The Role of Business in the Circular Economy

Markets, Processes and Enabling Policies

Report of a CEPS Task Force

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The Centre for European Policy Studies (CEPS) is an independent policy research institute based in Brussels. Its mission is to produce sound analytical research leading to constructive solutions to the challenges facing Europe today.

This report is based on discussions in the CEPS Task Force on 'The Role of Business in the Circular Economy'. The Task Force, co-chaired by Martin R. Stuchtey and Stef Kranendijk, was composed of business representatives, entrepreneurs, non-governmental organisations and research organisations. The group met on four occasions during the period November 2016 to May 2017. The views presented here do not necessarily coincide with the opinions of all the participants of the Task Force, nor were they explicitly presented by any of the participants (unless expressly mentioned in this report). A list of Task Force members as well as invited guests and speakers appears in Appendix II.

The views expressed in this report are those of the authors writing in a personal capacity and do not necessarily reflect those of CEPS or any other institution with which they are associated.

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FOREWORD

Europe's 2015 decision to adopt a Circular Economy Package marks a milestone towards a modern conception of economic growth fit for the 21st century. It has started to change the debate and link the social, economic and environmental agenda at points where irreconcilable choices have dominated in the past. However, the question of whether circular thinking will transform the European industrial landscape, shift consumer behaviour and trigger the aspired wave of technological and business model innovation remains to be answered. The circular economy will only fulfil the high hopes if businesses start to embrace it strategically and operationally, if governments start establishing a consistent set of rules and if both start to create a perfect flywheel.

The Task Force wanted to be a critical force to put this flywheel into motion. It took great effort to bring leading companies, authoritative thinkers and lawmakers into one room (four meetings). All of them took the opportunity to create a language and an agenda for business-driven change very seriously. Immediately it became clear how much ground could be covered and so the focus moved to some overarching themes:

1) **New markets.** First and foremost, the circular revolution can and should be seen as an opportunity to create new markets on which European companies can thrive and compete – for secondary resources, for components and products, for shared resources or for ecosystem services. Both government and businesses will have their part to play to bring these new markets to life.
2) **New technology.** Circular thinking provides acceleration and a compass for technology development, particularly in the fields of the internet of things, new materials, biotechnology and digital platforms. Most discussions reflected the conviction that digitisation and the circular economy need to go hand in hand.
3) **New alliances.** The work highlighted the need to collaborate, within businesses, across the supply chain and between the private and the public sector. This could play to Europe's strengths, because long-term strategic cooperation is at the heart of the European industrial model.
4) **New approach by governments/the EU.** The discussions to help accelerate the implementation of the circular economy highlighted several challenges that require solutions. For example, the EU's current policy framework on waste often hinders the transfer of used products or components between geographies. Active solutions in terms of new legislation or adaptation of directives from governments/the EU that will facilitate the circular economy are therefore more than welcome.

The enthusiasm of the Task Force participants was not fed by the circular economy's environmental promise alone. There was agreement that this could be a source of renewal and new competitiveness at a moment when low-cost, high-volume plays have proven to be untenable for Europe's industry. We truly hope that the Task Force report will trigger meaningful action by both sides – policy-makers and businesses – and foster the collaboration needed in times of deep, pervasive change.

Martin Stuchtey & Stef Kranendijk
Co-chairmen of the CEPS Task Force

EXECUTIVE SUMMARY

Originating in academia, in recent years the circular economy concept has found its way into mainstream policy and regulation, as well as the media. The concept, which in its various interpretations seeks to achieve a sustainable and efficient use of resources in the economy, is taken up by governments around the globe as a new model of sustainable economic growth. This is matched by significant business interest in the concept, which is evidenced by numerous business commitments, initiatives and partnerships adopted worldwide.

While there is momentum around the concept, a transition to a new economic system faces many challenges and will not happen overnight. It will require different regulation and new business models to ultimately foster new consumption and production patterns, and a new industrial landscape.

In the EU, the European Commission's Circular Economy Package of December 2015 is a first step in this direction. Achieving a large-scale industrial transformation, as envisaged by the EU, will require continuous support and a mix of well-designed policy interventions to remove barriers to circularity, make circularity profitable and thereby provide the ground for new business models and business innovation. It will most likely also need financial and other support.

Against this background, CEPS brought together a Task Force comprised of representatives of major multinational companies in Europe as well as senior executives from business associations, non-governmental organisations and research institutes (see Appendix II for a list of the members).

The report starts from the priorities set in the EU Circular Economy Package but goes beyond and identifies key areas that can trigger the necessary changes in the coming years. It analyses a number of policy areas according to their actual and potential impact on circularity and identifies ways forward.

The policy recommendations of this Task Force are presented below, grouped by different thematic areas. For a more detailed analysis, see chapter 6 on "The Way Forward".

Strategy

EU-level recommendations

- The European Commission should provide a well-defined vision for the circular economy concept and its various related policy domains and sectors. This would be the basis for setting clear objectives underpinned by a coherent mix of policies.
- In future strategic publications the European Commission should ensure that policies related to the circular economy and other major policy domains, such as the bioeconomy and the Digital Single Market, are consistent.

National-level recommendation

- Governments should adopt a more systemic approach to resources management that goes beyond traditional waste policies and narrow end-of-life perspectives (one example would be the materials management policy in Flanders). Synergies with various policies that may fall under the auspices of different ministries should also be harnessed.

Ecodesign and the link with extended producer responsibility

EU-level recommendations

- Continue and accelerate the process of setting circular economy design requirements for different product groups. Any such design requirements introduced in EU law should be verifiable, flexible and linked with the life-cycle impacts of products.
- Set horizontal and/or per-product group information requirements (e.g. on reparability, durability and certain substances) that can prepare the ground for setting specific, circular economy design requirements.
- The European Commission should coordinate with member states to identify the non-energy-related product groups that should be prioritised for future circular economy design requirements.
- Introduce harmonised criteria for applying differentiated environmental fees under extended producer responsibility to encourage the ecodesign of products. Harmonisation would help avoid large discrepancies in national approaches.

Digitalisation and emerging technologies

EU- & national-level recommendation

- Support the development of a functioning digital ecosystem that effectively generates data for circular economy business models through i) incentivising the creation of cross-industry collaboration platforms, ii) developing business support schemes and programmes, and iii) introducing regulatory frameworks that address the issues of data privacy and ownership.

EU-level recommendation

- Provide clarity on emerging issues arising from new disruptive technologies (e.g. liability and intellectual property issues related to 3D printing technology). Any adaptation of existing legislation or the introduction of new rules should not hamper innovation.

Regulatory challenges

EU-level recommendations

- Review the Waste Shipment Regulation and assess ways to facilitate the movement of waste for recovery of resources within the EU. An option would be to develop a fast procedure for shipping waste to pre-authorised facilities that comply with certain standards.
- Assess ways to facilitate the trade and sale of remanufactured/refurbished goods in a global market. A condition is that these products have similar performance and meet the same safety and environmental standards compared with products on the EU market.
- Introduce measures to improve transparency across the different life cycles of products while avoiding the creation of a large administrative burden for businesses. The possible development of an information system to enable information flows along supply chains would need to be done in close collaboration with all the related stakeholders.
- Utilise trade agreements to facilitate the movement of remanufactured/refurbished goods that can be safely reused.

National-level recommendation

- Review the effectiveness of national waste management planning and adopt a suite of policies (e.g. increased landfill taxes, investment in waste collection systems, development of recycling and reuse networks) to move up multiple levels in the waste hierarchy.

Finance

EU-level recommendation

- Set the circular economy as a horizontal objective for EU financing, in a way similar to low carbon goals. This means not having dedicated or earmarked funds but rather steering the circular paradigm in all financing programmes by, for instance, i) establishing a dedicated thematic objective within European Structural and Investment Funds, and ii) including resource efficiency as a key metric to award EU financing, e.g. in the European Fund for Strategic Investments Scoreboard.

EU- & national-level recommendation

- Collaborate with national and regional promotional banks to swiftly establish the Circular Bioeconomy Investment Platform as a large coalition for the development of specific financing tools for circular-bio business models. Such a platform, on top of making available resources by the European Investment Bank and the European Fund for Strategic Investments, should act as a single point of entry for all circular-bio-related projects and guide the joint use of different EU financial resources.

EU-, national-level & private sector recommendation

- The European Investment Bank and national promotional banks, perhaps in the framework of the same investment platform, could take the lead in establishing a database that facilitates the exchange of information about systemic cross-industry risk and residual values, and supports a better risk assessment of circular business models from the private sector too.

Corporate sustainability reporting

National-level recommendation

- Member states need to ensure comparability of company data across the EU by following the Commission's non-binding guidelines on non-financial information as closely as possible.

EU-level recommendation

- After a trial period and if a sufficient level of comparability of company data across member states cannot be reached, a revision of the non-binding guidelines should be envisaged in view of developing clear methodologies for common indicators to be used. Eventually a mandatory element of the guidelines may be introduced. A condition is that such a mandatory element would not pose a disproportionate administrative burden on small and medium-sized enterprises.

Public procurement

National-level recommendation

- Governments should introduce ambitious green requirements in public procurement (some examples are the rules introduced in Italy and France) and also use more extensively the green public procurement criteria provided by the Commission. The introduction of green requirements should take the characteristics of small and medium-sized enterprises into account.

EU- & national-level recommendation

- Promote circular procurement through i) targeted training programmes and initiatives, and ii) the introduction of measures that support transparency regarding the origins and composition of products throughout value chains.

EU-level recommendations

- Encourage all member states to revise their National Action Plans for greening their public procurement and to integrate circular economy aspects into the revised plans. An EU guidance document can assist member states in this process and support a consistent and structured integration of the circular economy into the National Action Plans.
- Provide more guidance on the use of life-cycle costing in the procurement process. The development of tools and methodologies for different product and service groups can support a wider and more consistent application of life-cycle costing across the EU.

New approaches to taxation

EU-level recommendation

- The EU should take further action and guide member states in a process of reassessing their taxation policies and considering tax shifts from labour to resources. The organisation of high-profile meetings and preparation of strategic policy documents dedicated to this topic are some examples of actions.

National-level recommendations

- The merits and demerits of different options for shifting taxation from labour to resources should be carefully assessed. The assessment should also consider the possible economic or distributional impacts.
- Member states should explore possibilities for introducing tax incentives for circular products and services that would coexist with tax penalties. While there is no one-size-fits-all approach, tax reductions for companies and/or VAT reductions under carefully assessed conditions would be two such examples.

1. INTRODUCTION

Over the past few years the circular economy has managed to achieve a broad appeal among a diverse global audience, including business leaders, policy-makers and academics. The concept challenges the linear economic model that has remained dominant since the onset of the Industrial Revolution and seeks to achieve a major transformation of our current production and consumption patterns. The potential economic benefits arising from using less energy and material inputs, combined with the commercial opportunities created by new technologies and emerging business models have fuelled business interest in the circular economy worldwide (World Economic Forum et al., 2014). In this context, there have been a range of business initiatives and partnerships creating a momentum around the circular economy.[1] The concept is also very appealing for policy-makers since it can be viewed as a solution for reconciling what at first sight seem to be the conflicting objectives of economic growth and environmental sustainability (Lieder & Rashid, 2016; Preston, 2012). Several governments in Europe and beyond have adopted strategies and government-wide programmes for a circular economy.[2]

In Europe waste policy has a long history of more than 30 years involving a series of Environment Action Programmes, strategies and legislation that have been introduced with the aim of reducing the negative environmental and health impacts linked to waste generation (European Commission, 2010). These policies have had a number of notable successes; one prominent example is the landfilling rate of municipal waste in the EU-28, which decreased from around 64% in 1995 to 24% in 2016.[3] Still, about 51% of municipal waste is either landfilled or burnt in incinerators (Eurostat, 2018a).

In recent years, concerns over rising global pressure on resources and insecurity of supply have elicited calls for a renewed approach towards waste policies in Europe. In response to these calls, the European Commission published in December 2015 the Circular Economy Package with the goal of expanding the focus of EU waste policy upstream and addressing the full product cycle from production and consumption to waste management and the market for secondary raw materials (European Commission, 2015a). The Commission's commitment to support the transition towards a circular economy has been restated in several strategic publications, including the EU Industrial Policy Strategy published in September 2017.[4]

Although the Circular Economy Package marks an important step towards a more holistic EU policy approach to resources management, there are several challenges that need to be resolved in the coming years. Moving towards an alternative economic system, as envisaged in the EU Action Plan for the Circular Economy, requires a transformation of production and consumption patterns, value chains and sectors. This in turn requires business models and innovations, which will be disruptive. Businesses have a key role to play in driving this process and some of them have already started implementing alternative solutions; however, there are various market, structural

[1] Examples include the 'Factor10' initiative by the World Business Council for Sustainable Development (WBCSD) (for more details, see https://tinyurl.com/yczs3f65) and the Ellen MacArthur Foundation Circular Economy 100 (CE100) programme (see https://tinyurl.com/zph2aj8).

[2] See Dutch Ministry of Infrastructure and the Environment and Ministry of Economic Affairs (2016), China Investment Promotion Agency (2008), Gobierno de España (2018) and Scottish Government (2016) for examples of circular economy strategies being actively pursued by governments around the globe.

[3] It should be mentioned that these figures hide the large variations in the landfilling rates across different member states.

[4] See European Commission (2017a).

and regulatory barriers thwarting the adoption of circular practices (Rizos et al., 2016; Vanner et al., 2014). An ambitious policy mix is therefore needed that removes barriers and supports businesses in unlocking the benefits of the circular economy.

In view of this challenge, CEPS formed a Task Force composed of representatives of some of the major multinational companies in Europe as well as senior executives from business associations, non-governmental organisations (NGOs) and research institutes, with the objective to prepare policy recommendations on the circular economy transition. This CEPS Task Force report is based on the discussions in the Task Force meetings and research conducted by the CEPS research team. The report seeks to contribute to the circular economy debate in the coming years and provides recommendations relevant to various policy domains that often go beyond the areas covered in the EU Circular Economy Package.

The report is structured in six chapters. Chapter 2 provides an overview of the circular economy concept and its processes, while chapter 3 is devoted to the drivers of the circular economy transition and the key enabling technologies. Chapter 4 focuses on the circular economy markets and the challenges in implementing different types of business models. This is followed by an analysis of some key options for policy action to be taken at the EU and national levels (chapter 5). The policy recommendations of the Task Force are provided in chapter 6.

2. THE CIRCULAR ECONOMY CONCEPT AND ITS VARIOUS PROCESSES

This chapter provides an overview of the circular economy concept, its various processes and business relevance.

Key messages

- The circular economy concept is used extensively today by governments, businesses and academics, although it is not framed or used consistently worldwide.
- The concept can be broken down into the following main processes: recycling; efficient use of resources; utilisation of renewable energy sources; remanufacturing, refurbishment and reuse of products and components; product life extension; product as a service; sharing models and a shift in consumption patterns.
- In addition to the more traditional applications of the circular economy (e.g. mechanical recycling), new processes are unfolding on many fronts, such as chemical recycling, closing loops for nutrients, water reuse and use of wood-based side streams in by-product applications.
- The different circular processes hold promise for providing significant environmental benefits when compared with traditional linear processes. However, to avoid drawing simplistic conclusions one has to apply life-cycle thinking when considering the merits and demerits of different circular solutions.

Despite its relatively recent emergence in the policy debate, the circular economy concept is hardly new and its conceptual origins can be traced back to the work of several authors who in previous decades discussed the biophysical limits of the present economic structure built on overconsumption and a growing ecological deficit. Such authors emphasised the need to move from an 'open' economic system that assumes resources are infinite towards a 'closed' one which takes into account the earth's limited resource stock (see Boulding, 1966; Pearce & Turner, 1990). Over the years several academic disciplines and research fields[5] have influenced the development of the concept and provided elements that can be found in the various interpretations of the circular economy.

The circular economy concept is used extensively today by various governments, businesses and academics, although it is not framed or used consistently worldwide. In short, there are two different groups of definitions/interpretations in the literature (Rizos et al., 2017). The first includes definitions that focus on physical and material aspects and stress the need to create closed loops of materials flows, use waste as a resource and reduce pollution throughout the life cycle of products (see, for example, Sauvé et al., 2016; Preston, 2012; EEA, 2014). The second cluster features interpretations that attempt to expand the scope of the concept and move beyond the notion of management of material resources. For instance, there are interpretations of the circular economy that highlight the importance of sustainable energy supply (see Heck, 2006) or cover additional aspects like energy efficiency and conservation, land management, soil protection and water (see

[5] Examples of such fields include industrial ecology, cradle-to-cradle design and product–service systems. For more details about the origins of the circular economy and the related concepts, see Rizos et al. (2017).

Su et al., 2013). Other interpretations in this second cluster give emphasis to the economic and competitiveness dimensions of the circular economy (see Ellen MacArthur Foundation, 2013 and Bastein et al., 2013) or to its potential in improving social well-being through the creation of jobs (see ADEME, 2014).

At the EU level, the European Commission (2015a, p. 2) has included a description of the concept in its Communication entitled "Closing the loop – An EU Action Plan for the Circular Economy", which is part of the Circular Economy Package. In this document there is emphasis on resource use, since the circular economy is described as one "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised". The economic dimension of the circular economy is also prominent in this Communication, which stresses that the transition to a more circular economy is "the opportunity to transform our economy and generate new and sustainable competitive advantages for Europe".

In an attempt to capture the multidimensional nature of the circular economy and the various available interpretations, Rizos et al. (2017) developed a framework of circular processes based on a review of the available literature (reports, policy publications, scientific articles, etc.) and interviews with experts in the field. The framework consists of eight main processes of the circular economy: recycling; efficient use of resources; utilisation of renewable energy sources; remanufacturing, refurbishment and reuse of products and components; product life extension; product as a service; sharing models and a shift in consumption patterns. These processes[6] can be further classified into three categories, namely using less primary resources; maintaining the highest value of materials and products and changing utilisation patterns (see Box 1).

Box 1. Main circular economy processes

Use less primary resources

- Recycling
- Efficient use of resources
- Utilisation of renewable energy sources

Maintain the highest value of materials and products

- Remanufacturing, refurbishment and reuse of products and components
- Product life extension

Change utilisation patterns

- Product as a service
- Sharing models
- Shift in consumption patterns

Source: Rizos et al. (2017).

Table 1 provides examples of the different sectors to which the processes can be applied. While not meant to be exhaustive, the mapping serves as an illustration of the breadth of sectors and businesses for which the circular economy concept is relevant.

[6] It should be emphasised that the list of circular processes is not presented in sequential order of importance. Additionally, the processes are not mutually exclusive; many of their elements are often interlinked, while in some cases businesses can adopt a strategy that involves multiple circular processes.

Table 1. Mapping the application of circular economy processes in various sectors

Circular process		Examples of sectors where circular processes can be applied
Use less primary resources	Recycling	Fast-moving consumer goods industry, metals sector, textile industry, building sector, packaging sector, critical raw materials, forestry sector, chemical industry
	Efficient use of resources	Building sector, plastics industry, mining and metals industry, food sector
	Utilisation of renewable energy sources	Chemical industry, food industry, forestry sector
Maintain the highest value of materials and products	Remanufacturing, refurbishment, and reuse of products and components	Automobile industry, manufacture of computer, electronic and optical products, building sector, medical imaging device industry, furniture sector, transport
	Product life extension	Manufacture of computer, electronic and optical products, automobile industry, household appliances, building sector, food industry, textile industry, defence industry
Change utilisation patterns	Product as a service	Household appliances, transport, building sector, printing industry
	Sharing models	Automobile industry, transport, accommodation, clothing
	Shift in consumption patterns	Food sector, publishing sector, E-commerce sector

Source: Own elaboration based on Rizos et al. (2017).

Use less primary resources

Recycling has been defined by United Nations et al. (2003, p. 79) as "the re-introduction of residual materials into production processes so that they may be re-formulated into new products". For many decades it has been the most traditional way of implementing circular economy principles by capturing the value of existing products and materials and decreasing the use of primary materials. That notwithstanding, recycling should not be understood merely as the process of reprocessing waste materials by physical means back into products and materials (i.e. mechanical/physical recycling). As technology progresses, new forms of recycling arise; an interesting example in this context is chemical recycling of plastic waste, which involves the recovery of the petrochemical constituents of the polymer in order to be used for plastics remanufacturing or the production of other synthetic chemicals[7] (Hopewell et al., 2009). Another example is water reuse,[8] which refers to the use of properly treated wastewater for other purposes (Lazarova et al., 2012).

[7] However, the further growth of chemical recycling would require the development of economically viable innovative technologies as well as addressing the presence of substances of concern in plastics (Ellen MacArthur Foundation, 2016a; European Commission, 2017b).

[8] The terms water reuse and water recycling are often used synonymously (Lazarova et al., 2012).

There are also other forms of recycling that fall within the scope of the bioeconomy, which encompasses the use of biological resources.[9] For example, extracting phosphorus and nitrogen from wastewater and transforming them into fertilisers is a form of recycling that closes the loop for nutrients, which starts with food production, and returning them back to the soil. Nutrients can also return to the soil through the composting of organic materials, such as garden and food waste (Jurgilevich et al., 2016; Ellen MacArthur Foundation, 2017). Another example in the bioeconomy field is the recovery of process side streams of the forest industry in order to be used in the production of other products for the same or other value chains. For instance, sawdust can be used in the manufacture of fibreboard, while lignin could be used in by-product applications in the chemical industry (SITRA & McKinsey, 2015).

Efficient use of resources refers to achieving material and energy resources efficiency in industrial processes (UNEP & Sida, 2006) and can involve both the careful use of resources and the replacement of resources that are hazardous or have a short life span (Nilsson et al., 2007). In this context, the application of ecodesign principles in the design of products can promote dematerialisation and material selection (Almeida et al., 2010). Efficient use of resources is also linked to the prevention of waste along the life-cycle stages of production and consumption, which can in turn help avoid the loss of resources and the environmental impacts associated with waste management (Jurgilevich et al., 2016). The issue of improving the sustainability of primary resources sourcing can also fall within this category of circular processes.

Utilisation of renewable energy sources has a key role to play in the circular economy transition. Various renewable energy technologies exist to replace fossil fuels in the electricity, building and transport sectors among others (European Commission, 2016a). Waste can be another source of energy: for example, biodegradable waste from landfills can be converted to biogas via anaerobic digestion. There are several waste-to-energy techniques available, such as co-incineration of waste in combustion plants, pyrolysis and gasification; however, the scale of environmental benefits achieved through such techniques depend on key parameters, such as the type of energy they replace, the type of waste used as a feedstock, its calorific content and the amount of energy captured (JRC, 2011). Notably, recycling or reuse of the material is generally a more preferred option from an environmental point of view than waste-to-energy processes unless in some cases the material contains certain substances of very high concern (European Commission, 2017c).

Maintain the highest value of materials and products

Remanufacturing, refurbishment and reuse of products and components are all ways in which products are recovered after their use in order to be given another life. In refurbishment and remanufacturing, the products' 'core' parts are restored so as to maintain the added value of the materials. While the terms 'refurbishment' and 'remanufacturing' are both used, the latter usually entails the idea of a more in-depth process aiming to restore the product into an 'as-new' condition[10] (Van Weelden et al., 2016). Such practices are closely linked to ecodesign: when remanufacturing or refurbishment options are already considered during the design phase of the product, this facilitates, for instance, its disassembly and the remanufacturing of parts (Prendeville & Bocken, 2015). Reuse of a product is direct reusage and/or resale of either the whole product or a part of it (JRC, 2011). Reuse should not be confused with recycling, as the former does not require the reprocessing of materials into new products, materials or substances.

[9] Specifically, according to the European Commission (2012, p. 3), the bioeconomy "encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy".

[10] However, this distinction is not always applicable since there are examples of products, such as medical devices, for which the refurbishment seeks to restore the product into an 'as-new' condition.

Product life extension is a similar process that also requires an increased emphasis on the design phase of the product life cycle (Bocken et al., 2016). Specifically, it refers to products and components that are designed with the objective of having a long-term durability and long life spans.[11] In the case inter alia of electronic products, product life extension practices deal not only with extending the lifetime of the hardware but also with the durability of the software. This is related to expanding the product lifetime and addressing the issue of premature obsolescence,[12] which has been observed in some cases[13] (Valant, 2016).

Change utilisation patterns

Product as a service refers to the concept of offering the product as a service, which challenges the traditional business approach of selling tangible products. It can be implemented via practices of leasing, renting, pay-per-use or performance-based business models (Tukker, 2004). It has been suggested that product-as-a-service models can bring forward several environmental benefits, since companies that own the products are motivated to repair and maintain them for a longer period (Accenture, 2014). Benefits may also occur from the use of these models by customers; as an example, HP (2017) estimates that customers choosing a product-as-a-service model can reduce their printing-related energy use by up to 40%. Still, research has indicated that the net environmental benefits of product-as-a-service models depend crucially on several factors that need to be carefully assessed; for instance, one factor concerns the use of leased products by customers and whether the model motivates them to treat these products with less care than the products they own or return them earlier to the service provider (Tukker, 2015).

Sharing models also reflect a transition from ownership towards accessibility and have been implemented in several markets, such as car-sharing and accommodation. Such models "are facilitated by collaborative platforms that create an open marketplace for the temporary usage of goods or services often provided by private individuals" (European Commission, 2016b, p. 3). As in the case of product-as-a-service models, although these models have the potential to radically transform our consumption patterns and reduce underutilisation of products, their overall sustainability depends on several parameters[14] (Demailly & Novel, 2014). Notably, in addition to the sharing of products and services among individuals, sharing models can also take the form of sharing technologies and infrastructure among industry partners (Balanay & Halog, 2016).

A *shift in consumption patterns* can be driven by technological advancements and improved information for consumers. For example, many consumers choose products or services that deliver utility virtually instead of materially.[15] At the same time, businesses can provide their products virtually using virtual channels[16] and also increasingly communicate with customers virtually through web advertisements and social media (Lewandowski, 2016; Ellen MacArthur Foundation, 2015). Food consumption is another area where improved information for consumers can lead to

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[11] One example is the design and use of LED (light-emitting diode) light bulbs, which can be more durable and energy-efficient than conventional light bulbs (ARUP, 2016).

[12] According to the European Commission's (2017d, p. 32) Horizon 2020 Work Programme for 2018–20, premature obsolescence refers to products "designed in a way that adversely affects their lifetime or prevents upgradability". Some other terms that have been used to emphasise the intentional production of goods and services with short economic lives are 'planned obsolescence' and 'programmed obsolescence' (Aladeojebi, 2013). It is worth noting that in France, Law No. 2015–992 aims to combat the issue of planned obsolescence (*Journal officiel de la République française*, 2015).

[13] For instance, according to a study by Prakash et al. (2016), the share of replacements due to a defect of large household appliances among the total replacements increased in Germany from 3.5% in 2004 to 8.3% in 2012.

[14] According to Demailly & Novel (2014) the quality of shared goods as well as the potential need for increased transport of goods entailing environmental impacts are two such parameters.

[15] Examples include digital books, smartphones and online stores (Ellen MacArthur Foundation, 2015).

[16] For instance, businesses can sell digital products through online shops (Ellen MacArthur Foundation, 2015).

changes in demand patterns (Jurgilevich et al., 2016). The above shifts in consumption patterns may in turn lead to resource savings and productivity gains. It should be kept in mind, however, that there are also concerns about the scale of the sustainability benefits that could be enabled by these products and services due to, for instance, rebound effects and the high energy consumption of data centres (Whitehead et al., 2014; Climate Group, 2008).

As discussed, the above circular processes hold promise for providing significant environmental benefits when compared with traditional linear processes. However, to avoid drawing simplistic conclusions one has to apply life-cycle thinking when considering the merits and demerits of different circular solutions and consider how the impacts are allocated across the products' life cycle stages. In this context, for some products the majority of environmental impacts are concentrated on the use phase. For instance, WRAP (2010) conducted a comparative life-cycle assessment to assess different options for domestic washing machines. The study concluded that whether refurbishment is environmentally preferable to replacement depends on the efficiency of the old and new models. In other words, given that the use phase makes the dominant contribution to overall environmental impacts in some cases it would be preferable to recycle an old machine in order to recover the materials and replace it with a new one instead of refurbishing it in order to give it a new lease on life.

Finding the optimum end-of-life solution for products from an environmental standpoint may also be dependent on the quality of the resource in question and the technologies available for recovery. This is particularly the case for packaging made of bio-based plastics from renewable feedstocks.[17] For example, Rossi et al. (2015) assessed different end-of-life options for bio-based packaging materials and concluded that although recycling should be prioritised, in cases where there are high levels of contamination with food in the material, anaerobic digestion would be a more environmentally friendly option. Additionally, depending on their grade and solubility, some types of bio-based materials cannot be recycled with existing technologies and thus other end-of-life options should be applied. There may also be trade-offs between the impacts of different processes. For instance, a study by Hottle et al. (2017) showed that although composting some bio-based plastics[18] provides significant climate change benefits compared with landfilling, there are other environmental effects[19] stemming from the composting process that need to be considered.

[17] Some examples of such feedstocks are corn stover, wheat and forest residues (Chen et al., 2017).

[18] The bio-based and biodegradable plastics assessed in the studies by Rossi et al. (2015) and Hottle et al. (2017) are polylactic acid (PLA) and thermoplastic starch (TPS).

[19] The study estimated that the following categories of impacts were higher in the composting process compared with landfilling: smog, acidification, carcinogenics, non-carcinogenics, respiratory effects, ecotoxicity and fossil fuel depletion (Hottle et al., 2017).

3. DRIVERS OF THE CIRCULAR ECONOMY TRANSITION AND KEY ENABLING TECHNOLOGIES

The aim of this chapter is to present the key drivers of the circular transition, namely environmental sustainability, competitiveness, investment, digitalisation and security of supply of resources. Some examples of leading technological innovations are also presented.

Key messages

- All economic activity depends on the use of natural resources. Companies can support the development of future markets that rely less on the use of resources through adapting their business models and finding more sustainable ways to create value.
- Operating in an increasingly international marketplace where resources and energy costs represent important competitiveness factors, companies can enjoy multiple benefits from reducing material needs and using resources more efficiently.
- The business interest in the circular economy has often been generated by an increasing understanding of the commercial opportunities arising from the circular economy and disruptive business models.
- There appears to be a large consensus that circular economy business models represent a significant investment opportunity. Still, evidence indicates that there is an investment gap in Europe and in various sectors there are investment opportunities that can be seized.
- Digitalisation is an influential driver of change in many companies and even entire sectors. It also creates new consumption and demand patterns.
- The circular economy can help Europe reduce its imports of raw materials and thereby its import bills. For certain materials there is also a supply risk that can be decreased via circular processes.
- New innovative technologies create the conditions for the circular economy to be rolled out at scale. Such technologies can be digital (information technologies), engineering (physical technologies) or a combination of the two (hybrids).

3.1 Drivers of the transition

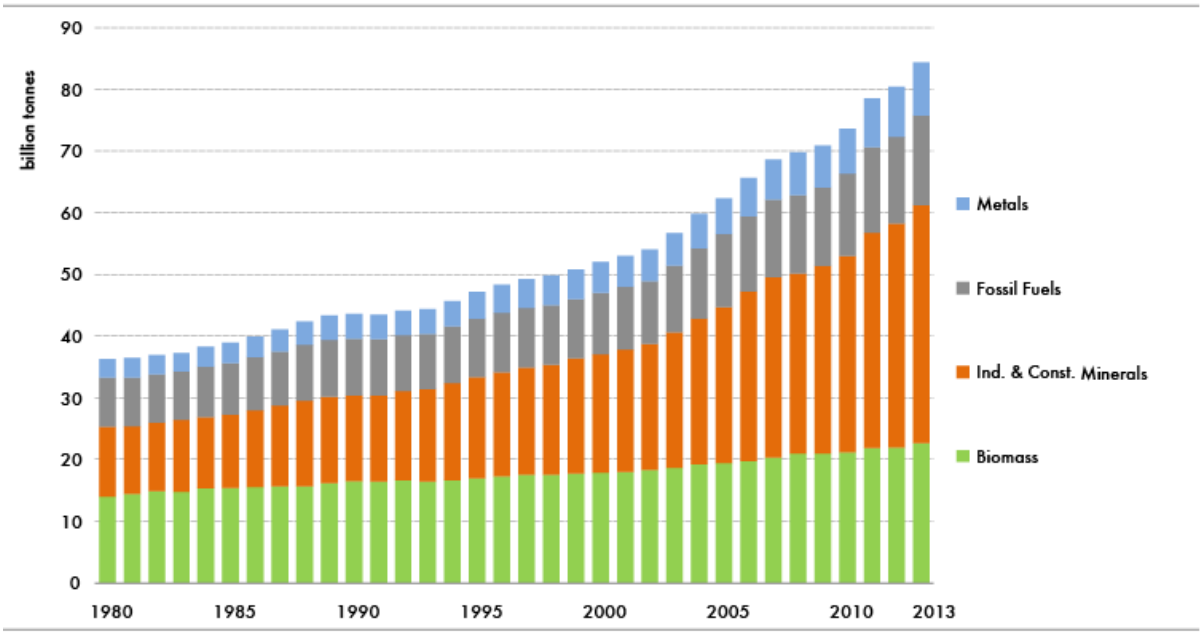
This report identifies five key drivers of the circular economy transition, namely environmental sustainability, competitiveness, investment, digitalisation and security of supply of resources. They are presented in more detail below.

3.1.1 Environmental sustainability

All economic activity depends on the use of natural resources. This interrelationship between the economy and the natural environment (or ecosystem) is at the root of global environmental problems such as climate change, desertification, biodiversity loss, marine pollution and more broadly ecosystem degradation. Behrens (2016), for example, highlights the direct link between the use of natural resources and climate change. The paper finds that greenhouse gas emissions accounted for almost 70% by weight of the material output of the global economy in 2010, thereby making "the atmosphere by far the largest site for the disposal of global waste" (ibid., p. 1).

Yet, global resource use continues to increase. Global material extraction more than doubled from 36 billion tonnes in 1980 to almost 85 billion tonnes in 2013 (see Figure 1). There are several indications that increasing resource use is already threatening the stability of the global ecosystem by pushing it beyond various "planetary boundaries". In particular, human activities are affecting climate change, biodiversity, biogeochemical flows and land-system change to an extent deemed unsustainable (Steffen et al., 2015).

Figure 1. Global material extraction by material category, 1980–2013



Source: WU Vienna et al. (2015).

Environmental sustainability requires the decoupling of economic growth from the use of natural resources. Eventually, absolute decoupling will need to be achieved, meaning economic growth while reducing material use in absolute terms. This is also enshrined in the Sustainable Development Goals (SDGs), which not only call for a decoupling of economic growth from environmental degradation (SDG8) but also for sustainable consumption and production patterns (SDG12). The transition to a circular economy is one of the key strategies for achieving both of these goals. However, this transition is still at the very beginning. Only 6% of globally used materials (excluding biomass) were recycled and reused in 2005 (Haas et al., 2015). Recycling flows in the EU-27 amounted to 13% of processed materials (excluding biomass), more than double the global average (ibid.).

The role of business in the transition to a circular economy is undisputed. On the one hand, sustainable development will be impossible without new and circular business models. On the other hand, environmental stress associated with the resource-intensive 'business as usual' causes increased business risks and costs, eventually jeopardising profits and growth in the future (Putt del Pino et al., 2017). Adopting circular business practices is thus not a matter of benevolence, but rather a hard business case. Business models will need to be adapted in such a way that they can serve "the markets of the future within the limits of the planet's resources" (ibid., p. 2).

A crucial aspect for the environmental success of circular business models is the extent to which secondary production (e.g. recycled materials) can actually replace primary production (from virgin raw materials). Where secondary production is a poor substitute for primary production, e.g. due to inferior quality, recycled products are likely to be produced in addition to primary materials, rather than replacing them. Referred to as a "circular economy rebound" (Zink & Geyer, 2017), this effect can even lead to an increase in resource and energy use. Similarly, there

may be a price effect associated with (sometimes inferior) secondary production, which could allow consumers of these products to purchase more and thus increase output. In order to minimise the circular economy rebound, companies and regulators should focus on maximising the potential of secondary materials to replace primary resources.

3.1.2 Competitiveness

Recent decades have seen a rapid increase in global value chains influenced, among others, by technological advances in transport as well as information and communication systems (Fung, 2013). To this end, companies operate in an increasingly international marketplace where resources and energy costs represent important competitiveness factors.[20] In this context, reducing material needs and using resources more efficiently can help businesses not only achieve material cost savings but also reduce their exposure to risks related to potential supply constraints and price volatility in the future. According to the Ellen MacArthur Foundation (2013), the first decade of the 21st century manifested higher levels of price volatility for metals, food and non-food agricultural output than in any single decade in the 20th century. For some materials, volatility risks may be amplified due to increased forecasted demand: for instance, by 2025, global steel is estimated to experience a 50% rise over current levels (PwC, 2015). In the future, political decisions, cartels, subsidies and trade barriers can also contribute to resource scarcity and increased price volatility (Ellen MacArthur Foundation, 2013). This indicates that despite the recent decrease in commodity prices[21] (IMF, 2016), circular economy practices can help decrease the above-mentioned looming risks for European businesses.

Additionally, business leaders increasingly realise that the circular economy and disruptive business models enabled by technological breakthroughs (see more details in the digitalisation subsection below) can help companies obtain a competitive advantage in a changing market emerging from the digital revolution (TechUK, 2015). It is also anticipated that these types of business models will gain an even greater competitive edge in the upcoming years, thereby stimulating more companies to follow the route and shift their business practices (World Economic Forum et al., 2014).

3.1.3 Investment

In a European context characterised by sluggish investment and low growth, circular business models represent a significant investment opportunity in many European countries. According to ING (2015), the growing market of the circular economy is estimated to generate up to 4% growth over the next decade. Another analysis carried out by SYSTEMIQ et al. (2017) points out that the growth potential attached to innovative circular models is rather high: by 2030 the next wave of investment in the circular economy will induce GDP growth of around 7%. Of course, there are large heterogeneities across sectors and the growth potential of circular business models largely depends on the specificity of the industry. Among the fast-growing niches, electric vehicles and residential space sharing show annual growth of over 100% and office sharing grows at around 80% annually. Substantial growth (around 25%) is also registered for car sharing and online grocery shopping.

There appears to be a large consensus that circular economy business models, which present above-average annual growth, represent not only an environmental opportunity but also an economic one (see, among others, World Economic Forum et al., 2014; EIB, 2015; ING, 2015; FinanCE, 2016). The FinanCE Working Group (2016, pp. 3–4) concludes that "the circular economy offers large potential economic gains that the financial industry should be able to capitalise on".

[20] It is important to note that raw materials account for around 40% of the total manufacturing costs of European manufacturing companies, while with the addition of energy and water costs this figure can reach 50% (Europe INNOVA, 2012).

[21] According to IMF (2016), among the reasons for this decrease is the reduced growth prospects for emerging market economies and especially China.

Still, according to SYSTEMIQ et al. (2017) circular business models remain currently underinvested. Quantifying the financial resources needed to attain an industrial renewal that supports circular supply chains is not an easy task. SYSTEMIQ et al. (2017) estimate that in Europe alone, to seize the opportunities of a circular economy as much as €320 billion should be channelled by 2025 in three circular sectors alone: i) mobility and transport, ii) food industry, and iii) the built environment.

The investment gap does not appear to be a direct consequence of the lack of liquidity and/or lack of investment supply from the side of institutional investors and capital markets. To encourage investment in the real economy, the European Central Bank has maintained interest rates very low, proactively. Furthermore, due to prolonged low returns on capital investment in Europe, most corporations have available liquidity.[22] The paramount reason constraining investment has been lack of confidence. For investment in the circular economy, on top of the lack of confidence regarding the general economic outlook for EU member states and the euro area in particular, confidence has also been inhibited by the potential mispricing of risk for disruptive models and new markets. Yet, taking into account the available evidence about the economic success of circular models and the fact that new markets have been opened and tested, many undertakings characterised by a circular logic would be ready to be scaled up and replicated. In such a context, business-led investment has the potential of becoming a leading driver of the transformation.

Two other factors indicate the key role of the next wave of investment as a main enabler and accelerator of the circular economy transition: i) the financial sector has been adapting to the new needs of the circular economy and its specific risks (see chapter 4, section 4.4), and ii) European and national institutions, the European Investment Bank (EIB) and national promotional banks in particular, have laid out tools to boost confidence in the markets, via publicly-backed guarantees, and have reinforced advisory services to support the offer of investment (see chapter 5, section 5.5).

3.1.4 Digitalisation

The rapid proliferation of new digital technologies, often referred to as the digital revolution, is currently a driver of change in many businesses and even entire sectors (World Economic Forum, 2016). Mutually reinforcing technologies such as mobile technology, the internet of things (IoT) and data analytics (see subsection 3.2.1 for more information about digital technologies) create the conditions under which new business innovations are triggered. Such innovations can take the form of innovative business models that create new markets or transform existing ones. For example, the increased connectivity of people and things through mobile devices has contributed to the proliferation of product-as-a-service and sharing models. As discussed in chapter 2, these models hold promise to reduce underutilisation of products and provide resource efficiency benefits if certain conditions are met. Other technologies can motivate industry leaders to reimagine their business processes. For instance, data captured from electronic devices, networks and internet-connected equipment can provide companies with insights about how they use their resources or how they could improve the design of their products and services (SAP, 2017; Ellen MacArthur Foundation, 2016b).

Digitalisation is also a driver of change in the way people look for and consume products. Specifically, consumers increasingly seek products through online channels and marketplaces and also decrease their reliance on physical products (Ellen MacArthur Foundation, 2015). These new consumption and demand patterns driven by the digital revolution can provide resource savings; however, rebound effects should also be considered when assessing the environmental benefits of the dematerialisation of products and services (Climate Group, 2008).

[22] The largest 75 European companies held 40% more liquidity in 2016 than in 2010 (SYSTEMIQ et al., 2017).

3.1.5 Security of supply of resources

The EU imports almost 23% of its direct material input from third countries. When including all materials required to produce the direct material input, this figure increases to 42%.[23] Import dependency is particularly high for fossil fuels (almost 63%) and metal ores (just below 55%)[24] (Eurostat, 2017a). In terms of non-metallic minerals and biomass, the EU is almost self-sufficient. In 2016, the EU spent €208 billion on imports of energy products alone (Eurostat, 2017b). Imports of metal ores and scrap in 2015 cost over €26 billion (Eurostat, 2017c).

Another important aspect to be considered is that due to the high labour costs and health and safety standards in Europe significant quantities of waste are leaving the EU market in order to be reused or recycled in other countries. Nevertheless, it is often uncertain whether this waste is treated properly outside the EU, while this loss of material may lead to lost opportunities for further enhancing the EU recycling industry and achieving economies of scale (Van Acoleyen et al., 2016; Probst et al., 2016).

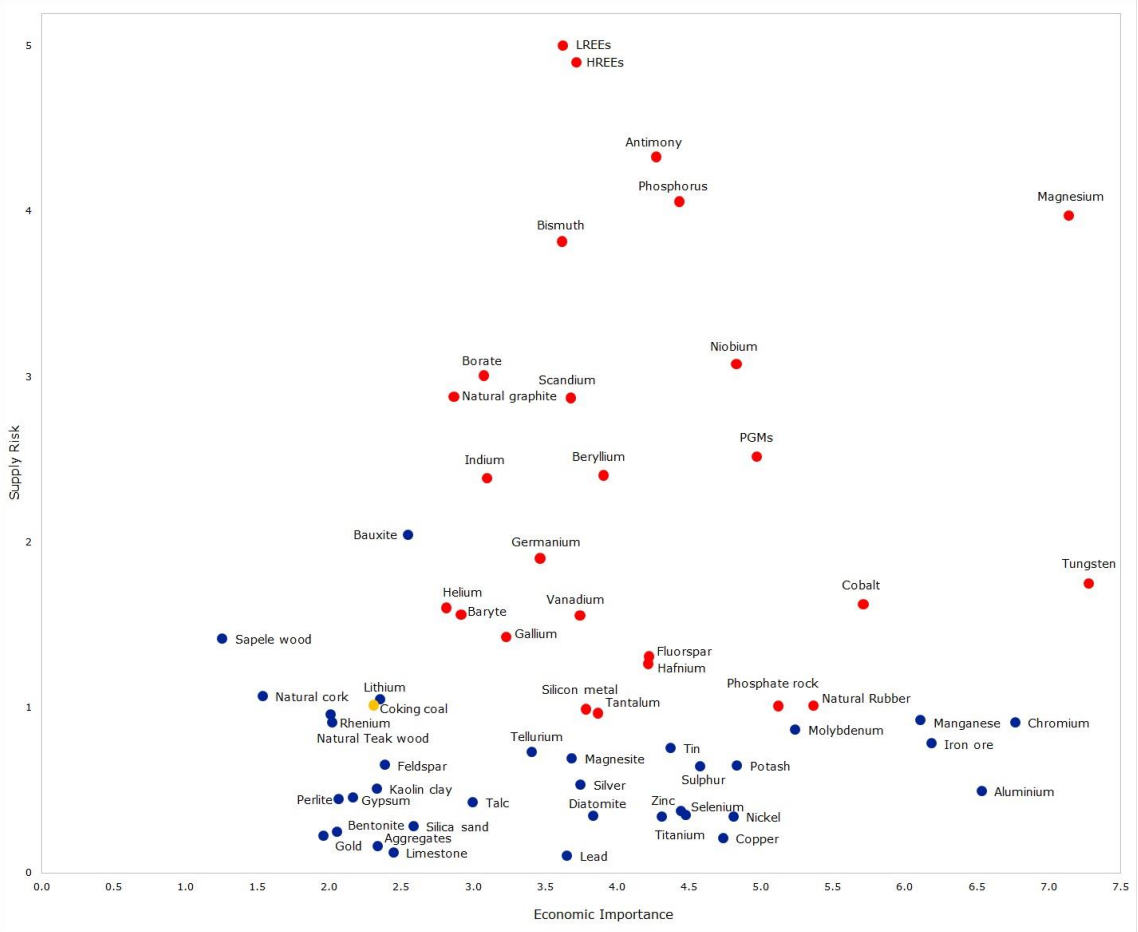
If energy security can be defined as "the uninterrupted availability of energy sources at an affordable price" (IEA, 2018), the same is true for many non-energy raw materials. Like energy sources, many of them are crucial for the functioning of most industrial sectors, for technological progress and for improving the environmental performance of the EU economy. Reliable and unhindered access must thus be ensured at all times. Although the reliance on imported raw materials does not pose a risk per se (and EU self-sufficiency is impossible in most cases), it becomes a problem where global markets do not function properly and where resources are concentrated in few exporting countries.

For energy sources, it has been shown that supply risks need to be assessed on the basis of a sector-specific approach (Checchi et al., 2009). Oil, gas, coal, nuclear and renewables all have their own sector-specific (and only partly interlinked) supply risks. Sector-specific considerations and approaches are also required when it comes to the utilisation model of non-energy resources. In this vein, the European Commission has identified 27 so-called critical raw materials (CRMs), which combine high levels of supply risks (mostly related to poor governance in exporting countries) with a high level of economic importance for the EU economy (see Figure 2) (European Commission, 2017e). Among these CRMs, supplies of rare earth elements (both heavy and light) are considered to be most at risk due to the fact that EU supplies depend almost entirely on imports from China. Overall, China accounts for 62% of the EU's CRM supply. Other important producers of CRMs include Brazil, the US, Russia and South Africa (European Commission, 2017f).

[23] Own calculation based on data for 2015. An import dependency of 42% is reached when measured in raw material equivalents, i.e. including the actual weight of imported goods and also the weight of materials extracted to produce them. See Eurostat (2017d).

[24] Data for import dependency refer to the share of extra-EU imports in the direct material input to the EU-28 economy in the year 2016 (Eurostat, 2018b).

Figure 2. Identification of critical raw materials based on their economic importance and the supply risk



Note: Critical raw materials are indicated by the red and yellow dots.
Source: European Commission (2017f).

The circular economy can play a pivotal role not only in reducing import bills but also in reducing supply risks associated with the import dependence on certain raw materials. Increased recycling – where feasible – can provide an alternative to primary production. However, recycling and recovery rates of various CRMs differ greatly and are still generally low (European Commission, 2017g). Increasing recycling rates will require appropriate incentives for industry to switch from primary to secondary materials as well as functioning markets for secondary raw materials.

3.2 Technological innovation creating the dynamics for transformation

As discussed in chapter 2, the circular economy is not a new concept and brings together elements from various other concepts that have been discussed and in some cases have been implemented by businesses over the past several decades. At the same time, what currently creates the conditions for the circular economy to be rolled out at scale are the new innovative technologies that have been rapidly emerging in recent years. Accenture (2014) has identified[25] three major categories of technologies in the circular economy field that can revolutionise the way businesses produce, distribute and market their products and services: digital (information technology), engineering

[25] The categories were identified through an analysis of more than 120 case studies and interviews with around 50 experts (Accenture, 2014).

(physical technology) and a combination of the two (hybrids). Based on this categorisation some examples of such technologies are presented below.

3.2.1 Digital technologies

Digital technologies are unfolding on many fronts, creating new market conditions for various companies. Examples include mobile technologies, the cloud and big data analytics. Such digital innovations contribute to a constant reshaping of the expectations of customers and the services offered by businesses. For instance, armed with usage data and other functionalities provided by mobile technology, companies are better equipped to offer services to customers that extend beyond the point of sale. One example in this context is the recycling incentive schemes that enable customers to automatically receive a quote on their mobile phone on the trade-in value of their used phone (Accenture, 2014). Given that there is often a lack of effective take-back schemes for mobile devices (Suckling & Lee, 2015), such schemes can incentivise consumers to return their phones at the end of life.

A catalyst of the digital business transformation is the IoT, which enables a networked connection of physical objects through embedding sensors, processors and control systems. Among its several assets, the IoT can provide information about material flows, energy use and underutilised assets. This information can help companies modify their business models in order to reduce waste and use resources more efficiently (Ellen MacArthur Foundation, 2016b). For instance, the performance of LED light bulbs in buildings can be monitored and optimised through IoT applications (ARUP, 2016).

The proliferation of electronic devices and networks, the IoT as well as the digitalisation of production processes has led to a large rate of data creation by economic and social activities. However, unlocking the potential value of these data sets, usually known as 'big data',[26] is not an easy task and requires techniques and processes that would help aggregate, analyse and interpret the data. Such techniques, often referred to as 'data analytics', can help businesses acquire knowledge and information from big data that can be used in, among others, the design of new products and services, product life-cycle management and supply chain planning (Davies, 2016; McKinsey Global Institute, 2011). For instance, in the automobile industry big data analytics can support the design of components and systems that can be more easily remanufactured (Ge & Jackson, 2014) or prompt the timely maintenance of components (Dhall & Vijender, 2017).

3.2.2 Engineering technologies

Rapid advancements in engineering technologies can contribute to a transformation of the way products are manufactured, collected, processed and recycled. For example, advanced recycling technologies hold promise for enabling the recovery and recycling of materials from complex sources and products, which have previously been difficult. Among the industries that can benefit from these technologies are consumer electronics, steel and textiles (Lacy & Rutqvist, 2015).

Modular design is another novel technology that enables the manufacture of products made up from small and often standardised components that can be easily removed. In this context, it can support the disassembly of products, refurbishment of deficient parts and low-cost maintenance. The technology can therefore facilitate the implementation of product-as-a-service and product life-extension models (Lacy & Rutqvist, 2015; Wang et al., 2014). As companies have their capabilities augmented by modular design, they are emboldened to better satisfy the changing consumer demands by recombining modules across product lines and increasing product variants. This can help them achieve cost benefits and improve their competitiveness (Eager et al., 2010).

Novel life and material sciences technologies may also offer ample opportunities in several sectors. The extraction of carbon from CO_2 in order to be converted into other products such as

[26] The main characteristics of big data are volume, velocity, variety and veracity (Pagoropoulos et al., 2017).

chemicals, plastics and cement would be one such example. Although there are various scientific and engineering challenges that need to be overcome in the upcoming years, this process holds the potential to revolutionise a number of industries (Covestro, 2016; Ganesh, 2014). The same holds true for processes that allow the utilisation of biological side streams for the production of valuable bio-products. Various examples of such innovative processes have been emerging and providing opportunities for the agricultural, food and beverages industries (DI, 2016). Another area encompassing promising advancements is the field of biological fibre technologies with several applications in the textile and healthcare industries among others (Tentori & Jaworski, 2014).

3.2.3 Hybrid technologies

Digital and engineering technologies can be combined in hybrid technologies that allow a form of control over assets and material flows. These technologies provide a twofold function: i) they enable companies to digitally acquire information about the history, location, status and application of materials and goods, and ii) they support at the same time the physical collection, treatment and reprocessing of these materials and goods. For instance, trace-and-return systems can optimise resource productivity and provide cost savings through the use of sensors that monitor the performance of equipment. The 3D printing technology that turns downloadable digital designs into physical objects represents another example of a hybrid technology (Accenture, 2014) (see Box 2).

Box 2. 3D printing

3D printing or additive manufacturing [a)] has been defined as the "process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies" (ASTM International, 2012, p. 2). This technology aspires to revolutionise not only the way products are made but also the whole delivery model of products and services.[b)] In contrast to the traditional manufacturing process, which aims to produce identical, standardised products in bulk, 3D printing allows products to be customised according to an individual's needs and preferences. Additionally, only materials that are needed are used in additive manufacturing, which can lead to cost and waste reduction benefits. Further resource savings can be achieved through the reuse of unused material from the various processes or through the geometric optimisation of 3D products. Other potential benefits of this technology include reduced shipping and logistical footprints as well as shorter development times for new products (Beck & Jacobson, 2017; Weireter, 2015; EY, 2016a).

The commercial possibilities for 3D printing span across several industries, such as automotive, aerospace, plastics and medical. These possibilities may be multiplied by emerging technology breakthroughs in 3D printers, software and printing materials, which can also improve the cost-effectiveness of this technology. Evidence shows that the worldwide application of this technology is growing: according to a global survey [c)] by EY (2016a), 24% of the surveyed companies have some form of experience with 3D printing, while 12% of the companies have considered adopting it. This is confirmed by another survey for US industry, which indicates that around two-thirds of manufacturers in the country either already use 3D printing in some way (i.e. for prototyping or producing end products) or experiment with how they could apply this technology (PwC, 2016). As 3D printing becomes more accessible and widely used at the global level, several sectors and supply chains may experience significant disruptions, while many companies might need to reconsider the nature of their business (Deloitte, 2014).

[a)] Other terms used for this technology are additive fabrication, additive processes, additive techniques, additive layer manufacturing, layer manufacturing and freeform fabrication (ASTM International, 2012).

[b)] For example this technology may lead to a significant decrease in inventory needs as well as to a reduced need for delivering products at the premises of clients (Weireter, 2015).

[c)] The survey featured 900 companies from 12 countries.

4. MAKING MARKETS FUNCTION FOR A CIRCULAR ECONOMY

This chapter concentrates on the regulatory, market and finance challenges that need to be addressed in order to develop well-functioning markets for a circular economy.

Key messages

- Business model innovation, in both the business-to-consumer (B2C) and business-to-business (B2B) markets, will be critical to mainstreaming the circular economy. However, there are different types of challenges in each market.
- In the B2C market it is often difficult to implement models such as product as a service and leasing. This is because consumers often prioritise the price of products rather than the entire life-cycle economic benefits provided by these models or because for many consumers, product ownership is still important. Policy measures are thus needed to improve consumer demand for circular products and services in relation to non-circular traditional products.
- In the B2B market some key issues relate to the lack of transparency on the origin or content of products and materials as well as to the lack of cooperation of multiple companies along the supply chain with different interests and priorities.
- The shipment of waste for recovery of materials within the EU is a complex process entailing a high administrative burden and costs. This indicates that some of the existing rules may need to be revised.
- EU legislation on substances of concern aims to protect human health and the environment. A shift towards circularity would require addressing challenges while ensuring safety. The challenges relate to difficulties in remanufacturing products, uncertainty about the substances included in products and a lack of predictability for businesses regarding future restricted substances.
- There are wide differences in waste management performance across the EU; a lack of waste collection and processing infrastructure is an issue in several countries.
- Emerging disruptive technologies require an enabling policy landscape that allows businesses to capitalise on the innovation opportunities arising from these technologies, while providing safeguards for consumers.
- The cost of capital for disruptive circular models might be higher because the financial sector lacks the appropriate tools, data and metrics to model the expected revenues and have a proper account of the risk linked to the disruptive enterprise.
- To enable the transition, circular business models must be able to exploit different types of financial resources: in-house resources, equity capital, debt facilities and crowd-funding.

4.1 Barriers in the business-to-consumer and business-to-business markets

Along with technological innovation (see chapter 3, section 3.2), business model innovation, in both the B2C and B2B markets, will be critical to mainstreaming the circular economy. Many product-as-a-service models (including leasing) tend to be successful in the B2B market. This is thought to be a result of the increased role of the total cost of ownership in business decisions. Nevertheless,

in practice, companies often face difficulties in implementing in the B2C market those models that work successfully in the B2B market. Among the chief reasons for this is that consumers tend to prioritise the price of products rather than the entire life-cycle economic benefits that could be provided by product-as-a-service models (TechUK, 2015; Bastein et al., 2013). Moreover, although many consumers have started favouring access to products over ownership, product ownership is still important for a large share of them (Van Eijk, 2015). As a result, product-as-a-service models often work better in the B2B market than in the B2C market.

In the B2C market, consumer attention to the upfront price can discourage businesses from producing products with recycled content, products with long-term durability or products that can be more easily repaired. Added to this, in some cases consumers consider reused or refurbished products to be inferior when compared with new products (Van Eijk, 2015; Bastein et al., 2013). Taken together, these factors pose obstacles to a wide uptake of circular products in the B2C market. It has also been suggested that in the B2C market the incentives for consumers to repair a product instead of buying a new one are generally weak (Ellen MacArthur Foundation et al., 2014). This indicates that policy support is needed to improve consumer demand for circular products and services in relation to non-circular traditional products.

Turning to the B2B environment, there is often a lack of cooperation of multiple companies along the supply chain due to their different interests and priorities. Similar to the B2C environment, in the B2B environment there is also sometimes a misperception that circular products and services are of lower quality or more expensive than traditional products and services. As a consequence, companies that change their business model to integrate circular processes sometimes face difficulties in convincing their customers in the B2B market about the benefits of the new model (Rizos et al., 2016). Further challenges in the B2B environment derive from the lack of transparency on the origin or content of products, resources and materials, which may discourage companies from adopting circular practices (Vanner, et al., 2014; Van Eijk, 2015).

4.2 Regulatory challenges

4.2.1 Waste shipments

As uncontrolled shipments of waste may cause adverse effects on human health and the environment, the EU regulates waste shipments through the Waste Shipment Regulation (EC) 1013/2006. The EU is addressing some of the challenges related to this regulation in particular as high levels of illegal waste exports are still reported (Van Barneveld et al., 2016). To this end, the European Commission adopted Implementing Regulation (EU) 2016/1245 in July 2016 creating a preliminary correlation table between customs and waste codes with the aim of tackling the problem of illegal exports of waste outside the EU.

While the problem of illegal shipments of waste still persists in Europe, there are further challenges related to the Waste Shipment Regulation and the circular economy. In particular, some of the procedures in the regulation entail a high administrative burden and costs for recycling businesses, which may prohibit the shipment of waste to recovery/recycling facilities in the EU. Although the strict procedures are important in order to minimise environmental and health protection risks linked to some types of waste, in some cases they may prevent movements of waste for recycling and recovery of resources to the benefit of solutions that are lower in the waste hierarchy (i.e. incineration and landfilling) (Van Acoleyen et al., 2016). Using Denmark and shipments of waste electrical and electronic equipment (WEEE) as an example, Box 3 illustrates this issue in more detail.

Box 3. Waste shipments from Denmark

Danish industry reports that the implementation of circular economy business models for WEEE, such as lifetime extension (repair and reuse), recycling and product as a service, has large economic potential in Denmark. It estimates that the market for the lifetime extension of high-value products, such as laptops or smartphones, has a potential value of more than DKK 2 billion per year (DI, 2017).

While there is significant potential for circular solutions in Denmark, its industry has identified barriers that slow down their uptake. One challenge concerns the use of electrical and electronic equipment waste and stems from the interaction between the EU Waste Framework Directive, the WEEE Directive and the Waste Shipment Regulation. Specifically, the Waste Shipment Regulation requires pre-approval of waste exports from both the exporting and importing countries as well as financial security, which is time consuming and expensive for companies. Meanwhile, the EU Waste Framework Directive regulates when processed waste can be considered 'secondary raw materials', but the criteria for this are unclear, and the end-of-waste classification at the EU level is not functioning properly according to the industry. More specialised waste recycling requires larger amounts of waste to obtain economies of scale. Therefore, Denmark (as well as other small countries) needs to export and import waste to specialised waste treatment facilities. In Denmark, WEEE is normally collected from businesses and exported to facilities in other EU countries to recover the resources. This process creates bureaucratic challenges for the industry, as obtaining a shipment authorisation is very time consuming (DI, 2017).

The heavy burden associated with the shipments of waste has been identified by a study prepared for the European Commission (Van Acoleyen et al., 2016) as one of the major obstacles preventing the efficient functioning of waste markets in the EU. Among the recommendations of the study for addressing this issue is to develop a fast procedure for shipping waste to pre-authorised facilities that comply with certain standards. In this context, a list of pre-authorised facilities that operate in the EU could be developed based on the available, legally binding standards.

4.2.2 Challenges related to substances of concern and remanufacturing

Remanufacturing, refurbishment and product life extension are circular economy practices for businesses as also described in chapter 2. The products' 'core' parts are restored in order to maintain the added value of the materials while providing business opportunities, given that business can generate a second or third income from selling the product. For example, the remanufacturing of used parts is a common practice in the automobile industry, while refurbishment is a well-established process in the medical imaging device industry. A remanufactured part fulfils a function that is at least equivalent to the original part by restoring the existing part and using industrial processes in line with strict technical specifications.

The REACH Regulation (EC) 1907/2006 aims to protect human health and the environment from the risks of chemicals while fostering the competitiveness of European industry. That notwithstanding, it also poses some hindrances for businesses. In particular, there are some concerns about possible impacts on innovation, as companies may prioritise research towards compliance with EU chemicals legislation at the expense of innovation activities, as well as on competitiveness – especially for small and medium-sized enterprises (SMEs), which may be sensitive to any additional compliance costs (Bourguignon, 2016). Some challenges are also linked to the circular economy as businesses may lack predictability regarding the substances that may be restricted in the future from updates in EU chemicals legislation. This in turn can cause difficulties for companies planning to use remanufactured products or product parts. Directive 2011/65/EU on the restriction of hazardous substances (RoHS) in electrical and electronic equipment is another key piece of legislation for the protection of human health and the environment that also entails some challenges.

Two specific challenges related to remanufacturing/refurbishment in two different industries are presented in Boxes 4 and 5.

Box 4. Refurbishment of medical devices

In the medical imaging device industry, refurbishment practices are carried out for medical devices such as magnetic resonance imaging devices or molecular imaging devices (Siemens, 2016). These devices are suitable for refurbishment due to their high value and the design of the product, which takes into account reparability (Van Barneveld et al., 2016). As customers that buy these devices, such as university hospitals or medical imaging centres, typically replace the device with the newer model every five to seven years (Siemens, 2016), the practices of refurbishment and lifetime extension provide business opportunities.

For medical device manufacturers, barriers manifest themselves when producers, after manufacturing the product bearing a CE marking,[a)] place the medical device as a new product on the market outside the EU. According to current EU requirements, if a new product is placed on the market outside the EU and if the manufacturer wishes to resell it on the EU market as a refurbished medical device, it needs to comply with the latest legislation, including, e.g. the RoHS Directive (Siemens, 2016). As before 2014 approximately 30% of the products in the sector were sourced outside the European Union, it could be argued that this constitutes a missed opportunity for the circular economy (Van Barneveld et al., 2016). In practical terms, if two new products bearing the CE marking were sold inside and outside the EU at the same time, the one sold outside the EU cannot be placed on the EU market as a refurbished device even if it is identical to the one first sold inside the EU as a new device, which was then refurbished according to the same process to be sold again on the EU market. Siemens (2016) estimates that this issue increases costs for healthcare systems and decreases the availability of refurbished medical equipment for patients in the EU.

A study commissioned by the European Commission on regulatory barriers to the circular economy suggests as a solution to this issue linking the term 'placing on the market' solely with the CE marking (Van Barneveld et al., 2016). This would entail that in the future refurbished medical devices bearing the CE marking would need to meet the same requirements provided by EU legislation in order to be resold on the EU market irrespective of whether they were placed on the market as a new device inside or outside the EU. The industry also argues that the CE marking, including the Declaration of Conformity of a device, should be treated as a passport for products to enter the European market.

The challenge lies in guaranteeing the quality and safety of the refurbished medical device as well as developing a solid approach to how such a process for proving the conformity of refurbished medical devices could be introduced into EU legislation. According to the industry, this could be done by introducing standards proving the conformity of the refurbished system with the original Declaration of Conformity – no matter whether the device was placed on the market inside or outside the EU as a new medical device – and confirming the original CE marking. The standards would lay out the basic requirements for a refurbishment process for medical imaging devices that would not change the equipment's original intended use, safety profile or performance. If these requirements set by the standards are met, refurbished medical devices would be able to be sold within Europe. The development of such standards should be led by an independent organisation and involve all actors in the value chain. The standards would also need to be agreed at the international level.

[a)] For products bearing the CE marking the manufacturer must draft and sign a Declaration of Conformity declaring that the product meets all legal requirements for the CE marking.

Box 5. Use of spare parts by the automotive industry

The circular economy promotes processes such as remanufacturing and product life extension while chemicals legislation aims to contribute to the protection of human health and the environment. Balancing these two objectives of the circular economy and chemicals legislation is not always easy as demonstrated below in a case study for the automotive sector.

Specifically, the lifetime of a vehicle can be extended by providing repair services and maintenance to the customer. Spare parts for old vehicles, also for those that are no longer in mass production, are therefore needed to perform the above-mentioned services. According to the industry, spare parts need to correspond to the qualities and the specifications of the original spare part, in particular for safety reasons and functionality. However, the industry argues that barriers to product life extension may arise when there are updates to the chemicals legislation and when substances used previously in spare parts are restricted. The issue manifests itself in situations where spare parts for vehicles that are no longer in mass production are requested by clients to provide a longer lifetime for their vehicles (ACEA et al., 2014).

The industry stresses that technical and economic constraints make it unfeasible to replace restricted substances with new materials due to the necessary testing requirements in conjunction with other functional parts when the vehicle has already ceased mass production and is no longer available to the industry. This is particularly the case as demand is low for spare parts of old models. The industry furthermore argues that without reasonable derogation the supply of technically approved and reliable spare parts of older models will be at risk – to the detriment of prolonged lifetimes of the product (ACEA et al., 2014). On this basis, the industry recommends providing exemptions from the provisions of the REACH Regulation for spare parts. At the same time, environmental NGOs suggest that such exemptions are not justified and priority should be given to redeveloping and revalidating new parts even if this comes at a cost (EEB & IPEN, 2016).

The above discussion indicates that finding the right balance between the objectives of the circular economy and chemicals legislation might not always be an easy task and a careful assessment of the impacts and benefits of all the different options would be needed.

A further challenge relates to the access to information on the presence of hazardous substances in products and recovered materials. A report by Bernard & Buonsante (2017) assessing different case studies of products concluded that the current legal framework often fails to ensure the availability of information about the presence of substances in products and waste streams. This issue of uncertainty about the substances included in products may hinder the work of businesses that would like to remanufacture products or use recovered materials in order to produce new products. It can also pose concerns to public procurement officials who wish to be informed about the composition of products they acquire (see chapter 5, subsection 5.4.2). Several solutions to this issue have been proposed: for example, introducing 'product passports' containing information about materials and components (EREP, 2014) or building an EU information system for products and substances (Bernard & Buonsante, 2017). It should be recognised, however, that making such information easily accessible in the material life cycles is not an easy task and could result in other difficulties such as an increased administrative burden (Bourguignon, 2017).

A Communication by the European Commission (2018a) on the interface between chemical, product and waste legislation recognises the need to ensure that all actors in the supply chain, including waste operators, have access to information on substances of concern. Among the planned actions mentioned in the Communication are the launch of a feasibility study on the use of different information systems, tracing technologies and strategies. The document also raises the question of what would be the added value of introducing an EU compulsory information system on substances of concern, indicating that this would be an option to be assessed.

4.2.3 Challenges in the implementation of EU regulation across member states

Over the past few decades, waste management within the EU has improved considerably. The quantity of municipal waste landfilled reduced from 64% in 1995 to 24% in 2016, while during the same period the quantity of recycled municipal waste increased from 11% to 29%. As a result, 73% of municipal waste in the EU is either incinerated, recycled or composted (Eurostat, 2018a). Nevertheless, despite improvements in the EU average, evaluating progress at the national level shows the limited advancements in a number of member states, including Malta, Croatia, Bulgaria and the Czech Republic (Eurostat, 2017e).

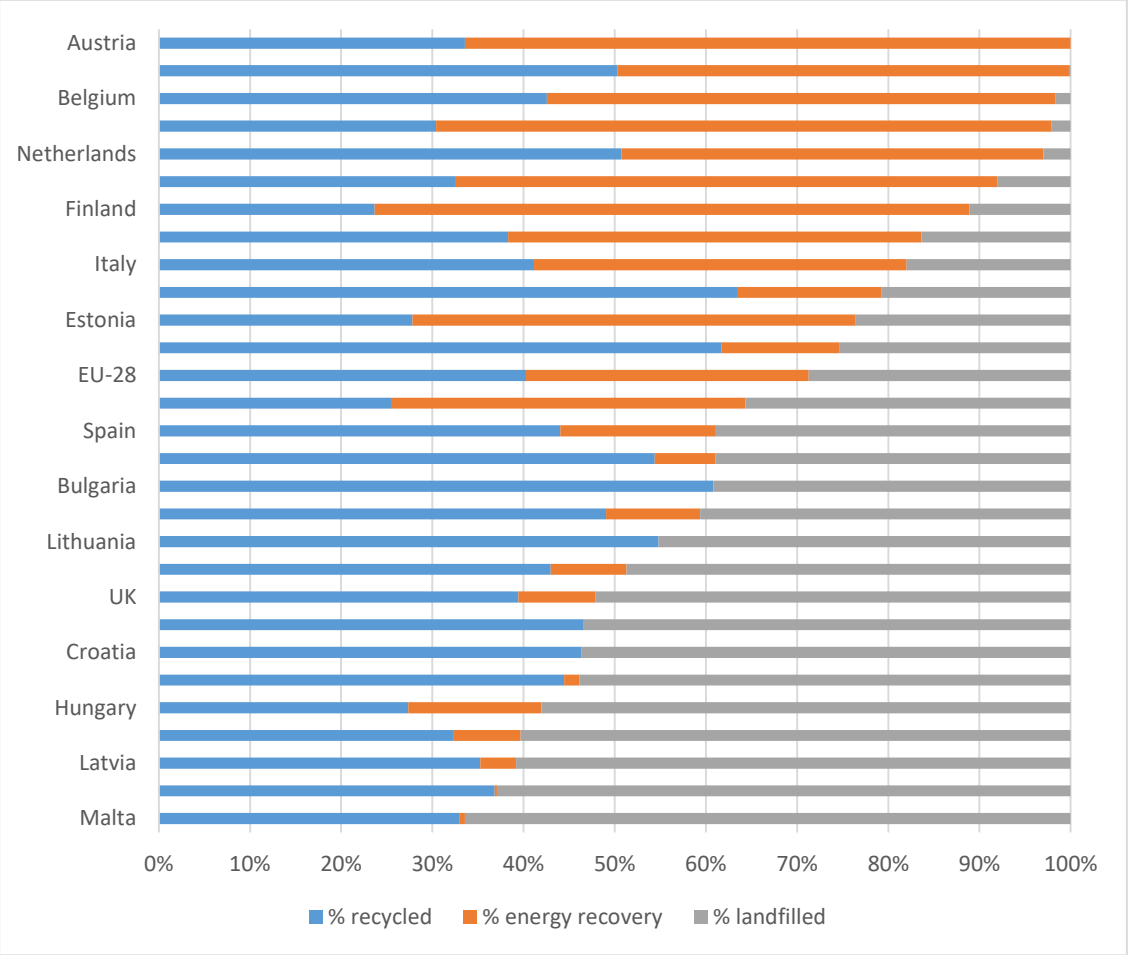
Various national contexts are seen across the EU. Deep-rooted user practices as well as the political culture inherent to a member state affect the approach used to implement legislation. Effective implementation of legislation necessitates prerequisites, such as the existence of infrastructure and systems. Those related to EU waste legislation include established waste collection processes, the infrastructure of waste treatment plants, and institutional and administrative set-ups, which have varying stages of development in member states (De Beer et al., 2017). This has led to divergent approaches in the implementation of EU waste legislation by national, regional and local governments. The waste hierarchy, as defined in the Waste Framework Directive (2008/98/EC), ranks waste management options from the most preferred "Prevention" to "Preparing for reuse", "Recycling", "Other recovery" and "Disposal" as the least preferred option. In the following boxes, two examples are provided for two different categories of the waste hierarchy, "Recycling" and "Other recovery". Specifically, Box 6 provides a case study on plastics recycling while Box 7 provides a case study on the cement industry.

Box 6. Recycling plastic packaging in the EU

In the EU Action Plan for the Circular Economy plastics are considered one of the five priority areas to be addressed. In January 2018 the European Commission (2018b) published a strategy for plastics, including a series of actions aimed at inter alia improving the economies and quality of plastics recycling.[a)]

This box focuses on plastic packaging applications, which are the largest application of plastics in the EU and account for approximately 40% of total plastics demand (PlasticsEurope, 2017). Although EU-wide recycling rates of plastic packaging waste have increased, there are still vast differences among member states. This is confirmed by 2015 data from Eurostat (2017f) showing that the European average recycling rate of plastic packaging was 40%, whereas in Finland and France it was between 24% and 25%, and in the Netherlands and Germany it was 51% and 50% respectively. These significant differences are likely to be accentuated by different calculating methodologies for recycling rates. Data from Eurostat also show that low plastic landfilling rates in member states generally result in higher energy-recovery rates, but they do not necessarily allude to higher recycling rates (see Figure B6.1).

*Figure B6.1 Recycling, energy recovery and landfilling rates of plastic packaging waste in the EU, 2015**



* At the time of preparation of this figure, 2015 data were not available for Denmark, Cyprus, Malta or Romania, so 2014 figures were used for these countries.

Source: Own design based on Eurostat (2017f).

Although currently there are economic and environmental limits to the amount of plastics that can be recycled effectively (Ellen MacArthur Foundation, 2016a), there is still room for improvement, particularly in some member states. The level of plastic recycling in member states highly depends on the development of waste collection and sorting processes. A study conducted for the European Commission concluded that countries that have implemented mandatory separate collection of certain categories of municipal waste have achieved high municipal waste-recycling levels (Seyring et al., 2015). France is an example of a country that has historically introduced separate collection for only certain types of plastic packaging (bottles and flasks) and has had persistently low rates of plastic packaging recycling; however, a decision was made in 2015 to extend sorting instructions to all types of plastic packaging for all regions by 2022.[b)] Another interesting finding comes from a study for the European Parliament, which identified a correlation between a reduction in the landfilling of plastics and landfill taxes and bans. Nevertheless, it appears that in some cases these measures have contributed to shifting plastic waste from landfills to incinerators instead of improving recycling (Lee et al., 2017). This indicates that such instruments alone are often not sufficient to move up multiple levels in the waste hierarchy and should be accompanied by other measures.

a) The actions are listed in Annex I of the strategy, see European Commission (2018c).

b) French Law No. 2015-992 of 17 August 2015.

Box 7. Barriers to the co-processing of waste in the cement industry

The Communication by the European Commission (2017c) on the role of waste-to-energy in the circular economy identifies the use of waste to supply thermal energy in the cement manufacturing process as one of the main waste-to-energy practices. The co-processing of waste in the cement industry is considered to be in the "Other recovery" category of the waste hierarchy. Although it is encouraged to use waste options that are high in the ranking of the waste hierarchy and deliver the most favourable environmental result, much waste is currently unable to be "Prevented", "Reused" or "Recycled" in an economical way (JRC, 2016) and therefore is still being landfilled (Eurostat, 2018a). Hence, despite waste-to-energy appearing lower down the waste hierarchy, there are still environmental benefits to it when compared with landfill disposal.

A study by De Beer et al. (2017) looks at the barriers and opportunities for the further uptake of waste as an alternative fuel in the cement manufacturing process. The study found that local factors constrain the potential to use waste in the industry to a much larger extent than technical and economic aspects. It showed that although the EU average co-processing rate is 41%, there are considerable variations in this rate across the assessed countries, with Ireland, Portugal, Spain, Bulgaria, Italy and Greece performing much lower than the EU average as a result of divergences in the implementation of waste legislation. Some of these countries have also been found to be in breach of EU law for illegal landfilling, which is likely to have some influence over the co-processing of waste rates since they directly depend on the availability of waste for fuel. Simply put, the percentage of thermal energy consumption in cement kilns coming from alternative fuels is negatively correlated with the percentage of waste being landfilled. In this regard, it may be hypothesised that using waste as an alternative fuel in cement kilns constitutes a direct substitute for landfilling the waste. A second conclusion is that there is likely a relationship between the maturity of waste management systems and co-processing of waste rates in the cement industry.

Economic instruments, in combination with other measures, can encourage the development of waste collection and processing infrastructure. Landfill taxes represent one such instrument. In the 24 member states that have implemented a landfill tax, rates vary significantly across the EU from €3/tonne of waste to more than €100/tonne. Romania has only recently applied a landfill tax of €26/tonne, while other regions, for example the Walloon region in Belgium, has a tax reaching up to €113/tonne of waste. Germany is a country without a landfill tax; instead a landfill ban was introduced in 1993 on untreated waste, which is another way to encourage more waste treatment facilities (CEWEP, 2017). An issue affecting landfill costs and consequently the demand for waste treatment infrastructure, is the presence of illegal landfilling in several member states.[27] Increasing landfill taxes or implementing landfill bans in the countries lagging behind in developing waste infrastructure, along with a stricter approach towards illegal landfills, might provide the incentives needed to advance waste treatment systems in these countries.

4.3 Harnessing the potential of digitalisation and emerging disruptive technologies

Chapter 3, section 3.2 provided a description of some of the leading digital technologies that hold the potential to redefine value creation, transform markets and change the way business operates. The IoT as well as the increased connectivity of devices and equipment will lead to a large generation of data. However, there are a number of barriers, such as a lack of common software interfaces, connectivity protocols and standard data formats, which can pose difficulties to having

[27] Several member states, including Slovenia, Spain, Italy, Romania and Greece, have breached EU rules on landfilling. For more details, see European Commission (2017h); European Commission (2015b); European Commission (2017i); European Commission (2015c); European Commission (2013a).

a functional digital ecosystem. To this end, cross-industry collaborations involving companies across the value chains could help overcome these challenges (McKinsey Global Institute, 2015; Ellen MacArthur Foundation, 2016b).

The growth of available data provided by the IoT and other digital technologies may equip companies with the capacity to adopt new business models and practices. While there are myriads of possibilities in several sectors, the growing availability of data about the actions of consumers and companies also raises important concerns related to data privacy and ownership, let alone cyber security. The questions of who owns the data and how the data are used are also particularly important in the B2B markets.

Some emerging technologies have a very disruptive nature, which can pose significant policy challenges. An example is 3D printing (see Box 2 in chapter 3), whose proliferation may have several legal implications. In particular, traditional product liability laws were designed for a supply chain system that involves actors that produce, sell and consume products. Under the current framework the producer or seller is generally held liable for providing a product to a consumer. Yet, with the advent of 3D printing these distinctions might not always be clear, given that in theory anyone with access to a 3D printer and a CAD[28] file can manufacture a product. An additional question is whether a CAD file should qualify as a 'product' and therefore fall within the scope of the product liability regime. The rise of this disruptive technology also involves risks[29] of infringing intellectual property rights (De Clercq, 2015; Beck & Jacobson, 2017). Notably, in a survey of US manufacturers by PwC (2016) "threats to intellectual property rights" is identified as one of the key potential disrupting effects of 3D printing.

Autonomous vehicles represent another technology that holds the promise of having a fundamental impact on our lives and transforming markets. These vehicles are currently under development and aim to replace some or all of the driving functions performed by humans. Pairing this technology with IoT applications such as centralised traffic-control systems and smart parking meters could help reduce traffic congestion, emissions and the frequency of accidents (McKinsey Global Institute, 2015). This technology may also change the way vehicles are produced, operated and maintained (Hörl et al., 2016). While the scale of market penetration of these vehicles is hard to predict,[30] their smooth roll-out would require an effective regulatory framework in place.[31] For instance, one issue concerns liability in the case of an accident involving a self-driving vehicle.

The foregoing discussion implies that there is a need for an enabling policy framework that will allow businesses to capitalise on the innovation opportunities arising from these emerging technologies but also provide safeguards for consumers.

4.4 How the circular economy challenges the financing of industrial renewal

The transition to a circular economy involves considerable costs linked to the need for industrial renewal, asset investments, R&D, subsidy payments to promote new business models, forward-looking technology for waste management, digital and energy infrastructure. Understanding how to finance such costs is an essential matter to better understand how to facilitate the transition.

A survey conducted by Henriksen et al. (2012) found that in 2012 over 85% of companies[32] finance their transition to a 'green' business model by means of internal resources.[33] On the one

[28] This stands for computer-aided design (Beck & Jacobson, 2017).

[29] The risks relate to copyright law, patent law, design rights and trademark law (De Clercq, 2015).

[30] According to McKinsey Global Institute (2015), by 2025 around 1–2% of all vehicles on the road worldwide could be fully autonomous, while about 12–15% could be semi-autonomous.

[31] Notably, at the EU level there already variations in the liability rules across member states (Pillath, 2016).

[32] Out of the 41 surveyed.

[33] About 24% of surveyed companies rely on conventional bank loans, 20% on private equity, 20% on national government grants and 18% on EU programmes (Henriksen et al., 2012).

hand it is positive to observe that companies cross-subsidise the set-up of resource-efficient value chains with profits deriving from their linear businesses; on the other hand, it is alarming to see how little the banking and financial sector is able to support the transition.

It is rather undisputed that SMEs especially face major barriers to access finance for green business models (see, for instance, Vasilenko & Arbačiauskas, 2012; Rizos et al., 2015). Upfront costs and the anticipated pay-back period are among the main reasons for such difficulties. SMEs and startups willing to develop innovative and sustainable supply chains, due to the difficulties in obtaining the guarantees and collateral required, have hard a time getting finance through the standard banking sector (Müller & Tunçer, 2013).

Regardless of whether the transition is financed with in-house resources or through financial intermediaries, there is a crucial need to assess and manage the technical and financial risks that come with large upfront investment and with the application of new business models or new collaborative ways of production. Having an understanding of the risk associated with circular activities requires a wide set of information to manage the various 'uncertainties': on the scalability of solutions, on expected cash flow, on the value of end products for secondary markets and on the ownership/legal structure (ING, 2015).

Table 2 provides an account of the implications that circular business models have for the financing of economic activities. In line with EIB (2015), financial implications are grouped around the type of novelty brought about by the circular business: i) a transition from product to service, ii) industrial symbiosis and collaborative models, and iii) product and process innovation, with the understanding that such categorisation is not mutually exclusive.

Table 2. Main financial implications of circular business models

Product-as-a-service transition >> change in the ownership of the asset	**Industrial symbiosis, collaborative and sharing models >> multiple actors in the value chain**	**Product & process innovation models >> disruptive innovation**

• A different and more uncertain cash flow dynamic:
  • No asset sales imply no initial inflows to repay manufacturing
  • Market-related risk, uncertainty about consumers' behaviour
• Increasing capital needs to pre-finance clients
• Balance sheet extensions
• Maintenance contracts and costs
• Easier reuse and re-manufacturing, but of uncertain value
	• High upfront costs for the industrial renewal and machine compatibility with up- & downstream partners
	• Partial loss of flexibility to respond to market requests
	• Cost of capital depends on the creditworthiness of the value chain, not only of the borrower:
	  • Creditworthiness and reliability of partners affect the borrower's risk
	  • The solidity of the value chain is not taken into account as a risk-mitigating factor
		• High upfront costs for industrial renewal and new resource-efficient machinery (particularly for product innovation)
		• Technological and operational risk remains high till project implementation
		• High market risk due to the uncertainty about customer acceptance
		• Uncertainty related to the residual value of new products

Source: Own elaboration based on EIB (2015), ING (2015) and FinanCE (2016).

In short, the cost of capital for disruptive circular undertakings might be higher because the financial sector lacks the appropriate tools, data and metrics to model the expected revenues, and have a proper account of the risk associated with the disruptive enterprise. For instance, longer

cash-to-cash cycles, as there is no purchase price but a series of payments for subscriptions of unknown length, may discourage the banking sector even in the case of a solid balance sheet. Furthermore, an increase in operating assets due to a balance sheet extension is most likely linked to a decrease of the average liquidity of the company's overall assets, which in turn increases the cost of capital and makes it costlier for the firm to finance its circular initiative through debt (EIB, 2015).[34]

With the shift from traditional ownership models to product-as-a-service models, changes in liability will also require an adaptation of insurance contracts. The legal implications of product usage, the higher risk due to customers' lower care and the accompanied risk premiums are to be included in the new business model (FinanCE, 2016).

Changes in the product value chain also pose a challenge to the financing of innovative business models. In certain cases, firms developing circular solutions might have both the product and the technology available but crucially lack relevant business partners to collaborate with. Increasing business investment in the circular economy requires transversal cooperation among different sectors and considering industrial synergies to be a form of guarantee, rather than a source of uncertainty.

The bottom line is that to enable the transition, a circular business model must be able to exploit different types of financial products. As stressed by FinanCE (2016), various types of financing may be employed at different phases: the early transition phase characterised by high risk and uncertainty is suited more to in-house resources, equity capital or even crowd-funding. Generic debt facilities, commercial loans and institutional investors may be more apt to support the transition once implementation is on the go.

Indeed, a better interplay between crowd-funding and standard financing could prove useful for accelerating the transition; the same applies to equity financing, which is still largely underdeveloped in Europe, especially vis-à-vis the US. The main challenge nonetheless remains linked to adapting the tools and means of the standard banking and financial sector to the needs and business practices of the circular economy.

[34] Only in the case of slow depreciation of the operating assets could a heavier balance sheet result in lower borrowing costs, owing to the higher security it provides.

5. HOW POLICY-MAKERS CAN SUPPORT THE CIRCULAR ECONOMY

This chapter focuses on some options for policy action to be taken at the EU and national levels in order to support the circular economy transition.

Key messages

- Ecodesign is a crucial instrument in the transition towards a circular economy. Any circularity design requirements would need to be verifiable by the member state authorities and also flexible enough so as not to hinder innovation.
- Linking extended producer responsibility (EPR) with the ecodesign of products can support the implementation of the waste hierarchy, but the introduction of differentiated fees should be done at the EU level through a harmonised system.
- New approaches to taxation can foster the transition to a circular economy. Although there have been many calls for shifting taxation from labour to resources, in practice only negligible progress has been achieved within the EU due to several existing barriers.
- Tax approaches related to material resource efficiency are generally penalty-led in the EU. However, recent examples of policies at the national level and beyond the EU indicate that there is perhaps a need for a renewed approach that would complement tax penalties with tax incentives (e.g. reduced VAT and/or tax reductions for companies) in order to provide a market pull for circular products and services.
- There is untapped potential for using public procurement as a major demand-side policy instrument for the creation of markets for more environmentally friendly products and services across the EU.
- The EU's circular economy strategy as well as the national programmes adopted by member states promote the inclusion of circularity criteria in procurement procedures. Nonetheless, the use of life-cycle costing as a decision-making tool should be further encouraged, while policy-makers need to also promote product transparency throughout value chains.
- While there is significant funding potentially available via EU funds, it is not directly earmarked for the circular economy and does not appear to be sufficiently taken up.
- The financial support for the transition is fragmented across various programmes and there is room to better steer the circular logic within all EU programmes, particularly in the context of the post-2020 Multiannual Financial Framework.
- In the EU, corporate sustainability reporting has become mainstream over recent years. Still, there is currently no common framework or methodology to measure circular economy activities in companies. There is thus a need to identify operational indicators based on the inventory of available circular economy indicators and on an assessment of indicators already in use by companies in other areas (e.g. greenhouse gas emissions reporting).

5.1 Ecodesign

The Ecodesign Directive was first adopted in 2005 (2005/32/EC) for energy-using products and later expanded to cover energy-related products (2009/125/EC). Its core objectives are to encourage manufacturers to design products that are more environmentally friendly, to strengthen

Europe's competitiveness, economic growth and job creation, to ensure a level playing field in the internal market and to reduce CO_2 emissions while saving money for consumers (European Commission, 2016c). As a framework directive, it fixes the overarching legal framework, which opens the ground for specific regulations providing mandatory design requirements prescribed for different product groups. Regulations can be horizontal or vertical. The former target one aspect across many product groups while the latter are specific to individual product groups. By the end of 2016, 40 product groups were bounded by the Ecodesign Directive with 28 regulations adopted. Voluntary agreements can be recognised by the European Commission as alternatives to regulatory measures and so far there are three recognised agreements in place: complex set-top boxes, games consoles and imaging equipment.

The Ecodesign Directive was designed to directly interact with the Energy Labelling Directive (2010/30/EU), which set mandatory labelling requirements. Products that fulfil the mandatory design requirements bear the CE marking and those that are non-compliant with the requirements are legally unable to reach the EU market. Energy-related products within the scope of the Energy Labelling Directive that fulfil the ecodesign requirements, for example certain washing machines, refrigerators and cooking appliances, must carry an energy label that classifies the energy efficiency of a product from A to G, or for some product groups from A+++ to D. However, Regulation (EU) 2017/1369 repealed the Energy Labelling Directive and set a framework for the energy efficiency labelling that replaces the A+, A++ and A+++ classes with an A to G scale. The combination of legislation on ecodesign and energy labelling is estimated to provide primary energy savings of 18% by 2020. This is equivalent to 7%[35] lower greenhouse gas emissions in the EU, based on 2010 figures (Kemna et al., 2016). These figures highlight that these policies have brought some successful energy effciency outcomes.

Since the introduction of the Ecodesign Directive the focus of requirements has primarily been on energy efficiency, although resource efficiency aspects are among the parameters[36] that need to be considered when preparing ecodesign requirements[37] (Bundgaard et al., 2017). Nevertheless, in the Circular Economy Action Plan the European Commission (2015a) mentions that circular economy aspects, such as the reparability, durability, upgradability and recyclability of materials or substances, will be examined when developing future product design requirements under the Ecodesign Directive. In line with this action, the Ecodesign Working Plan for 2016–19 (European Commission, 2016c) states that it will strengthen the contribution of the directive to the circular economy for new product groups and in reviews of existing product groups. To do this, a circular economy 'toolbox' is being developed as guidance for the inclusion of circular economy principles for new and existing product groups. The intention is to provide examples of how these aspects could be taken up in the future in product-specific or horizontal requirements.

To move to a more systematic adoption of circular economy requirements, the European Commission (2015d) issued a standardisation request to the European standardisation organisations regarding ecodesign requirements on material efficiency aspects for energy-related products. The request was accepted by the standardisation organisations, which have set up a joint working group to develop about 20 generic standards (European Commission, 2017j).

Although it is generally agreed that ecodesign can be a key instrument for the transition towards a circular economy, there are concerns about the strengthening of the resource efficiency/circular economy requirements in the Ecodesign Directive and introducing circularity design requirements for non-energy-related products that are currently not covered by the Ecodesign Directive. For example, there are concerns by various stakeholders regarding the

[35] These figures are based on a comparison between two scenarios: one representing what was perceived to be the baseline without the measures included in the Ecodesign or Energy Labelling Directives and one including the effects of these measures (Kemna et al., 2016).

[36] See Annex I of the Ecodesign Directive (2009/125/EC).

[37] Some examples of product groups for which resource-efficiency design requirements have been introduced are vacuum cleaners and imaging equipment (voluntary agreement) (Bundgaard et al., 2017).

measurement and testing methods for circular economy design requirements (Egenhofer et al., 2017; Bundgaard et al., 2017). Market surveillance and verification of compliance with some specific circularity requirements might not be easy, especially for products manufactured outside the EU. It has furthermore been suggested that enhancing the circular economy/resource efficiency aspects in the requirements of the Ecodesign Directive would make the process longer and more complex. Another issue relates to innovation, as some actors claim that strict design requirements that specify, for example, the materials that must be used, can hinder innovation (Dalhammar et al., 2014).

To address these concerns, an option for the policy-makers would be to set horizontal and/or per-product group information requirements (e.g. a requirement to display information on certain substances, reparability and durability) to prepare the ground for effectively introducing circular economy design requirements into EU law. Voluntary industry-led agreements can also be encouraged as a gradual approach for the introduction of such requirements into the EU law.

5.2 Extended producer responsibility

Extended producer responsibility can be a major instrument to support the implementation of the waste hierarchy (Monier et al., 2014). According to the OECD's (2001) guidance for governments on EPR, the key objectives of EPR schemes are to internalise producer externalities by shifting responsibility for waste management to producers and to incentivise investment in the ecodesign of products. EPR schemes first appeared in the EU in the 1980s and have since spread globally. After the OECD released its guidance for governments in 2001, the majority of OECD countries and several emerging economies have implemented EPR policies (OECD, 2016), among them being all EU member states (Monier et al., 2014).

Many claim that EPR schemes with fees differentiated by weight alone do not encourage the ecodesign of products (OECD, 2016; EY, 2016b; EEA, 2017). Although this strategy may encourage producers to diminish the amount of material used in production, or opt for different materials entirely, it does not incentivise producers to design products for reuse, repair and remanufacture (EEA, 2017). There might also be negative effects, since using lighter material could potentially reduce a product's durability. In response to many studies suggesting linking EPR schemes with the ecodesign of products, the European Commission (2015a) has proposed that member states encourage ecodesign by differentiating the financial contributions paid by producers based on a product's end-of-life costs. This would create a direct incentive for the implementation of the waste hierarchy. Some schemes are already designed to stimulate the ecodesign of products: for example, the model by the French EPR scheme CITEO (previously Eco-Emballages) penalises producers if they put on the market non-recyclable packaging and rewards them if they decrease the weight of their packaging or improve recyclability (Watkins et al., 2017).

At the same time, however, there have also been concerns about the effectiveness of differentiating environmental fees under EPR schemes. A report by Damgaard et al. (2015) conducted a price sensitivity analysis of light bulbs and concluded that an increased price differentiation of the environmental fees based on the actual reprocessing and treatment costs may have a marginal impact on consumers' purchasing patterns and in turn also on producers' incentives for designing more environmentally friendly products. Moreover, according to the report, setting up the differentiation criteria for some product types, based on the actual reprocessing and treatment costs, would be a complex process entailing significant administrative costs (Damgaard et al., 2015; OECD, 2014). The above discussion implies that the criteria for introducing differentiated fees in EPR schemes should be carefully developed. A further argument is that the introduction of differentiated fees should be done at the EU level through a harmonised system to avoid having a large number of different national schemes.

Another issue with EPR schemes within the EU is that despite guidelines specified in the Waste Directive, inconsistencies in the design and application exist (OECD, 2016). Because of these wide disparities in the scope, objectives and reporting methods, it is challenging for policy-makers

and national governments to compare schemes to assess the cost-effectiveness of individual design features. On top of this, cost-benefit analyses are difficult to calculate because the expected benefits – such as ecodesign, increasing recyclability and correcting ineffective recycling markets – are hard to quantify (OECD, 2014). One aspect that is clear, however, is that opportunities for free-riding can diminish the cost-effectiveness of schemes. This occurs when a producer's fee to the producer responsibility organisation does not cover the collection and recycling costs at all or at an adequate level and naturally happens more often in collective schemes where responsibility is shared. Free-riding is more prevalent in arrangements where it is hard to monitor activities, such as products sold online or schemes with many producers/actors. A consequence is that those producers contributing fees at an adequate level are at a competitive disadvantage to those contributing insufficient fees.

5.3 New approaches to taxation

Taxes play an important role in steering investments and consumption in an economy. In the EU, taxation is an exclusive competence of the member states. Historically, member states put the brunt of the tax burden on labour. Taxes on (employed) labour income contributed almost half of EU total tax revenues in 2014 (European Commission, 2016d). Value added-type taxes contributed another 18% to total tax revenues in 2015 (Eurostat, 2016). New approaches to taxation can foster the transition to a circular economy. In this section we first look at the potential for a tax shift from labour to natural resources and then at the possibilities to use reduced VAT rates to support circular products, including secondary raw materials and recycled goods.

5.3.1 Shifting taxation from labour to resources

In comparison with labour-related taxes, environmental taxes only contributed slightly over 6%[38] to EU total tax revenues in 2015.[39] With globalisation increasing labour mobility, high unemployment rates (7.7% in July 2017, Eurostat (2017g)) and unsustainable levels of resource use across the EU, a shift from labour to natural resources as a tax base has long been advocated. This idea is based on the theory that increasing resource taxes will incentivise a reduction of their use and decreasing labour taxes will reduce unemployment as well as stimulate economic growth. Furthermore, a reduction in labour taxes can facilitate the transition to a circular economy by improving the competitiveness of labour-intensive activities, such as maintenance and repair of products, as well as R&D efforts. It is thus not surprising that the EU has repeatedly advocated such a tax shift, inter alia in its 7th Environmental Action Programme[40] and in the Roadmap for a Resource Efficient Europe (European Commission, 2011a). More recently, the European Commission reiterated that environmental taxes are "less detrimental to growth" than labour taxes (European Commission, 2016e, p. 37) and that there is "room to shift taxes away from labour" (European Commission, 2016e, p. 14) in view of creating a more labour-friendly environment.

Environmental taxes increase the price of anything "that has a proven, specific negative impact on the environment" (Eurostat, 2018c). Four types of environmental taxes can be distinguished: energy, transport, pollution and resource taxes. Over 76% of environmental tax revenues came from energy taxes in 2015, while in the same year around 20% came from transport

[38] Own calculation based on data from Eurostat. For data on total tax revenue by country, see https://tinyurl.com/yal9v3v6. For data on environmental tax revenue, see https://tinyurl.com/y7nkc4rz.

[39] According to an assessment of green fiscal policies in the Netherlands, Germany and UK by Woltjer et al. (2017), concerns about international competitiveness, distributional issues and stranded assets are among the key reasons for inconsistent use of green taxation.

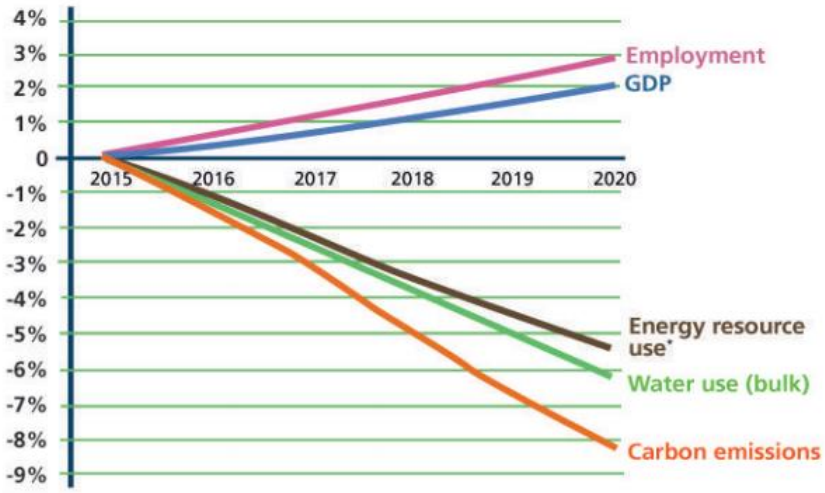
[40] See Decision No. 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet', OJ L 354/171.

taxes and less than 4% from resource and pollution taxes combined (Eurostat, 2017h). Taxes on natural resources (e.g. on the extraction of raw materials) thus still play a negligible role in tax revenues and in steering resource consumption towards a circular economy.[41]

There are several ways to implement a resource tax. ETC/SCP (2012) considers three different taxation schemes. First, an *extraction tax*, which is levied on the point of extraction. However, since the EU imports large amounts of resources from third countries, this kind of tax only has limited potential. In addition, an extraction tax levied on the domestic mining industry may give rise to international competitiveness concerns. These can be addressed by complementary border tax adjustments. An alternative option is a *material input tax*, which is levied on raw materials at the first point of industrial use. This would also apply to imported intermediate products that might already have been processed abroad. A drawback of this kind of resource tax is that the tax base can often not accurately be determined and requires large amounts of data, which may incur high administrative costs. Finally, the resource content of final products could be taxed in the form of a *consumption tax*. Similar to the material input tax, the determination of the tax base may be difficult particularly for products with a complex composition of resources. ETC/SCP (2012) conclude that the taxation of natural resources is much more difficult than the taxation of fossil fuels. Acknowledging that the perfect taxation scheme does not exist, the introduction of a resource tax is nevertheless recommended, at least for some resources or products, to steer the economy towards more sustainability.

The potential effects of a budget-neutral shift from labour to natural resources have been presented inter alia by The Ex'tax Project et al. (2016). The project concluded that a €554 billion decrease in labour taxes combined with an equivalent increase in taxes on natural resources and consumption could lead to positive results in terms of both GDP and employment (see Figure 3).

Figure 3. Key modelling results for the EU-27, 2015–20 (% difference from baseline)



Source: The Ex'tax Project et al. (2016).

Despite the increased visibility of this potential reform in EU policy cycles, negligible progress has been seen within the EU. The lack of progress in the EU is a result of many barriers that are present during a tax reform of this design (EEA, 2016).

The biggest factor that limits reform is the immense level of political attention received when a national fiscal system is changed (EEA, 2016). The political culture in most member states encourages short-term techno-economic arguments that dominate the policy-setting process. A

[41] It should also be noted that data on resource taxes is very limited, making it difficult to properly assess the situation in each of the member states.

study conducted for the European Commission (Hogg et al., 2016) looked at two scenarios to reform taxes, a 'good practice' scenario and a 'politically feasible' scenario.[42] A comparison of the two scenarios showed that the politically feasible level of resource taxes is lower than the required 'good practice' level. It can thus be concluded that under current conditions national governments will likely overlook the European Commission's advice to reform taxes. Other barriers include the regressive quality of resource taxes with associated equity concerns, the potential detrimental effect on the competitiveness of EU industries and the costs associated with administering such a reform (EEA, 2016).

In a tax shift, difficult trade-offs will have to be made and fiscal reforms are generally a lengthy and complex process. Policy-makers will have to prioritise objectives and weigh up their different goals. The design and implementation of any reform is influenced by the institutional context and political environment in which the reform occurs (OECD, 2010). Hence, political factors will impact the outcome of a tax reform process and as a result it should be expected that member states will approach the change in various ways. Because of the difficult trade-offs, fiscal reforms warrant concrete research and analysis prior to and during the process to avoid any negative economic and social impacts. Included in the research should be an analysis of the distributional impact of such a reform, which would inform policy-makers and help ensure that accompanying policy measures are included in the policy mix to protect or compensate those most vulnerable to the change, particularly low-income households (OECD, 2011). Fiscal reform advocates and correspondents must build a consensus on the merits of reforming the fiscal system to disseminate the change to citizens and adversaries of a reform (Hogg et al., 2016).

5.3.2 Tax incentives for circular products and services

Governments can use tax incentives or penalties as a tool to shift consumption and achieve policy goals. Tax incentives can be defined as the act of reducing tax to incentivise the use of a good, whereas tax penalties penalise the use of less environmentally friendly products (KPMG, 2013). In this section we focus specifically on tax incentives to encourage resource efficiency, such as reducing VAT for circular goods, including secondary raw materials and recycling activities.

There are a number of examples of countries around the globe that have implemented tax incentives for activities associated with the circular economy. In China, for instance, a reduction of VAT is provided on certain goods produced from recycled materials. These materials include sand produced from construction waste and powdered rubber from old vehicle tyres (China Briefing, 2011). More information on tax incentives in China is provided in Box 8. Tax incentives for circular goods and services are also present in other countries. As an example, in South Korea the government is planning to provide incentives to companies producing large amounts of waste in order to set up plans for resource circulation and monitoring (KPMG, 2017).

Box 8. Reduced VAT rates for circular goods in China

In 2011, the Chinese State Administration of Taxation released a government notice (caishui [2011] No. 115) regarding the adjustment and improvement of VAT policies for products and services related to recycling businesses (China Briefing, 2011; EY, 2015). Within this notice, companies are granted the eligibility to receive lower or eliminated VAT rates. Products are listed under three reduced VAT rates, 100%, 80% and 50%. Reduced rates on secondary raw materials appear in the notice, for example feed-grade mixed oils produced from waste animal/vegetable oils receive a 100% VAT reduction, certain products produced from agricultural and forestry residues receive an 80% VAT reduction and metals produced from waste metals as well as products produced from waste

[42] The 'good practice' scenario assumes that new, or amended, environmental taxes are introduced, set against a notional concept of 'good practice' for each tax. The 'politically feasible' scenario takes into account the environmental taxes that can be reasonably introduced, or rates increased, taking into account the feasibility, politically.

plastics are within the product list for a 50% VAT reduction. The caishui [2011] No. 115 government notice, however, has been revoked and replaced by the "Catalogue of Products and Services related to Recycling Businesses Qualified for Value-Added Tax (VAT) Preferential Treatment" caishui [2015] No. 78, released in 2015. The objective of the more recent notice is to promote energy savings and emissions reductions (EY, 2015). Essentially it provides an update to the list of products that qualify for VAT preferential treatment and the rules as to the companies that can participate.

In China, reduced VAT rates have been coupled with tax penalties. In 2012, China increased taxes on primary raw materials with the objective of conserving domestic mineral resources as well as the environment. These resources comprise six minerals: tin ore, iron ore, molybdenum, magnesium, talc and boron. The tax on iron ore increased from 60% to 80% of the iron ore base rate and similar increases were seen in relation to the other materials (KPMG, 2013). It is intended that combining increases in VAT rates for primary raw materials with decreasing rates for secondary raw materials will accelerate the circular economy.

Although tax approaches related to material resource efficiency are generally penalty-led in the EU, more recently there are examples at the national level that move beyond this approach. Specifically, in Belgium companies are entitled to a 3% tax reduction when acquiring tangible or intangible fixed assets that support packaging recycling (KPMG, 2013). Similarly, in Poland, loans and grants are offered for activities including construction of new recovery and recycling facilities, while in Ireland a reduced VAT rate is applicable for services provided by recycling companies such as waste collection (KPMG, 2017). In 2016, Sweden announced[43] that it will introduce tax incentives to scale down resource use by reducing VAT on repairs to bicycles, clothes and shoes from 25% to 12%, as well as reduced tax for the repair and maintenance of white goods (Government Offices of Sweden, 2016).

At the EU level, VAT is governed by Directive 2006/112/EC on the common system of value added tax. This directive sets out a framework outlining the rules member states have to set for VAT rates. A minimum VAT rate for all taxable goods and services is set at 15%, while member states have the freedom to have two reduced rates, set at 5% or more, confined to certain goods and services listed in Annex III and Annex IV of the VAT Directive. Only a limited number of goods and services listed in these annexes can be considered to be 'circular'; one example is the repair of certain goods. As a result, it can be argued that the directive provides limited flexibility for reducing VAT for circular goods and services. Nevertheless, in 2016 the European Commission (2016f) published an Action Plan on VAT recognising that although the common VAT system is a core element of Europe's single market, it does not take into account technological and economic developments and needs to be modernised.

Following an open consultation on different options for reforming the VAT system,[44] in January 2018 the Commission published a legislative proposal to update the VAT Directive. The proposal foresees that member states would be provided with more options for applying reduced VAT rates.[45] In addition, contrary to the current rules based on a limited list of goods and services to which reduced rates can be applied, the new rules[46] would allow the application of reduced VAT rates to any goods and services apart from a 'negative' list (Annex IIIa of the proposal) to which the minimum 15% rate would always be applied (European Commission, 2018d, 2018e). Thus, if

[43] The proposals are available at (in Swedish): https://tinyurl.com/yc3xg5ns and https://tinyurl.com/ycqytd8u.

[44] About 49% of the all respondents believe that the list of goods and services within Annex III of the VAT Directive should include more products and services, including ecolabel products, 30% find the list adequate and the remaining did not provide an answer (European Commission, 2017k).

[45] Specifically, member states would be able to apply i) two reduced rates of a minimum of 5%, ii) one reduced rate between 0 and 5%, and iii) one exemption from VAT (0% rate) (European Commission, 2018d).

[46] The entry into force of these new harmonised rules is intended to coincide with the entry into force of the definitive VAT system in 2022 (for more info, see https://tinyurl.com/y88tysjq).

these proposals are adopted by the Council, they would provide governments with more flexibility for applying reduced VAT rates for circular goods and services.

The above policy updates and examples at the global level highlight that there is a need in the EU for a change in the current framework, which is dominated by penalty-led policy approaches. Tax incentives, enabled by an effective EU framework in place, could coexist with tax penalties and provide a market pull for circular products and services.

5.4 Public procurement

5.4.1 A demand-side instrument for more environmentally friendly products and services

In most countries around the globe the public sector represents the largest consumer in the economy. OECD countries spend on average about 12% of their GDP on public procurement (OECD, 2017). At the EU level, it is estimated that public procurement annually accounts for about 14% of EU GDP in expenditure (European Commission, 2017l). Accounting for a significant part of overall demand for goods and services, public procurement could therefore be utilised as a major demand-side policy instrument for the creation of markets for more environmentally friendly products and services (Georghiou et al., 2014; Testa et al., 2012). Promoting more sustainable and green public procurement (GPP) across the EU is among the key priorities of the public procurement strategy published by the European Commission (2017l) in October 2017.

Within the EU, GPP has been introduced on a voluntary basis and seeks to support the procurement of goods, services and works with a reduced environmental impact throughout their life cycle (European Commission, 2008). Aiming to minimise any distortions of the single market, the European Commission has developed a set of GPP criteria[47] for a number of product and service groups.[48] These criteria have two ambitious levels ('core'/'comprehensive')[49] and can be included by countries in the National Action Plans (NAPs) on GPP. The development of NAPs is part of the voluntary approach to GPP and aims to encourage countries to define GPP targets and measures to achieve them (European Commission, 2003). Additionally, a voluntary political target of introducing by 2010 common core GPP criteria in 50% of all tendering procedures was set (European Commission, 2008).

According to a study by Renda et al. (2012), although there has been progress in the uptake of GPP across the EU, the above voluntary EU target has not been met because there are large variations across countries. The study also concluded that only a few core GPP criteria are frequently used, while many authorities face difficulties in including such criteria in the procurement process. Among the most cited barriers to the further uptake of GPP are lack of environmental knowledge, lack of managerial and political support, lack of training and a perception that 'green' products are more expensive (Bouwer et al., 2006; Testa et al., 2012).

Although GPP in the EU is generally voluntary, there are examples of policies that feature mandatory requirements. One example is Regulation (EC) 106/2008 on the Energy Star energy-

[47] It is to be noted that a study for the European Parliament concluded that a large share of existing GPP criteria have links with the circular economy (Neubauer et al., 2017).

[48] As of January 2018, 22 product and service groups were covered by EU GPP criteria; more info is available at: https://tinyurl.com/7dvdssq.

[49] According to the European Commission (2008), the core criteria prioritise the easy application of GPP, focusing on the key area(s) of environmental performance of a product and aimed at minimising the companies' administrative costs, while the comprehensive GPP criteria go further and provide authorities the opportunity to consider additional aspects.

efficiency label,[50] which obliges EU institutions and central government authorities in member states to purchase office equipment that as a minimum meets the energy efficiency requirements of the label. In a similar vein, Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles, also known as the Clean Vehicles Directive, requires public authorities to take into account the energy and environmental impacts associated with the whole lifetime of vehicles when making their purchasing decisions.

There are also examples of EU member states that have moved beyond the voluntary approach towards GPP. A prominent example is Italy, which in December 2015 adopted Law No. 221/2015[51] on environmental provisions to promote measures for the green economy and to contain the excessive use of natural resources. The law requires public entities in Italy to include minimum environmental criteria in public procurement. The application of minimum environmental criteria is mandatory for energy-related supplies (for instance, LED for public lighting and electronic and electrical office equipment), while for other services and types of supplies specified (for example, urban waste management, office paper and catering) the criteria should apply for at least 50% of the value of the tender (*Gazzetta Ufficiale della Repubblica Italiana*, 2015). Additionally, in France, according to Law No. 2015–992 by 2020 at least 40% of paper products, fibre-based stationery and printed materials acquired by the state services and by local authorities and their groups should be made from recycled paper.[52] The law also provides requirements for the procurement of road construction and maintenance (*Journal officiel de la République française*, 2015).

Outside Europe, Asia features several examples of governments that have put forward ambitious policies for green and sustainable procurement (UNEP, 2017). Box 9 is devoted to Japan, which is an example of a country with strong government support for green public procurement.

Box 9. Green public procurement in Japan

Under the 2001 Act on Promoting Green Purchasing, GPP in Japan is mandatory for government ministries and agencies, and voluntary for local governments. Among the key objectives of making GPP mandatory for government agencies was the development of economies of scale for eco-friendly products in order for their prices to decrease. The Act is complemented by the Basic Policy on Green Purchasing, which includes a list of designated procurement goods and their standards. As of 3 February 2015, the list has 21 product categories featuring 270 designated products and services, including smartphones, home appliances, lighting and metal blinds. The Basic Policy foresees that the contract award decision should be based on both the environmental performance of products and the lowest price. It is thus foreseen that for some product categories the award criteria can incorporate additional aspects such as life-cycle costing, energy-saving and long-term uses of products, while the use of ecolabel criteria in the procurement process is also encouraged (UNEP, 2017).

Although there is no overall quantitative target on GPP, ministries are obliged to develop a green procurement policy or plan (including self-defined procurement targets) as well as publish annually a summary of their green procurement track records. Additionally, a 'Green Purchasing Network' has been established in order to promote GPP, provide training for procurement staff and contribute to raising awareness. The network has 2,400 member organisations from business, local

[50] Energy Star is a voluntary labelling programme originally developed by the US Environment Protection Agency (US EPA) and implemented in the US, Canada, Australia, New Zealand, Japan and Taiwan (US EPA, 2003). Recognising the importance of energy consumption of office equipment and the global nature of the ICT market, the US and the EU signed in 2000 an agreement to jointly manage this programme and mutually recognise the products registered in the EU and the US (European Commission, 2011b). For updates see https://www.eu-energystar.org/.

[51] The law is also known as "GU Serie Generale n.13 del 18-1-2016" and is available at: https://tinyurl.com/kekd3y8.

[52] According to the law, these products should contain at least 50% recycled fibres.

governments and NGOs. Between 2001 and 2012 there was an increase in the market share of all designated products. Moreover, in 2014 around 70% of all local governments had made commitments to implement GPP in addition to all government ministries and agencies (UNEP, 2016). Regarding the environmental results, it is estimated that GPP has resulted in a CO_2 emissions reduction of 412,390t which is equivalent to the annual CO_2 emissions from 239,000 homes (UNEP, 2017).

5.4.2 Circular economy requirements

At the EU level, the European Commission (2015a) has made commitments to take action on green public procurement and emphasise circular economy aspects in new or revised criteria. In this context, the revised GPP criteria for furniture include aspects linked to the circular economy, such as refurbishment, reuse and durability (European Commission, 2017m). A number of governments across Europe have also adopted strategies and programmes for a circular economy; such strategies often encourage the integration of circular economy and resource efficiency requirements in the procurement process. For example, in its circular economy programme the Dutch government has put forward the ambition of achieving by 2020 a share of 10% of circular procurement[53] within public procurement (Dutch Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2016). Furthermore, a study for the European Parliament indicates that some member states[54] plan to revise their NAPs on GPP and are considering integrating circular economy elements into the revised plans.[55] (Neubauer et al., 2017).

While such initiatives hold potential to encourage market penetration of circular products and services, there are some challenges that need to be addressed by policy-makers. A particular challenge stems from the relation between circular procurement and transparency. Products often come from global supply chains involving multiple transactions and companies (Vanner et al., 2014). This adds complexity to the task of public procurement officials who are often interested in obtaining information about the origins and composition of the products that they acquire. Such information is needed by officials who would potentially like to retain the value of products over multiple use cycles and is not necessarily provided by the certificates used to verify that the criteria of the tender are met.

The influence of the purchase price in the contract award decision represents an additional key issue. Under Directive 2014/24/EU on public procurement, contracts must be awarded to the most economically advantageous tenders on the basis of a price or a cost-effectiveness approach such as life-cycle costing (LCC)[56] and may include the best price–quality ratio. A number of LCC tools and methodologies have been created by national authorities. For instance, the Swedish National Agency for Public Procurement has developed LCC tools for different product groups[57] (e.g. indoor and outdoor lighting, household appliances) in addition to a general one. At the EU

[53] Circular procurement can be described as "the process by which public authorities purchase works, goods or services that seek to contribute to closed energy and material loops within supply chains, whilst minimising, and in the best case avoiding, negative environmental impacts and waste creation across their whole life-cycle" (European Commission, 2017n, p. 5).

[54] Namely, Croatia, France, Italy, Malta and Slovakia (Neubauer et al., 2017).

[55] However, it should be noted that according to Neubauer et al. (2017), Belgium, Bulgaria, Denmark, Finland, Germany, Lithuania, the Netherlands and Portugal have no plans to revise their NAPs.

[56] According to Directive 2014/24/EU, "life-cycle costing shall to the extent relevant cover parts or all of the following costs over the life cycle of a product, service or works: a) costs, borne by the contracting authority or other users and costs imputed to environmental externalities linked to the product, service or works during its life cycle, provided their monetary value can be determined and verified".

[57] The tools are available at: https://tinyurl.com/ybq5sa5z.

level, the Clean Fleets EU-funded project has also developed a LCC procurement tool[58] that compares the life-cycle costs of different vehicles.

Still, various studies have indicated that in the procurement process the purchase price is usually a more influential factor than the costs occurring during the lifetime of the product or service (see, for example, Renda et al., 2012; Perera et al., 2009). According to an assessment by the Danish Ministry of the Environment (2013), businesses in Denmark often face challenges when proposing circular solutions requiring high levels of initial investment, since authorities usually focus on the purchasing price or the budget of a single year. Thus, circular solutions that provide large benefits over the life cycle of products or services may have a competitive disadvantage during the procurement award process. This suggests that more guidance and policy support is needed for the use of tools that help assess and take into account the costs over the life cycle of a product or service.

5.5 EU financial instruments

In addition to its legislative role, the EU can also accelerate the transition through its direct involvement in the financing of circular undertakings. The European Commission itself has by now several financing programmes that can be used to support investment in circular economy projects. Some are under shared management with managing authorities in EU regions and member states, i.e. the European Structural and Investment (ESI) Funds, which basically consist of the agricultural, regional, urban and cohesion policies of the Union. Some are centralised and managed directly in Brussels, for instance Horizon 2020 for innovation policy, COSME for the competitiveness of SMEs, and LIFE, the funding instrument for the environment and climate action. Others are run in partnership with the EIB, as is the case for InnovFin and the European Fund for Strategic Investments (EFSI). However, while there is significant funding potentially available via EU funds, it is not directly earmarked for circular economy targets and does not appear to be sufficiently taken up.

With no specific earmarking, it is rather cumbersome to determine exactly how much the EU contributes to financing the circular economy in the Multiannual Financial Framework 2014–20. Nonetheless, it is instructive to have a panoramic view over all the financial tools that might be employed to provide funds useful to the circular transition. Box AI.1 in Appendix I presents an account of different EU programmes that can support circular initiatives financially.

Financial support from the EU comes in different forms: there are grants for either projects or research, as well as various financial instruments – such as guarantees, loans, equity and debt financing – that leverage public (national) and private sector investment. The picture depicts a situation in which a wide set of financial programmes, instruments and products are available at the EU level. Up to a certain extent, that shows the commitment of EU institutions to design new products that respond to the needs of the market, but it remains to be seen how different programmes can work together and whether they offer a coherent setting to accelerate circular economy investment, leverage private funds and ensure the long-term sustainability of projects.

An array of EU facilities and financial instruments absorb risk in different manners; a contingent loan that offers repayments linked to milestones is for instance quite well suited to support circular economy-related risk. However, there is need to deploy a full range of financial tools to address specific industry needs pertaining to the circular economy project in its different stages of development.

As discussed in chapter 4, section 4.4, SMEs face particularly high barriers to access the finance needed to redesign their supply chains. European institutions are mindful of this and have made available substantial financing via the ESI Funds (thematic objective 3), COSME and InnovFin, the European Investment Fund and the EFSI SME window. All in all, the EU framework

[58] For more details about the tool, see http://www.clean-fleets.eu.

to support SMEs appears rather fragmented and the logic of the circular economy is insufficiently pursued.

The low carbon objective has found its way into the EU financial architecture and is properly steered both in the context of the ESI Funds, thanks to a dedicated thematic objective, and within the EFSI, as a key component of the Infrastructure and Innovation Window Scoreboard, which assists the market-based allocation decision. That is not the case for resource efficiency and the circular economy, which are not considered eligibility criteria for accessing EU finance.

Recent initiatives by the Commission move in the direction of addressing such shortcomings and help steer circular logics through the EU financial arm. In particular, the creation of a Circular Economy Finance Support Platform (CEFSP) is expected to improve the synergies and complementarities between existing instruments and institutions, as national promotional banks will also participate. The CEFSP has three pillars: i) knowledge coordination and dissemination (to identify market opportunities, share best practices and awareness raising); ii) advisory services (through potentiating and better coordinating technical assistance for circular economy projects), and iii) ad hoc financial support (which consists primarily of a more integrated functioning of current programmes but may lead to the development of dedicated financial products or a fund for the circular transition). As a concrete action in the context of the above third pillar, the EU institutions intend to develop a thematic investment platform[59] to mobilise private and public resources for circular bioeconomy-related projects.

As stressed by the EU High-Level Expert Group on Sustainable Finance (2018, p. 10), "Europe has now the unique opportunity to build the world's most sustainable financial system", if it succeeds in reconnecting finance and investment with the real economy. The post-2020 Multiannual Financial Framework by the European Commission could be the occasion to relaunch the ambitions towards accelerating the transition by means of the EU budget. There is indeed ample room for better rationalisation of EU financial support for the circular economy and specific measures could be taken to better steer the circular economy within the regional, cohesion and agricultural policies and the EFSI. The easier and faster way to promote the circular paradigm by means of EU financing would be to stop financing non-circular industrial projects and infrastructure, but politically it does not emerge as a viable option.

In theory, all EU financing programmes supporting innovation and SMEs are apt to address the needs of circular business models, however, the notion of *innovation* changes from programme to programme and it does not always fit with the innovation brought about by circular models. For instance, InnovFin originally provided support to technological innovation, whereas some of the emerging business models of the circular economy are rather based on organisational innovation (EIB, 2015). The extension of eligibility criteria to include all types of innovation is therefore a great step in the direction of accommodating the financing of new, disruptive business models.

As mentioned in chapter 3, subsection 3.1.3 on investment, to seize the opportunity generated by the circular transition, it is not only necessary to increase the supply of investment, i.e. provide more funds. It is also essential to bolster confidence in the market and promote quality projects through a better offer of investment opportunities, i.e. more bankable and viable circular projects. The design of the EFSI, InnovFin and COSME, which make ample use of guarantees and are able to absorb the first and second loss pieces, is functional to inspiring confidence among institutional and private investors. The involvement of the EIB, with its status, rating and capacity does the rest, so that the multiplier/leverage effect of EU funding is able to meet the ambitious targets (x15 for the EFSI). Furthermore, EU institutions have well understood the relevance of advisory services and technical assistance, which are fragmented across different programmes (JASPERS, ELENA, InnovFin Advisory, EPEC, Fi-Compass). Yet, they are going to be better integrated and coordinated by the European Investment Advisory Hub (EIAH or Advisory Hub), which is being developed in the framework of the Juncker Investment Plan for Europe and will act as a single point of entry. The Advisory Hub has the potential to play a pivotal role in capacity

[59] The introduction of such an investment platform is recommended in EIB (2017a) and EIB (2015).

building for the circular transition in those areas where there is less expertise and to help the development of bankable projects. Still, the size of the Hub at the moment is rather limited for having an impact where institutional capacity is critically low (Rinaldi & Núñez Ferrer, 2017). The CEFSP initiative and expert group will hopefully help consolidate the mandate and expertise on the circular economy within the EU-run advisory services. An additional useful tool that the EIB is planning, in order to offer guidance to project promoters and managing authorities seeking sponsors for circular economy initiatives, consists of a comprehensive lending guide for financing in the circular economy.

Due to the cross-cutting nature of the circular economy, the impact that the EU can have on the transformation process also depends on interaction with the main internal policies. The EU is perhaps the political actor that is better placed to drive the interplay between the circular economy and the digital economy, through the support for i) the Digital Single Market, ii) the energy transition, in the context of the Energy Union and the Connecting Europe Facility, and iii) the smart cities, through networks of good practices and dedicated financing for urban development.

5.6 Corporate sustainability reporting

Corporate sustainability reporting has become mainstream over recent years. In the EU, environmental reporting is regulated by the EU Directive on the "disclosure of non-financial and diversity information" (Directive 2014/95/EU). This directive sets a minimum legal reporting requirement, inter alia, on environmental issues for around 6,000 large companies[60] listed on EU markets or operating in the banking and insurance sectors. Reporting is mandatory as of 2018 (for the financial year 2017). This will include information on the broader environmental impact of a company's operations as well as on specific issues such as the use of renewable or non-renewable energy, greenhouse gas emissions, water use and air pollution. In June 2017, the European Commission published non-binding guidelines on the methodology for reporting non-financial information (NFI),[61] which aim to increase the consistency and comparability of information disclosed by companies.

An example of circular economy-related requirements as part of the corporate sustainability reporting of large companies[62] is included in the French Code of Commercial Law. It was amended in 2015 and 2016 to include specific requirements for a circular economy chapter in corporate sustainability reports. This chapter needs to include information about a qualifying company's activities in the areas of waste prevention and sustainable resource use (see Table 3).

Table 3. Circular economy reporting requirements in France

Waste prevention and management	Measures regarding waste prevention, recycling, reuse and other forms of waste recovery
	Measures for combatting food waste
Sustainable use of natural resources	Water consumption, taking into account local water availability constraints
	Use of primary raw materials and measures taken to increase primary resource efficiency
	Energy consumption and measures taken to increase energy efficiency and the use of renewable energy sources

Source: *Journal officiel de la République française* (2017).

[60] Defined as companies with more than 500 employees.

[61] The guidelines are available at: https://tinyurl.com/y9g84yts.

[62] Defined as companies with more than 500 employees or a balance sheet total or net turnover of €100 million.

While the reporting requirements in France are quite detailed, there is currently no common framework or methodology to measure circular economy activities in companies. Thus, there is a need to identify operational indicators based on the inventory of available circular economy indicators and on an assessment of indicators already in use by companies in other areas (e.g. greenhouse gas emissions reporting). The aforementioned non-binding guidelines published by the European Commission contain examples of environmental key performance indicators for companies. This is a step in the right direction; however, in order to ensure comparability of indicators and methodologies across companies from different member states, a more detailed and technical approach will be required.

Previous proposals by the European Commission to measure the environmental impact of products and organisations include the Product Environmental Footprint (PEF) and the Organisation Environmental Footprint (OEF) (European Commission, 2013b). The PEF measures the environmental performance of a good or service over its whole life cycle, taking into account material and energy flows. The OEF is calculated based on aggregate data of resource and waste flows that enter or leave an organisation. Both indicators are meant to harmonise European environmental footprint studies.

In addition, existing economy-wide frameworks for measuring circular activities – such as the Commission's monitoring framework for the circular economy[63] or the Resource Efficiency Scoreboard[64] – may be useful to build on circular economy indicators for companies. For example, the Resource Efficiency Scoreboard includes a headline indicator called "resource productivity", which is expressed as the ratio between GDP and domestic material consumption.[65] It therefore measures how efficiently an economy uses material resources to produce wealth. For companies, a similar indicator could be constructed by putting the turnover (or a similar financial indicator) in relation to the company's raw material consumption.

There are various global reporting frameworks that can help companies to pilot a circular economy strategy, including the UN Global Compact, the OECD Guidelines for Multinational Enterprises, and the Global Reporting Initiative. Among the more than 8,000 companies that have signed up to the UN Global Compact, for example, some 60% have reported taking specific action on '3R' (reduce, reuse, recycle) while 29% have engaged in life-cycle assessment/costing (UN Global Compact, 2014).

[63] See http://ec.europa.eu/eurostat/web/circular-economy.

[64] See http://ec.europa.eu/eurostat/web/europe-2020-indicators/resource-efficient-europe.

[65] Domestic material consumption measures the total amount of materials (in tonnes) used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports minus all physical exports (Eurostat, 2018d).

6. THE WAY FORWARD

In recent years the circular economy has been gaining policy, business and academic interest worldwide as a concept that goes beyond an exclusive focus on waste management and seeks to achieve a transformation of production chains and consumption patterns. The EU took action through the publication of the Circular Economy Package in late 2015, with the aim of reframing waste policy, which traditionally focused on the end-of-life disposal and management of materials. The publication of the package together with the adoption of circular economy initiatives by a number of governments across Europe have created a momentum around the concept. However, this momentum is likely to be maintained in the upcoming years if policy support at the EU and national level continues and translates into well-designed and ambitious measures commensurate with the challenges of achieving a large-scale industrial transformation.

Businesses have a key role to play in driving this transition and some of them are ahead of the curve by having already started implementing circular solutions. Nevertheless, a large-scale development and adoption of circular economy business models requires a policy mix that removes existing barriers, provides a fertile ground for innovation and creates opportunities for businesses. Achieving coherence and consistency in this circular economy policy mix would be essential to avoid conflicts that would undermine the effectiveness of individual policy measures. This section presents the key messages and policy recommendations of this Task Force report on the role of business in the circular economy grouped by different thematic areas. The recommendations arise from the analysis presented in the previous chapters and the discussions in the Task Force meetings.

Key messages and recommendations

Strategy

The Circular Economy Package has started breaking down silos within the European Commission and marked an important step towards linking the circular economy with other agendas, such as those on jobs, growth and climate, rather than dealing with the circular economy as a separate topic. Although the package includes an interpretation of the circular economy (see chapter 2), the scope of the concept is very broad, which leaves room for interpretive flexibility regarding the related sectors and policy domains. In future strategic publications the European Commission should further elaborate on its interpretation of the concept and better develop the links with other policy domains. This would be the basis for setting a clear set of objectives, underpinned by a coherent set of policies that foster synergies and avoid conflicts. In the long term this could also support the adoption of targets to monitor progress.

At the member state level governments should renew their traditional waste strategies and policies and adopt a more systemic approach to resources management. Such approaches should overcome silos and harness synergies with other policies that may fall under the auspices of different ministries. An interesting example is the Government of Flanders, which transposed the EU Waste Framework Directive into a Materials Decree with the objective of preparing a legal framework for sustainable materials management. To support this more systemic approach the government also adopted a Materials Programme,[66] with important levers such as ecodesign, bioeconomy and sustainable chemistry, and plastics.

[66] For more details about the materials management policy in Flanders, see https://tinyurl.com/yd8e4h3s.

Recommendation (EU level). The European Commission should provide a well-defined vision for the circular economy concept and its various related policy domains and sectors. This would be the basis for setting clear objectives underpinned by a coherent mix of policies.

Recommendation (EU level). In future strategic publications the European Commission should ensure that policies related to the circular economy and other major policy domains, such as the bioeconomy and the Digital Single Market, are consistent.

Recommendation (national level). Governments should adopt a more systemic approach to resources management that goes beyond traditional waste policies and narrow end-of-life perspectives (one example would be the materials management policy in Flanders). Synergies with various policies that may fall under the auspices of different ministries should also be harnessed.

Ecodesign and the link with extended producer responsibility

Achieving the EU's circular economy aspirations will be very difficult without an ambitious and effective framework in place for ecodesign. To this end, in line with the commitments made in the EU Action Plan for the Circular Economy, the European Commission should continue and accelerate the process of setting circular economy design requirements for different product groups. Still, the introduction of such design requirements requires careful consideration of some parameters. First, any requirements (for the reparability, durability, upgradability and recyclability of products) would need to be verifiable by the member states' authorities. Second, they should be carefully designed and flexible enough in order not to hinder innovation. Any design requirements should furthermore be linked with the life-cycle impacts of products and not impose disproportional costs on the manufacturers. An option for the European Commission would be to encourage, as a first step, the formulation of industry-led voluntary agreements that would pave the way for the introduction of design requirements in EU law. Policy-makers can also set horizontal and/or per-product group information requirements (e.g. on reparability, durability and certain substances) that can prepare the ground for setting specific design requirements.

The European Commission should furthermore coordinate with member states to identify the non-energy-related product groups that should be prioritised for future circular economy design requirements, as has also been requested by the Council of the European Union.[67] Priority product groups should be identified on the basis of whether they carry potential for providing significant environmental benefits through circular economy design requirements and whether any such requirements would be verifiable by the market surveillance authorities.

The link between ecodesign and extender producer responsibility should be further developed. The EPR schemes in some countries (e.g. France) have already moved in this direction and have introduced differentiated producer responsibility fees (e.g. increased fees for putting on the market non-recyclable packaging and reduced fees for decreasing the weight of packaging or improving recyclability) to incentivise ecodesign. However, the criteria for the introduction of such differentiated fees under EPR should be carefully developed and harmonised across the EU. This would help avoid substantial inconsistencies in national approaches.

Recommendation (EU level). Continue and accelerate the process of setting circular economy design requirements for different product groups. Any such design requirements introduced in EU law should be verifiable, flexible and linked with the life-cycle impacts of products.

[67] See the conclusions of the Council of the European Union on the EU Action Plan for the Circular Economy: https://tinyurl.com/ycw96zx2.

Recommendation (EU level). Set horizontal and/or per-product group information requirements (e.g. on reparability, durability and certain substances) that can prepare the ground for setting specific, circular economy design requirements.

Recommendation (EU level). The European Commission should coordinate with member states to identify the non-energy-related product groups that should be prioritised for future circular economy design requirements.

Recommendation (EU level). Introduce harmonised criteria for applying differentiated environmental fees under EPR to encourage the ecodesign of products. Harmonisation would help avoid large discrepancies in national approaches.

Digitalisation and emerging technologies

In a digitally powered circular economy, IoT devices and systems developed by different manufacturers would need to work together in order to effectively generate data. Currently there are several bottlenecks in place that can undermine the potential of data-driven circular business practices, such as a lack of common software interfaces, connectivity protocols and standard data formats. Policy-makers can help remove these bottlenecks through encouraging the development of collaboration platforms[68] involving all industry actors across value chains as well as through support schemes and programmes. These initiatives can also help develop trust among different companies and actors in the value chain, which is essential to enable data sharing and the tracking of a product or product parts.

The growing availability of data, also in the context of new business models such as sharing models, about the actions of consumers and companies raises concerns related to data privacy and ownership. These concerns are also important for the business-to-business markets. Policy-makers would need to develop regulatory frameworks that address these concerns and provide trust and confidence in the markets.

Moreover, emerging disruptive technologies will need an enabling policy framework that provides safeguards for consumers and at the same time does not hinder innovation and helps businesses capitalise on the opportunities offered by these technologies. The development of such a framework would sometimes involve adaptation of some existing legislation to keep up with the emerging technologies or the introduction of new rules in order to address new challenges and issues. Two examples are the rules on product liability and intellectual property, which at some point may need to be adapted to provide clarity on cases where 3D printing technology is used by businesses or by anyone with access to a printer that can manufacture a product.

Recommendation (EU & national level). Support the development of a functioning digital ecosystem that effectively generates data for circular economy business models through i) incentivising the creation of cross-industry collaboration platforms, ii) developing business support schemes and programmes, and iii) introducing regulatory frameworks that address the issues of data privacy and ownership.

Recommendation (EU level). Provide clarity on emerging issues arising from new disruptive technologies (e.g. liability and intellectual property issues related to 3D printing technology). Any adaptation of existing legislation or the introduction of new rules should not hamper innovation.

[68] An example of a collaboration platform in this field is Digital Catapult in the UK: https://www.digitalcatapultcentre.org.uk/.

Regulatory challenges

Resolving a number of regulatory challenges can support the adoption of circular economy business practices. First, the EU should assess ways to facilitate the shipment of waste for recovery of resources, which is often time consuming and costly, while ensuring safety. An option would be to develop a procedure that allows fast shipment when it can be verified that the waste will be shipped to another member state for recovery of its resources in a pre-authorised facility. A condition is that the facility complies with certain standards to ensure safety.

Another issue concerns the remanufacturing and refurbishment of goods. The EU should explore ways to facilitate the trade and sale of remanufactured/refurbished goods with a global market. A condition is that these products have similar performance and meet the same safety standards compared with products on the EU market. The introduction of standards for remanufactured/refurbished goods could facilitate this process. Such standards would need to be agreed at the international level.

The EU should furthermore try to utilise trade agreements to facilitate the movement of remanufactured goods that can be safely reused. One example is the EU–Vietnam Free Trade Agreement,[69] which introduces the concept of remanufactured goods and opens the way for trade of remanufactured goods that have similar performance, working conditions and life expectancy compared with the original new goods.

The need for transparency about the presence of substances of concern in products and waste streams is an additional key issue that requires policy action. Policy-makers should carefully assess measures to improve transparency across the different life cycles of products while not creating a large administrative burden for businesses. Among the potential options identified in the Communication by the European Commission on the interface between chemical, product and waste legislation, published in January 2018, is the development of an EU information system to enable information flows along supply chains. The possible development of such a system would need to be done in close collaboration with all the related stakeholders.

Finally, there are wide differences in waste management performance across the EU. The lack of waste collection and processing infrastructure is among the chief barriers to improving the waste management performance of some countries. Based on a review of national waste management planning, member states should adopt a combination of measures following the waste hierarchy. Landfill bans for certain waste streams, which have already been introduced in some member states, and increased landfill taxes can help reduce the amount of waste ending up in landfills. Such instruments should be combined with other initiatives to ensure moving up multiple levels in the waste hierarchy, for example investments in waste collection infrastructure and development of networks of high-quality recycling and reuse activities.

Recommendation (EU level). Review the Waste Shipment Regulation and assess ways to facilitate the movement of waste for recovery of resources within the EU. An option would be to develop a fast procedure for shipping waste to pre-authorised facilities that comply with certain standards.

Recommendation (EU level). Assess ways to facilitate the trade and sale of remanufactured/refurbished goods in a global market. A condition is that these products have similar performance and meet the same safety and environmental standards compared with products on the EU market.

Recommendation (EU level). Introduce measures to improve transparency across the different life cycles of products while avoiding the creation of a large administrative burden for businesses. The possible development of an information system to enable information flows along supply chains would need to be done in close collaboration with all the related stakeholders.

[69] For more details, see chapter 2 of the agreement: https://tinyurl.com/jl24l6c.

Recommendation (EU level). Utilise trade agreements to facilitate the movement of remanufactured/refurbished goods that can be safely reused.

Recommendation (national level). Review the effectiveness of national waste management planning and adopt a suite of policies (e.g. increased landfill taxes, investment in waste collection systems, development of recycling and reuse networks) to move up multiple levels in the waste hierarchy.

Finance

The upcoming investment wave has the potential to accelerate the transition considerably, but the large financial needs of the circular transition require an adaptation of the financial sector. Internal resources, equity capital and crowd-funding can be crucial means to support circular initiatives, particularly at their early stage. This report has looked at the challenges encountered with the standard banking and financial sector and the role that EU programmes can play with direct financing as catalyser of private investment. We find it relevant to devise ways in which public institutions, commercial banks, institutional investors and national promotional banks can collaborate to exchange information that is useful for better measuring the risk associated with circular initiatives. The EU High-Level Expert Group on Sustainable Finance has recommended[70] taking serious steps towards more ample disclosure of all sustainability-related financial risks for both companies and financial institutions. The Commission's Action Plan on Financing Sustainable Growth[71] acknowledges the role of the public sector in mainstreaming sustainability into the risk management practices of the private sector. It is indeed positive to open up the possibility to revise the Capital Requirements Regulation and Directive and the disclosure and reporting requirements to facilitate sustainable investment. For the circular economy specifically, however, the intervention by the public sector could be even more relevant upstream. For instance, it could facilitate the collection of the data necessary to decrease the uncertainty associated with the business performance of circular models. Data could be shared to reduce the uncertainty about the performance of secondary markets and the residual values of products. The European Investment Bank is already involved in working on developing a new risk framework, and we suggest that such an exercise and exchange of information involve commercial and national promotional banks as much as possible

European institutions are also engaged in improving the framework for financing the circular economy. Important steps in the direction of better steering the circular paradigm in the numerous EU financial and technical assistance programmes are expected thanks to the creation of the Circular Economy Finance Support Platform and the upcoming Circular Bioeconomy Investment Platform. Nonetheless, in order to truly seize the opportunity that the circular economy offers in terms of competitiveness and sustainability for European economies, EU institutions must properly address the circular economy in the Multiannual Financial Framework as well as in the European Fund for Strategic Investments.

Recommendation (EU level). Set the circular economy as a horizontal objective for EU financing, in a way similar to low carbon goals. This means not having dedicated or earmarked funds but rather steering the circular paradigm in all financing programmes by, for instance, i) establishing a dedicated thematic objective within European Structural and Investment Funds, and ii) including resource efficiency as a key metric to award EU financing, e.g. in the EFSI Scoreboard.

Recommendation (EU & national level). Collaborate with national and regional promotional banks to swiftly establish the Circular Bioeconomy Investment Platform as a large coalition for the development of specific financing tools for circular-bio business models. Such a platform, on top

[70] For more details, see the Group's report: https://tinyurl.com/ybkdor6z.

[71] See "Action Plan: Financing Sustainable Growth", 8 March 2018 (https://tinyurl.com/y9mhpvpm).

of making available resources by the EIB and the EFSI, should act as a single point of entry for all circular-bio-related projects and guide the joint use of different EU financial resources.

Recommendation (EU, national level & private sector). The EIB and national promotional banks, perhaps in the framework of the same investment platform, could take the lead in establishing a database that facilitates the exchange of information about systemic cross-industry risk and residual values, and supports a better risk assessment of circular business models from the private sector too.

Corporate sustainability reporting

The EU Directive (2014/95/EU) on the "disclosure of non-financial and diversity information" provides a good basis for more relevant, transparent and harmonised environmental reporting of companies across the EU. Obligatory reporting of NFI needs to take circular economy indicators into account. The European Commission's non-binding guidelines on the methodology for reporting NFI, published in June 2017, contain some examples of potential environmental key performance indicators to be used. Still, to ensure the comparability of companies from different member states, common indicators and common methodologies should be proposed on a more detailed and technical level. There are plenty of options for choosing appropriate circular economy indicators for companies. Potential options include the Product Environmental Footprint and the Organisation Environmental Footprint as previously proposed by the European Commission. Further inspiration could come from existing economy-wide frameworks for measuring circular activities, e.g. in the form of a key performance indicator similar to the 'resource productivity' headline indicator of the Resource Efficiency Scoreboard.

NFI reporting rules are currently only binding for large companies. While the costs of implementation may outweigh the benefits for some SMEs, in particular medium-size companies above a certain threshold should still be encouraged to measure and publish data on circularity. For this purpose, the guidelines may need to be adapted to the needs and capacities of SMEs.

Recommendation (national level). Member states need to ensure comparability of company data across the EU by following the Commission's non-binding guidelines on NFI as closely as possible.

Recommendation (EU level). After a trial period and if a sufficient level of comparability of company data across member states cannot be reached, a revision of the non-binding guidelines should be envisaged in view of developing clear methodologies for common indicators to be used. Eventually a mandatory element of the guidelines may be introduced. A condition is that such a mandatory element would not pose a disproportionate administrative burden on SMEs.

Public procurement

Despite the progress achieved in introducing green requirements in public procurement across Europe, evidence shows that there is a large untapped potential. This indicates that further policy action is needed to utilise public procurement as a major demand pull for more environmentally friendly products and services. There are already some examples of countries that have introduced ambitious, mandatory green requirements in public procurement (e.g. Italy and France). The introduction of such requirements should take the characteristics and limited capacities of SMEs into account. Governments should also use more extensively the green public procurement criteria provided by the Commission.

The EU strategy on the circular economy as well as the strategies and programmes adopted by member states have created a tendency for including circular economy criteria in procurement procedures. In view of this momentum, the European Commission should encourage all member states to revise their National Action Plans for greening their public procurement and to integrate circular economy aspects into the revised plans. In this context, a guidance document on how the

circular economy can be integrated into the NAPs can assist member states and support a more consistent approach to circular procurement across the EU.

The use of life-cycle costing as a decision-making tool in public procurement should be further encouraged and guided. In this context, tools and methodologies for different product and service groups can promote wider uptake of LCC as well as a more consistent application of this tool across the EU. Additionally, targeted training programmes and initiatives[72] for procurement officers can support the use of LCC and more generally the integration of circular economy requirements into public procurement. Policy-makers at the EU and member state levels should also support transparency throughout the value chains regarding the origins and composition of products, which appears to be important for procurement officials.

Recommendation (national level). Governments should introduce ambitious green requirements in public procurement (some examples are the rules introduced in Italy and France) and also use more extensively the GPP criteria provided by the Commission. The introduction of green requirements should take the characteristics of SMEs into account.

Recommendation (EU level). Encourage all member states to revise their NAPs for greening their public procurement and to integrate circular economy aspects into the revised plans. An EU guidance document can assist member states in this process and support a consistent and structured integration of the circular economy into the NAPs.

Recommendation (EU level). Provide more guidance on the use of LCC in the procurement process. The development of tools and methodologies for different product and service groups can support a wider and more consistent application of LCC across the EU.

Recommendation (EU & national level). Promote circular procurement through i) targeted training programmes and initiatives, and ii) the introduction of measures that support transparency regarding the origins and composition of products throughout value chains.

New approaches to taxation

Although the prospect of reforming taxation systems and shifting taxation from labour to resources is increasingly visible in policy discussions, limited progress has been achieved within the EU. The EU should take further action and guide member states in a process of reassessing their national taxation policies and considering the option of shifting taxation from labour to resources. To mobilise member states, the EU could, for example, promote regular exchange of best practices and organise high-profile meetings to discuss the prospects for tax shifts. The preparation of a strategic policy document by the Commission dedicated to the topic of potential tax shifts from labour to resources and including specific actions could also contribute to further highlighting the importance and opportunities of this idea.

In this context, the merits and demerits of different options for a tax shift would need to be carefully assessed. Any potential tax shift by member states would also require careful planning and assessment of possible economic and distributional impacts. To this end, in the design phase such policies should consider measures to protect those most vulnerable to the change, e.g. low-income households. A widespread consultation reflecting good governance principles would need to be part of this process.

Although tax approaches to resource efficiency are generally penalty-led in the EU, a number of EU countries have introduced tax incentives for products and services that could be considered 'circular'. Member states should further explore possibilities for complementing tax penalties with tax incentives. Such incentives could take the form of tax reductions for companies and/or VAT reductions that encourage resource efficiency. With regard to the latter option, the current VAT

[72] An example is the Circular Procurement Academy developed by the Dutch Public Procurement Expertise Centre (for more details see https://tinyurl.com/m7adulo and https://tinyurl.com/yaqfeqos (in Dutch)).

system sets a minimum VAT rate (15%) and allows certain exemptions to the rules; however, recent policy updates indicate that in the coming years this system could become more flexible.

Recommendation (EU level). The EU should take further action and guide member states in a process of reassessing their taxation policies and considering tax shifts from labour to resources. The organisation of high-profile meetings and preparation of strategic policy documents dedicated to this topic are some examples of actions.

Recommendation (national level). The merits and demerits of different options for shifting taxation from labour to resources should be carefully assessed. The assessment should also consider the possible economic or distributional impacts.

Recommendation (national level). Member states should explore possibilities for introducing tax incentives for circular products and services that would coexist with tax penalties. While there is no one-size-fits-all approach, tax reductions for companies and/or VAT reductions under carefully assessed conditions would be two such examples.

LIST OF ABBREVIATIONS

B2B	Business to business
B2C	Business to consumer
CAD	Computer-aided design
CEFSP	Circular Economy Finance Support Platform
COSME	Competitiveness of Enterprises and Small and Medium-sized Enterprises
CRMs	Critical raw materials
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
EPR	Extended producer responsibility
ESI	European Structural and Investment (Funds)
GDP	Gross domestic product
GPP	Green public procurement
IoT	Internet of things
LED	Light-emitting diode
LCC	Life-cycle costing
NAP	National Action Plan
NFI	Non-financial information
NGOs	Non-governmental organisations
OEF	Organisation Environmental Footprint
PEF	Product Environmental Footprint
REACH	Registration, evaluation, authorisation and restriction of chemicals (Regulation)
RoHS	Restriction of hazardous substances (Regulation)
SDGs	Sustainable Development Goals
SMEs	Small and medium-sized enterprises
WEEE	Waste electrical and electronic equipment

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APPENDIX I: EU PROGRAMMES FOR FINANCING THE CIRCULAR ECONOMY

Box AI.1. EU programmes through which the circular economy transition can be financed

European Structural and Investment Funds (2014–20)

- Operational programmes designed by national and regional authorities
- €35 billion committed to environment and resource efficiency
- That includes €5.5 billion for waste management:
    - €2.1 billion for prevention and recycling
    - €2.8 billion for incineration and thermal treatment
    - €0.6 billion for hazardous waste management
- Additional funds may be channeled to the circular economy from the financial envelopes dedicated to the following:
    - the competitiveness of SMEs
    - low carbon economy
    - network infrastructure in transport and energy
- The large part of ESI Funds consists of EU grants with national co-financing but financial instruments are also available in some regions

Horizon 2020 (2014–20)

- €650 million for research and innovation under the Industry 2020 in the circular economy initiative
- In the Working Programme 2018–20, €941 million is allocated to the focus area on the circular economy under the headline of 'Connecting economic and environmental gains – the Circular Economy'

COSME (2014–20)

- €2.3 billion to support SMEs' access to finance and markets and to promote entrepreneurship
- Provides either:
    - financial instruments (guarantees, loans, equity capital) via the EIF
    - funds for specific actions, studies and campaigns via the EASME

LIFE (2014–20)

- €3.4 billion for protection of the environment and climate
- Two sub-programmes: Environment and Climate Action. Environment includes, among others, thematic priorities for water, waste and resource efficiency
- Resource efficiency includes activities for industrial symbiosis and knowledge transfer, and development of new models for the shift towards a circular and green economy

Connecting Europe Facility

- Centrally-managed fund to finance major infrastructure project in three key sectors:
  - €26.2 billion for transport (TEN-T), of which over €11 billion is available via ESI Funds
  - €5.8 billion for energy-related projects (low-carbon and climate change primarily)
  - €1.1 billion for digital infrastructure and digital infrastructure services
- Negligible contribution to financing the circular economy

InnovFin

- €24 billion in financial instruments for innovative SMEs, startups and midcaps, made available through Horizon 2020 and the EIB Group
- It provides senior and subordinated loans and guarantees, including mezzanine and quasi-equity financing to boost the growth of innovative midcaps
- It provides guarantees and counter-guarantees on debt-financing for innovative midcaps and SMEs

European Fund for Strategic Investment (2015–20)

- Flagship initiative of the Juncker Commission in partnership with the EIB to leverage private investment by means of an EU-backed guarantee: €33.5 billion to raise €500 billion by 2020
- Two windows, one dedicated to infrastructure & innovation (managed by the EIB) and one for SME financing (managed by the EIF)
- The circular economy per se is not targeted but environment & resource efficiency is defined as an eligible sector and made up 4% (€9.4 billion) of the mobilised investment as of 19.9.17
- Circular business models may also be eligible in transport infrastructure, R&D&I, ICT, and SME/mid-cap support

EIB Standard and Special Activities

- Approximately €2.4 billion in co-financing for circular projects over the last five years:
  - €680 million in lending for industry and service
  - €640 million for water management
  - €530 million for agriculture and the bio-economy
  - €360 million for waste management
  - €170 million for product-to-service
- Special activities run by the EIB in partnership with other institutions may also play a role:
  - Green Bonds (Climate Awareness Bonds), which raised over €15 billion in a decade to finance over 60 projects with a strong environmental impact
  - The 2020 European Fund for Energy, Climate Change and Infrastructure (Marguerite Fund) with €710 million committed

Notes: COSME = Competitiveness of Enterprises and Small and Medium-sized Enterprises; EASME = Executive Agency for SMEs; EIB = European Investment Bank; EIF = European Investment Fund; ESI = European Structural and Investment (Funds); SMEs = small and medium-sized enterprises; R&D&I = research & development & innovation; TEN-T = Trans-European Transport Network.

Sources: Own elaboration based on EIB (2017b), European Commission (2017o) and on European Commission, EIB and European Parliamentary Research Service websites.

APPENDIX II: MEMBERS OF THE CEPS TASK FORCE ON THE ROLE OF BUSINESS IN THE CIRCULAR ECONOMY AND INVITED GUESTS AND SPEAKERS

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The circular economy is attracting significant interest worldwide, as evidenced by the numerous government strategies, business commitments and partnerships devoted to its development. At the EU level, the Action Plan for the Circular Economy and several other policy documents have demonstrated a strong commitment to move towards a low-carbon and circular economy. While the calls for a new economic model grow louder, it is clear that the transformation of markets and industries on a large scale will not be an easy achievement. It will require well-designed and ambitious policies to foster the transition as well as new business models.

Against this background, CEPS brought together executives from major multinational companies as well as representatives of business associations, non-governmental organisations and research institutes to form a Task Force charged with tackling the immense challenges associated with the circular economy. This report is the outcome of their deliberations. It analyses the key obstacles that need to be addressed, explores numerous policy areas at the EU and national level where support can act as a catalyst for market transformation, and puts forward actionable policy recommendations.

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