THE PRINCE OF WALES'S
CORPORATE LEADERS GROUP

Business conversation

European industry in the 21st century:

New models for resource productivity

UNIVERSITY OF CAMBRIDGE
INSTITUTE FOR SUSTAINABILITY LEADERSHIP

WE MEAN BUSINESS

The Prince of Wales's Corporate Leaders Group

The Prince of Wales's Corporate Leaders Group (CLG) brings together executives from a cross-section of European industry to accelerate progress towards a low carbon, sustainable economy. Through cross-fertilisation of ideas and influential conversations with policymakers and peers, the CLG advocates forward-looking solutions that build a resilient and prosperous future. The CLG is convened by the University of Cambridge Institute for Sustainability Leadership (CISL).

The CLG is a founder member of the We Mean Business coalition.

The University of Cambridge Institute for Sustainability Leadership

For 800 years, the University of Cambridge has fostered leadership, ideas and innovations that have benefited and transformed societies. The University now has a critical role to play to help the world respond to a singular challenge: how to provide for as many as nine billion people by 2050 within a finite envelope of land, water and natural resources, whilst adapting to a warmer, less predictable climate.

CISL empowers business and policy leaders to make the necessary adjustments to their organisations, industries and economic systems in light of this challenge. By bringing together multidisciplinary researchers with influential business and policy practitioners across the globe, we foster an exchange of ideas across traditional boundaries to generate new solutions-oriented thinking.

Rewiring the Economy

Rewiring the Economy is our ten-year plan to lay the foundations for a sustainable economy. The plan is built on ten interdependent tasks, delivered by business, government, and finance leaders co-operatively over the next decade to create an economy that encourages sustainable business practices and delivers positive outcomes for people and societies.

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Executive summary

This report is based on interviews with companies that are using circular economy principles to reduce their exposure to risk, and to access new markets. It discusses some of the successful transformations and changes made, obstacles faced, and potential policies for overcoming those obstacles.

We asked 14 companies to share their experiences and motivations for transitioning towards a business model that delivers greater **resource productivity**. Those companies are from a number of different sectors, and interviewees were asked what changes they are making, what the corporate drivers are, what challenges need to be overcome, and what kind of policies would assist them to make further transformations.

All companies interviewed are **changing the way they operate:** redesigning value chains and products to use less materials and to last longer, choosing innovative bio-based materials over fossil-fuel-based materials, and circling waste back into production processes. There is a focus on **designing waste out of the system** at an early stage, to avoid relying on end-of-life disposal activities. Business models are **changing from selling a product to selling a function, or level of performance**, allowing the company to retain ownership of the materials, and to move much quicker to provide customers with technology and product upgrades, staying ahead of the market.

The companies we spoke to describe a future economy that must support a growing number of people whilst working within the confines of **diminishing reserves of critical finite materials, supply chains made vulnerable** by climate and political instability, **tightening environmental regulations** and the urgent need to **reduce greenhouse gas emissions** to net zero.

For businesses looking to reduce their exposure to these risks, developing new business models based on circular economy principles can bring very real economic benefits: direct **cost savings** from improved resource productivity and new uses for 'waste', **continued growth** in increasingly regulated markets, **improved market positioning** where consumption trends are demonstrating increasing consumer awareness of impacts, and **access to new markets** with associated new jobs.

There are still **systemic challenges** slowing progress, such as the perceived secondary materials market failure, for plastics in particular. All companies recommended increased harmonisation of EU regulations affecting 'waste' definitions, treatment and potential reuse, as well as more sophisticated end-of-life landfill and incineration policies, to help create value for a better functioning secondary materials market. **Cultural changes**, including consumer behaviour, are also a challenge, with companies adopting many 'nudge' policies to affect consumer choices.

There was wide agreement on the need for more **effective EU policies** to help companies overcome these barriers, such as setting minimum design requirements, targeted tax measures for disposable items or to encourage repairs, more ambitious public procurement criteria, or reducing labour taxes in favour of resource taxes. All these policies have the common aim of moving the tax burden or the material decisions further up the value chain to stimulate solutions to minimise waste in the economy.

In summary, many companies are adapting now to meet current and future changes in consumer trends, government regulation and strategy; and to place themselves at the front of changing markets and expectations of corporate responsibility. Other companies would do well to examine this trend and consider its relevance to them. Governments can help support and accelerate this transition, guiding it towards the best impact on social and environmental goals.

Image provided by Stora Enso

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Introduction

A global economy that secures a sustainable future and delivers prosperity to all requires a step change in how resources are used. To bring down energy demand, reduce pollution and ensure products and services are provided in ways that do not tax the planet's potential to provide beyond its ability to cope will require a reinvention of many business processes. However, a wave of innovation is offering businesses the chance to deliver such a reinvention and secure significant economic and market benefits while doing so.

This report from The Prince of Wales's Corporate Leaders Group documents stories from leading companies that have taken steps to improve their resource productivity, exploring why they have done so and what they have learnt along the way.

Much of this innovation is captured by the new focus on developing a 'circular economy' business model that displaces the traditional linear model of production, consumption and waste, which is increasingly recognised as unsustainable. The circular economy label describes approaches that can help business deliver greater resource efficiency with associated economic gains. This improved resource productivity can lower the material use per unit of produce manufactured, and therefore save material costs, drive innovation, and create new markets with new jobs, often distributed across a wide geography.

The information presented in this paper is based on the real experiences of companies in our network, and our aim is to share it with policymakers to help make better, more targeted policies, and allow other companies to learn from the experience of these pioneers. It demonstrates the breadth of learning that has been achieved by a variety of companies across a range of sectors, the challenges they have faced and the benefits that they have accrued.

By drawing together these companies' experiences, we examine the case for moving away from traditional linear take/make/waste models. We talked in detail to 14 companies (12 of which are members of the Corporate Leaders Group) through face-to-face and telephone discussions, as well as during a dedicated workshop which brought in more businesses and other experts.

Image provided by Stora Enso

We would like to thank in particular the following people and companies for their time and contributions:

3M	Natasa Sbrizaj, Manager, Public Policy & Government Affairs, Europe Jean Marie Coant, Sustainability Technical Project Manager
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Introduction to key concepts

Bio-economy: Economic activity that encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. Its sectors have a strong innovation potential due to their use of a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering).

Circular economy: An alternative to a traditional linear economy of make, use, waste, in which resources (both finite and renewable) are designed to be used for as long as possible and then recovered and reused in the same or an alternative function, ie they retain economic value and remain in the economic system.

Closed loop (also referred to as cradle-to-cradle or regenerative) design: An approach to the design of products and systems, eg manufacturing, that is both efficient and essentially waste-free, and in which all materials in a process are consistently reused for their original purpose rather than discarded as waste.

Extended producer responsibility (EPR): An environmental policy approach whereby producers take over the financial and sometimes organisational responsibility for collecting or taking back used goods, as well as sorting and treatment for recycling.

Industrial symbiosis: Describes how a network of organisations can share mutually profitable transactions offering benefits to both parties. In the context of resource efficiency, this could be as simple as one organisation using a waste product from another organisation as a primary resource, saving the donor organisation from (paying for) disposal and providing the recipient organisation with a cheaper material. There are examples of industrial symbiosis operating at local and regional levels in particular.

Product life extension: To extend the lifetime of a product in use, eg by reusing, refurbishing or upgrading.

Resource efficiency: Measure of the value per unit of resource input.

Resource intensity: Measure of resources required to provide one unit of a service or product.

Resource productivity: Measure or ratio of the output for each unit of resource/input.

Secondary material: By-product or waste from a manufacturing process that is used as an input for another manufacturing process to create another product.

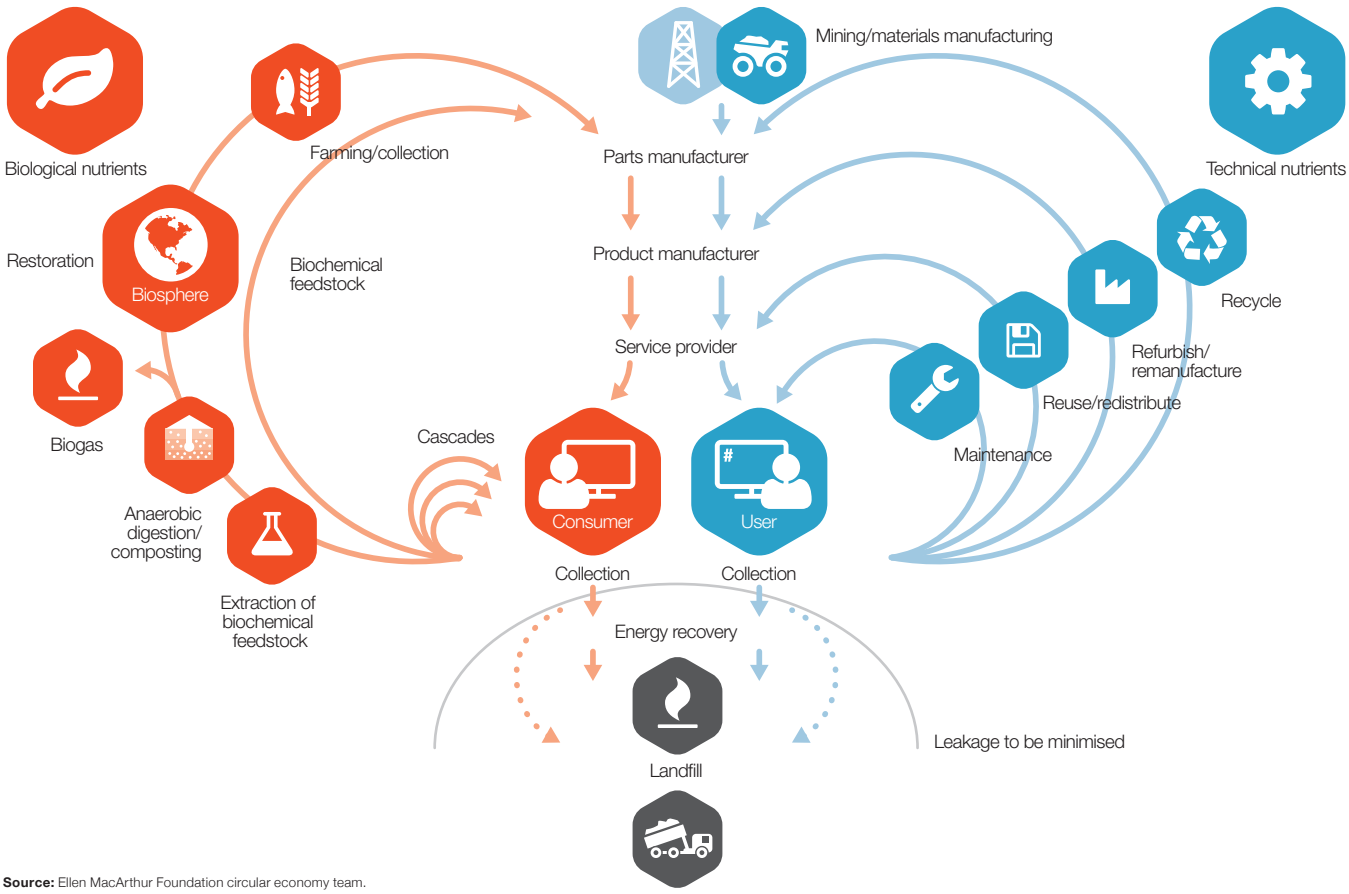
Servitisation: Closed loop system whereby rather than buying the product, the producer and the client enter into a contract for the provision of a service such as light, heat, energy efficiency, printing, etc. At the end of the service or product's life, the producer of the equipment recovers and repurposes it.

Section 1

How can businesses improve resource productivity?

The changing shape of the global economy, combined with new environmental pressures and consumer concerns, increasingly brings into question the current ways that businesses operate. The traditional linear model, adopted since the beginning of the first industrial revolution, of production, consumption, then waste is now recognised as unsustainable given increased environmental understanding, the growing global population and the rapid economic growth shown by emerging economies. Increasing consumption puts increasing stress on our environment and natural resource stocks.

The circular economy



Source: Ellen MacArthur Foundation circular economy team.

The future economy must square this circle and support a growing number of people whilst working within the confines of diminishing reserves of critical finite materials, supply chains made vulnerable by climate and political instability, competition for materials, and tightening regulations around the disposal of 'waste', toxic material, and other pollutants. And, of course, the urgent need to reduce greenhouse gas emissions to net zero well before the end of the century if we are to avoid runaway climate change.

For business, beyond anticipating and avoiding harm from these challenges, real opportunities lie in the economic wins from changing current business models. Developing new business models can drive innovation and create new markets with associated new jobs. For companies needing, or wishing, to reduce their carbon footprint, increased **resource productivity** and circular strategies can offer many opportunities to cut emissions at various stages of the production cycle. Expanding the scope of the business, whilst improving risk and resilience, can ensure continued growth and better market positioning. Keeping products in the economy for longer can result in cost savings, and there is clear value in an improved reputation.

In discussing this topic, the phrase **'circular economy'** proved a popular one with the companies we spoke to – it provides a useful shorthand to indicate a type of vision and direction that helps frame conversations with other businesses and stakeholders. However, in practice the circular economy represents a huge variety of different actions.

Circular economy initiatives can describe any action that moves towards a more efficient and productive business model by eliminating the 'waste' part of the product life cycle. This can include choosing alternative innovative materials, increasing the product yield of resources, maintaining the product's value in the economy, circling waste back into production processes and decoupling production from the use of natural resources entirely. The ultimate goal is to design waste out of the process before it can become an issue, including reducing the amount of material used in the first place.

In some cases, designs intended to reduce cost have had unintended consequences in other areas, as **Philips Lighting** have found. In their sector, the move to sealed LED lighting has offered both energy and cost savings but has reduced the opportunity for maintenance, repair or reuse. Consequently, Philips Lighting have recognised the need to increase the 'value' of their lighting components to encourage reuse, ie redesigning them to be accessible, fully repairable or upgradable to potential new functions (future-proofing and extending the economic lifetime of the product). They have introduced an internal design framework that focuses on reducing the material footprint, allowing for future connectivity (to cameras, the internet, movement sensors, phones), and reducing emissions from plastics/electrics down the value chain and from its operational use. Given the predicted 35 per cent growth in lighting points by 2030, a global move to 100 per cent smart LEDs could, according to Philips Lighting, save up to €272 billion and avoid 1,400 million tonnes of CO_2 equivalent per year.

Philips Lighting's fully serviceable luminaires at Schiphol Airport, Amsterdam

What kinds of 'circular economy' actions are different companies taking?

70% of circular economy policy is currently on end life, maybe 15% on input, and the other 15% on the design phase. Ideally, it should be nearer 5% responsibility left for end-of-life decisions.

Mat Roberts, Group Director of Sustainability Strategy, ***Interserve***

Designing materials and products in a simpler way leads to better recycling and hence reuse of materials… as a materials provider, we support our customers by closing the materials loop in their end products.

Kimberley Chan, Circular Economy Lead, Corporate Sustainability, ***Royal DSM***

The circular economy model must address the length of life cycles for different materials and indeed the use of the same materials in different products. Fibres from trees can be renewably produced in as little as a decade or can take many decades depending on species and location. These fibres can then be used in products with short lives such as paper or in long-term applications like construction where the lifetime can be several hundred years. Therefore, it is just as important to focus on the application of the material as the renewability of the material itself.

Noel Morrin, Executive Vice President, Sustainability, ***Stora Enso***

We are focusing on eliminating the materials in the cycle before they even get in there.

Nigel Stansfield, President Europe, Middle East & Africa, ***Interface***

Given the predicted 35% growth in lighting points by 2030, a global move to 100% smart LEDs could, according to Philips Lighting, save up to

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and avoid 1,400 million tonnes of CO_2 equivalent per year.

Royal DSM is developing bio-based alternatives to scarce fossil-fuel-based materials and designing out toxic materials, in order to avoid landfill and recycling problems at the product's end of life. This includes developing halogen-free engineering plastics for electronic and electrical applications. The company is also simplifying its designs and reducing the amount of different materials in any one product to enable higher quality reuse and recycling.

For **Stora Enso**, increased consumer awareness of the impact of fossil-based and other non-renewable materials, such as packaging and construction materials, is helping them transition to a circular bio-economy, in which their materials and inputs (including energy) will be both renewable and recyclable. Demand is rising for renewable, fibre-based packaging materials that can, for example, start life as beverage cartons, then be reused in the production of linerboard, copy paper and tissue paper, being recycled up to seven times before finally being recovered as renewable energy. To ensure their growth is sustainable, the company take their process residues and return them into the loop as renewable energy (being around 64 per cent energy self-sufficient). In addition, Stora Enso have introduced multiple process and product innovations that enabled them to double the number of cartons produced from the same amount of wood in the past 50 years – giving significant reductions in their fibre, water, energy and transport requirements.

They are also looking to replace traditional construction materials (concrete, bricks, etc.) with renewable (and more easily recyclable) wood products, in the process redesigning their entire business model to go well beyond pulp and paper manufacturing. A recent construction project using Cross Laminated Timber avoided 2,100 tonnes of CO_2, or the equivalent of heating and lighting all 41 apartments built for 29 years.

ACCIONA have substituted innovative composite materials for traditional materials in infrastructures (beams, bars, etc.), which have demonstrated improved environmental impact along their life cycle compared with concrete or steele. The advantages are lightness (less energy consumption and oil consumption during the construction phase), durability, and other physical and mechanical properties that reduce maintenance requirements and improve recyclability. This approach led ACCIONA to build the first composite lighthouse in the world in Valencia, saving 50 per cent on working time and generating 20 per cent less embodied emissions.

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20% less embodied emissions.

The first composite lighthouse in Valencia, Spain; built by ACCIONA.

To begin to close material loops, companies need to exert some measure of influence over what happens to their products at the end of their life. **IKEA** see this as an ownership issue: by taking more conscious ownership of their operational waste, they can identify opportunities to set up sustainable closed loops with suppliers. For example in one location, operational cardboard waste is sold directly to a producer of paper products who in turn supplies materials used in IKEA products. For customers, they also offer product take-back schemes at their stores.

Is it all about recycling waste?

Recycling waste has a key role to play, but as the policy frameworks state and as feedback from the companies we spoke to indicated it is only a limited part of the picture. There is clear agreement that prevention of waste in the first place is highly preferable to recycling.

It is also not an easy option as there are a number of issues that companies face. One of the main challenges that the companies highlighted in relation to recycling is that poor initial sorting of waste can degrade the quality of the secondary material produced. The resulting downward spiral of material 'value' is especially difficult with plastics, as the low oil price means that primary material is cheap and plentiful. It is also essential to keep food and non-food grades of plastic separated if they are to retain their value.

For example, **Coca-Cola European Partners** highlighted their need for comprehensive local recovery and collection schemes, saying that in many of their markets the quality of the recovered materials will not improve without better collection, sorting and separation of valuable materials like PET. When it comes to recovering their packaging, Coca-Cola European Partners are reliant on informed and responsible consumers taking action when they are finished with the product, but even so they are challenged by the inconsistent availability of appropriate recycling facilities across many of their markets in Western Europe.

> Recycling is no doubt an important part of the circular economy, but you cannot rely on recycling alone, and anyway recycling processes can be very energy-intensive as well. Most approaches should encompass the whole life cycle of the product, taking action when material efficiency can be optimised (ie designing the product, repairing, refurbishing, leasing instead of selling, etc.).
>
> *Natasa Sbrizaj, Manager, Public Policy & Government Affairs, Europe,* ***3M***

> We are required by legislation that 85% of the mass of a car must be recyclable – that is an end-of-life requirement. That is worked out in the design phase, so JLR only have to prove that it can be recycled, not that it is actually done. The target is just a proxy for action; if it is not subsequently recycled, all that design money is wasted.
>
> *Ian Ellison, Sustainability Manager,* ***Jaguar Land Rover***

> At the beginning of the 1990s – with increasingly scarce fossil-fuel-derived materials – we realised we couldn't continue ignoring the end-of-life material in the traditional linear take/make/waste model.
>
> *Nigel Stansfield, President Europe, Middle East & Africa,* ***Interface***

> As a materials company, we see that all the levers to address resource scarcity are important, including reducing resource use, replacing scarce and potentially harmful resources, extending the lifetime of materials and products, enabling recycling and recovering resources after use. However, it is really the steps of enabling and recovering that truly close the loop – enabling through better material choices and product design, recovering through new business models
>
> *Kimberley Chan, Circular Economy Lead, Corporate Sustainability,* ***Royal DSM***

Stora Enso utilise

98%

of their by-products and process residuals, circling them widely through different sectors and so reusing materials that would otherwise end up as waste.

What other areas are companies focusing on?

Companies have adopted a wide variety of strategies to manoeuvre themselves into a more sustainable place in their current and future markets. The major shifts have come from not solely focusing on end-of-life activity, but making pre-emptive changes further up the design and production cycles. Some of the main strategies adopted to achieve this are:

- designing waste out of the system
- extending the life of the product
- choice editing (limiting the unsustainable options available to consumers)
- selling functions, not physical goods
- switching to a bio-economy
- industrial symbiosis
- 'green' procurement.

Here we explore two of these strategies in detail.

Industrial symbiosis

One of the beneficial developments of the circular economy is an increased focus on new business partnerships across sectors, which is known as **industrial symbiosis**.

Stora Enso utilise 98 per cent of their by-products and process residuals, circling them widely through different sectors and so reusing materials that would otherwise end up as waste. Residuals such as ash and sludge are used for landscaping, road construction, agricultural purposes or brick manufacturing. The majority of the company's mills use residual materials from their production processes, such as wood-handling waste, sawdust and sludge, to produce energy. The company enables others to reduce their emissions: 13 of their mills use production process residuals to create and provide renewable energy to local district heating systems and industrial partners, directly reducing their use of fossil fuels. In 2016, 3.7 PJ of heat was sold, resulting in estimated emission reductions amounting to 0.28 million tonnes of CO_2.

> The energy needed for the production process is not some 'other' resource but a vital material input and must be considered, along with water usage. Lighting companies, for example, can sell light as a service, but they don't produce electricity, they produce bulbs – so we are obliged to work together to co-design low carbon solutions.
>
> *Claude Laveu, Chef de Mission,* ***EDF***

> To shift from linear to more circular material use, we used the principles of biomimicry – how nature solves problems – to see how we could get like-for-like recycling of carpet tiles. We learnt instead that we needed to be more collaborative – nature operates circular models through different kingdoms – so we looked for partners with waste or non-virgin-derived materials, and now nearly 60% of our input material is either recycled or bio-based.
>
> *Nigel Stansfield, President Europe, Middle East & Africa,* ***Interface***

ACCIONA's Energy Division runs biomass plants in Spain that incinerate agricultural cereal straw and forest waste to generate renewable electricity – a process that results in ash and slag by-products. These were traditionally sent to landfill; however, their richness in potassium makes them valuable to the agriculture industry as fertiliser additives. The company now avoids annual landfill of around 2,000 metric tons of ash and 25,000 tons of slag – saving $1.4 million per year in landfill expenses and generating income from sales to the agriculture industry. It also avoids emissions from the process of otherwise manufacturing new fertilisers. Additionally, ACCIONA's Construction Division is carrying out an innovative Horizon 2020 project entitled FISSAC, to foster industrial symbiosis across the extended construction value chain. It is expected to deliver a 15 per cent reduction of waste generation, 12 per cent gains in productivity for waste treatment, and 20 per cent energy efficiency and GHG savings.

Anglian Water are also taking the by-product of their core business process and turning it into an input material for another sector. After used water had been treated in a plant, the resulting sludge had been considered waste and companies disposed of it in the sea. But now sewage is seen as a valuable resource and Anglian Water produce about 400,000 tonnes of biosolids for use in agriculture. They also generate about 100 GWh of renewable energy from sludge, equivalent to around 14 per cent of the company's consumption and worth millions of pounds to them.

Servitisation – selling the function, not the product

Philips Lighting have found that consumers appreciate the benefits of buying a service, not a product, as it is less work for consumers not having to deal with the physical elements themselves. A contract for 'lighting performance' is a nearly circular business model: their products are designed to be repaired, upgraded and collected again – the customer only pays for the light and performance, and the company takes care of the end of life of the product. That can be either recycling or refurbishing and returning to the market as a second-hand product. The company avoids waste by extending the use-phase of its materials.

Performance-based contracts can also include 'benefit sharing', for example if the company installs more energy-efficient products during the course of the contract, the savings can be split or accrued to the service provider to incentivise them to innovate further.

This is a shift from an 'invoicing products' towards a 'leasing services' economy, and although waste reduction is a key benefit and characteristic, the prime objective is the broader spectrum shift to financed services. This allows companies to incentivise the latest technology and its sustainable resource-efficient benefits, staying ahead of the market, whereas current business and procurement models are often lagging one full technology cycle behind what is possible.

> "Business consumers appreciate not needing to spend staff time and costs outside of their core business maintaining assets or monitoring products. For example, some storage rooms have specific light requirements 24/7, but our customers are not lighting experts – so instead of selling the products, we provide a service contract for assurance on performance."
>
> *Bruno Pedrotti, Head of European Public & Government Affairs,* ***Philips Lighting***

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Section 2

Why are businesses acting?

Sustainability is DSM's core value, and a business growth driver. We have seen that circular economy business models can help us tap into new growth opportunities, as well as to address concerns related to resource scarcity, and linked to that, risks around security of supply chains and price volatility. Another benefit of these new models is that it can help companies to prepare for the inevitable tightening of regulations on resource use, waste management and pollution.

Ward Mosmuller, Director EU Affairs, ***Royal DSM***

There is a clear benefit to our business of acting on the circular economy – it helps us to reduce our carbon footprint, improve the sustainability of our packaging and decrease our reliance on fossil-fuel-based virgin materials.

Joe Franses, VP, Sustainability, ***Coca-Cola European Partners***

We know it is coming – there are initiatives on raw materials and waste, and research by the EU, so we need to understand how to manage our resources.

Natasa Sbrizaj, Manager, Public Policy & Government Affairs, Europe, ***3M***

It is no good using high-energy processes to recycle or repurpose material as that does not reduce our carbon footprint – we are working towards having a positive impact.

Nigel Stansfield, President Europe, Middle East & Africa, ***Interface***

Consumers' awareness of the scarcity of natural resources and their sense of social responsibility are increasing, creating market pull for environmentally and socially responsible products. Combined with new legislation, this is also driving our customers to use renewable and recyclable raw materials to create more sustainable products. In the long run, the world is looking to replace fossil-based materials with renewable alternatives.

Per Lyrvall, Executive Vice President, Legal, General Counsel, ***Stora Enso***

Schiphol airport started with the aim of making savings on energy efficiency, but then realised that if they were going to be efficient, they should really make a reputation for themselves by aiming to be the most sustainable airport – so they have gone beyond energy efficiency to looking at resource efficiency and end-of-life aspects of infrastructure.

Bruno Pedrotti, Head of European Public & Government Affairs, ***Philips Lighting***

Positive potential climate impact of a circular economy:

Reduction of 600 million tonnes GHG between 2015 and 2030.[1]

What are the broader benefits to business?

The focus on the circular economy and resource productivity is driven by a wide variety of factors, including **legislation, climate and sustainability concerns, reputation and consumer concern**. Ultimately for many companies, they are doing this **to ensure the future growth of the company in the face of already-apparent trends**: this is a **risk and resilience** issue of diminishing natural resources causing increased scarcity and competition; increasing vulnerability of supply chains and subsequent price volatility; changing consumer expectations of corporate responsibility in the community and the environment; and a desire to reduce CO_2 emissions. Tightening regulations are already addressing many of these issues, and companies see the need to anticipate these changes if they are to position themselves in the forefront of the market.

These are all drivers for examining the way companies do business, and replacing business as usual with more resource-efficient business models and processes not only addresses these issues, but can also produce significant **cost savings** through increased resource efficiency.

Interface began investigating circular principles early in the 1990s, when rapidly rising oil prices caused them to look at the **vulnerability of their supply chain** for fossil-fuel-derived raw materials. Moving to using secondary materials as inputs has not only helped address this issue, but has also enabled them to achieve a 95 per cent CO_2 reduction per unit of carpet produced, from a 1996 baseline.

In the case of **ACCIONA**, the main driver is the need to transition towards a decarbonised economy, using a production model that reduces raw materials, energy and water consumption as well as waste generation. Waste management, and the waste management hierarchy is a core strategic priority at the heart of the company's '*Sustainability Master Plan 2020*'. Circular economy principles are key to achieving greater resource productivity in the company. It is also an opportunity to reduce energy costs and emissions by improving processes, hence increasing their competitiveness.

For some industries, there is no imminent or alarming resource scarcity issue or economic drive to change to a more circular business model, except that they have a very clear ambition to reduce their carbon footprint. **GSK's** 'Complete the Cycle' inhaler recycling programme in the UK has both a waste- and a carbon-saving goal; the latter is due to the capture and recycling of the propellant in metered-dose inhalers. While the estimated carbon savings to date are 6,500 tonnes, if the infrastructure allowed similar schemes in other countries the savings could be considerable.

Many companies agree that whilst there is little direct market pull or push to adopt circular models at present, it will take longer for incumbents to change business models and designs than for new market entrants. Given the lack of drivers, policies supporting a shift towards circular business models could help companies to prepare now for expected future changes.

What are the opportunities for wider economic transformation?

During the 20th century, a commercial model of built-in obsolescence has increasingly dominated many markets.

Much of the cost of maintenance is labour which, particularly in countries with high labour costs, resulted in most systems being designed around replaceable, disposable products, rather than repairable parts. It will take a fundamental shift to bring longevity, repair and reuse back into the market, affecting every stage of a product's life, from design, material choice, supply chain behaviour, and responsibility for subsequent incarnations of the product as well as its end-of-life destinations.

This shift has the potential for major economic implications and is already visible in **new trends in consumption**, such as sharing models, digitisation, automation and connectivity, which are affecting consumers' behaviour; at the same time their awareness of the impact of the products and services being offered is rising[2]. Companies are increasingly expected to **demonstrate social responsibility** – while the general public would not necessarily

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and is already visible in new trends in consumption such as sharing models, digitisation, automation and connectivity.

talk about 'externalities', they can feel strongly about companies that are discovered to be exploiting workers, polluting rivers or using excessive amounts of packaging. Companies aiming for a highly visible market **reputation** often need to demonstrate a positive impact, not just a negligible impact.

It could help to create new, and new kinds of, **jobs**, as materials and products become more expensive and people will be needed in jobs to repair/upgrade them. Maintenance and repair of goods is a local jobs agenda, and worthy of further investigation. Job creation is likely to be amongst low- to mid-skilled workers, a group particularly at risk from economic instability[3], as well as the increasing mechanisation of traditional linear production jobs. As **Interserve** point out though, to take advantage of these opportunities there is the need for **skills and training** at the local level, which needs the engagement of education and industrial policymakers.

For **Stora Enso**, these trends add up to a **transformation** into a company that uses only renewable materials. They see that bio-based solutions will be used in many new ways, being adopted by industries such as textiles and automotives. Their aim is for renewable materials to replace plastics and metals, expanding the reach and scope of their business. Already, stronger and lighter packaging is made using microfibrillated-cellulose-based packaging board, and glues and carbon fibre can be made from lignin, a natural polymer found in wood. They recently began extracting lignin on an industrial scale with a view to using it as a replacement for fossil-based glues. Biochemicals will open new horizons in numerous applications.

However, while individual companies can be very strong at design and innovation, they cannot necessarily carry their sector with them, especially where that sector is entrenched in selling on a least-cost basis. **Measures to shift the whole market are needed** where the macro-economic case is clear, but the micro-economic case for individual companies is weak. This is where the policy landscape is key.

> "It should be cheaper for customers to pay for the labour on maintenance, than to get something replaced."
>
> *Mat Roberts, Group Director of Sustainability Strategy,* ***Interserve***

> "The circular economy is on the agenda in many ways. Capital markets look at efficient use of renewable raw materials, capital expenditure (CAPEX) and lower CO_2 emissions."
>
> *Seppo Parvi, Chief Financial Officer,* ***Stora Enso***

Section 3

What are the obstacles companies have faced?

We had some clean topsoil to dispose of, which a housing site over the road wanted, however, they couldn't take it as they would need to register as a waste facility to receive it. Being a registered waste facility impacts on the willingness of lenders to offer mortgages (as it is classified as a 'landfill' site), and so the company couldn't have sold the houses.

Mat Roberts, Group Director of Sustainability Strategy, ***Interserve***

We cannot transfer waste over borders without a permit. To get material from Paris to a recycling plant in the Netherlands we need additional packing and permits. The regulations are there to prevent harmful waste, but the categorisation is not sophisticated enough – so only a few huge waste management companies have the permits.

Nigel Stansfield, President Europe, Middle East & Africa, ***Interface***

We were prompted to help solve the problem of bulk waste from products such as carpets, mattresses and furniture, as DSM is a materials supplier to such products. Carpets account for approximately £4 billion in waste per year in the US alone, whereas recycling percentages today are as low as 5% in the US and 3% in Europe, with the rest being landfilled or incinerated. We discovered that the key to easier and economically viable recycling is to simplify materials and product design. However, we are faced with a challenge – there is limited awareness about the complexity of materials. The mandatory disclosure of materials ingredients in everyday products would support better recycling rates.

Kimberley Chan, Circular Economy Lead, Corporate Sustainability, ***Royal DSM***

In Norway, 70% of all the aluminium they have produced is still in circulation, because recycling aluminium takes only

5% of the energy

it takes to produce new aluminium.

Waste not, want not… the challenges of waste regulation.

Companies completely understand that many waste regulations have been concerned for human and environmental protection, but many find the message that waste is 'dangerous' in some way has sunk in too far. They would welcome a more sophisticated **distinction between by-product and waste** – including at what point 'waste' is sufficiently recovered to be deemed a product again. A more holistic view of products would also help, eg not regulating just for the use of certain ingredients in paint or furniture, but for their overall impact.

The lack of consistent regulations across borders has also proved a challenge. As **IKEA** say, the organisational burden of dealing with different rules for importing/exporting waste for recycling, different administrative rules for reporting of extended producer responsibility (EPR) and the licences needed for handling waste all mean that opportunities are often ignored as too time-consuming and resource-heavy to follow up.

> For us, the circular economy is the only way forward – with 9,500 products in our range we must swap from linear to circular. We use a lot of renewable material such as wood and cotton, as well as buying recycled materials like wood, PET bottles and glass – **but there isn't enough provision of second-hand material in the market to fill our requirements**.
>
> *Eva Margareta Stål, Senior Policy Adviser Public Affairs,* ***IKEA Group***

> There was a state-of-the-art **plastic bottle recycling plant** in London – that could sort the different types of plastic – but **when the oil price dropped and stayed low, they went into administration**.
>
> *Dr Paul Barnett, Programme Manager, Environmental Sustainability Centre of Excellence,* ***GSK***

Getting the secondary materials market right

Recycling processes in many sectors are not considered sophisticated enough yet to provide an acceptable standard of secondary material to displace virgin material inputs. The technology may exist, but the policies that help to make the shift economically viable are not yet in place. In addition, **Sappi** highlight that it can be hard to **pin down the provenance of secondary material** with any certainty to be sure of what, exactly, it is composed. They explain that not all recycling processes are of the same standard, so that even where the provenance is beyond reproach, the end result may be a lesser quality material than expected, or use more energy than desirable in its processes.

Some markets in secondary materials are more easily supported, due to the intrinsic value of scarcer types of material. Aluminium has a long, successful history of recycling. As **Norsk Hydro** point out, in Norway, 70 per cent of all the aluminium they have produced is still in circulation, because recycling aluminium takes only 5 per cent of the energy it takes to produce new aluminium. But **IKEA** currently use 25 per cent recycled plastic in their plastic products, because the market doesn't supply enough secondary plastic of the right quality or type at a price that is economically sensible.

For other materials, the economics of the secondary market often do not work. Despite its long-term commitment to use recycled PET in its plastic bottles it is currently cheaper for **Coca-Cola European Partners** to buy virgin PET rather than food-grade recycled PET, because of its additional recovery and processing costs. Where the intrinsic value of the secondary material is negligible, the risks of investing can be too high for the third-party resource management companies providing the services. And as **Royal DSM** point out, if there are not enough providers in the market to provide a sufficient and stable level of supply, companies will continue to use their traditional materials, leading to a reduced market incentive for investment in better processes to provide that recycled material.

Interface point out that attempts to stimulate the market can have unintended consequences though. For example, the absence of tax incentives or other financial measures to make collection, packaging, transporting, delivering and sorting less expensive than landfill results in more landfill. However, raising the landfill tax may result in more waste being burned for energy, resulting in increased emissions (although this can be avoided by introducing an incineration tax or a tax on all residual waste).

As **Sappi** say, the beginning of the market is already there – there is someone to buy, and someone to sell – so an opportunity for value generation at two different points. The two main challenges are: firstly, to place an economic value on the externalities of wasted resources in the economic cycle, to create incentives (or disincentives) that will build an effective secondary market; secondly, to connect 'waste' to its potential users. This is an issue of resource information – if we are to shift to a 'nothing is waste' culture, we need better information on what the potential uses are for the various waste streams, and who will want them when – collaboration across the value chain will become vital.

Addressing cultural barriers

Culture change starts within the company, and several companies highlighted the need to start early with regards to internal **awareness raising** in order to have the capacity to act later on.

ACCIONA have a portfolio of life cycle assessments (LCAs) containing 50 studies of 19 projects regarding the assessment of different materials, process and technologies. LCA is considered to be a powerful decision-making tool for selecting the better option in terms of the environmental and technical performance of bridges, roads, wind farms, etc. In addition, environmental product declarations (EPDs) of civil infrastructures were obtained, enabling ACCIONA to transparently communicate their environmental impacts.

LCAs need special skills, however, which is why **IKEA** developed their own scorecard with 11 sustainability criteria (such as ease of disassembly for recycling, how much renewable energy was used in production, how much renewable material a product contains) – it was important to have a tool that each department could use. Its simplicity meant that it took only one and a half years to get from idea to implementation – applying to all 9,500 products in the range. The whole range of their products is subject to the same sustainability scorecard precisely to avoid situations where a customer might choose, for example, between a 'sustainable' product and one that is less sustainable but a preferred colour. Running for six years now, it has developed and includes goals to improve the sustainability results year on year.

Consumer behaviour, however, is the challenge most companies raised, in terms of adequate information and education – with some querying whether information is enough to change behaviour, or if companies need to do some choice editing on their behalf.

IKEA Retail Belgium offer a policy that is a combination of choice editing and awareness raising; it offers customers different options to give their furniture a second life, eg re-selling used furniture, renewing the furniture, repairing, returning, or donating it to charity. In many countries, IKEA also host physical workshops with their consumers, where they can learn how to refurbish or upgrade their goods themselves – as 'life extension' automatically lowers the impact of the product. In Sweden, IKEA encourage customers to buy and sell second-hand IKEA products by offering free ads on the biggest online marketplace, blocket.se. This links to issues that **Interserve** identify around the potential perception of risk around second-hand or refurbished products.

Lastly, some companies raised the issue of culture change within regulatory language as well – **encouraging policymakers to talk of 'resources', not 'waste'**. This is not just a matter of semantics, but carries implied biases about the way policy is then developed.

Unfamiliarity is a problem when changing people's behaviour – we present their data back to them and they literally do not believe it. We need to count it, and then persuade people it's true, before we can act…The culture change failure in policy is treating 'waste' as something to get rid of as soon as possible – eg not encouraged to store on site until it may be reused in the future.

Mat Roberts, Group Director of Sustainability Strategy, ***Interserve***

It takes time to embed non-linear thinking into an organisation's strategy and processes. Our sustainability strategy has its roots in safe and responsible operations, and improving traditional environmental performance indicators such as energy efficiency and waste reduction. Over time, this has developed towards a focus on the impact of the products and services we deliver, which is measured through standardised sustainability metrics (life cycle assessments). Sustainability and circularity have become embedded in our organisation and governance, not by coincidence, but through purposeful inclusion into our decision-making processes.

Ward Mosmuller, Director EU Affairs, ***Royal DSM***

Two years ago my boss said the mission was to explain inside the company what a circular economy could do – this year, the whole group now understands and we are ready to implement concrete actions.

Claude Laveu, Chef de Mission, ***EDF***

We must undergo a huge transformation in the company´s mindset in terms of resource productivity and process efficiency along the whole value chain.

Juan Ramón Silva Ferrada, Chief Sustainability Officer, ***ACCIONA***

We believe that everything that's made with fossil-based materials today can be made from a tree tomorrow. This is our transformation to a renewable materials company.

Karl-Henrik Sundström, Chief Executive Officer, ***Stora Enso***

Section 4

Policy: what can be done to drive change?

> We would like the EU and its Member States to be more progressive, and less voluntary, in their approach, if public procurement is to really bite across the EU. Additionally, if the EU is serious about driving a circular economy, they need to do much more around the recycling infrastructure in Member States.
>
> *Natasa Sbrizaj, Manager, Public Policy & Government Affairs, Europe,* ***3M***

> The only market push is mandatory recycling rates, and these are too low. There is no market pull or incentive to use recycled or renewable materials in our packaging.
>
> *Joe Franses, VP, Sustainability,* ***Coca-Cola European Partners***

> If it's not legislative or fiscal, it won't happen – we need policies that create the right incentives to make it more expensive to discard than to reuse.
>
> *Ian Ellison, Sustainability Manager,* ***Jaguar Land Rover***

> We must overcome the difficulties of applying innovative construction products or technologies. National regulations and standards must be designed in order to promote and foster industrial symbiosis, like facilitating waste transference between value chain components.
>
> *Juan Ramón Silva Ferrada, Chief Sustainability Officer,* ***ACCIONA***

The issues faced by companies interviewed for this report are diverse, and many of them will be familiar to policymakers. Indeed discussions at the European level are grappling with issues like: what the potential is for environmental taxes, how to implement **extended producer responsibility (EPR)** in a way that can transform companies' relationship with waste and how best to harmonise waste regulation – exactly the areas that companies are identifying as needing more progress.

The shared story across this group of businesses is one that is optimistic about the potential of a transformative shift, and supportive of stronger, more assertive policy framework that lets companies move forward with confidence. However, the diversity of approaches means that a diversity of challenges has been encountered, and there is also a real risk of unintended consequences or suboptimal outcomes.

Keeping an eye on the outcome

Resource efficiency and circular model principles are powerful as a way of prompting innovation and can deliver transformative impacts on waste, carbon emissions and business. However, not all actions are equally effective and there are examples of **unintended consequences**. Initiatives in this area will not necessarily decarbonise a product or process unless specifically designed to do so. They may increase the cost of products and services in the shift from longer-lived, better quality, more repairable products, and they are likely to change the nature of jobs required by the economy. **The public and economic goals** of planned activities in this space need to be clear and kept in view, and the wider **social and environmental impacts** should be explored.

Part of the challenge of doing so is the well-known question of insufficient **data**. There are many misconceptions that can lead to ultimate outcomes being different to intended ones. More understanding of the economic, social and environmental impacts of recycling and resource productivity policies is needed, and in an accessible and comparable format.

Policies on design

To help ensure that modern products and services are created with the circular economy in mind, companies have suggested setting **minimum design requirements** across a range of 'circular' characteristics, such as recycling potential, ease of disassembly, amount of renewable or bio-based material used, minimising the amount of different materials used, or an emissions

Repair and upgrading of products

could be made easier by encouraging common design standards for component shape and size, such as recommended by Open Source Circular Economy[5] – a platform for product designs which can be shared freely.

limit for the life cycle assessment of products. Policies such as the EU legislation on Ecodesign and energy labelling could adopt these requirements, or even make it a requirement to highlight information such as the relative use in production of fossil fuels and fossil-fuel-based raw materials.

Repair and upgrading of products could be made easier by encouraging common design standards for component shape and size, such as recommended by Open Source Circular Economy[4] – a platform for product designs which can be shared freely. Common quality standards for secondary materials, as suggested by the European Commission[5], would also create more confidence in materials found on the market.

Policies for behavioural change

For changing **consumer behaviour**, we know that **targeted, direct taxes or tax breaks** on single-issue products can make a massive difference. A five pence charge on single-use plastic bags not only had an immediate effect in **Ireland** (a 90 per cent reduction within a year of its introduction in 2002), but also caused consumers to pause and think about their unconstrained use of plastic packaging – they were made aware at every point of purchase that there was something 'wrong' with disposable plastic bags. **France** has not only banned plastic bags and packaging on produce; it has also become the first country to ban plastic plates, cups and utensils by 2020. Any policies that are introduced should be simple to implement and provide long-term certainty for companies to make investment decisions.

Removing VAT from labour and new parts would **encourage repair**, rather than disposal[6]. In **Sweden**, VAT has been more than halved for bikes and clothing repairs, and consumers can claim back half the labour cost of the repair of white goods on their income tax bill. Most of the cost of repair is usually the labour, so this is a noticeable incentive.

An example of targeting **corporate behaviour** is **Germany's** 'Waste Water Fee', which is charged to companies for discharging water in rivers – but that fee can be redeemed if they invest an equivalent amount in improving their waste water treatment. **Denmark and the Netherlands** operate similar 'incentive to improve' schemes, with the Danish example being tax based and part of a broader shift to 'green' taxes away from purely income as an indicator of corporate activity[7].

> "Co-ordinated buying power is immense: as an individual, I can't specify the material used in my car – but as EDF Energy, we can ask for specific requirements for the fleet."
>
> *Claude Laveu, Chef de Mission,* ***EDF***

France has not only banned plastic bags and packaging on produce; it has also become the first country to

ban plastic plates, cups and utensils by 2020.

In Sweden,
VAT has been more than halved
for bikes and clothing repairs, and consumers can claim back half the labour cost of the repair of white goods on their income tax bill.

The role of subnational authorities

Another lever for stimulating market pull is **public procurement**, which can prompt significant changes in market demand for a certain type of product, service or business model. For example, the prioritisation of materials and services with a low carbon footprint, helping society at large to reduce CO_2 emissions.

Companies have noticed that officials at the city and regional level of procurement can often be unaware of many of the issues discussed in this report, but are keen to develop better **information, templates and shared best practice** to enable them to know how to buy the 'right' product. The EU 'EUROCITIES' group is looking at improving this, and there is business support for looking at minimum ratings criteria in these areas, to apply across all Member States. The EU infrastructure fund specifies that public projects must have a waste management strategy – but the criteria are not specifically aligned with emissions reductions or circular economy approaches.

Policies on waste and recycling

The current end-of-life policies for materials are not yet driving the shift to more innovative business models that is required. The relative costs and challenges mean that for some key secondary materials there is not a healthy market (either due to supply of the materials or because they are more difficult and expensive to recycle than to send to landfill or incinerate), and the regulation on waste can act as a dampener to circular approaches. Regulatory definitions and requirements for dealing with 'waste' are different in every country: companies would welcome more progress on the harmonisation of waste and policies to allow reuse cases that cross borders and improve the security of supply of secondary raw materials.

The EC's legislative proposals[8] on EPR could have an impact far beyond waste, if implemented in the right way, and could be a key policy for driving forward product innovation.

Germany's 'Waste Water Fee', which is charged to companies for discharging water in rivers, can be redeemed if they invest an equivalent amount in
improving their waste water treatment.

Conclusions

There is a large and growing cohort of major businesses that are extremely energised about the circular economy and finding transformative ways to improve resource productivity and reduce waste. To date, these efforts have only just begun to implement what is possible, and relatively few companies have been able to incorporate the most ambitious implications of how these approaches can radically reduce material and energy use. But more will do so as the huge economic opportunities (cutting costs, opening up new markets, creating new jobs, delivering a resulting prosperity and improving economic productivity) as well as the significant carbon reductions become clearer. Businesses that are not already examining the potential for progress in this area would be well advised to look at it.

Such action is incredibly varied – covering a huge range of sectors, business activities and policy drivers. While there is wide agreement that potential circular approaches for resource productivity are far more than just about waste, the tendency is to default to a waste-led framing that is too limited, underselling the opportunity and also the complexity of the business and policy challenge.

There is, however, an enormous amount of experience building up in companies about what is possible and what hinders progress on resource productivity, and policymakers could learn much from talking to business about this and disseminating their best practice. The understanding of resource productivity is becoming more sophisticated as companies stand back to look at the full picture of impacts rather than focusing narrowly on specific resource or waste issues.

Many of the suggestions offered by companies involve moving the tax burden further up the value chain to fall on the use of natural resources (which are diminishing) rather than on, for example, labour (where there is unemployment). Moving the tax burden further forward in the value chain would encourage innovation further forward in the value chain, and so stimulate solutions to minimise waste, rather than cope with it at the landfill stage. Extended producer responsibility (EPR) may also help to prompt greater business innovation – indeed, it is in line with the thinking of companies that are already seeking greater ownership of their waste.

Finally, there is persistent concern about those secondary materials where a market is not developing such as plastics. The difficulties in ensuring both quality and secure sources of secondary materials that are available at a competitive rate in order to drive recycling will require significant policy engagement. Similarly, most bio-based products are not yet competitive with fossil-fuel-based materials, and if national and global goals for emissions reductions are to be met, appropriate policy measures are needed.

Companies' experiences of challenges and barriers raise some interesting problems that will be of interest to policymakers looking to encourage progress that is more ambitious in resource efficiency. Governments looking to seize the opportunities will need to engage at a broad strategic level, making it part of their economic and industrial planning and locating expertise in finance and business ministries as much as in environment ministries. They will need to do so because this is not simply an issue around waste; it is in fact a complex re-envisioning of the way the economy works that has a lot to offer, but needs clear and thoughtful engagement as to how it happens to secure the best outcomes and head off unwanted impacts.

Governments that fail to think things through will still see rapid change, but may be blindsided by unintended consequences and stubborn challenges. Those that develop a joined-up forward-thinking industrial strategy will be able to use it to drive innovation that provides transformative improvements in resource productivity and consequent economic, social and environmental benefits.

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