. When considered alongside the potential for (amongst other things):

- Improved product design;
- Manufacturing, and remanufacturing, in novel ways;
- Using newer technologies to enable consumers and businesses to transact in ways that were impossible to envisage in the past; and
- Using digital technology to track assets and material flows; and
- Enhancing the efficiency of logistics,

then the opportunity looks compelling.

The coming together of a series of environmental crises at the same time as a range of disruptive technologies are exerting their full force will challenge society to ensure that these technologies are deployed in ways that help solve these crises rather than exacerbating them. Adopting a circular economy mind-set will help to ensure this is the case. Helpfully, businesses who do this may find that the current of consumer attitudes is increasingly supportive of that move.

Businesses have much to gain – today – by adopting circular economy principles. This is true with policies as they stand today. This report highlights how a number of countries and regions and cities are starting to shape their futures around the pursuit of a more circular economy. Global political momentum is also gathering around addressing issues of climate change, and of marine plastic pollution. As policies shift to address these issues – as they must – then adopting circular economy principles will become an ever more obvious choice for businesses. Circular business models will have to become the norm.

Consultants at Accenture note:

"efforts by leading companies suggest this change is already happening, is successful, and is inevitable. That's why it is important for organizations—regardless of market, geography or industry—to begin laying the foundation for change."[8]

There will be different hurdles and barriers for different businesses seeking to make this transition. However, adopting circular economy principles holds the promise, for businesses, that they can enhance their profitability, ensure their businesses are more resilient, and that they are part of a badly needed solution rather than part of the problem. This latter point should not be under-emphasised: the best talent, in a global market, rarely seeks to be deployed in manifestly destructive activities.

8 Accenture (2014) *Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth*, 2014, https://www.accenture.com/t20150523T053139__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf

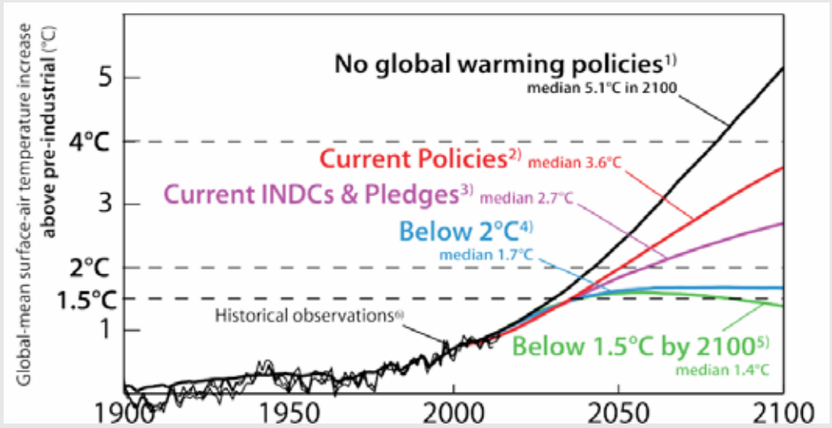
1.0 Introduction

Businesses, governments and individuals – in particular in the developed world – are becoming increasingly aware of the impact of their actions on the environment. The environmental issues that have been gaining more and more attention over the past decades have now made it to the top of the agenda of many national, regional and city authorities, as well as many businesses.

In 2015, the Paris Agreement saw 194 nations come together to sign a treaty, recognising the need to address the urgent challenges posed by climate change. This was the world's first comprehensive climate agreement. One of the headline aims of the Paris Agreement is to constrain the increase in global average temperature well below 2°C, and to pursue efforts to limit the increase to 1.5°C by 2100.[9] Figure 1-1 illustrates the different scenarios modelled depending on the strength of environmental policies put in place. The difference between the red curve (current policies) and the green one (below 1.5°C by 2100) gives an indication of the challenge ahead to keep global temperature below 1.5°C of warming.

9 UNFCCC (2015) *The Paris Agreement, December* 2015, https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf

Figure 1-1: Global Average Temperature Increase under Different Scenarios



Source: Climate Analytics

This transformation will require the emissions of greenhouse gases (GHGs) to be stabilised by the year 2020 (i.e. no growth), and thereafter:

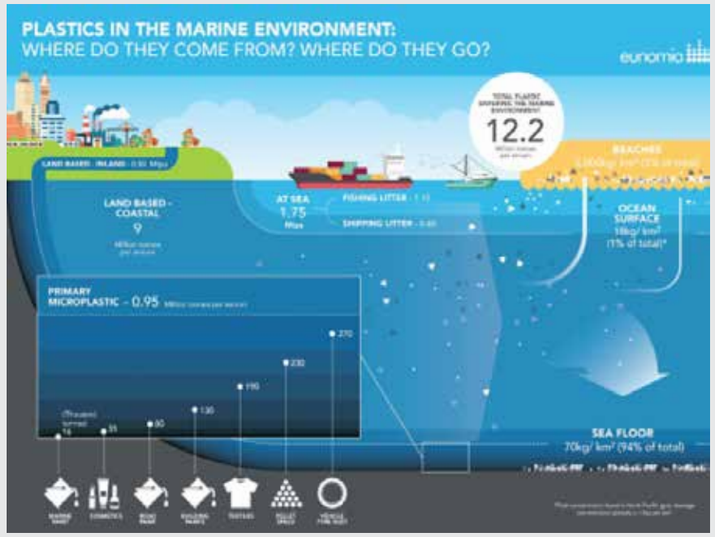
- Halved between 2020 and 2030;
- Halved again between 2030 and 2040; and
- Halved again between 2040 and 2050.

Indeed, in some scenarios, the planet will need to achieve 'net negative' emissions by 2050, implying that any remaining emissions will have to be sequestered by means of changing land use (e.g. planting trees), and other technologies.

In addition to the threat posed by global warming, other major challenges to the environment include:

- **Plastics:** the enormous quantities of plastic used and their mismanagement during disposal is one of the principal sources of pollution to the terrestrial and marine environment.

Figure 1-2: Global Emissions of Plastic to the Oceans



Source: Eunomia

- **Loss of biodiversity and natural capital**: human population growth, increased need for land and resources, air, land and water pollution, and global warming are all contributing to an unprecedented loss of biodiversity. According to the State of Nature report in 2016, between 1970 and 2013, 56% of UK species declined, with 40% showing strong or moderate declines. 44% of species increased, with 29% showing strong or moderate increases. A new measure, which assesses the overall health of a country's biodiversity, suggests that the UK has lost significantly more nature over the long term than the global average. The index suggests that we are among the most nature-depleted countries in the world.[10] At a global level, one study indicates that the loss of ecosystem service value due to impaired ecosystem function has been of the order $6.3 trillion per year.[11]

Several metrics have been used to show how humankind is living well beyond the limits which can be sustained into the future. The concept of ecological footprinting has been used to highlight the fact that over time production and consumption patterns have steadily increased the level of resource use to the extent that, whilst in 1970, the planet was broadly 'living within its limits', in 2018, production and consumption would be sustainable only if humanity had 1.8 'Planet Earths' from which to draw resources. Another way of showing this is that the world 'overshoots' a 'one planet' footprint at an earlier date each year: this year, at a global level, we will overshoot our sustainable level of resource use on 1st August. For the UK, the equivalent date was May 8th.

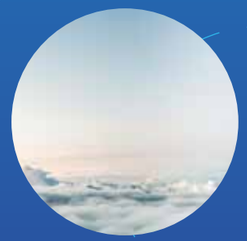
In order to combat these global challenges and to bridge the gap between the red and green lines in Figure 1-1, swift action and strong policies are needed. Key to the mitigation of global warming is the reduction of GHG emissions. This will be achieved by switching from fossil to renewable energy and enforcing better land management, such as reforestation. However, estimates show that on their own, these measures will not maintain the planet within a 2°C (let alone, the more desirable 1.5°C) warming trajectory. In order to limit the temperature increase further, additional measures are needed, specifically in the form of more efficient use of energy. Tied in with this measure is the more efficient use of resources, and the use of recycled materials. This is because:

- the extraction of raw materials and manufacturing of primary materials makes use of energy;
- but the use of secondary materials typically results in lower energy use; and
- the more materials used, and the greater the energy demand, the slower will be the rate of decarbonisation of energy supplies as a result of the increasing supply of renewables.

The circular economy is a model that can enable the challenges mentioned above to be tackled in an integrated manner. The sections below describe how it can achieve this, and in particular the part that businesses will play.

10 RSPB (2016) *State of Nature 2016* - UK Report, 2016, https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/state-of-nature/state-of-nature-uk-report-2016.pdf

11 Sutton, P.C., Anderson, S.J., Costanza, R., and Kubiszewski, I. (2016) The ecological economics of land degradation: Impacts on ecosystem service values, *Ecological Economics*, Vol.129, pp.182–192



2.0 What is the Circular Economy?

The circular economy can be seen as a key conceptual response to the threats highlighted in the introduction. Its aim is to ensure that economic activity is restorative in nature, and that humankind respects environment constraints, and the natural capital that sustains life. The pillars of the concept of the circular economy are:

- the more efficient (circular) use of materials and resources;
- clean energy production through renewable energy; and
- maintaining and enhancing natural capital.

In this report, we focus on the first of the three pillars – the use and management of materials and resources – as this tends to be the sector that is least addressed. It is clear though that the three cannot be separated, and that efficient and clean energy and water use are essential in order for the economy to be truly circular.

The reference to 'circular' effectively speaks to the need to ensure that resources do not escape from the various loops in which they can be kept in productive use. As such, it aims to maintain resources and products in use for as long as possible, maintaining the value of the products of which they are a part at the level where the value they deliver is greatest.

Resource efficiency achieved through a circular economy can help to mitigate the main environmental issues highlighted above. Through better maintenance, reuse, remanufacture and recycling of resources, fewer raw materials and less energy and water will be consumed, resulting in reduced air pollution, and less waste created during the life-cycle of products. Moreover, the circular economy helps to protect biodiversity and natural capital by reducing the need for primary resources, reducing emissions to the environment and encouraging measures that place natural capital at the centre of decision-making.

The Circular Economy Model

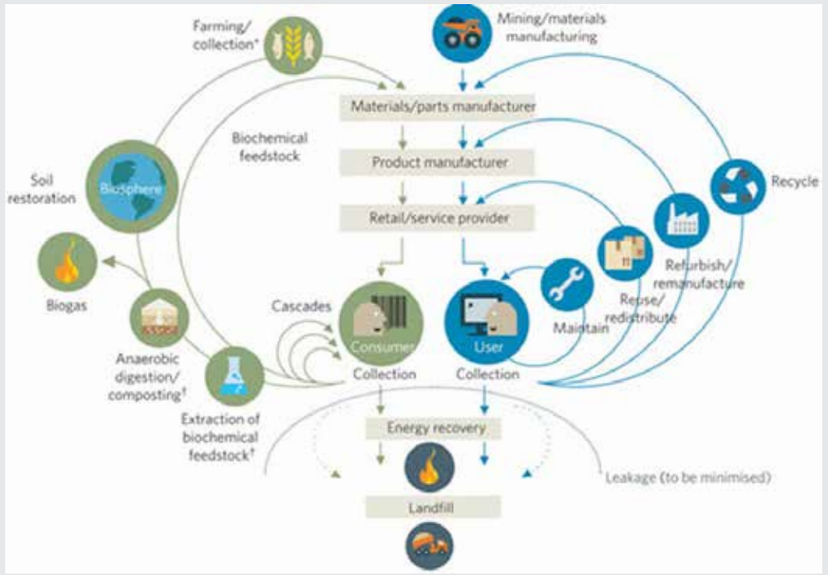
The circular economy has been described as being '*restorative and regenerative by design*'.[12] The role of 'design' is central in the development of a more circular economy. Many products (for example, single-use cups) are designed as 'disposable items' and have extremely short life-times. Others, such as some furniture products, break easily, and may be difficult to repair. Still others may have component parts which break down, but cannot easily be removed to be replaced (for example, parts of mobile phones). A large proportion of what is consumed has no possibility of even being recycled because the product, or the packaging, simply has no prospect of being recycled by existing infrastructure (even in advanced economies). Good practice in design, therefore, is important to help ensure that products and packaging can, at the very least, be recycled. Better still – because more of the value added in the product can be conserved in this way – products are designed for ease of repair, and so that their life is long enough to facilitate reuse and are situated within systems that seek their refurbishment and remanufacture to bring them to 'good as new' status.

Design for durability, repair, upgrade and recycling are crucial enablers of a circular economy. Similarly, digital technology has a crucial role to play, from product condition monitoring and self-repair, to product sharing and food redistribution 'apps'. Traceability is another important area, digital data (e.g. through encrypted blockchain coding) allowing product information to be easily communicated throughout the supply chain and throughout a product's life cycle (allowing for information on recyclability, and the make-up of products, to be made readily available).

There are exceptions to these 'rules': from a carbon perspective, for example, it might not make sense, even if we could, to keep a washing machine or TV in use for 50 years because the state of technology moves on, and more energy / water efficient devices are likely to come to market. Different product groups have an optimum lifetime, and will gradually move from the inner to the outer loops to be remanufactured and eventually recycled.

The diagram below from the Ellen MacArthur Foundation illustrates the concept neatly (see Figure 2-1). The right-hand side shows a set of concentric circles: the inner circles retain the greatest share of a product's value, and so businesses who manage to successfully redesign their products, and reconfigure their business models, to keep their products within these inner circles, can minimise resource use consistent with their corporate objectives. The inner circles of the so-called 'Butterfly Diagram' offer the greatest benefit in general, both in economic and environmental terms, whereas the outer loops – including recycling – retain less of a product's value, though they still confer environmental benefits. Finally, the diagram indicates that both energy recovery and landfill are represented as a 'leakage' of resources, to be avoided as far as possible.

Figure 2-1: Diagram of the Circular Economy



Source: Towards a Circular Economy, EMF

12 Ellen MacArthur Foundation (2013) Towards the Circular Economy Vol.1: *Economic and Business Rationale for an Accelerated Transition*, January 2013, www.ellenmacarthurfoundation.org/business/reports/ce2012

Debunking Circular Economy Myths

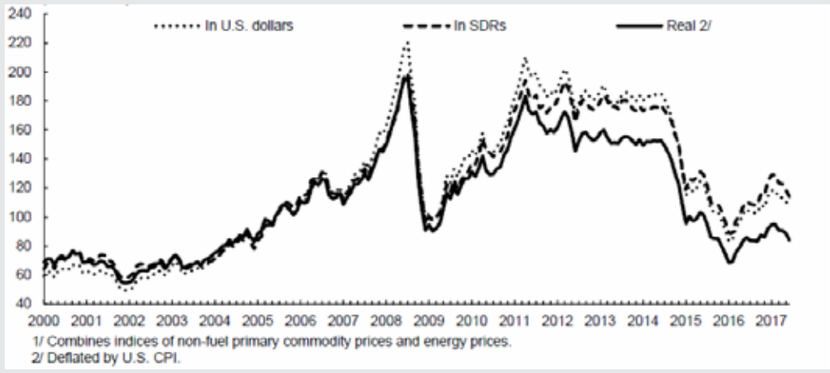
A common portrayal of the circular economy is that it stands in opposition to a 'make, take, dispose' model that is supposed to represent the economy as it stands today.[13] Strictly speaking, however, even if the UK economy is not completely 'circular', the 'make, take, dispose' no longer accurately reflects the way in which resources are managed. Considerable progress has been made over the last two decades in moving away from this model. Indeed, currently reported recycling rates for household waste stand at 45% (albeit these figures might include some material not actually recycled), whilst for construction and demolition waste, the material recovery rates are much higher.[14] Citizens and businesses are no longer simply consuming and throwing away their products: indeed, if they were, and if they were content to carry on behaving in that way, the business case for change would not be so strong. There is plenty of evidence to indicate that many consumers, if not yet all of them, are concerned at the wastefulness of their consumption, and would like to see a more sustainable set of choices available to them.

Businesses that strive to make resource efficiency and energy savings will also feel poorly represented by a model that assumes that they are inherently wasteful, and simply manufacture with 'disposal' as the end in mind. Many businesses are already strongly engaged in what is now termed the circular economy. For example, in the manufactured goods sector, MRO (maintenance, repair and overhaul) has been common practice where high value engineered products are concerned – JCB and Rolls Royce engines being good examples. This does not mean there might not be room for improvement – well-managed businesses understand that standing still is not a viable strategy – rather, it suggests that juxtaposing a circular economy with a completely linear one is accurate only for some sectors and products.

It is clear that for some products, the deviation from a circular economy appears extreme. For example, some single-use products which are widely littered may be designed with no prospect of their ending up anywhere other than in disposal or residual waste treatment facilities, or as litter, potentially flowing into oceans and seas. In recent decades most business models have focused on designing products for cost reduction, to compete in an increasingly competitive global market and on the discount-driven retail high street. In what some see as a 'dive to the bottom', little thought is given to a product's entire life cycle.

Another comment worth making about the way in which some proponents have argued the case for a more circular economy relates to the issue of commodity prices. It has been suggested that commodity prices are likely to increase over time in future as resources become scarcer due to increasing consumption linked to an increase in the number of people achieving middle income status across the world. We would suggest that this is a false premise upon which to build the circular economy. Indeed, the last decade has shown that far from rising uncontrollably, commodity prices have been fluctuating unpredictably, and have been falling in the last 5 years (see Figure 2-2). Few businesses will feel it makes sense to completely revamp their business models on the basis of a one way bet on commodity prices.

Figure 2-2: The Fluctuation of Commodity Prices since 2000



Source: Towards a Circular Economy, EMF

A more accurate representation is that those who embrace the circular economy may be less exposed to the fluctuations of energy and commodity prices, potentially ensuring access to resources for their operations through their own processes. Similarly, a more circular economy can help provide greater resource security in the face of potential geopolitical disruptions in the availability of commodities. A good example here is in regard to the remanufacture and recycling of WEEE in Europe so as to retain valuable components and critical raw materials (CRMs) for ongoing production of products.

13 Ellen MacArthur Foundation (2015) *Towards a Circular Economy: Business Rationale for an Accelerated Transition*, December 2015, https://www.ellenmacarthurfoundation.org/assets/downloads/TCE_Ellen-MacArthur-Foundation_9-Dec-2015.pdf

14 DEFRA (2018) *UK Statistics on Waste - 2016, February 2018*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/683051/UK_Statisticson_Waste_statistical_notice_Feb_2018_FINAL.pdf

3.0 The Business Case for the Circular Economy

Not only does the circular economy help to tackle some of the major threats to our environment, it also makes business sense. The business case for embracing a shift to a circular economy has been examined in a number of studies, which have resulted in quantification of the potential benefits that could accrue to businesses, or the wider economy. The main studies are summarised in Table 3-1.

Somewhat less eye-catching, but nonetheless persuasive studies have been conducted around the benefits of replacing the sale of products with the sale of the services which are often derived from products – so-called product-service systems – which are an important element of circular economy business models. A study in France in 2015, for example, analysed manufacturing businesses and concluded that (controlling for other factors) those which expanded into shifting towards service-based models (so called servitisation) of their products increased profitability by between 3.7% and 5.3% and their number of employees by 30%.[15]

15 Crozet, M., and Milet, E. (2017) Should everybody be in services? The effect of servitization on manufacturing firm performance: *Journal of Economics & Management Strategy*, Volume 26(4), pp.820-841

It seems clear that there are benefits to be grasped through adopting a circular economy, but the true magnitude of these benefits is difficult to estimate. Often, the benefit estimates are based on extrapolations of case studies where transformative business models have been introduced to great effect in a particular market but assuming that a whole sector's performance can be transformed in this way. Similarly, assumptions are occasionally made – somewhat speculatively – about cost reductions that might be expected to arise as a result of 'scale-up', these helping drive the gains being identified.

Nonetheless, there are undoubtedly benefits to be made, even under existing policy regimes. What seems to make the business case for a circular economy yet more compelling is the fact that policy makers are waking up to the fact – in the face of the various threats facing humanity – that 'business as usual' is no longer an option. Seen from this perspective, businesses that embrace the concept of the circular economy can make gains today, but the gains from the changes that they make, and from which the gains result, are likely to stand them in good stead for the future. Adopting a circular economy mentality will, therefore, help to build the resilience of businesses, as well as providing the basis for increased profitability now, and enhanced profitability in the future. Furthermore, with ethical consumerism on the rise, businesses that can prove their commitment to environmental causes though adopting circular economy principles will attract a growing tranche of consumers and increase their brand loyalty.

Table 3-1: Summary of the Benefits reported by studies on the Circular Economy

Study	Region	Main Concepts	Suggested Benefits
The Performance Economy, 2010 – Walter Stahel	Global	Sales of products in many areas replaced by leasing, coupled with high-quality services.	Net benefit to employment as service sectors are more labour-intensive than the increasingly mechanized industrial sector.
Green Economy Report, 2011 – UNEP	Global	Enhance resource efficiency by investing at least 2% of GDP in greening the main sectors of the economy.	Save energy, reduce carbon emissions and bring new job opportunities.
Towards a Circular Economy I, 2012 – Ellen MacArthur Foundation (EMF)	EU	Design of products for ease of reuse, disassembly and remanufacturing – or recycling. Shifting the foundation of economic growth towards the reuse of material reclaimed from end-of-life products, rather than the extraction of new resources.	A subset of the EU manufacturing sector (representing a little less than half of the GDP contribution of EU manufacturing) could realize net materials cost savings worth up to $630 billion annually towards 2025—stimulating economic activity in the areas of product development, remanufacturing and remanufacturing.
Towards a Circular Economy: Business Rationale for an accelerated transition, 2015 – EMF	EU	The circular economy could create tremendous opportunities for industrial renewal, regeneration, and innovation.	Technology revolution to create a net benefit of €1.8 trillion by 2030.
A Resourceful Future: Expanding the UK Economy, 2016 – Eunomia report for SUEZ	UK	A more circular industrial strategy bringing changes in waste management and broader shifts in the consumption and use of furniture, electronic equipment, and textiles.	Total net gain in GVA of £47 billion between 2016 and 2030. Overall, GHG savings are estimated to be in the order of 27 million tonnes of $_{2\,eq}$ eq by 2030.
London's Circular Economy Route Map, 2017 – LWARB	London	Businesses and consumers using services rather than owning. Remanufacturing products and ensuring re-use of materials.	Net benefit of up to £7bn a year by 2036 if London accelerates its transition (£2.8bn by delivering the actions route map document. Other £4.2bn of benefit comes from the UK, Europe and the world embracing circular economy)

Circular business models cross-cut numerous areas of a business, from its supply-chain to its operations and its interactions with customers. As a result, the ways in which these models will bring benefits to a business, and how each area of the business plays off another, is difficult to assess and measure. Through increasing energy and resource efficiency, closing the loop on resources, and protecting businesses from the fluctuation in commodity prices, the benefits of a circular economy are potentially large – even if they might not be as large as some have claimed.

4.0 Circular Economy Business Models

At a conceptual level, the circular economy is a simple and attractive solution that can enable businesses to reduce their consumption of energy, water and materials and their dependence on primary resources. In addition, it can help businesses turn their waste into an asset with value attached to it. However, at a practical level, current business models are not built in such a way to make the concept of circular economy easily and practically feasible. New business models and enabling technologies are required in order to facilitate the transition to a circular economy. Such models are emerging as a response to a shift in consumer trends towards a sharing economy.

4.1 Consumer Trends and Attitudes

Shifting Consumer Attitudes

Consumer trends, in particular in Western economies, are changing. Consumers are increasingly moving away from the desire to buy and own assets and products and are instead becoming more interested in leasing goods and services. Terms such as the sharing, collaborative or digital economy have become common parlance in the last few years. They are all based around the concepts of the circular economy: using underutilised assets to improve efficiency, sustainability and community, through collaborative forms of consumption and the use of digital technologies to enable this.[16]

In their research, SITRA identified some of the reasons behind the general shift in consumption trends. They state that there a shift away from an "abundance model", where the consumer feels a need to own larger volumes or greater qualities of goods, towards a "multifocal model". The latter model seeks to satisfy several sociocultural needs and values simultaneously and is in opposition to the abundance model where owning goods is a question of identity and status.

The report highlights that *"amid an increasingly more fluid digital world, goods relate to behaviours that represent an entire spectrum of needs"*.17 The four predominant themes for these needs are summarised as:

- In a world in constant motion, consumers actively experiment with decluttering. They become mobile and autonomous while simplifying and making parts of their lives more convenient.
- Consumers seek goods as a way to focus and regain a sense of control in a fast-moving environment. Some goods also express the individual's quest for non-materialistic self-improvement or "betterment."
- Goods can connect to a larger narrative, whether environmentally or socially. Therefore, consumers see their choices as carrying a long-term impact.
- Consumers seek to balance their need for mobility with things that provide a sense of stability and longevity.

Leading Sectors in the Sharing Economy

The sectors in which the sharing economy is currently strongest are the automotive (Uber, Lyft) and accommodation industries (Airbnb), as well as the media (Spotify, Deezer).[18] These sectors are characterized by either being high-value, under-utilized assets (homes, cars) or intangible assets that are easy to share (media). As an example of the importance these businesses now hold in consumers' choices, a PwC study found that Airbnb averages 425,000 guests per night, nearly 22% more than Hilton Worldwide.[19]

The electronics sector is another sector where consumers are increasingly becoming interested in leasing business models. In a case study, WRAP found that a quarter of waste electronic items were fit for reuse, but most are landfilled or recycled.

he same research showed that 55% of people would be willing to buy used items.[20] There are three key models for keeping electronics in use for longer:

- Repair, refurbishment and upgrade by users themselves (e.g. Fairphone, through modularity with spare parts and manuals available online);
- Repair by trained technicians (e.g. iPhone or other smartphone providers);
- Remanufacture back to 'as new' condition with a full warranty.

16 What exactly is the sharing economy?, accessed 20 June 2018, https://www.weforum.org/agenda/2017/12/when-is-sharing-not-really-sharing/

17 Korkman, O., and Greene, S. (2017) *The Changing Relationship Between People and Goods - SITRA study*, 2017, https://media.sitra.fi/2017/05/05143553/Selvityksia122.pdf
18 Farronato, C. (2015) *The Sharing Economy - New opportunities, new questions*, October 2015, https://www.oxfordmartin.ox.ac.uk/downloads/GI_215_e_GesamtPDF_01_high.pdf
19 PwC (2015) *The Sharing Economy*, 2015, https://www.pwc.fr/fr/assets/files/pdf/2015/05/pwc_etude_sharing_economy.pdf
20 WRAP (2014) *Switched on to Value*, December 2014, http://www.wrap.org.uk/sites/files/wrap/Switched%20on%20to%20Value%2012%202014.pdf

In Germany an online consumer survey[21] covering washing machines, TV sets, notebooks, electric kettles and handheld electric mixers showed that approximately one third of the interviewees were dissatisfied with the product's lifespan. An average of 11% of the interviewees indicated that the product's lifetime was far too short and 19% of interviewees had expected the products to have a longer useful life. WRAP surveys in the UK have also identified similar dissatisfaction with product lifetimes and a willingness to pay more for more durable and reliable products; something that is often not obvious to the consumer at the point of sale other than through the offer of 'free' extended warranties.

Currently, there are several factors deterring users from engaging with reuse and refurbishment of electronic devices. These are mostly down to user perceptions (e.g. inferior performance, financial risk in case of malfunction) which could be resolved through warranty systems and transparency of the second-hand market.[22] Many devices are hoarded and become of limited economic value very quickly as technology moves on.

The lease and share economy is also venturing into other sectors in search of new opportunities. Areas in which initiatives are already taking hold are the luxury goods industry, furniture, sports and hobbies, appliances and toys, with a rental market already existing for each of these.[23]

Wider use of product lease arrangements also offers good possibilities, effectively bringing asset management from the commercial arena into the domestic arena. Lease of domestic appliances, for example, may make more sense now than ever before given the increasing number of people (e.g. the millennials) who are renting a flat together for a relatively short period. Lease, if done well, can offer all sorts of benefits in terms of trouble free maintenance and repair as part of the lease and use of better quality products that do a better job. For example, leasing of Dyson vacuum cleaners and Miele washing machines could be very attractive at a predictable and affordable monthly charge. Lease and hire models incentivise the supplier to provide goods that are durable and reliable as they need to minimise repair costs and maximise second and third life opportunities. The CEO of Dixons Carphone recently commented on their emerging position and the idea of developing a bundled Product Service System offer for householders.

21 Prakash, S; Dehoust, G.; Gsell, M.; Schleicher, T.; Stamminger, R. (2016): Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung – Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen Obsoleszenz. Im Auftrag des Umweltbundesamtes. Texte 11/2016. Dessau-Roßlau. Download at: www.umweltbundesamt.de/publikationen/ einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1.

22 Ellen MacArthur Foundation (2017) *Circular Economy Electronics: An Initial Exploration*, 2017, https://www.ellenmacarthurfoundation.org/assets/downloads/Circular-Consumer-Electronics-2704.pdf

23 Farronato, C. (2015) *The Sharing Economy - New opportunities, new questions*, October 2015, https://www.oxfordmartin.ox.ac.uk/downloads/GI_215_e_GesamtPDF_01_high.pdf

The circular economy provides an opportunity for businesses to adapt to these shifting consumer trends, for example through bridging the gap between design, production and through-life product management. Although some extended producer responsibility (EPR) schemes are in place in different countries that try and make producers accountable for the end-of life treatment of products, these schemes rarely cover the full cost of recovery and/or are often poorly enforced. The circular economy could help to ensure that these schemes become truly effective.

Table 4-1: Circular Economy Business Models and Examples of Businesses

Business Model	Concept	Examples of businesses
Repair and Refurbish	Extend the lifecycle of products and assets through repair or remarketing.	Premier Workplace Services* Tayside Diesel Engineering*
Sharing and Reuse	Promote a platform for collaboration among product users, either as individuals or as organizations.	Warp It* Trringo
Take-back and Recycling	Recover the embedded value of a product at the end of its lifecycle, either through re/upcycling or using waste/by-products from one product chain as a resource within the same chain, or in another chain.	MUD Jeans* Mainetti*
Upgrade and remanufacturing	Extend the lifecycle of a product or create an entirely new product; the use of recycled parts; upcycling, additive manufacturing and remanufacturing.	Tayside Diesel Engineering* Stannah Stairlifts* Premier Workplace Services* Caterpillar Toast Ale*
Servitisation	Use of products through a lease or pay-for-use arrangement, in opposition to buying and owning a product.	Mud Jeans* Rolls Royce Juice* RentSher

** these businesses are discussed in more detail in the Case Studies (section 3.3), as well as an enabler of food waste prevention*

4.2 New Business Models and Enabling Technologies

There are several ways in which businesses can make their practices and operations more circular, depending on how they operate and what services they offer. The most common types of business models are presented in Table 4-1.

In terms of the product service systems approach there are many existing examples involving high value products. The Rolls Royce Power-by-the-Hour Corporate Care programme for example means that airlines don't need to buy engines *per se* but rather a whole package that ensures engine availability and reliability. The Xerox Cost-per-print model for photocopying machines is similar, as is the Phillips Pay-per-Lux lighting model. It is essentially offering trouble-free low-risk 'utility' that incorporates maintenance and ongoing upgrade and makes the costs of ownership predictable.

Many of these business models would not be possible without the support of some key enabling technologies, not least digital web-connected technologies. Indeed, they rely strongly on the access to and sharing of information, providing data to service providers on how their products are used, and their condition, so as to optimise and extend their useful lives. Embedded sensors, internet connectivity (the IoT), 'big data' analytics and artificial intelligence and machine learning, all combine to allow real-time information exchange and visibility and smart control of assets. Sharing platform business models, such as Airbnb, also rely on the internet and data access, run mainly through online platforms on social media and through mobile devices.

In the physical world, remanufacture is another important area of life extension, allowing 'as new' products to be offered to customers with a full warranty, but made with cheaper components and materials recovered from older machines and hence higher profitability. This approach also improves security of supply and reduces supply chain risk for manufacturers. In the EU remanufacture already represents €30bn in turnover and employs 190,000 people, although the ratio of remanufacturing to new manufacturing is only 1.9%.[24] Consequently, it is estimated that the EU remanufacturing industry could grow to €100 billion, with as many as 500,000 employees, by 2030.

Engineering technologies and know how, including modular design, advanced materials and additive (3D) manufacture, are also crucial in facilitating low-cost repair, upgrade and remanufacture. 3D printing is a good example of a hybrid technology that brings together digital and engineering technologies, providing the possibility to digitally access a part that needs upgrading or fixing, no-matter how old, without the need for warehouses of spares that may never be used. Another example of hybrid technologies that will be instrumental in developing circular business models are tracking technologies such as physical tracking technology (e.g. RFID tags), blockchain (for encrypted and irreversible transaction tracking) and 'product passports', containing information on the product materials (including hazardous ones) and potentially repair and recycling instructions.

24 Robinson, S. (2015) *Remanufacturing Market Study*, November 2015, http://www.remanufacturing.eu/assets/pdfs/remanufacturing-market-study.pdf

4.3 Case Studies

The business models described above are becoming more and more familiar, with big names such as Caterpillar (remanufacturing), Rolls Royce (servitisation and remanufacturing), Phillips (servitisation) and ShareMyOffice (sharing) often cited as leaders. These models, or elements of them, are now being applied, equally, by new start-ups as well as major global enterprises. This indicates that as well as some high-profile major companies, the concept is equally applicable to smaller businesses, and indeed, start-ups. Indeed, adopting circular economy business models is sometimes associated with 'disruptive' approaches to existing markets or sectors.

In what follows, we give some examples of businesses based in the UK that have successfully developed businesses that are strongly aligned with circular economy principles.

4.3.1 Premier Workplace Services

Premier Workplace Services is a UK-based workplace change and clearance service provider. Their environmental office clearance business, Premier Sustain, offers *"a comprehensive range of sustainable services for the resource efficient management and sustainable clearance of office furniture, IT and redundant electrical equipment"*.[25]

The company started out as a simple office removals business, and soon realised that when companies moved or changed their offices, they would often simply discard their old furniture and buy new replacement items. They turned this into a business opportunity, deciding to expand their business to removal and remanufacturing of used furniture. Remanufacturing implies refurbishing products to a 'good as new' standard. The investments the company has made have been focused on achieving quality remanufactured products. After investing in machinery and a warehouse to store their goods, Premier Workplace Services now offers a comprehensive range of services to companies that want to relocate.

Premier Sustain featured in a case study by WRAP about resource efficiency in facilities management which highlighted the savings made:[26]

- 251 desks remodelled;
- Approximate saving of £90 per unit, compared to new replacements;
- 8.6 tonnes diverted from landfill;
- 23.22 tonnes of carbon equivalent saved.

25 http://www.premierworkplaceservices.co.uk/premier-sustain/services
26 WRAP (2016) Furniture remodelling cuts costs while maximising space

4.3.2 Mainetti

Mainetti is a well-known example of a circular economy business. The company is a leading manufacturer of garment hangers, meeting half of all UK demand. It diversified over the past decade and has become an industry-leading recycler, with two-thirds of output produced from recycled processes. This has allowed Mainetti to reduce its carbon footprint, its energy related overheads, and its production costs. A recent presentation from the company noted:

"We've changed greatly over the last seven years, to answer retail sector demand for 'closed loop' supply. Boxes under the counter in the clothes stores, that fill up with hangers are returned, where we sort, recycle, and remanufacture into new products" – Mainetti

4.3.3 Juice

The Scottish company, Juice,[27] is the SME version of a system from a larger provider: the Philipps Pay-per-Lux.[28] The concept consists of selling 'light as a service', i.e. leasing lighting, rather than selling the hardware and equipment for lighting (e.g. bulbs and fittings). The idea behind the Juice business model is that companies are reluctant to switch to LED lighting as this requires a significant upfront payment, even though the savings to business from lower energy bills justify the investment in a relatively short time period. The Rent a Light service from Juice removes this barrier, so that businesses do not need to buy bulbs and fittings (the usual upfront cost), but instead, rent a certain level of lighting. This enables them to make immediate energy savings and improve their carbon footprint without having to make a single upfront investment in the switchover to LED fittings.

This business model has been praised by Zero Waste Scotland, and the company features in one of their case studies (the company was called Market LED at the time).[29]

27 http://www.savejuice.co.uk/rent-a-light/

28 *Selling light as a service*, accessed 20 June 2018, https://www.ellenmacarthurfoundation.org/case-studies/selling-light-as-a-service

29 Zero Waste Scotland (2015) Market LED Case Study

4.3.4 Tayside Diesel Engineering

Tayside Diesel Engineering is a small business with over 25 years' experience in the maintenance and repair of large diesel engines for the offshore, marine and industrial sectors.[30] This company demonstrates that the concept of the circular economy is not brand new but has been in place in some sectors for quite some time. Indeed, in sectors where products are highly engineered, expensive, and have a high residual value, reconditioning, maintenance, repair and overhaul has always been sound commercial practice, so there is a good market for these services.

4.3.5 Stannah Stairlifts

Another example of a business where the products are highly engineered, and built for length of use, is Stannah Stairlifts.[31] The products sold by the company are well engineered, long lasting products. Due to the demographic the company's products are intended to serve (the elderly), a stairlift's first life may often be short, with the product still retaining most of its value. Stannah used to offer to remove the stairlift when it was no longer needed, disposing of it in accordance with prevailing environmental standards. However, the business is now moving towards leasing its products so as to be able to retrieve them, refurbish them and re-lease them.[32] This is an excellent way of the business recovering the residual value that still inheres in their products.

30 http://www.taysidediesel.co.uk/index.php

31 https://www.stannahstairlifts.co.uk/

32 REBus *Remanufacture lifts market and environmental benefits*, http://www.rebus.eu.com/wp-content/uploads/2017/05/REBus-Case-Study-Stannah.pdf

4.3.6 MUD Jeans

MUD Jeans is a Netherlands-based jeans rental and recycling service.[33] The concept behind the company is that many garments often do not get worn, and either sit in the cupboard, or are thrown away, often ending up incinerated or landfilled, when the materials could easily be recovered and reused. The 'Lease A Jeans' model enables members to lease a pair of jeans for a monthly fee and return them for repair, or replace them for another pair, at the end of a year's use. This is beneficial to MUD Jeans as it guarantees them a security of high-quality recyclable material to include in their new jeans.

4.3.7 Toast Ale

In order to tackle the growing issue of food waste, the team behind the start-up Toast Ale came up with the idea of brewing beer from fresh surplus bread which is destined for the bin.[34] In the UK, it is estimated that 24 million slices of bread are wasted every day and almost half of that waste occurs during the food-making process, before it reaches the home.[35] Toast Ale collects the discarded bread from delis, bakeries and sandwich and incorporates it into the brewing process. It replaces around a third of the malted barley used for producing their beer. Currently, their main source of bread comes from Adelie foods who donate and deliver the bread to them. This solution is beneficial to both parties, as Adelie would otherwise have to pay for the disposal of their excess bread. To date, the company estimates that it has upcycled 743,423 slices of bread in the UK by producing 263,751 litres of beer. It now brews in six countries.

33 *Circular Economy - Our Story | MUD Jeans*, accessed 25 June 2018, https://mudjeans.eu/circular-economy-our-story/

34 *Surplus Story - Toast Ale*, accessed 28 August 2018, https://www.toastale.com/surplus-story/

35 WRAP (2013) *Household Food and Drink Waste in the United Kingdom in 2012*, 2013

4.3.8 Winnow

Winnow is a UK-based company, with offices in Dubai, Shanghai and Singapore. They offer a simple and novel technology package that helps commercial kitchens manage their food resources in a smarter way.[36] The Winnow Waste Monitor is a simple system comprising of a weighing scale and a data recording terminal. Every time a kitchen employee throws food into a bin, the scale under the bin records the weight and the employee inputs basic details about the type of food thrown away. This data is recorded and stored in a cloud-based tracking system that also holds data on the business costings and menus. The data can then be analysed by the kitchen staff to identify areas where food waste can be avoided and improve their productivity.

The company estimates that since its creation in 2013, it has helped save $21,000,000 of otherwise unconsumed food as well as 26,194 tonnes of CO_2.[37]

36 *Winnow Demo Video*, accessed 22 August 2018, http://info.winnowsolutions.com/winnow-food-waste-demo

37 *Winnow Solutions*, accessed 22 August 2018, http://www.winnowsolutions.com/

5.0 Policy and Other Drivers

The previous section demonstrated that businesses are taking up circular business models of their own accord, as they increasingly see that these offer a combination of business benefits and improved environmental performance, as well as engendering brand loyalty. In the political sphere, the concept of the circular economy is also gaining more and more traction. Governments across the globe are writing circular economy route maps and implementing new ways of leading their economies.

5.1 Summary of Regional and National Approaches

There are both similarities and differences in the approaches undertaken by the different countries, regions and cities considering circular economy route maps. The plans vary in the scope of their action. Broadly speaking, they vary from being 'mainly waste-related' strategies (e.g. South Australia), to plans that genuinely seek to change the way products are designed, and the way businesses and 'product-users' transact (e.g. London, Finland). Essentially, what was once product consumption might now be delivered as a service. In some cases of the latter, the waste element is, to a degree, de-emphasised. This is more likely to be the case where either the waste management activities are covered in other strategies, or where those drivers are already in place through other policies and strategies.

Table 5-1 summarises the sectors that have been prioritised in the main national, regional, and city-wide circular economy plans and strategies. A more detailed description of a wider range of strategies is given in Appendix A.1.0.

5.2 Other Influences

A successful circular economy would see much more business activity retaining materials within the inner circles of the butterfly diagram in Figure 2-1. At worst, materials would be recycled where their value could not be retained within inner circles. This makes recycling a very important element of the circular economy because it essentially provides the final opportunity to prevent leakage of materials into (typically) landfills and incineration plants.

Table 5-1: Sectoral Priorities in Plans/Strategies

	EU	Finland	Denmark	Scotland	London	Rotterdam Delta
Food related	Food waste	A sustainable food system	Food products	Food, drink, and the broader bio-economy	Food	
Plastics related	Plastics				Plastics	Plastic packaging
Construction related	Construction and Demolition		Building and construction	Construction and the built environment	Built environment	
Electrical related	Critical raw materials	Technical loops		Remanufacture	Electricals	Copper in WEEE
Biomass related	Biomass and bio-based Material	Forest based loops				
Energy related				Energy infrastructure		Energy sector, gas and carbon
Other		Transport and logistics	Industry		Textiles	Aquaculture

5.2.1 China's National Sword

For nearly two decades, the major destination for many of the world's recycled materials has been China. In 2016 alone, Chinese manufacturers and recyclers imported 7.3 million metric tons of waste plastics (valued at $3.7 billion) from developed countries, including the EU, Japan, the U.K., and the U.S. China was also the recipient of more than half of the world's exports of waste paper.

This market helped support growth in recycling in many parts of the world often with little regard for the quality of what was being collected. The economy appeared to be bending into a more circular shape, with much of the actual recycling happening in the world's most populous country.

However, China recently announced a ban on imports of a range of recyclable materials under its National Sword programme. The import covers most commonly recycled plastics, textiles, unsorted mixed paper, and other materials. This has already exerted its effect on commodity prices and has heightened the focus both on quality, and on developing sustainable markets for recyclable materials in the country of origin of the waste. In order to compensate for this reduced demand from China, countries that have become reliant on China as an outlet for sorted materials will need to create a new market for their paper and plastics, and this has to be based on a system that delivers materials of a high quality that reprocessors can use with ease. In turn, there can be expected to be a stronger emphasis on increasing the recycled content of what we consume.

There are already signs of this occurring in the EU and the UK. In launching its Plastics Strategy, the EU has asked industry to come forward with voluntary pledges to increase the use of recycled material within their products. European Commissioners have indicated that if the pledges are inadequate, they intend to consider the potential for legal instruments to increase recycled content. Under the Plastics Pact, a voluntary agreement launched by WRAP and the Ellen Macarthur Foundation, signatories have indicated they will achieve 30% recycled content across all plastic packaging by 2025.

Some countries and regions are already shifting their attention towards developing a more circular economy partly in response to China's National Sword. In Australia, the New South Wales (NSW) Government has established an Inter-Governmental Taskforce to progress long-term responses to China's National Sword policy and strengthen recycling in NSW. A Circular Economy and Inter-Jurisdictional Engagement working group has been established to lead this work, and whilst its short-term focus is on developing a long-term response to National Sword, it is expected to take a broader view in the months and years ahead. See also the Appendix A.1.0 for more detail on examples of Circular Economy policies and actions.

5.2.2 Plastics in the Marine Environment

Another key factor which is focusing interest on what happens to materials, and how they are designed and used, is the enormous public interest in the problems caused by plastics in the marine environment. There are many sources of this, and their relative significance varies by location.

The issue highlights what happens when the economy creates 'the wrong types of circle'. In reality, all the non-biodegradable materials we discard have the potential to come back to haunt us in other forms for the simple reason that they do not simply disappear. Plastics provide a perfect example of this, whereby things that are littered and improperly disposed of are first transported to rivers and oceans, where they then have the potential to harm wildlife through entanglement, or affecting digestive tracts, and where they may break down to be consumed by aquatic and marine organisms which are part of the human food chain.

Much focus has been placed on adopting a completely different attitude to plastics. The EU's Plastics Strategy and Draft Directive on Single-use Plastics are a direct response to the threats posed by marine plastics. Similarly, the Secretary of State for the Environment, Michael Gove, has already announced his intention to implement a deposit refund scheme for beverage containers (helping reduce littered bottles and caps), and an intention to ban plastic straws and stirrers. The UK Government's 25 Year Plan for the Environment promises to eliminate avoidable plastic waste and to revamp the UK's system of producer responsibility. Finally, HM Treasury has also consulted on the use of taxes and charges to address the issue of single-use plastics. Announcements regarding these issues, as well as a new Resources and Waste Strategy, are expected in the Autumn of 2018.

There is a growing movement to ensure that company reporting takes into account non-financial issues, notably, risks associated with exposure to environmental problems and issues. This parallels a move in the investment community to seek forms of 'labelling' of financial assets as 'green' or otherwise. This movement is not merely a UK, or European, phenomenon: China has taken a leading position in the market for so-called Green Bonds, the market for which is expected to exceed $1 trillion by the end of the decade.

Investors are increasingly concerned with environmental risk factors and policy makers are beginning to help all investors understand these risks by requiring companies to report on these matters. In 2015, the Financial Stability Board (FSB) launched the Task Force on Climate-related Financial Disclosures (TCFD). The FSB (Chaired by the Governor of the Bank of England, Mark Carney) was tasked by the G20 (the world's major economies) with monitoring the global financial system. The FSB asked the TCFD to understand how climate change would affect global markets, and what information companies needed to disclose to the investment community to assess climate-related risk and opportunity. In June 2017, the TCFD released four broad recommendations, suggesting companies provide the following disclosures in their annual financial filings.

1. Governance: Disclose the organisation's governance around climate-related risks and opportunities.
2. Strategy: Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning where such information is material.
3. Risk Management: Disclose how the organisation identifies, assesses and manages climate-related risks.
4. Metrics and Targets: Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

The Task Force's recommendations have been widely supported by industry leaders. As of April 2018, more than 275 companies, with a combined market capitalization of more than $6.6 trillion, have publicly expressed support for the TCFD recommendations. The companies include more than 160 financial firms — responsible for assets of over $86.2 trillion.[38]

38 Deciphering the Task Force on Climate-related Financial Disclosures (TCFD) https://www.bloomberg.com/professional/blog/deciphering-task-force-climate-related-financial-disclosures-tcfd/

5.2.3 Non-financial Reporting

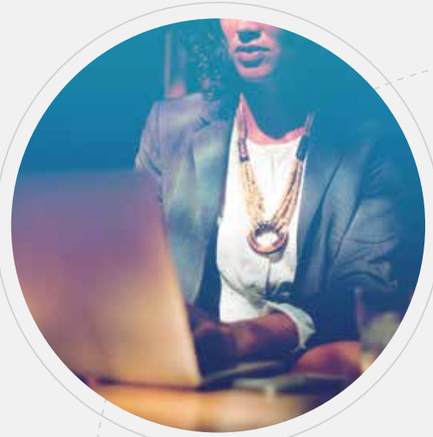
Investors are also encouraging portfolio companies to act towards implementing the TCFD recommendations. For example, the global head of investment stewardship at BlackRock, the world's largest asset manager, sent letters to the corporate governance teams at over 120 companies urging them to assess the risks posed by climate change to business operations in line with TCFD recommendations.

EU law now requires large companies to disclose certain information on the way they operate and manage social and environmental challenges. In particular, Directive 2014/95/EU lays down the rules on disclosure of non-financial and diversity information by large companies. From 2018, companies are now required to include non-financial statements in their annual reports.

Interestingly, interest has spilled over from climate change into other environmental areas. The ratings agency, Moody's, has already issued reports indicating that as governments seek to address the issue of marine plastic pollution, so the credit-worthiness of manufacturers of plastic packaging might fall. An analyst at Moody's also noted:

"If we see sustainability increasingly having an effect on growth rates and investment needs, I think that could become a greater focus," he said. "I don't think any company that we rate is unaffected by this trend."

This highlights the fact that, as environmental issues become more prominent, and as their impact permeates all areas of human activity, so the backlash against businesses who are implicated in creating environmental problems can be expected to become more severe. It follows that businesses which seek to minimise their environmental impact through adopting the principles of a circular economy will be more resilient in the face of the potential flight of investors away from assets which are linked to environmental problems.



5.2.4 Education

An essential step towards embedding the circular economy in the mindset of the business community will be the education of business owners and employees. Although many of the concepts surrounding the circular economy are relatively pragmatic and make common sense, concrete examples and guidelines are required to help businesses actually put these concepts into practice.

Online learning platforms have great potential for providing educational tools that can be used by businesses everywhere, spreading the word about the circular economy. In this regard, the Ellen MacArthur Foundation has led the way. It has collected a large array of teaching resources on their website, including online courses, videos, business case studies and articles.[39] The e-learning course provides an overview of the key concepts, as well as details about how it is applied in specific business functions, such as R&D, design, supply chain management, marketing, strategy and finance. The layout of the resources in a mind map display makes it easy for the user to navigate and understand how all aspects of the circular economy are interlinked. Design and technology is one of the central topics in their resource map, highlighting its fundamental importance for the circular economy.

In addition, the EMF provides resources aimed at schools and colleges as well as links to higher education opportunities in the circular economy and institutions with which the Foundation has partnered.[40]

39 *Circular Economy Educational resources • Ellen MacArthur Foundation*, accessed 31 August 2018, https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/key-for-general-resources-map/ict

40 *Circular Economy Learning, Circular Economy Education, Courses, Higher Education Opportunities*, accessed 31 August 2018, https://www.ellenmacarthurfoundation.org/programmes/education

5.2.5 Technology as an Enabler

There are profound changes already underway in key areas of the technological sphere, these relating to (amongst others):

- Artificial intelligence and big data;
- Robotics, machine learning and automation;
- Blockchain;
- 3D printing and nanotechnology;
- Networks and sensors; and
- Biotech, bioinformatics and synthetic biology.

How these are deployed will have a profound influence on societies in future, but each presents opportunities in terms of enabling a more circular economy through enhancing business efficiency, new business models and enhancing stewardship.

Already, the use of neural networks and machine learning is being used in improving the efficiency and accuracy of sorting facilities. The use of sensors can support both the tracking of assets and the sorting of materials: sorting at the level of branded products may help the development of policies that are more targeted at specific products. The use of blockchain can help track assets through their lifetime and improve management of assets at the end of their first life, whilst also, potentially, enabling the application of policies that fully internalise externalities of production, even to complex products that may be produced using geographically dispersed supply chains. 3D printing enable cost effective remanufacturing of complex products, whilst also seeding up the manufacture of prototypes for subsequent scale-up. These technologies have transformative potential, and whilst they might not obviously appear as strongly linked to the circular economy, they can play an important enabling role in the development of the circular economy.

6.0 Key Messages

This report has sought to inform businesses as to what a circular economy means, and why businesses might wish to adopt a 'circular economy mindset' to how they design, produce and sell their goods and services. In our view, notwithstanding the fact that some of the cases presented for adopting a circular economy may be overstated, the case for adopting circular economy principles appears extremely strong. Studies on business resource efficiency have shown, over decades, that business practice varies significantly, even within sectors, and sometimes, across sites within the same business, with plenty of scope for improved practices. When considered alongside the potential for:

- Improved product design;
- Manufacturing, and remanufacturing, in novel ways;
- Using newer technologies to enable consumers and businesses to transact in ways that were impossible to envisage in the past; and
- Using digital technology to track assets and material flows; and
- Enhancing the efficiency of logistics,

then the opportunity looks compelling.

The coming together of a series of environmental crises at the same time as a range of disruptive technologies are exerting their full force will challenge society to ensure that these technologies are deployed in ways that help solve these crises rather than exacerbating them. Adopting a circular economy mindset will help to ensure this is the case. Helpfully, businesses who do this may find that the current of consumer attitudes is increasingly supportive of that move.

Businesses have much to gain – today – by adopting circular economy principles. This is true with policies as they stand today. We have highlighted how a number of countries and regions and cities are starting to shape their futures around the pursuit of a more circular economy. Global political momentum is also gathering around addressing issues of climate change, and of marine plastic pollution. As policies shift to address these issues – as they must if we are to survive as a species on this planet – then adopting circular economy principles will become an ever more obvious choice for businesses. Circular business models will have to become the norm.

Consultants at Accenture note:

"efforts by leading companies suggest this change is already happening, is successful, and is inevitable. That's why it is important for organizations—regardless of market, geography or industry—to begin laying the foundation for change."[41]

There will be different hurdles and barriers for different businesses seeking to make this transition. However, adopting circular economy principles holds the promise, for businesses, that they can enhance their profitability, ensure their businesses are more resilient, and that they are part of a badly needed solution rather than part of the problem. This latter point should not be under-emphasised: the best talent, in a global market, rarely seeks to be deployed in manifestly destructive activities.

41 Accenture (2014) *Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth*, 2014, https://www.accenture.com/t20150523T053139__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf

A 1.0 **National and Regional Approaches to the Circular Economy**

A.1.1 **EU Circular Economy Package**

The European Commission's Circular Economy Action Plan[42] reflects a range of work that the Commission has been involved in for many years and had already been initiated before the concept of the Action Plan materialised. It entered into EU law on June 14th 2018 and will be transcribed into national laws over the next two years. As a result, much of the work being identified is not 'new' but builds on actions already underway: what the Action Plan does is enables what might otherwise have been seen as loosely related actions into an Action Plan.

The Actions set out under the Plan are many and varied. They are grouped under a number of headings:

1. **Production:** ongoing work on eco-design and the identification of Best Available Techniques is supplemented by a range of actions whose outcome is not entirely clear.
2. **Consumption:** a range of existing initiatives (such as on Green Public Procurement, the development of Product Environmental Footprint) and some less well-defined new ones are considered here.
3. **Waste Management:** virtually all actions under this heading were well underway by the time the Action Plan was released.
4. **Markets for Secondary Materials:** an extension of work the Commission had embarked on in earnest as early as 2008. The concerns related to market failures in demand for secondary materials. The concerns around resource availability, both primary and secondary, led also to the development of what is known as the European Innovation Partnership on Raw Materials.
5. **Sectoral Actions:** a number of sectors were identified as being worthy of specific actions. In the words of the Action Plan, these sectors '*face specific challenges in the context of the circular economy, because of the specificities of their products or value chains, their environmental footprint or dependency on material from outside Europe.*' The sectors were:
   - Plastics
   - Food waste
   - Critical raw materials
   - Construction and Demolition
   - Biomass and bio-based Material
   - Innovation and investments.

Design for durability and repair will be enshrined to a much greater degree into the EcoDesign/ Energy related Products (ErP) Directive, and hence will become a legal requirement for many products where the Life Cycle Assessment (LCA) warrants it.[43] Vacuum cleaners already have some durability requirements for motors and hoses and 3 or 4 other product categories have durability and/or reparability requirements. The 2016 to 2019 plan notes that "With this new working plan, the Commission will explore the possibility of establishing more product-specific and/or horizontal requirements in areas such as durability (e.g. minimum life-time of products or critical components), reparability (e.g. availability of spare parts and repair manuals, design for repair), upgradeability, design for disassembly (e.g. easy removal of certain components), information (e.g. marking of plastic parts) and ease of reuse and recycling (e.g. avoiding incompatible plastics) …"

42 European Commission (2015) Closing the loop – An EU action plan for the circular economy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(20015) 614 final, 2/12/2015.

43 European Comission (2016) *EU Ecodesign Working Plan 2016-2019,* November 2016, https://ec.europa.eu/energy/sites/ener/files/documents/com_2016_773.en_.pdf

A.1.2 National Approaches

A.1.2.1 **France**

France's circular economy roadmap is comprehensive and is centred around four main objectives that were identified as a result of the consultation and workshops: [44]

1. Facilitate sustainable consumption by offering access to robust, reliable and well-designed products that have minimal environmental impact. This goes hand-in-hand with eco-design and the recognition of local skills- and knowledge-base.
2. Improving waste management in order to ensure that circularity can be achieved through the recycling of materials, and incorporation of recycled material into new goods.
3. Driving sustainable production through use of recycled materials, sustainable and environmentally-friendly resource extraction and the eco-design of products, in order to move towards a sustainable use of resources.
4. Mobilising actors at all levels of society and all over the country, in order to drive the change forward. This will happen through information campaigns for citizens, industry cooperation and obligations, and public sector sustainable procurement. There is a strong emphasis on the importance of regional authorities on driving these changes.

44 Ministère de la Transition écologique et solidaire (2018) *50 mesures pour une économie 100% circulaire*, April 2018, https://www.consultation-economie-circulaire.gouv.fr/la-feuille-de-route-economie-circulaire

A.1.2.2 **Denmark**

The vision for Denmark's transformation to a circular economy is built from five specific objectives. [45] These objectives are:

1. Gaining greater economic value from materials by boosting resource productivity by a) 40% based on amount of materials used, and b) by 15% based on their value;
2. Increasing circularity by boosting overall recycling to 80% and reducing the amount of waste generated by 15%;
3. Retaining its leading position in Europe by developing circular technologies and solutions, and increasing the exports of both;
4. Utilising surplus capacity better through 50% of the population becoming active in the 'sharing economy'; and
5. Boosting circular consumption by quadrupling overall turnover of eco-labelled products and services.[46]

45 Ministry of Environment and Food of Denmark (2017) *The Advisory Board for Circular Economy - Recommendations for the Danish Government*, June 2017, http://en.mfvm.dk/fileadmin/user_upload/MFVM/Miljoe/Cirkulaer_oekonomi/Advisory-Board-for-Circular-Economy-Report-2016-Content_311017_Spreads_WEB.pdf

46 Ministry of Environment and Food of Denmark (2017) *The Advisory Board for Circular Economy - Recommendations for the Danish Government*, June 2017, http://en.mfvm.dk/fileadmin/user_upload/MFVM/Miljoe/Cirkulaer_oekonomi/Advisory-Board-for-Circular-Economy-Report-2016-Content_311017_Spreads_WEB.pdf

A.1.2.3 **Finland**

Finland's road map to a circular economy (2016-2025) was launched in 2016 and outlines the steps required for transition to a fully circular economy by 2025. Sitra, the Finnish Innovation Fund, launched the road map in collaboration with the Ministry of the Environment, the Ministry of Agriculture and Forestry, the Ministry of Economic Affairs and Employment, Business Life and other stakeholders.[47] The roadmap is based on three major strategies:

1. Pilot Trials: These are smaller scale initiatives which can be trialled, evaluated and replicated at larger scale and allow for highlighting of best practice. They are allocated to 'owner' regions;
2. Key projects: These are flagship projects, taken from pilot ideas which develop the circular economy. They are central to one of the focus areas entities and the aim is for these projects to begin immediately; and,
3. Policy Actions: Covers the legislative changes required in the process such as finding ways to streamline, co-ordinate and improve cost-efficiency.

47 SITRA (2016) *Leading the cycle: Finnish road map to a circular economy* 2016–2025, 2016, https://media.sitra.fi/2017/02/28142644/Selvityksia121.pdf

A.1.2.4 China

In its circular economy plans, China focuses on working at three different levels: individual companies, eco-industrial parks, and cities and provinces.

- Company level approaches focus on management systems, cleaner production, the design of industrial plants and green technology;
- Eco-industrial parks aim to co-locate industries to enable utilisation of waste products locally, the establishment of green supply chains, and resource and energy efficiency. The fact that most Chinese manufacturing is located in industrial parks has assisted the move toward eco-efficiency; and
- The goal of eco-cities and eco-provinces is to establish the whole region as a circular economy, where everything is powered by recycled renewable energy and produces close to zero carbon waste.

A.1.2.5 Scotland

The Scottish Government's 'Making Things Last – A Circular Economy Strategy for Scotland'[48] was published in 2016. It followed on from a range of activities already underway in respect of waste. The implementation of the strategy is already underway. The strategy builds upon the targets, ambitions and foundational actions within Scotland's Zero Waste Plan, published in June 2010, and its 'Safeguarding Scotland's Resources: Blueprint for a more Resource Efficient and Circular Economy (SSR)' published in October 2013.

The strategy aims to contribute to the following National Outcomes:

1. Reduce the local and global environmental impact of consumption and production in Scotland;
2. Live in a Scotland that is the most attractive place for doing business in Europe;
3. Create a better educated, more skilled and more successful society, renowned for research and innovation; and
4. Realise Scotland's full economic potential with more and better employment opportunities for people.

A.1.2.6 New Zealand

New Zealand has recently announced its intention to move towards a more circular economy. The Sustainable Business Network in Auckland launched its Circular Economy Accelerator project in 2017. Earlier this year, the Ministry for the Environment developed a plan for its approach to develop a roadmap to a more circular economy. This covers both the waste related elements of the circular economy, and the more encompassing, economy wide transformation, building on work undertaken to develop a carbon negative New Zealand in the future.

48 Scottish Government (2016) Making Things Last – A Circular Economy Strategy for Scotland, http://www.gov.scot/Resource/0049/00494471.pdf

A.1.3 Regional approaches

A.1.3.1 **Rotterdam Delta**

The development of a strategy for Rotterdam was based on the view that the Port of Rotterdam held a strategic position. The study took, as its point of departure, four key features of the circular economy:

1. Minimise the use of inputs and eliminate waste and pollution;
2. Maximise the value created at each stage;
3. Manage flows of bio-based resources and recover and retain flows of non-renewable resources in closed loops;
4. Establish mutually beneficial relationships between companies within each circular chain.

The bulk of the strategy is developed around the elaboration of a vision for each of 4 chosen sectors. These appear to have been chosen on a pragmatic basis. The 4 sectors are:

- The energy sector;
- Copper in e-waste;
- Plastic packaging; and
- Aquaculture.

The Netherlands have opened in Rotterdam the Circular Economy Hotspot, launched in June 2018, to create a formal agency able to offer advice and help find finance for CE start-ups wanting to position their businesses in the area. Situated in Blue City, currently about a dozen businesses are located there.

A.1.3.2 **South Australia**

South Australia does not have a formal 'roadmap' for transition to a circular economy. However, the foundations for work in the circular economy area were laid in South Australia's Waste Strategy

2015-2020.[49] The Strategy identifies the need to evolve South Australia's approach in this area to take account of economic and climate change linkages and impacts. It places the waste strategy in context with the South Australian Government's policy framework.

The key documents that flesh out South Australia's approach include:

- **South Australia's Waste Strategy 2015-2020.** Establishes a circular economy focus, sets up the evolution of Zero Waste South Australia into Green Industries South Australia, and identifies the key roles and responsibilities going forward.
- **Benefits of a Circular Economy in South Australia (May 2017).** This is a report commissioned by Green Industries South Australia, that identifies what transitioning to a more circular economy could deliver and the key types of initiatives that could be involved.
- **South Australia's Waste and Resource Recovery Infrastructure Plan (February 2018).** The intent of this plan is to provide a guide for future waste and resource recovery infrastructure needs across the State and support a resource efficient economy in South Australia.
- **Green Industries SA Business Plan (2017-18).** This document outlines the programmes and activities which aim to maximise resource recovery opportunities, create jobs and improve the environment in South Australia.

49 Office of Green Industries SA (2015) South Australia's Waste Strategy 2015-2020, 2015, http://www.zerowaste.sa.gov.au/upload/resource-centre/publications/waste-strategy/ZWSA%20WASTE%20STRATEGY%202015-2020.pdf

A.1.4 City-wide approaches

A.1.4.1 **London**

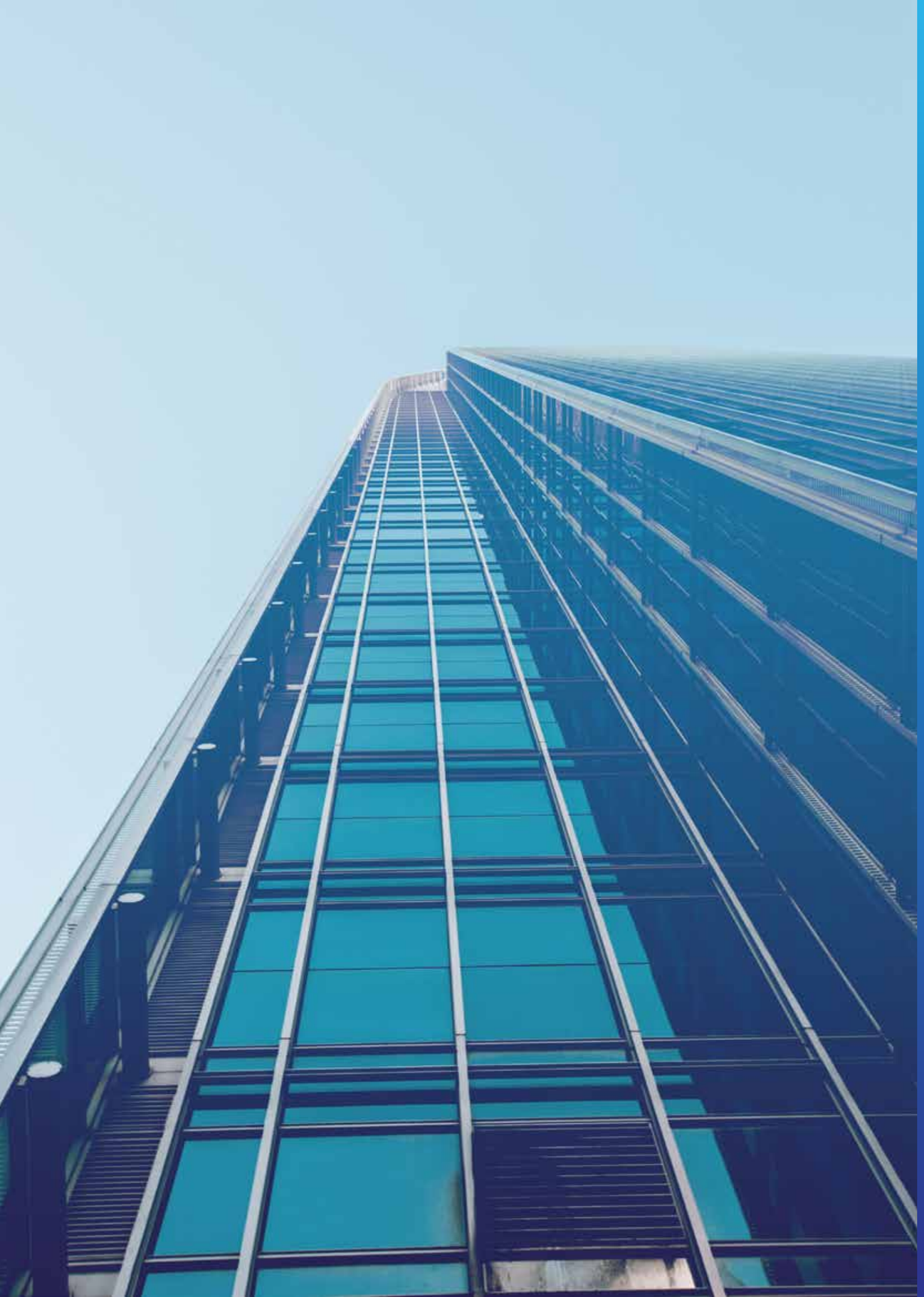
London's Routemap for a Circular Economy considered how best to develop an approach for London.[50] It took the approach of considering some priority sectors, which were identified through consideration of data on waste and their contribution to London's economy (both in terms of employment and Gross Value Added). These sectors were:

1. Services: the financial services sector is a significant part of the economy, but professional, scientific and technical services is the largest employer, followed by wholesale and retail trading;
2. Construction: employs more people than all manufacturing in London, and contributing more or less double the GVA of manufacturing; and
3. Of the manufacturing sub-sectors, the following are the most significant to London (although in relative terms, their contribution is minor when compared with the service sectors):
    a. Food products, beverages and tobacco;
    b. Other manufacturing and repair;
    c. Wood and paper products and printing; and
    d. To a lesser extent, textiles, wearing apparel and leather.

The measures proposed for development in London were sub-divided into:

- Cross Cutting Measures;
- Data-related measures;
- Sector Specific Plans;
- Local Authority Collected Wastes;
- Commercial Sector;
- Construction Sector;
- The Reuse Sector;
- Education; and
- Policies Outside London's Competence.

50 LWARB (2017) London's Circular Economy Routemap, June 2017, https://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf



Report for Ditto Sustainability Ltd

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The Impact of Circular Economy on Business

Final Report

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