Business Models in a Circular Economy

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Summary

A successful shift to a circular economy could help meet the Sustainable Development Goals, the Paris Climate Agreement targets, the ambitions of the European Green Deal and reach carbon neutrality in Europe by 2050. Achieving this shift to a circular economy in Europe depends on reducing resource use, adopting and upscaling the lengthening of the useful life of products, reuse and shared use of products, repair and remanufacturing, and the recycling of materials.

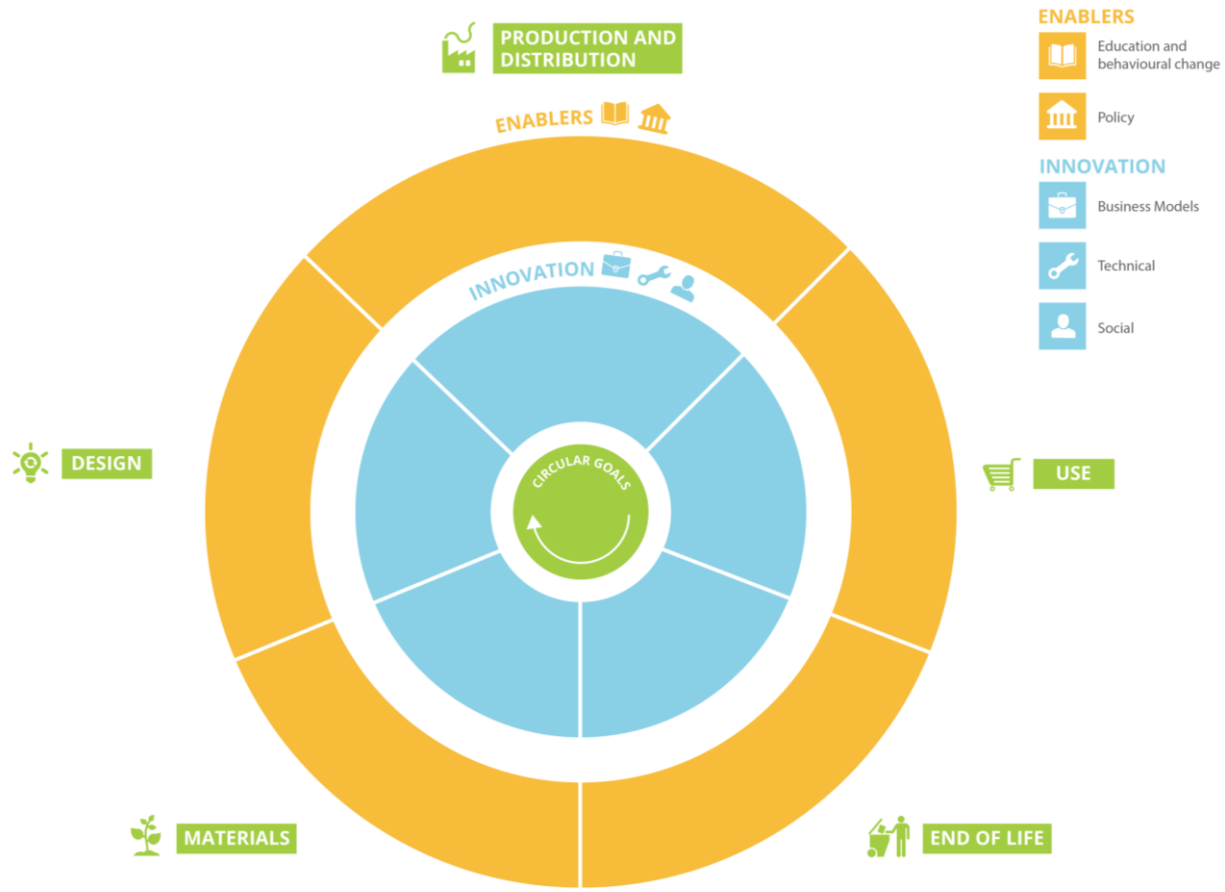
Developing appropriate circular business models is considered to be a key enabler in implementing these circular goals. The term circular business model has, however, become something of a buzzword, with many different interpretations being used by different actors in literature and the public debate. Furthermore, most analyses and discussions are focused on defining and conceptualising circular business models. Much less attention is being paid to the dynamics that are needed to transform current business practices into circular business models.

This Report provides an analytical perspective on the circular business model concept that allows the assessment of mechanisms by which business models can help the adoption of circularity in an economically feasible way. It presents an **analytical framework for circular business model innovation**, shows how it can **provide guidance on which business models are effective and feasible under what circumstances**, and **identifies appropriate action** different actors need to take to implement effective circular business models.

This analytical framework for business models in the circular economy (Figure 1) is built on the following key elements:

- circular strategies, such as lengthening the useful life of products, reuse, repair, remanufacturing, or recycling, are defined as the circular goals that need to be achieved through innovation and enabling action;
- business models are defined as a combination of value creation, value proposition and value capture strategies;
- business model innovation is framed as a means of implementing those circular goals;
- business model innovation is placed in the context of two other important dimensions: technical and social innovation
- the acknowledgement of appropriate policy, behavioural and educational action as important enablers for circular business model innovation.

Figure 1 Analytical framework for business models in a circular economy



Source: ETC/WMGE

Applying the framework to the different life cycle phases of products provides some **useful general insights into the role of business model innovation in relation to technical, social and system enablers**. In the raw materials phase, circular business models may seem challenging as the sector's main business models are driven by incentives contrary to the circular economy vision. The analysis, however, shows that it is possible for companies in the raw materials part of value chains to adopt circular goals. Reducing production waste, using recycled materials or even reducing the use of specific materials altogether can be integrated into a working business model, provided that the right boundaries are in place.

Product design is a key factor for the implementation of all circular goals, as the design of products determines their potential for reducing, reusing, remanufacturing or recycling materials. The implementation of circular design critically depends on technological solutions to put the principles into practice, on business model innovation to align business incentives with the costs and benefits of circular design practices, and on social innovation to align the intentions behind a product's design with the actual way it is used.

In the use phase, it is the behaviour of users that plays a key role in determining how products are managed during and at the end-of-use phase. Consequently, business model innovation and social innovation are key to increasing circularity in the use phase, for example by introducing access-based business models. To ensure that these effectively contribute to increased circularity, however, the degree of resource reduction and avoidance of rebound effects needs to be assessed, and consumers need to remain critical about their sustainability.

The end-of-life phase is crucial in enabling reuse and remanufacturing. Appropriate incentives are needed to ensure the efficient take back of products that can be reused, or from which parts can be salvaged. This can be enforced by policy measures, and companies can provide economic incentives as well, by offering discounts on new products, such as smartphones and laptops, when old ones are returned. Effective return logistics are a challenge, often requiring the cooperation of retailers, as well as ensuring that the handling of goods for reuse or remanufacturing during transport does not destroy their value.

This report also includes **a deeper dive into circular business model innovation in the textiles sector**. Overall, four main business model types can be observed in the textiles system, each supporting the shift towards a circular textiles system:

- longevity and durability: selling durable textile products, focused on delivering longer product lives, for example, by using sturdy, high quality materials and repairable designs.
- access-based models, based on renting and leasing (business-to-business/business-to-consumer) or sharing (mostly consumer-to-consumer): the textile products remain in the ownership of the company running the system, while the customer pays for having access to them.
- textile collection and resale: business models related to resale, focusing on extending the useful life of textiles beyond the first user;
- recycling and material reuse: this model focuses on closing the loop for textiles, by turning waste textiles into raw materials for new production chains.

Each of these four pathways tap into different societal opportunities but face different systemic challenges. Using the analytical framework on circular business model innovation developed in this report, specific opportunities and challenges related to business models, and social and technical innovation can be highlighted for each pathway. This creates a new perspective on the possibilities and limitations of business model innovation in driving the transition to a circular economy. It makes clear which action is needed to mainstream a certain type of circular business model. But equally important, it also shows that different pathways can be useful, depending on the technical, social and policy context.

1 Introduction

A successful shift to a circular economy could help meet the Sustainable Development Goals, the Paris Climate Agreement targets, the ambitions of the European Green Deal and reach carbon neutrality in Europe by 2050. Since the rise of the circular economy as a major policy topic in Europe (EC, 2015, 2020), interest in the potential of circular business models has increased strongly among policy makers, companies, entrepreneurs and other stakeholders. A successful transition to a circular economy depends on the adoption and upscaling of activities such as reduced resource use, the reuse or repair of products and the recycling materials. Across circular economy focused reports and briefings published by the European Environment Agency (EEA) (EEA, 2016, 2017, 2018a, 2019a), there has been recognition of the importance of business models to support the transition. Other reports have also touched on the role of sustainable or circular business models in specific sectors and systems (EEA, 2019b; ETC/WMGE, 2019; ETC/SCP and ETC/WMGE, 2014).

According to EEA, the circular economy can be defined "as one that is restorative, and one which aims to maintain the utility of products, components and materials and retain their value" (EEA, 2016). Many organisations, academics, companies and policy makers have recognised the circular economy as a huge business opportunity (EC, 2020; Ellen MacArthur Foundation, 2015, 2013, 2012; Accenture, 2014; WEF, 2014). According to this viewpoint, companies can generate considerable cost savings and additional revenues by adopting what are commonly referred to as "circular business models". Reports estimating the potential business opportunity in different sectors, as well as examples of successful pioneering companies, further drive the narrative that reaching a circular economy is mainly in the hands of business owners grasping the opportunities (Accenture and Fashion for Good, 2019; Ellen MacArthur Foundation, 2015, 2013). The implementation of the 2015 EU; Circular Economy Action Plan and the process leading to the development of the new 2020 Plan has initiated an EU-wide development of national circular economy strategies, public investment in research and innovation and partnerships across sectors and value chains (EC, 2019). There are still many barriers that need to be overcome to spur companies, consumers and public authorities to adopt a circular way of production and consumption if the transition is to be further accelerated in Europe (EEA, 2019b; Kirchherr et al., 2018; Ghisellini et al., 2016) as well as in the rest of the world (Circle Economy, 2019; de Wit et al., 2018).

The fact that the economy is far from circular shows that realising the assumed business opportunities is less straightforward than it would at first seem. While some studies tend to focus on technical barriers to circularity, the key barriers are not in fact technical, but rather social, cultural and market-related (Kirchherr et al., 2018). New business models are considered by many scholars and stakeholders as key enablers to facilitating the transition from a linear to a circular economy (Henry et al., 2020; Bocken et al., 2016; EC, 2019; Lewandowski, 2016; Ellen MacArthur Foundation, 2015). Thus far, however, the term circular business model has become something of a buzzword, with many different interpretations being used by different actors in literature and the public debate. Furthermore, most analyses and discussions are focused on defining and conceptualising circular business models. Much less attention is being paid to the dynamics necessary to transform current business models into circular ones, involving innovation of business models, technology or social practice, as well as enabling factors such as policy measures and education.

To better understand the power as well as the limitations of circular business models in the transition to a circular economy, this report aims to create a clearer view on the topic by focusing on the mechanisms behind circular business models and innovation. A deeper understanding of how to develop circular business models and how to support their effective implementation and scale-up is needed. Indeed, shifting to a circular way of producing and consuming requires fundamental changes in the way products and services are conceived; new types of relationships between producers, retailers, consumers and service providers; alternative notions of material and product value and associated revenue models.

This report provides an analytical perspective and guidance on the circular business model concept that allows the assessment of mechanisms by which business models can help implement circularity in an economically feasible way. Similarly, the role of social and technical innovation in supporting the adoption of business models that support circularity are discussed. Finally, the links with policy, education and behavioural change as key enablers are discussed as well.

Chapter 2 elaborates the analytical framework, which is then used in Chapter 3 to provide a general assessment of the dynamics of circular business models in the different product lifecycle phases. Chapter 4, offers an in-depth illustration of how the framework can be used to describe primary pathways towards circular business models in the production and consumption of textiles, and assesses which dynamics are needed to support the implementation and growth of such business models.

2 Circular business models: an analytical perspective

2.1 Circular business models – what's in a name?

When the Ellen Macarthur Foundation published its first report, it framed the circular economy as a business opportunity (Ellen MacArthur Foundation, 2012). Since then, business as well as research interest in the concept of circular business models have rapidly increased (Geissdoerfer et al., 2017). Follow-up reports from the Ellen MacArthur Foundation, as well as from other organisations, focused on encouraging companies to take action, often by presenting successful examples or projecting macro-scale business opportunities (ING Economics Department, 2016; Ellen MacArthur Foundation, 2015, 2013, 2012; Accenture, 2014; WEF, 2014) Academic research on circular business models grew rapidly as well, mainly focusing on defining concept of circular business models and their implications for sustainability implications (Kirchherr and van Santen, 2019).

Over the years, research has provided valuable insights into the potential of circular business models to contribute to sustainability in specific cases, systems or sectors. Alongside insights into the opportunities offered by circular business models, increasingly, more knowledge has also become available on various barriers and limitations to their implementation. As the research field grew, however, so did the variations in definitions and typologies to explain and discuss circular business models (Kirchherr et al., 2017). As a result, there is no clear definition or unique understanding of the concept, but rather a variety of definitions and understanding.

Many authors define circular business models, in contrast to traditional or linear business models, as a static concept. In this context, a circular business model can be defined as a one that acts within closed material loops (Mentink, 2014). A slightly broader definition describes a circular business model as one that combines the creation of economic value with the narrowing, slowing or closing of resource loops (Antikainen and Valkokari, 2016; Bocken et al., 2016; Lewandowski, 2016). By doing this, circular business models aim to preserve the embedded value and functionality of products, and the materials within them, at their highest possible level (Webster, 2015). Other authors approach the circular business model concept from an innovation perspective. In this line, the focus is on the dynamic process of redirecting business models into the direction of more sustainable or circular ways of working (Pieroni et al., 2019; Geissdoerfer et al., 2018; Linder and Williander, 2017).

However, as pointed out by Kirchherr and van Santen (2019), companies and policy makers need to know how to make a circular economy work in practice, regardless of its academic definitions. The priority of business owners and policy makers lies in understanding *what* they need to do to and *how* they can bring about a circular economy in a smooth way. Most conceptual frameworks dealing with circular business models are constructed with the goal of either linking sustainability science with business science (Pieroni et al., 2019), or classifying existing examples of successful circular business cases into different typologies (Henry et al., 2020). As a result, it is difficult to identify the right action and conditions for the creation of circular business cases where they do not exist today (Nußholz, 2017). This issue is illustrated by the following two examples of how circular business models are often presented.

1. Circular activities are often presented as business solutions
   By presenting circular activities such as circular product design, longer product lifetimes or recycled resource use as ways to make money, the impression is created that adopting these activities in current business practice is simple business logic. Such activities are, however, often not profitable today.

2. Specific business models are often presented as circular
   Another common misrepresentation of circular business models is labelling existing models as circular. A prominent example of this is the framing of product-service models as key circular business models. While this business strategy can definitely contribute to the realisation of circular

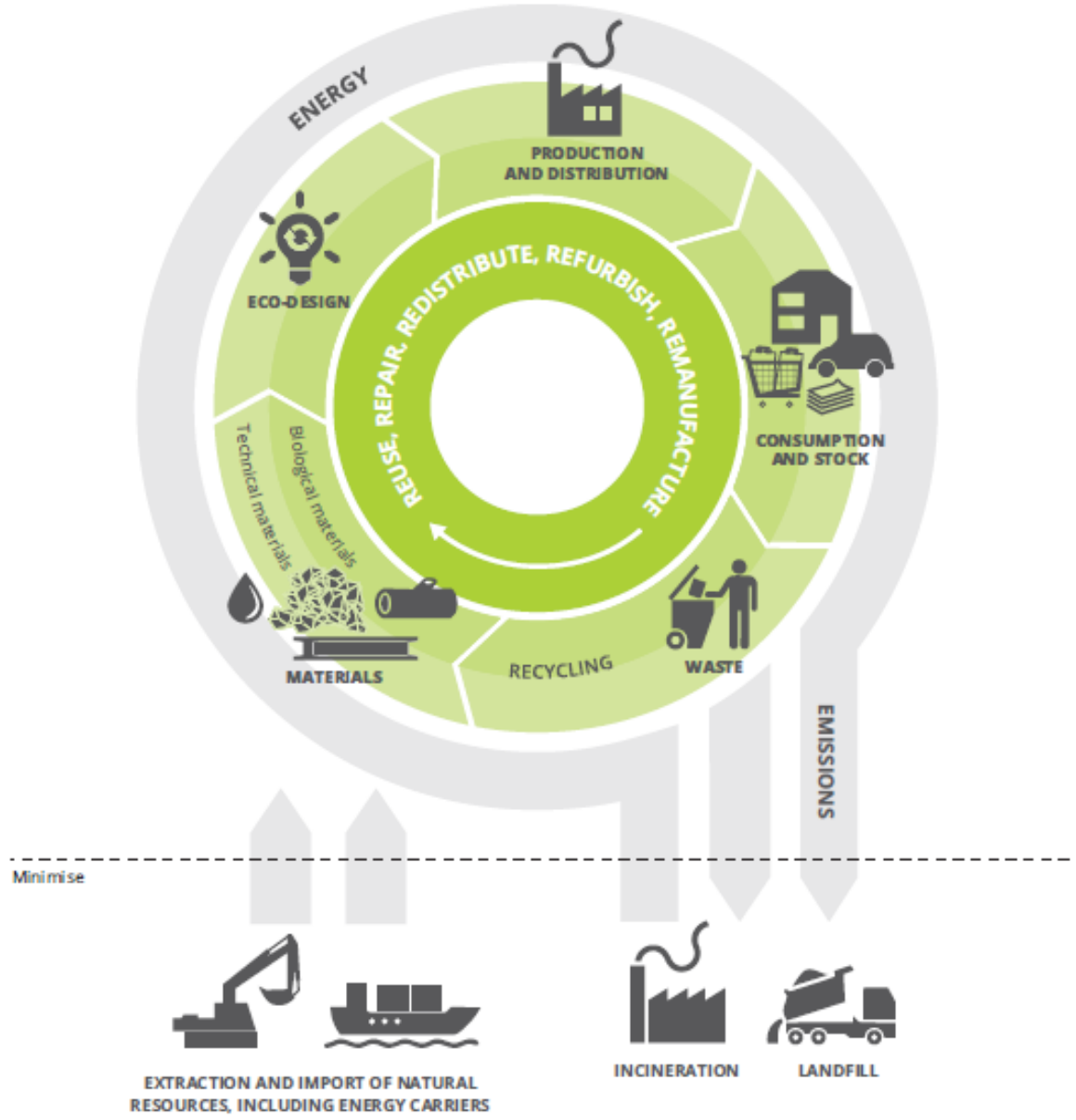
value chains in some cases, for example by enabling take back of products after use, having a product-service model alone does not guarantee circularity (EEA, 2017; Tukker, 2015). Vending machines in canteens, for example, are often provided through a service-contract: the supplier installs, maintains and sometimes even refills the machine for a fee. The drinks, however, are in single-use, disposable containers and the machine itself is neither necessarily refurbished nor recycled at its life end.

To stimulate the creation and upscaling of circular business models, explaining *what* such models are is not sufficient. Guidance on *which* circular business models are feasible and most effective and *how* they can be implemented is needed as well. In the following sections, an analytical perspective is presented with this goal in mind. It is based on a more explicit separation of the goals of a circular economy from the means of realising them in a business context. For a company, the main objective is to achieve circularity by bringing recycling, reusing, repairing, etc. into practice, while making profit. The business model is one of the means of achieving this goal and is the central focus of this report. But of course, a strong business model alone is not enough to make a company successful. In addition, suitable technologies are crucial to turn ideas into reality, as well as appropriate social practices to support the implementation. Finally, policies, education and behaviour need to create the right conditions to make it all work.

2.2 Business model as a means to realize circular goals

A circular economy has the objective of keeping the use of resources to fulfil society's needs within the limited resources available on a finite planet. According to the EEA, a circular economy can be defined "as one that is restorative, and one which aims to maintain the utility of products, components and materials and retain their value" (EEA, 2016). This vision is translated into a visual model of a circular economy, focusing on different phases in a product's lifecycle and the flow of materials and energy throughout it (Figure 2).

Figure 2 A simplified model of the circular economy for materials and energy



Source: EEA (2016)

In this model, the general vision of a circular economy is further explained as the implementation of activities such as eco-design, reuse, repair, redistribution, refurbishment, remanufacture or recycling. Furthermore, in scientific as well as grey literature on materials management, the different levels of waste management are typically expressed using R-words: reduce, reuse and recycle are the most common, while often a fourth, recover, is added to indicate the valorisation of heat from waste incineration (Brusseau, 2019). In the literature other hierarchical lists of R-words exist, with the number of Rs varying between three and ten, depending on the source (Henry et al., 2020). These Rs are considered in hierarchical order, with reduce being the most desirable option , and recover the least .

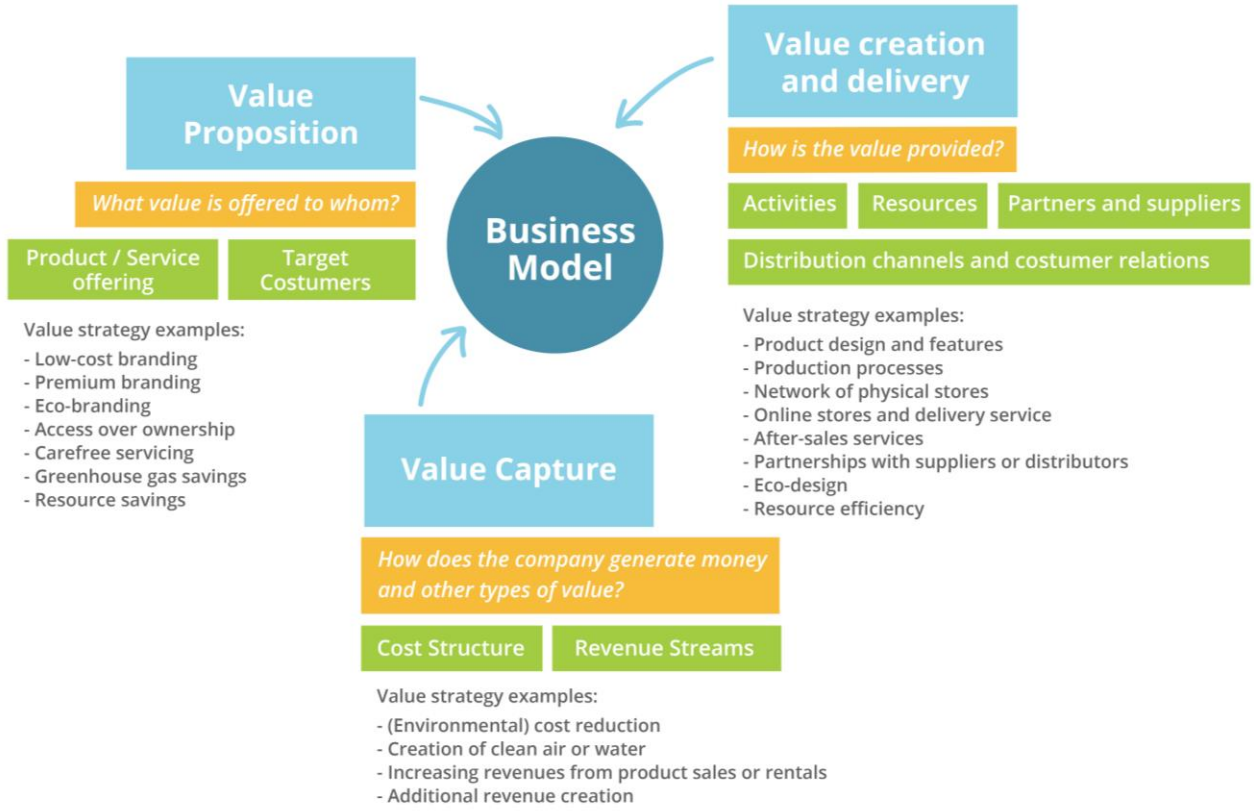
Whatever the terminology and framework used to describe a circular economy, it is important to understand that the different strategies mentioned – recycling, reuse, repair, shared use, etc. – actually represent targets or goals of a circular economy. This report uses the term circular goals as a general term to refer to such concepts as recycling, reuse, repair, circular design, etc. However, to realise these 'circular goals, however, different kinds of intervention are needed of which using appropriate business models is one.

A business model is a conceptual tool to describe the way business is done (Magretta, 2002). It outlines the rationale of how an organisation creates, delivers and captures value (Osterwalder et al., 2005). In the business-model literature (Bocken et al., 2014; Osterwalder and Pigneur, 2010; Richardson, 2008), a business model is often defined by three main elements that relate to value (Figure 3):

- the value proposition: the product or service offering and the target customer – what value is offered to whom;
- the value creation and delivery: the product or service's specific features and the distribution channels – how is the value provided; and
- the value capture: cost structure and revenue streams – how does the company generate value?

In the case of a take-away pizza shop, for example, the value of convenience food is offered, and the pizza is the specific way this value is created. The value is delivered by means of a take-away shop, and the value is captured by the price of the pizza exceeding the cost of making it.

Figure 3 A business model, consisting of value creation, value proposition and value capture strategies



Source: ETC/WMGE

There are many different ways for firms to propose, create and capture value. In this report, these different ways are called value strategies (Figure 3). Consequently, combining strategies across the three value dimensions of proposing, creating and capturing value will yield a large variety of business models, even for a single type of product or service. A book, for example, can be sold in a bookstore, through a web shop or through a subscription service. It can be offered in hardcover, paperback or even as a digital file. But that same book can also be borrowed from a library or offered on an open-access web platform. In all these cases, the resulting business model –b the combination of a value proposition, creation and capture strategy – is different.

While the literature on traditional business models strongly emphasises economic value capturing in terms of turnover and profit (Teece, 2010; Osterwalder et al., 2005), the literature on sustainable business models broadens the idea of value capturing to environmental and social value (Nußholz, 2017; Bocken et al., 2016, 2014; Bocken and Short, 2016). This extension is useful to explain sustainable business models

in a similar way to other business models. A reuse shop, for example, captures economic value by gathering revenues from selling second-hand goods, but it also generates environmental value by reducing the environmental footprint of consumption (Bocken et al., 2014). In this report, the term value refers to economic, environmental and social values.

However, if the goal is to identify how existing business models can be transformed into circular ones, such an extension to a static description is not sufficient to explain how business models can support or impede the implementation of circular goals. In this respect, it is more useful to examine how the introduction of a specific circular goal affects the value strategies of a company to propose, create, deliver and capture value. Implementing resource efficiency in the packaging sector, for example, is well aligned with the predominant current business models of companies in the sector. Decreasing the thickness of packaging is a relatively easy intervention in the production process (value creation), leads to cost reductions (value capture), and provides an improvement in the distribution of goods (value delivery). In this case, the implementation and upscaling of resource efficiency in the packaging sector does not require radical changes to the way business is done, although it can have some technical implications.

Conversely, redesigning consumer electronics for a longer product life, for example, is far less common in today's economy. By looking at the structure of business models in the electronics sector, why this is the case can be understood. The main value proposed to customers is the ability to have the newest, most advanced electronic tools. This value is created by adopting new technology as fast as possible in new products. Next, the value is captured by selling products at a price far higher than the cost of producing them, and convincing customers to replace their old devices with the newest model regularly. In that context, increasing the cost of production by introducing measures to increase the product's life are not rewarded. Even worse, this goes against the value capture logic, as consumers would be less tempted to buy a new model if their old one remains functional for longer. To achieve the circular goal of longer product lives in this sector, more radical changes are needed, which can be brought about by new business models, alongside social or technical innovation. Furthermore, policy, educational and behavioural changes are needed to enable such innovation to be accepted by society. Those aspects are discussed in the next sections.

2.3 Innovation as a means of achieving circular business models

As explained above, a circular business model is a means of implementing one or more circular goals in an economically feasible way. From the perspective of the three dimensions of value, this requires the inclusion of one or more circular goals – reuse, repair, recycling, etc. – in the business model. Where this is not compatible with the existing business model of a company, business model innovation by the company or a competitor is required.

Based on an extensive literature review, Geissdoerfer et al. (2018) developed an integrated definition of (sustainable) business model innovation that can be translated into a working definition of circular business model innovation: circular business model innovation is "*the conceptualisation and implementation of new circular business models. This can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another. The transformation can affect the entire business model or individual or a combination of its value proposition, value creation and deliver, and value capture elements, the interrelations between the elements, and the value network.*"

From this perspective, circular business model innovation does not necessarily require the development of a completely new business model. The introduction of a business model that is new to the firm or the sector in which it operates is also considered an innovation, even if it is considered fairly common in another firm or sector. Introducing a fashion library service, for example, is quite new to the clothing sector and thus innovative, while in the publishing sector, libraries existed for a very long time. Following the

logic of Geissdoerfer's typology of sustainable business model innovation (Geissdoerfer et al., 2018), four types of circular business model innovation can be distinguished:

(1) start-ups: a new organisation with a circular business model is created;
(2) business model transformation: the current business model is changed, resulting in a circular business model;
(3) business model diversification: without major changes in existing non-circular business models of an organisation, an additional circular business model is established; and
4) circular business model acquisition: an additional circular business model is identified, acquired and integrated into the organisation.

In practice, business model innovation is an iterative process, involving experimentation and piloting to obtain experience, and eventually scaling up (Bocken et al., 2018). Adapting or changing the business model of a firm, or developing a business model for a new enterprise, can be driven either by a need to address challenges – decreasing demand, increasing competition, etc. – or by the possibility taking advantage of new opportunities – changing customer preferences, new technology, new social practices, policy changes, etc.

As a consequence, circular business model innovation should *not* be considered independently from related technological and social innovation. The transition to a circular economy corresponds to a paradigm shift in these closely intertwined types of innovation which imply the adoption of an idea, behaviour, system, policy, programme, process, device, product or service that is new to the company and to the society (Mothe and Nguyen-Thi, 2010).

Accordingly, technological innovation can be defined as an iterative process initiated by the perception of a new market and/or service opportunity for a technology-based invention. This definition addresses two fundamental aspects:

(1) in order to be considered an innovation this new technology-based invention derived from processes and outcomes needs to be combined with market diffusion and adoption by end-users;
(2) technological innovation is an iterative process and thus it automatically includes both the first introduction of an innovation and the reintroduction of an improved one (Garcia and Calantone, 2002; Griffin and Page, 1993; Freeman, 1991).

Social innovation, notwithstanding its long-recognised importance for the transition to a circular economy, still presents some conceptual challenges. The practice of social innovation is hectic: the term has been deployed for several purposes and carries a variety of connotations (Howaldt and Kopp, 2012). Many attempts have been made to harmonize existing discourses and bridge conceptual gaps. In particular, recent definitions of social innovation move away from defining it as an end state or simply as a social strategy itself, but rather concentrate on its process (Howaldt, Domanski, et al., 2016; Howaldt and Kopp, 2012). Similarly, in this report, social innovation is defined as a process encompassing the emergence and adoption of new solutions and processes that meet a social goal(s), while simultaneously reconfiguring behaviour and thus leading to new or improved capabilities and relations as well as the better use of assets and resources (Pue et al., 2016). Social innovation also leads to the development of new social norms, which aim to cope better with needs and problems than existing strategies. Once diffused and adopted, these new norms, relations and behaviour lead to social change (Howaldt, Kopp, et al., 2016).

Against this background, and framed within circular economy discourse, the provided definitions of technological and social innovation can be translated into practice.

2.4 Supporting enablers

The transition to a circular economy requires not only increased business, technological and social innovation, but collaboration and strategies across society by governments, companies and citizens alike. These essential collaboration and strategies can be defined as circular economy enablers, facilitating and

shaping the transformation of businesses, organisations and individuals towards the circular economy. Understanding the meaning of the key circular economy enablers will help businesses as well as governments and consumers to see the scale of the opportunities, and challenges, involved and what wider issues to consider when taking first steps towards circularity. In this report, the focus is on policy, education and behavioural change as key enablers.

2.4.1 Policy

Effective circular economy policies can incentivise the adoption and diffusion of appropriate business model, technical and social innovation by providing the necessary stimuli to unlock their potential for the transition. Policies can support business model innovation by, for example, setting up reverse logistics ([1]); technical innovation, for instance, influencing product design or production process standards; and social innovation by, for example, kickstarting new collaboration and social initiatives to enhance cooperation in the value chain (WBCSD and Navigant, 2019).

Although the literature provides a vast array of policy definitions and classifications, in the context of this report, policy is broadly defined as actions adopted or proposed by legislative and executive bodies that help unlock and accelerate circular actions and accordingly, the following policy tools are considered:

- Legislative measures, regulations and information requirements
- Support to research and innovation
- Economic incentive mechanisms
- Voluntary tools & Guidelines

Established legislative measures, such as the EU Ecodesign Directive have already successfully regulated energy efficiency and some circularity features of energy-related products (European Commission, 2020b). Regulations restricting the use of hazardous substances in electrical and electronic equipment could improve coherence with relevant legislation, including the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation and the Ecodesign Directive (European Commission, 2020b). In 2018, the Single Use Plastics Directive set in motion a comprehensive set of initiatives to, for example ban the use of certain types of single use plastics, increase the uptake of recycled plastics and contribute to its more sustainable use; regulations for recycled content; or waste reduction measures for key products such as packaging (European Commission, 2020b).

At the same time, financial and non-financial incentives can help businesses to overcome initial upfront costs that typically deter transformational change and prevent circular products from reaching market maturity (WBCSD and Navigant, 2019; Vasileios et al., 2018). In the textile sector, for example, the EU aims to provide incentives and support to product-as-service models; circular materials and production processes; and increasing transparency through international cooperation; as well as by boosting the sorting, reuse and recycling of textiles by supporting research and innovation through, for example, Horizon 2020 projects, and by encouraging regulatory measures such as extended producer responsibility (European Commission, 2020b). Voluntary instruments such as the EU Ecolabel or the EU green public procurement criteria have reduced impact due to the limitations of voluntary approaches (European Commission, 2020b). Economic instruments, such as environmental taxation, have been also actively promoted by the European Commission to help ensure the extension of a product lifespans through reuse and repair. One of such instruments, is the use of value added tax (VAT), currently governed by the EU Directive on a common system of value added tax (Directive/112/EC). A number of EU Member States have already made efforts to reduce VAT on both second-hand goods and repair services, such as Ireland, Luxembourg, Malta, Netherlands, Poland, Slovenia or Sweden which have applied VAT reductions on minor repair services, including mending and alteration, of bicycles shoes and leather goods, amongst others. Similarly, other countries, such as Austria and Spain have introduced tax reductions as a means of

[1] Reverse logistics is a process of a cost-efficient method of planning, implementing and managing the flow of goods or material from the point of consumption to the point of origin for recycling or disposing of them properly. Sometimes goods obtained through the process of reverse logistics are remanufactured or refurbished to get them back in the market.

incentivising repairs. In Spain the Patronage Law, which provides companies and individuals who donate money from assets to charities with tax reductions, includes the donation of used goods, without differentiating them from new ones. Furthermore, the Waste Framework Directive requires EU Member States to organise regular stakeholder interactions on policy instruments to encourage reuse.

Clear policies, including specific targets and proper enforcement, can aid, prioritise and encourage strong action towards the transition to the circular economy. Identifying innovation needs and opportunities in favour of circular business models and connecting them with appropriate policy actions along the different lifecycle phases will increase the enabling power of policy for the implementation of circular business models.

2.4.2 Education and behavioural change

The need for tailored top-down and bottom-up policies to transition towards a circular economy is as important as the need to understand how the proposed innovative changes could fit in today's societies and what impact they could have on social norms. Nowadays, consumers hold a central position in socio-economic, political and ecological systems. However, the variety of personal context-based determinants, such as culture, age, gender, level of education, job and income, and the heterogeneity of individual characteristics – attitudes, values and beliefs, lead to diversified behaviour in practice, which influences and is influenced by the production and consumption systems of which we are all part (OECD, 2017; Van Weelden et al., 2016; Schotman and Ludden, 2014). As a result, market analysis pays more attention to fine segmentation of different customer types and many companies offer a broad range of products and solutions to accommodate different target audiences and environments.

Initially, data on consumer behaviour have been primarily used to protect consumers' decision making and choices in different areas (OECD, 2017) and attempts to understand consumer behaviour has typically fallen into two camps, one describing them as determined by context and infrastructure – including physical infrastructure, taxation and pricing policies, technological innovations etc., while the other holds consumer behaviour to be the result of psychological and social drivers. Neither of these approaches is sufficient in isolation: an holistic perspective approach is required to understand how various political, technical, social and economic drivers overlap and influence each other in creating today's consumer society (ETC/SCP and ETC/WMGE, 2014). Throughout the years, behavioural insights have been recognised and utilised as an important part of the development and implementation of a circular economy in all areas and at various levels. The choices made by millions of consumers can support or hamper the transition to a circular economy (European Commission, 2015), enabling the adoption and upscaling of those business models that implement various circular goals – reuse, refurbishment, recycling, etc. – increasing the likelihood of mainstreaming such goals (Van Weelden et al., 2016).

The broader diffusion and adoption within society of circular business models is crucial and call for the inclusion and consideration of behavioural change aspects along the whole lifecycle starting from the design of products/services, through the use, to waste phases (Piscicelli and Ludden, 2016). A great recycling or reuse business model will not be able to recirculate the materials or products unless users, in this case both consumers or companies, return or deposit them in the right way. Similarly, repairing products, purchasing something that has been pre-owned or remanufactured, or renting rather than purchasing items, are all value strategies that demand appropriate behaviour and choices if they are to be successful in the long term. In other words, when designing and implementing business models for a circular economy, it is paramount to consider behavioural change enablers to encourage key actors in the economy to behave in the desired way (Daae and Boks, 2014).

Having clarified the importance of consumer behavioural change in the transition to a circular economy perspective, the questions which may arise are:

- *to what extent, and how, behavioural change strategies and tools to enable a circular economy goals can be successfully developed and applied in the market;*

- *to what extent, and how, the various behavioural change dimensions that contribute to a transition towards a circular economy are already applied in the design or communication of products and services?*

These questions, consequently, bring also the issue of education as a key circular economy enabler to the forefront. In this report, the concept of education is framed within the notion of engagement. This is because as attitudes change, so can values and beliefs and consequently consuming and purchasing choices (Daae and Boks, 2014; Tromp et al., 2011). In order to effect behavioural change, consumers will have to adjust/alter those individual aspects which in turn can be influenced by an array of strategies and tools including simplified information through the creation/revision of food labels further supported by *ad-hoc* regulations; framing the language used to communicate (Thaler and Sunstein, 2008); and promoting, through for example economic incentives, the change of the default option making more circular products and services the default option from which to choose.

Accordingly, in this report the aspects of education and behavioural change enablers are treated as complementary and addressed together. It is not functional to the understanding of their influence and role to treat them separately. To effectively move towards a circular economy, it is critical to understand why people consume and what shapes their related behaviour. This context-specific understanding needs to be considered when addressing education and behavioural change strategies, and it can be derived from three linked factors:

(1) motivation: this refers to the immediate personal and social reasons and justifications that compel people to take certain action or make certain decisions;
(2) drivers: this refers to the circumstances that support motivation, normalising it or making it practicable – for example cultural norms or media marketing;
(3) determinants: these are factors that affect consumers actions, such as accessibility to certain services and price considerations (UNEP, 2016; Michie et al., 2011; Tromp et al., 2011).

In other words, consumers will change when they have to or can see a good reason to do so, feel the relevance of the change, have the capability and knowledge to adopt/move towards different behaviour and finally have the possibility, socially or physically, to change.

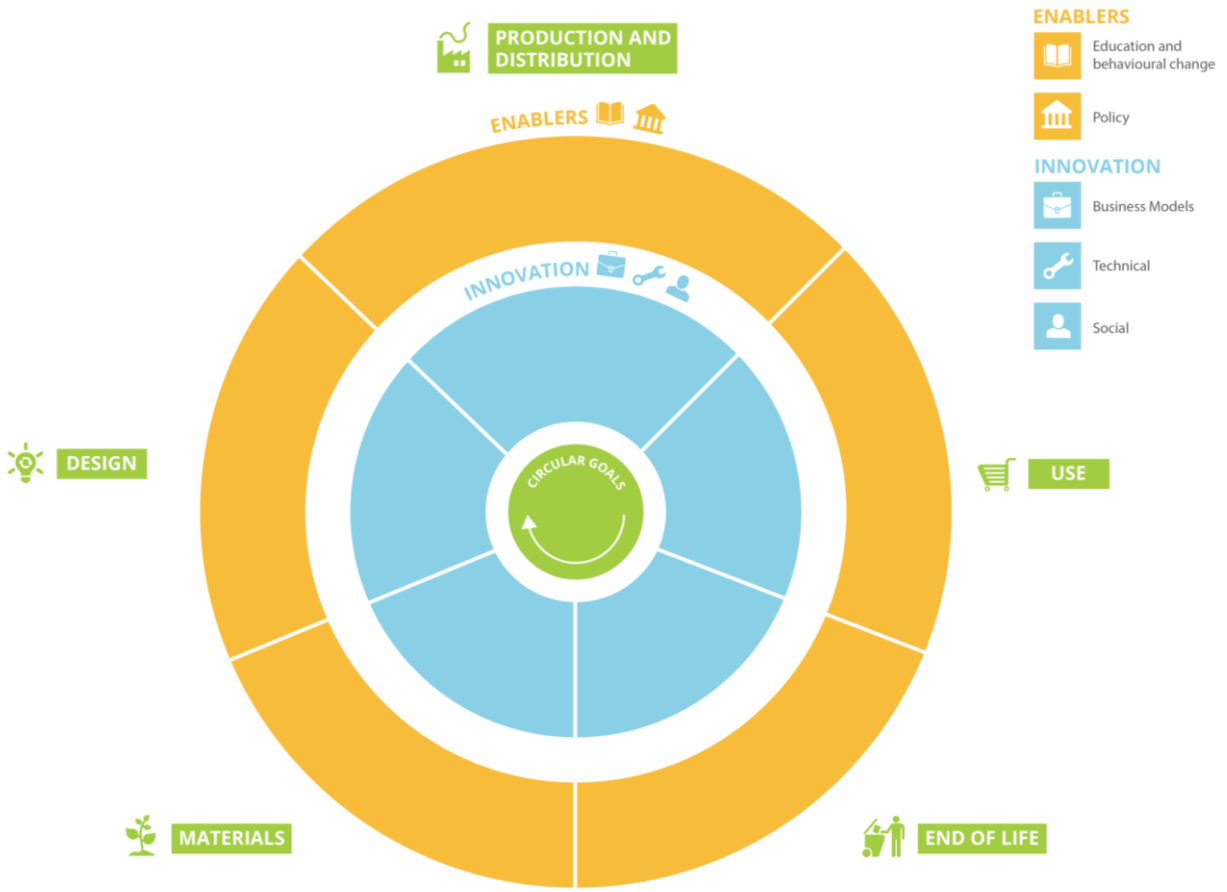
The issue of how the behaviour of an individual, and consequently society, can be changed to embrace the concept of a circular economy is a key element in successful circular business model development and implementation. Accordingly, Chapter 3 provides examples along the different lifecycle phases of possible educational and behavioural change strategies to influence attitudes and positively alter choices towards the adoption of circular business models**.**

2.5 Analytical framework for circular business model innovation

In Chapter 3, an analytical framework is developed for circular business model innovation that enables the identification of appropriate action different actors need to take for effective circular business model implementation, as well as the necessary interactions between. This has been done by:

- refocusing the business model as a means of implementing circular goals;
- putting business model innovation in the context of two other important innovation dimensions – technical and social;
- acknowledging the importance of appropriate policy, education and behavioural action to enable innovation.

Figure 4 Analytical framework for business models in a circular economy



Source: ETC/WMGE

Figure 4 is a visual representation of this analytical framework. It is built up according to the different lifecycle phases (shown in green outside the circles), with the circular goals that could be implemented in the different lifecycle phases depicted in the centre of the figure. The three types of innovation are shown as a layer (blue) around the circular goals, highlighting that specific types of business model, and technical and social innovation can be required to implement a given circular goal in a lifecycle phase. The enablers further supporting the implementation and uptake of the required innovation are added as a second layer (orange). In the next chapter, the analytical framework will be demonstrated by discussing, for each lifecycle phase, what kind of business model innovation is generally needed to implement the relevant circular goals, and how this relates to technical and social innovation, as well as to the supporting enablers. In Chapter 4, a similar but more in-depth analysis is provided for the textiles sector.

3 Business model innovation to enable circular strategies throughout the product lifecycle

In Chapter 2, a business model was defined as a combination of value creation, proposition and capture strategies (Figure 3). It was explained that start-ups and existing businesses need to change their business models to introduce circular goals, such as circular design, reuse, remanufacturing and recycling, implying they need to engage in business model innovation. It was also argued that, in order to be successful, business model innovation should go hand-in-hand with technical and social innovation, and should be supported by appropriate policy measures and education.

In this chapter, the visual model in Figure 4 is used to analyse how companies can pursue circular goals by implementing different value strategies into their business models. To structure this analysis, the phases of the product lifecycle, according to Figure 4, will be followed. For each lifecycle phase, the most relevant circular goals that can be addressed are identified and value strategies that could be instrumental in achieving such circular goals are assessed.

The different lifecycle phases can be defined as follows.

1. Materials: the sourcing of raw materials. This sourcing can be from virgin sources – mining/agriculture – or from secondary sources – recycling, recovery of biological materials.
2. Product design: because the choice and organisation of the different materials that go into a product are main determining factors for the ability to keep materials and products in the economy for as long as possible, the product design step is included as a separate phase.
3. Production and distribution: the production and distribution processes – transport, storage, retail – not only impact circularity but other environmental aspects such as. greenhouse gas emissions, and water pollution.
4. Use: this is the phase during which a product is consumed or used. This entails first use or reuse of products, and all action that is required to keep products in use – maintenance, repair, reselling for reuse, etc.
5. End-of-life: in this phase a product is no longer used as such, but is dismantled into components for remanufacturing, sent to recycling or energy recovery, or is disposed of by incineration or in landfill.

As the analysis will show, the relevance of the different circular goals is not the same for each lifecycle phase. The circular goal repair, for example, can be actively addressed during the design phase, by deliberately choosing designs that are repairable (design-for-repair), or, during the use phase, by selling spare parts or offering repair services. However, during the raw materials, production or end-of-life phases, product repair is not a directly achievable goal. Similarly, while recycling is a relevant goal in the raw materials and end-of-life phases, it does not come into play in the use phase.

It is also important to mention that different actors operate in each phase of a product's lifecycle. In the materials phase, typical actors are mining companies and material processing industries, while in the consumption and stock phase, the actors are consumers or companies buying and using finished products. It can be expected that these actors have different capabilities, as well as different motivations, to address particular circular goals. While an individual consumer has little influence on product design decisions, he or she can actively choose to engage in repair and reuse initiatives. Similarly, companies specialised in efficient, automated material recycling may face more barriers to adopting labour-intensive dismantling activities for parts reuse than repair-shops organised around social labour.

For each lifecycle phase and its actors, the business model innovations that can facilitate the implementation of a particular circular goal in the business model of company's active in this lifecycle phase is discussed. In the analysis, the following questions are addressed:

- which circular goals are most relevant to address in this lifecycle phase;

- to what extent can these circular goals be incorporated into the current predominant business models of companies operating in this phase;
- which circular goals are less compatible with existing business models, and thus require business model innovation;
- which examples illustrate the process of business model innovation in practice and demonstrate a successful implementation of circular goals in a business context;
- what opportunities and benefits can companies capture by introducing circular goals into their business model;
- what barriers can be expected that hamper the integration of circular goals in business models;
- what technical and social innovation is needed to support the required business model innovation;
- which policy measures and educational activities are needed to enable new business models to become successful and scale up?

The analysis presented below is not intended to be exhaustive. Rather, the aim is to illustrate how the analytical framework drafted in Chapter 2 can be used to gather useful insights on the role of business model innovation for a circular economy, as well as on possible action that different stakeholders can take to support circular business model innovation. The following sections will take a general angle on business model innovation in a broad range of sectors. In Chapter 4, a deeper analysis of the textile system is provided.

3.1 Materials phase

The materials phase provides the basic raw materials for industry. Mining companies, agricultural firms and a broad range of material processing industries produce the raw materials that companies further down the value chain use to manufacture components and products. The raw materials sector is organised in large, global trade chains. On the one hand, material production and trade are driven by material demands from upstream manufacturers. The production of lithium, for example, is largely driven by the demand from battery production. On the other, market dynamics are heavily influenced by price competition. Recently, the sharp decrease in oil prices has resulted in a competitive advantage of virgin plastics over recycled plastics as a raw material for packaging (S&P Global Platts, 2020).

Current business models of companies active in the raw materials phase are typically built around the following value strategies:

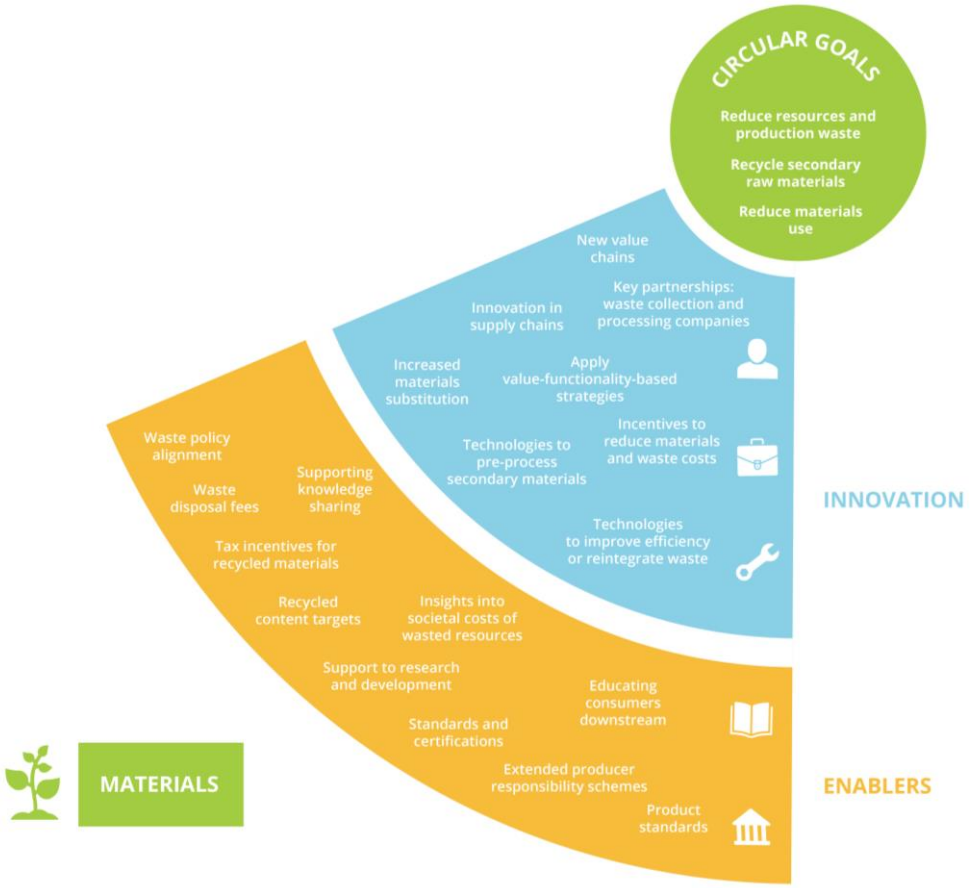
- **value creation**: efficient mining and production processes, maximising economies of scale, including cost-efficient transportation and guaranteed supplies;
- **value proposition**: high quality and low cost can be important value propositions, depending on the type of material and target market
- **value capture**: weight- or volume-based sales of (processed) raw materials

To contribute to the circular economy, companies active in the raw materials phase can consider integrating the following circular goals into their business models:

- reducing the use of supporting resources – water, energy, etc. – and the generation of waste during the production of raw materials, increasing process efficiency;
- increasing the production of recycled materials from waste and integrating material recycling into new material production, closing material loops;
- reducing the production volume of materials by shifting to material-related services that are less dependent on the maximisation of weight- and volume-based production and sales.

Possible innovation and enabling interventions to implement these circular goals in the materials phase are summarised in Figure 5 Overview of key innovation and enabling actions to stimulate circular business models in the raw materials Figure 5.

Figure 5 Overview of key innovation and enabling actions to stimulate circular business models in the raw materials phase



Source: ETC/WMGE

The first pathway to increase circularity in the raw materials phase is to **reduce the use of supporting resources – energy, water, land, chemicals, etc. – and to reduce the production of waste**. In this case, the existing business model is further optimised by cutting production costs and reducing waste management costs. This pathway does not require a fundamental change of the existing business model, since the strategies to create, propose and capture value stay the same. Nevertheless, it typically requires technical innovation to boost the efficiency of the production process. Process alterations need to be designed and implemented to, for example, recirculate process water, recover process heat, regenerate chemicals or allow the direct recycling of production scrap in the production process.

In many cases, a more efficient production process makes good economic sense and although practical hurdles can arise, this strategy can be easily implemented by companies across sectors. Nonetheless, policy measures can provide further incentives to integrate this circular goal in current business models. Project support for research and development on resource efficient production processes can encourage technical developments. Investment support for the adoption of best available technologies can overcome financial barriers. Introducing fees or bans on the disposal of production waste stimulate companies to tackle their waste problems, as well as contribute to less land use and soil contamination related to the mining of raw materials. Taxes on the use of virgin resources can encourage product developers to shift to the use of recycled materials. Additionally, an important part of a successful adoption of this pathway is creating awareness and providing education to companies about the business and societal benefits of reducing resource use and waste.

A second pathway to a more circular business model is to integrate the **recycling of waste materials**, both production waste and post-consumer waste, in the material production process. In various metal production value chains, such as steel, aluminium and copper, the recycling of post-consumer scrap metal in combination with virgin production is already common practice (Box 1).

Box 1 Precious metals: from mining to recycling business models

Several companies that used to have a business model based on the mining and processing of ores for the production of precious metals, have successfully implemented circular business models. While their value capturing strategy is still targeted towards selling large volumes to world metal markets, their value creation strategy has, partly of fully, shifted towards the sourcing of waste metals, for free or for a fee, instead of virgin ores. To support this process change, these companies have made their production process capable of processing recycled inputs alongside or instead of virgin ones. When the recycled materials are cheaper to process than their virgin counterparts, a shift to recycling represents a cost reduction for the company. Furthermore, processing electronic scrap as a source of metals also solves a supply need and has the benefit of higher metal yields than those from virgin ores. Indeed, since metal concentrations in virgin ores are decreasing as deposits become depleted, electronic scrap offers an alternative source of valuable metals in concentrations that exceed those of current commercial deposits.

An important challenge of any business model based on using recycled materials is avoiding quality issues with the resulting new materials. Addressing this barrier requires technical innovation to develop adequate sorting and pre-processing, as well as social innovation to create new partnerships with companies responsible for waste collection and sorting. Such partnerships are needed to assure consistent and sufficient volumes of accurately sorted waste materials, free from contaminants, to meet the process capacity of the raw material producers.

To support the use of recycled raw materials, policy measures can be put in place. Examples are tax exemptions or economic incentives for the use of recycled materials, recycled content targets, quality standards and certification protocols. In addition, waste policy measures and targets are needed to mobilise and collect sufficient volumes of waste, aligned with the quality requirements of the raw material sector. Furthermore, education and awareness creation are needed to stimulate cooperation between raw materials producers and waste handlers, companies that normally operate at opposite ends of linear value chains.

Finally, a more fundamentally different pathway to make the raw material sector more circular is to make the shift from the traditional output-driven business model based on sales volumes towards a **materials-as-a-service model**. Reducing the mining and production of virgin materials is the fundamental aspiration of the circular economy but, needless to say, this presents a fundamental challenge to companies in the raw materials sector. Given their traditional business model based on volumes and sales, it is clear that their business model will come under serious pressure when the circular economy takes off. When longer product lifetimes, reuse and recycling become mainstream (see following sections), the demand for virgin raw materials will decline. Policy measures to stimulate the shift to a circular economy can also affect business models directly: taxes on virgin material use will negatively affect competitiveness with recycled materials, while taxes on consumption could reduce the demand for materials in general. As a consequence, in order to be ready for the circular economy, companies in the raw materials sector need to rethink their role in the value chain and adapt their business model accordingly.

In a materials-as-a-service model, materials are no longer sold to manufacturers further down the value chain, but their functionality serves as the main value proposition. This has the consequence that the business logic changes from selling high material volumes to providing maximal functionality in an efficient way. As a result, the value creation and capture are no longer directly linked to the amount of materials processed. Instead, there is an intrinsic motivation to provide the service as efficiently as possible, for example with as little material or material losses as possible. An example of such business model innovation is the concept of chemical leasing. Traditionally, industries buy large quantities of processing chemicals such as solvents and disinfectants, use them once, and discard them as chemical waste. This generates costs at both ends – buying the chemicals and getting rid of the waste. In a chemical leasing model, the chemical producing company does not sell processing chemicals to its industrial clients, rather,

clients buy the performance such chemicals provide, for example, cleaning dirt and rust from metal parts, and return the u chemicals to the raw materials provider, who then regenerates or recycles them for reuse.

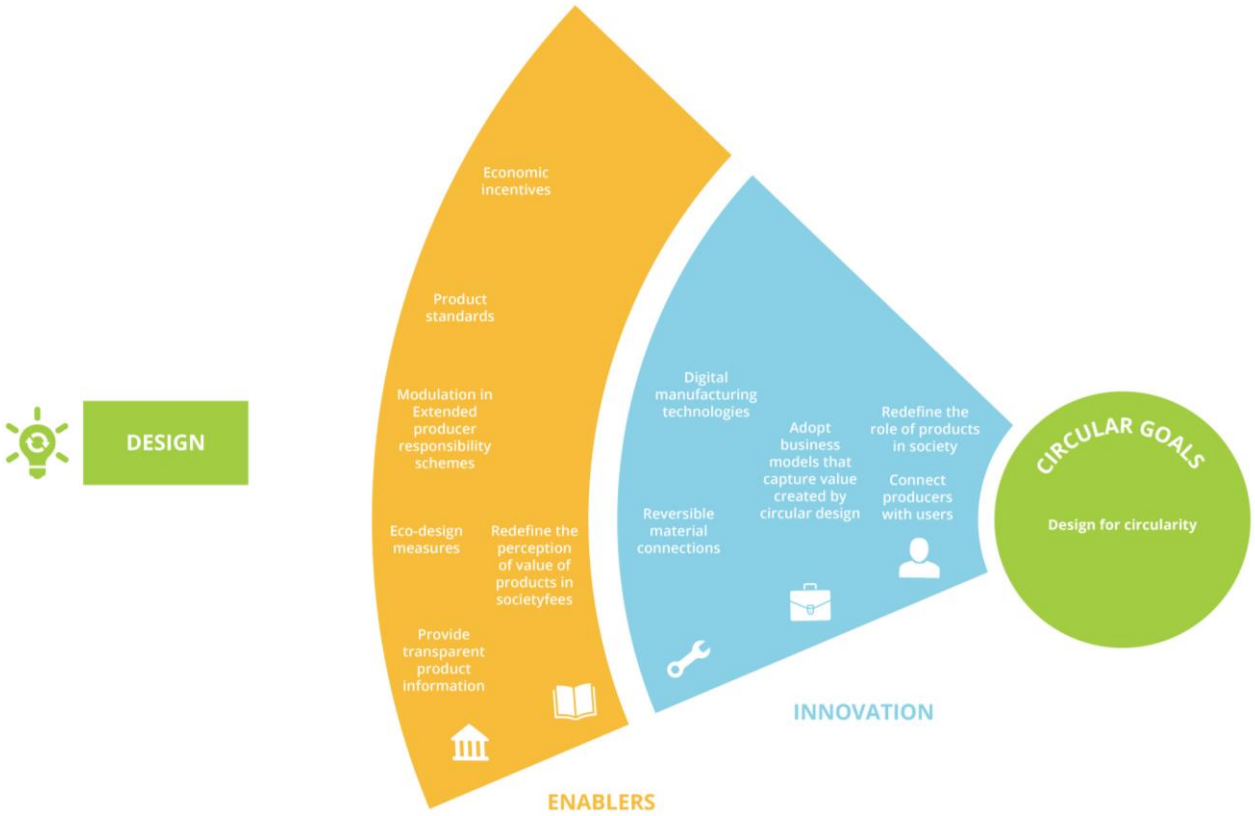
In conclusion, adopting circular goals in the raw materials sector may seem challenging because the main business models in this sector are driven by incentives contrary to the circular economy vision. It is clear from the analysis above, however, that it is possible for companies in the raw materials sector to adopt circular goals. Reducing production waste, using recycled materials or even reducing the use of certain materials altogether can be integrated into a working business model. Alongside business, technical and social innovation are also needed. Technical innovation, such as the development of a new bio-based and biodegradable material in the laboratory, alone is not sufficient. Social innovation, such as new ways of collaborating between companies along the bio-based value chain, are needed to achieve full-scale, competitive production of bio-based packaging. Policy incentives and education play an important role in enabling the change, especially when fundamental changes are needed in established companies. Policy measures such as banning substances of concern or economic measures, including extended producer responsibility schemes and product standards, that affect material demand further down the value chain can provide important triggers of change. Providing research and development support is important as well as, for example, it is very difficult to develop new production processes or new materials that can compete with well-established processes that are strongly optimised, both technically and economically.

The above types of business model innovation require rethinking the way value is created, proposed and delivered in the field of raw materials. As a consequence, the role and identity of the companies involved may need to change as the circular economy starts to become reality.

3.2 Product design phase

What materials, how much, or how they are combined and joined together: all these product design decisions affect the eventual lifetime of a product, whether it can be repaired, remanufactured or recycled, as well as how many resources will be needed for its production and what its environmental impact will be. The product design phase can thus be considered the most critical one for successfully creating circular lifecycles (EEA, 2017). A lot of attention has been given to developing circular design principles (Bocken, Circular Fashion, 2019; Pauw et al., 2016; Bakker et al., 2014) with the aim of providing guidelines for the design of products in such a way that one or more circular goals are achieved. Bocken et al. (2016), for example, several design strategies with the goal of either slowing resource loops or closing them have been discussed. One category contains strategies such as ‘design for ease of maintenance and repair, ‘design for upgradability and adaptability’, or ‘design for attachment and trust’ while a second category includes ‘design for a technological cycle’ and ‘Design for a biological cycle’. In addition, phasing out hazardous substances is also an important circular design consideration. Irrespective of how the circular design principles are defined, they all need appropriate innovation and enabling action to support their implementation (Figure 6).

Figure 6 Overview of key innovation and enabling actions to stimulate circular business models in the design phase



Source: ETC/WGME

The 'design for …' terminology clearly highlights the intended goal of the circular design strategies. These principles, however, need to be connected to practical or technical solutions if they are to be brought into practice. Design for disassembly, for example, requires technical solutions to the combining of different materials in such a way that they can be separated again. As a consequence, there is a clear link between circular design and technological innovation, such as 3D printing (Sauerwein et al., 2019).

A second requirement for successful implementation of circular design strategies is that their costs and consequences need to be in line with the business model around the product. Design for durability, for example, might require the use of high-quality materials which increase the quality and lifetime of a product. This is a great feature for a company active at the high-end, premium segment of a certain market, which nonetheless has also to consider the fact that this usually leads to higher material costs. For companies that need to regularly replace their product models with newer versions, however, increasing product lifetimes is not in their economic interest, nor are higher production costs. It is important to acknowledge that design decisions are driven by market and user requirements. If a product does not meet the requirements of the user, it will not succeed in the market. A product made of recycled materials that breaks more rapidly than its competitors because the material is weaker, for example, will fail. Market conditions can hold back the introduction of circular design practices as well (Box 2).

Box 2 Printers/copiers in the consumer market: locked into linearity

In the consumer printer/copier market, the dominant business model is to sell the copier very cheaply and sell ink at very high prices. This is possible because consumers are locked-in to the particular brand they own, and often producers deliberately build in technical barriers that block third party ink cartridges. The low price for the copier reflects the use of quality materials and components, causing short product lifetimes. While there are plenty of technical options available to increase the circularity of the copier design and increase its lifetime, such a copier would be outcompeted in the current market, because consumers typically do not consider the total cost of ownership when deciding which machine to buy. In this market, business model innovation alone will not be sufficient to create a breakthrough for circular business models.

Business model innovation is a key factor in increasing the implementation of circular design principles,. A useful question to ask when rethinking business models linked to circular design principles, is where the added value of a circular design measure is created, and where it can be captured. When improving the durability of goods, the value can be captured by the producer if its customers are willing to pay for a product that lasts longer or is of better quality. This is the case in high-end automotive, furniture or clothing markets, but when selling copiers in the consumer market, it makes little business sense to design the machine for disassembly. However, in the business-to-business printer/copier market, design for disassembly is a common feature. Those producers make use of leasing models, such as pay-per-copy, and thus capture the value of a copier that can be repaired, reused or resold because it was designed to be easily disassembled. Based on the experience in the business-to-business market, implementing circular design in the business-to-consumer printer/copier market should thus be possible, provided that companies can adopt leasing models that are accepted by consumers.

Social innovation has a key role to play, too. Of particular relevance for product design is the rise of so-called prosumers, characterised by a breakdown in the delineation of producers and consumers. Consumers can become active producers of goods and services rather than passive consumers, enabled by increased availability of information and technologies. The easier access large amount of data and news enable consumers to go beyond what they were used to and act semi-professionally in their hobbies and pursuits, leading to an increasing demand for higher technologically advanced and complex products and services. The concept of do it yourself (DIY), defined as the culture of designing, creating, customising and repairing products yourself, is often associated with a more sustainable consumption pattern. Nonetheless, prosumers that actively partake in the production process require not only technical shifts in the manufacturing of products – which will arise slowly as different industries adopt new technologies – but also a societal mind shift.

In those cases where business and social practices are inherently contrary to circular design, policy measures can provide appropriate incentives for change. The Ecodesign Directive (EU, 2009) has already proved to be effective in improving the sustainability of several product types, mainly from an energy efficiency perspective. Expanding the scope to circular design principles would provide a more level playing field for those companies that are willing to improve the circularity of their products. Evolving product and minimum durability standards could play a role in the uptake of circular design standards as well. Policy measures to support designing out hazardous substances have had a great impact as well, not only directly on consumer health and safety, but also indirectly by taking away an important barrier for recycling materials for use in new applications.

Finally, as the design of products is strongly connected to user behaviour, education and behavioural change have crucial roles to play as well. A more conscious relationship with the products and services, acknowledging the human and material resources that went into their production, could likely lead to a higher awareness for the value of circular, sustainably designed products. Circular product design needs to be combined with tailored information and education campaigns. Consumers are often unaware of, or do not fully grasp, the circular model behind products and services, and perceive repaired products lower

quality. *Ad-hoc* communication efforts are key to successful mainstreaming. An example of how crucial information is in positively influencing consumer behaviour is demonstrated by the use of social media. Nowadays, consumers can heavily influence each other's understanding and awareness, and thus behaviour, by creating communities for more circular-type products and services which can drive education and adoption of these products and enable successful creation of a market. Examples are online platforms which create trust among people and foster goodness, while promoting fair and ethical trade, or online shops that specifically focus on brands that apply circular designs and engage in consumer education (Ccrave, 2020). Putting consumers in the driving seat – moving beyond nudging – also means helping people understand what drives their own behaviour, so that they can adjust their surroundings and make circular and sustainable choices easier.

Circular design is a key factor in the implementation of all circular goals, as the design of products determines their potential for reducing, reusing, remanufacturing or recycling materials. The implementation of circular design critically depends on technological solutions to put the principles into practice, on business model innovation to align business incentives with the costs and benefits of circular design practices, and on social innovation to align the intentions behind the product design with the actual way the product is used. For each product in each specific market, the challenge for innovators is to discover the appropriate combination of technical, business and social innovation that results in mainstreaming the circular design of products. Both policy and behavioural enablers have important roles to play as well, in that they need to create appropriate regulatory, economic and behavioural triggers for designers and users to make the right decisions.

3.3 Production and distribution phase

In the production and distribution phase of the lifecycle, the most relevant circular goal to pursue is to reduce resource use. Different ways of achieving lower resource use in the production and distribution phase can be:

- increasing resource efficiency of production and distribution processes;
- radically decreasing resource use in production and distribution by digitising production;
- integrating the use of remanufactured parts or components in the production process;
- reducing resources needed for packaging, or using recycled materials instead.

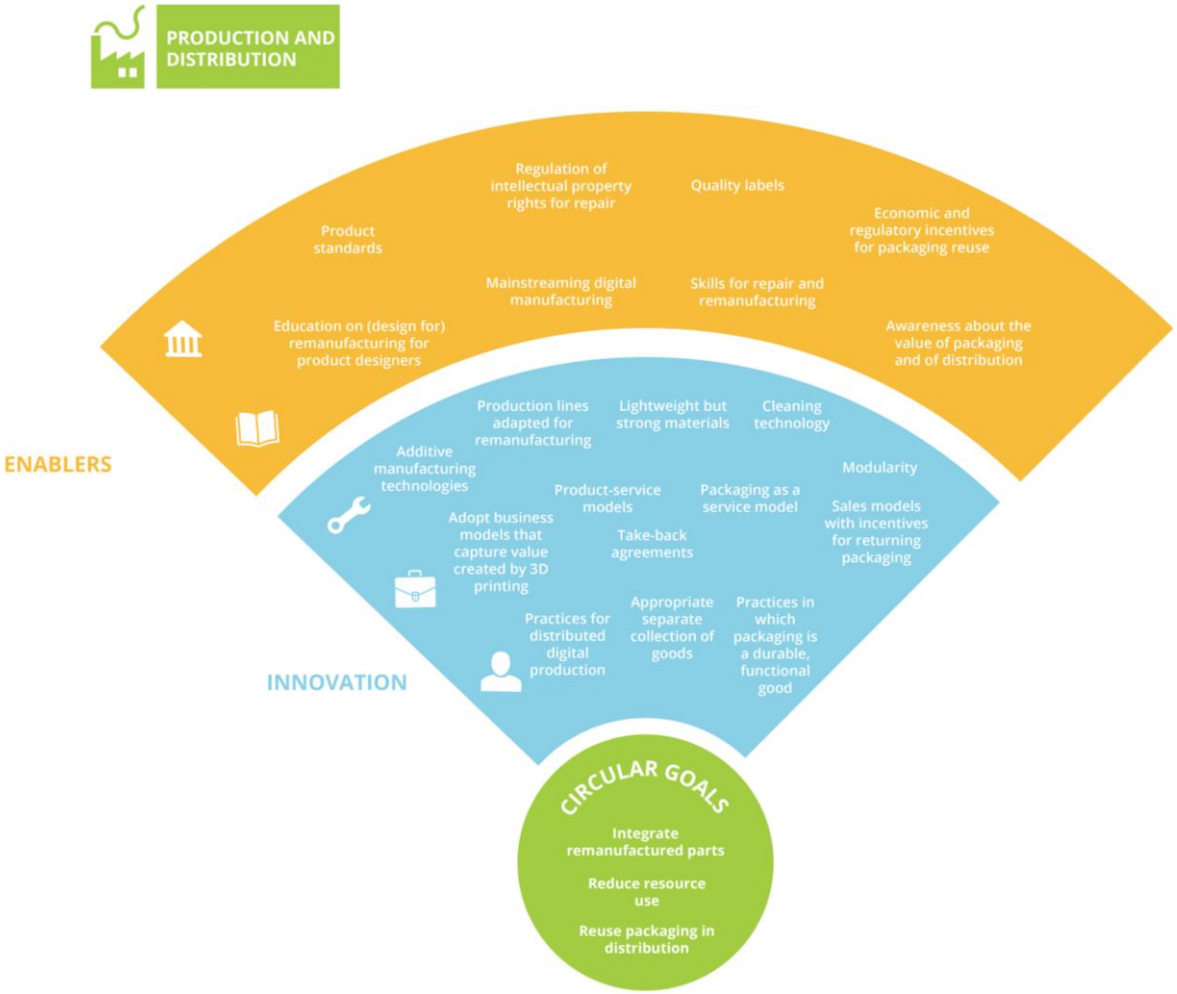
Figure 7 summarises different innovation and enabling action relevant to those circular goals in the production and distribution phase.

From the previous section, it is clear that the design phase determines potential resource savings during production and distribution. In today's economy with global supply chains, production waste and transport costs have a direct impact on the profitability of production companies. Consequently, product design is often optimised to minimise production waste and transport weight/volume. Companies in fast moving consumer goods, and those operating in the packaging sector, excel in designing products in such a way that they take up as little space as possible during transport. In general, **increasing resource efficiency during production and transport** is well aligned with current business drivers, requiring little innovation other than perhaps technical design innovation.

The advent of digital technologies and 3D printing has, however, enabled the possibility of achieving a more **structural decrease in resource use for production and distribution**. Laser sintering, 3D printing and other additive manufacturing techniques allow the manufacture products in a distributed network, thus closer to the customer. Apart from lower material use compared to subtractive manufacturing, additive manufacturing also reduces the need for transportation. Nevertheless, taking advantage of these benefits depends on innovative business models and social practices. The 3D printing of spare parts could, for example, increase repairs to, and hence longer use of, many home appliances (Kringwinkel Antwerpen, 2014). But for this to happen, consumers need to be willing to adopt the practice of looking for such solutions, rather than to simply buying new devices. This in practice also need to translate into the

development of a sufficiently dense network of repair shops, with those shops being able to generate sufficient income to cover the infrastructure costs of additive manufacturing technology. Policies that force producers to provide access to technical information about their products and spare parts, are needed as well.

Figure 7 Overview of key innovation and enabling action to stimulate circular business models in the production and distribution phase



Source: ETC/WGME

Today, many manufacturers of high-value, complex products such as vehicles, aeroplanes, medical scanners, etc. already implement the circular goal of **remanufacturing** in their production. Especially in business-to-business markets, where balancing quality with cost is a dominant consumer requirement, it makes sense to use still functioning or reparable parts retrieved from end-of-life products in new or refurbished products (Box 3).

Box 3 Use of remanufactured car parts in the automotive industry

The automotive industry has well established systems of collecting car parts like gear boxes or doors from crashed or end-of-life cars and using them to remanufacture defective or damaged cars. To achieve this, the industry uses existing networks of dealerships and car repair shops to organise the retrieval of still functioning parts, and redeploying them to other car repair shops. The practice creates value for car owners by decreasing the cost of repair. Furthermore, it stimulates customer loyalty, which ensures that the local car dealerships keep receiving the recurring income from regular car maintenance. The fact that the structural design of cars within a certain brand is highly standardised greatly helps the disassembly and reintegration parts in other vehicles. This has also created an extensive ecosystem of third-party repair shops that reuse still functioning car parts.

Increasing the use of remanufactured parts in production processes depends on a combination of different factors. First, the value of the product and its parts needs to be sufficiently high to warrant the cost of retrieving one or more parts and reintegrating them into new or second-life production lines. Second, it should be possible for the manufacturer to at least partly capture the added value of remanufacturing the product. Third, the customer needs to be willing to accept remanufactured goods, and usually also has a role to play in making sure the product is returned to the manufacturer as well. For these reasons, remanufacturing usually needs to be combined with some form of take-back or product-service model (Section 3.4). Product standards and independent quality labels are important policy enablers to increase consumers trust in value chains that make use of remanufactured products, such as the Bra Miljöval (Good Environmental Choice) label criteria set for second-hand textiles applied in Sweden. Furthermore, companies need to leverage the consumer opportunity through tailored awareness raising campaigns together with concrete initiatives, such as local charities, to incentivise and further promote behavioural change. This, in turn, requires collaborative approaches and partnerships to lower, for example, the logistics costs of take-back schemes while mainstreaming behaviour in favour of second-hand and recycled products.

A particularly important aspect of the production and distribution phase in terms of circularity is the **packaging system for the distribution of goods**. In the past, the focus was on reducing the amount of packaging material per unit (Coelho et al., 2020). While reusable packaging, such as crates and pallets for transport packaging, or glass bottles in the beverage industry, has been used throughout history in many applications, there has been a trend towards single-use packaging in all countries where no strict policy on reuse is in place. Recent trends such as smaller portion packages or a focus on packaging as a branding mechanism further discourages reusable solutions (Coelho et al., 2020). Nevertheless, at least 20 % of plastic packaging could be replaced by reusable equivalents according to the World Economic Forum (2016). For this to happen, the perception of packaging, particularly among consumers, needs to change towards an increased awareness that packaging provides a service within the supply chain, and that single-use packaging creates external costs in terms of waste and environmental impacts. Currently, reusable packaging services exist in e-commerce, allowing environmentally conscious retailers and their consumers to make use of standardised packaging that can be mailed back to the packaging service providers (Repack, 2020). Big brand producers of fast-moving consumer goods are also experimenting with reusable packaging, for examle for cosmetics. In this, a subscription model is used to deliver the products to the customer on a regular basis, including reverse logistics for the empty packaging from the previous delivery (Loop, 2020). The rise of packaging-free retailers, only selling bulk goods, mainly dry foods, is an example where social innovation drivers change in the supply chain. While the business model of the retailer remains the same as other retailers, they involve customers in the distribution costs by having them buy or bring reusable packaging. As the number of packaging-free shops increases, so does their bargaining power with producers and distributors to develop reusable solutions for secondary (transport) packaging. Packaging related policy measures, such as the Packaging and Packaging Waste Directive or extended producer responsibility schemes, will need to keep up with such evolving social and business model innovation, in order to provide the right regulatory and economic incentives for the further growth of more circular, sustainable packaging systems. This can for example be done by increasing packaging reuse

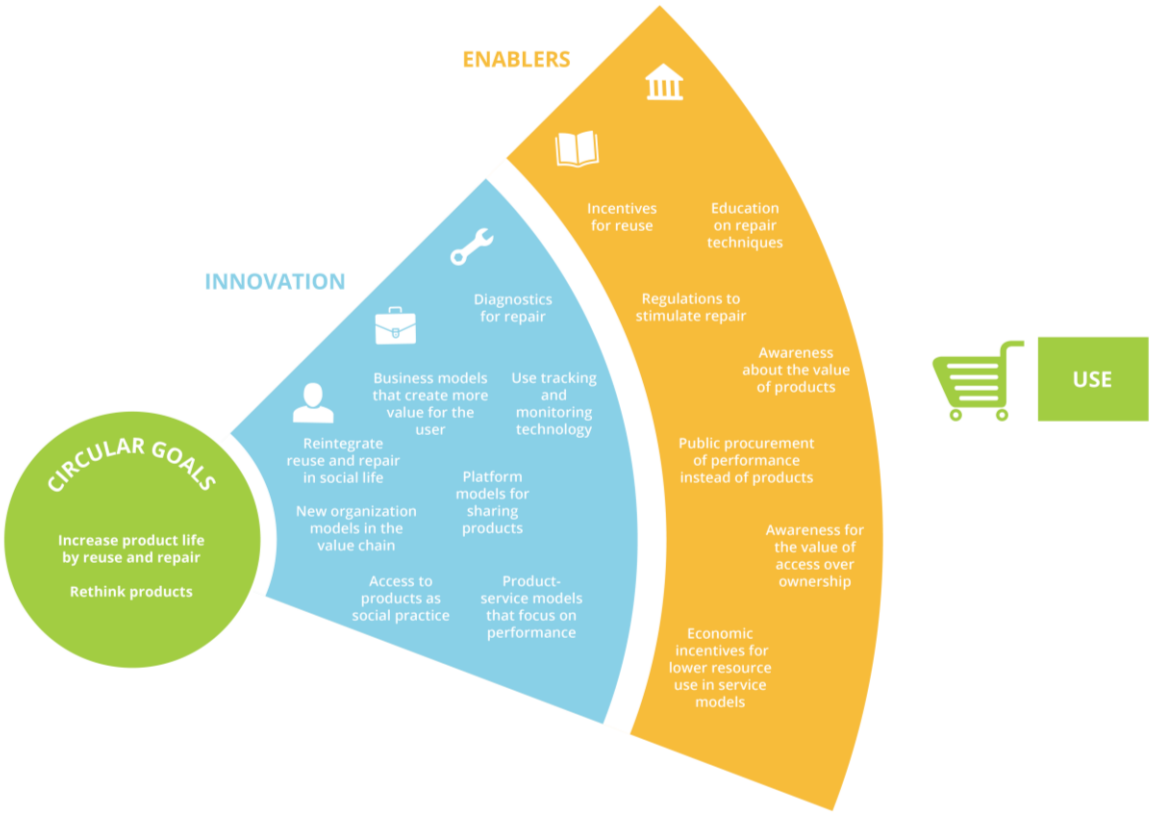
targets when appropriate reusable packaging systems become available, providing a stimulus for their uptake.

In summary, increasing circularity in the production and distribution phase can be achieved both by incremental and radical innovation. Incremental innovation in production and distribution technologies in general, and in remanufacturing practices in the business-to-business sectors of high-value products in particular, have already contributed to lower resource use in production processes and optimized one-way distribution systems. More radical innovation is required, however, to achieve decoupling of resource use from economic value in production and distribution. Such innovation is partly technological, such as the introduction of digital, distributed production technology; partly business model related, service models or take-back models that allow producers to capture the value of reduced resource use, and distributors to create value with reusable packaging; and partly social, consumers engaging in new practices to obtain their goods or acknowledging the residual value of goods after use. Proper education on the value of goods in general, and of packaging in particular, would benefit the success of such innovation, as would policy measures that keep track of innovative solutions.

3.4 Use phase

As the use phase covers as many contexts as there are product types and customer segments, the realisation of circular goals in this phase can differ widely from product to product, and from business-to-business through business-to-consumer to consumer-to-consumer activities. What all these contexts have in common, however, is that the behaviour of users plays a key role in determining how products are managed during and at the end of the use phase. Even if products are designed for circularity, and even if proper reuse and recycling solutions exist, it is the user who decides which product to use for a certain need, for how long to use it, how often it is replaced, whether it is repaired when it breaks down and if it will be reused afterwards. Consequently, the importance of business model innovation and social innovation to increase circularity in the use phase cannot be underestimated (Figure 8).

Figure 8 Overview of key innovation and enabling action to stimulate circular business models in the use phase



Source: ETC/WMGE

The concept of the **reuse shop** is a longstanding example of social innovation. In some countries, the business model of a reuse shop is supported by waste policy, which provides preferential access to reusable goods discarded by citizens, as well as by social labour policy, which provides subsidies for workers that have difficulties in entering the regular labour market. Nevertheless, the existence of privately-owned second-hand shops, mostly for clothing and furniture, demonstrates that reuse can be part of regular business models as well. With the rise of the internet, reuse of goods based on economic transactions between consumers has probably become a more important economic activity than reuse through reuse shops (EEA, 2018b). Cars are another example of a market in which reuse is a regular economic activity (EEA, 2019a).

In the past, **repairing goods** was a common economic activity. Today, this is still the case in lower-income countries, but the increasing buying power and busy schedules of consumers, , together with high labour costs and companies' focus on ever increasing sales volumes have created a culture of single-use consumption for many goods, including shoes or clothing, replacing them when they are broken. Nevertheless, for some valuable goods, such as expensive electronics or vehicles, repair services and shops provide cost savings for consumers, even if manufacturers try to limit the repair possibilities (Vallauri, 2019). In recent years, repair cafés – informal social gatherings where citizens with technical skills help to repair small appliances of other citizens – have grown all across Europe, providing social innovation that builds on increased awareness of the value of products. Nevertheless, reusing or repairing products is far from mainstream today, partially because the environmental awareness that acts as a major driving force for the mentioned reuse and repair activities is not mainstream. Increasing policy efforts for creating awareness and providing financial incentives for reuse and repair can help further diffuse consumers´ attitudes and behaviour in favour of reuse and repair. Availability of repair skills and repair parts at reasonable prices are key in supporting repair attitudes. Thus, policy instruments need to combine requirements for increasing product quality, and thus prices of new products with wage subsidies and VAT-reductions in the attempt to reduce price differentials between products and services provided by circular business models compared to linear ones.

A more fundamental way to address circularity in the use phase, however, is to develop business models and social practices that **focus on the function or performance of products** instead of on buying the product itself. Such access-based business models, or product-service systems product-service systems, provide access to services that meet the customer's needs, without the necessity of owning the product itself. Product-service systems represent a group of different value propositions that companies can offer to their clients, consisting of a combination of product and service elements (Tukker and Tischner, 2006). While product-service systems are by no means a novel business concept, consider, for example, libraries, laundromats, or car rental services, it has become a main business innovation topic linked to the circular economy (Witteveen, 2016; EMF, 2013), because such models have the potential to decouple revenue generation from material and product consumption and waste (Box 4). Since users only pay for a (limited) access to the product, the same product can be used by multiple customers, either for short periods – renting or sharing – or for longer ones through, for example, leasing. Consequently, customers' needs can be fulfilled with a much smaller number of products than were each of them to buy their own. This way, production of new products is reduced, while the intensity of product use is potentially increased through shared use and/or reuse. Furthermore, because the producer remains responsible for the product during and after the use phase, he or she should be incentivised to increase product lifetime through design choices that enable reuse, repair, remanufacture and recycling. Communication with the user is key to limit impacts during the use phase, for example, through specific users' guidance about the best use of the product in terms of durability, or communication about the reduction of negative environmental impacts. For example, companies providing the leasing of clothes could include among the complementary services clear advice on how best to wash/clean the product (Mud Jeans, 2020).

Box 4 Performance-based models on the rise in the construction sector

The construction sector has recently become a particular hotspot for the development of circular performance-based service models. This can be explained by the fact that most assets in or as part of buildings – flooring, interior walls, ceiling, lighting, etc. –) have long use phases, high initial costs and considerable costs for maintenance and decommissioning. Developers and owners of buildings generally assess the cost of building projects from a total lifecycle perspective, and want to avoid excessive costs and hassle in dealing with repairs. At the same time, the cost of building waste management has increased, as well as the awareness of recycling and more sustainable materials management in the construction sector. Consequently, performance-based business models, that are more affordable because costs are spread out in time, remove operational hassles and address the end-of-life phase of building related assets, have a clear advantage over traditional sales-only models.

According to Kjaer et al. (2019), product-service systems provide an opportunity to realise circular goals because of "(1) the ability to direct and control the use of resources and (2) the ability to design and implement service intensive and value-adding offerings, essentially dematerializing the need fulfilment and influencing user behaviour". In practice, however, increased circularity is no intrinsic consequence of product-service systems models. The full lifecycle environmental costs need to be internalised in product-service systems business models, otherwise product design and use will be optimised for only a part of the lifecycle. The current business model for dock-less e-scooter services, for example, does not seem to incentivise long product life. As a consequence, such models appear to be less sustainable than other transportation modes in their current configuration (Moreau et al., 2020). Similarly, an assessment of the environmental potential of sharing platforms concluded that in their current form, these platforms do not always stimulate circularity and sustainability (EC, 2018).

To ensure that product-service system models effectively contribute to increased circularity, the degree of resource reduction and avoidance of rebound effects need to be assessed, and consumers need to remain critical about their sustainability. Sustainability assessment frameworks for product-service systems could be used as a tool to guide further sustainability improvements of such models (Kjaer et al., 2019; Matschewsky, 2019). To support companies in designing and implementing product-service system models that make a real contribution to circularity, policy measures that create the right incentives to

internalise lifecycle environmental costs are important. Additionally, technical innovation can provide service providers the tools to better monitor the use of their products, enabling them to increase product lifetimes through optimised maintenance and repair, as well as design improvements to eliminate weaknesses in the product's performance.

Finally, changing consumer behaviour with regard to the status of products is a key factor for the replacement of sales models by services that focus on consumers' needs (Akbar and Hoffmann, 2018). While the social status of product ownership may be decreasing – think, for example, of the increasing popularity of car sharing platforms – for many products, the impact of status and marketing cannot be underestimated. Although the basic human need of drinking can be easily, cheaply and resource efficiently fulfilled by the service of tap water, bottled water remains a common way for many consumers to fulfil this need, be it in their homes or in a restaurant. This is due to a lack of consumer awareness and often trust in both the business model as well as in existing regulations and policies. In the use phase, factoring in consumers priorities is important, as much as focusing on key circularity objectives. Applying behavioural economics (nudging) can help in this respect. Consumers also need to be better informed about the business model principles and infrastructure underpinning product-service systems and policy instruments need to support their mainstreaming.

3.5 End-of-life phase

The end-of-life phase generally starts when products lose their original function or value. In the current economy, this means that products become waste, and, after proper collection, enter the waste management system to be reused, mainly through reuse shops, or destroyed for material recycling, energy recovery or disposal. However, other circular goals than recycling for which the end-of-life phase is important are becoming more important as well:

- collection for reuse or remanufacturing;
- repurposing products and materials to create new value.

Figure 9 summarises the main innovation and enabling action relevant to the end-of-life phase.

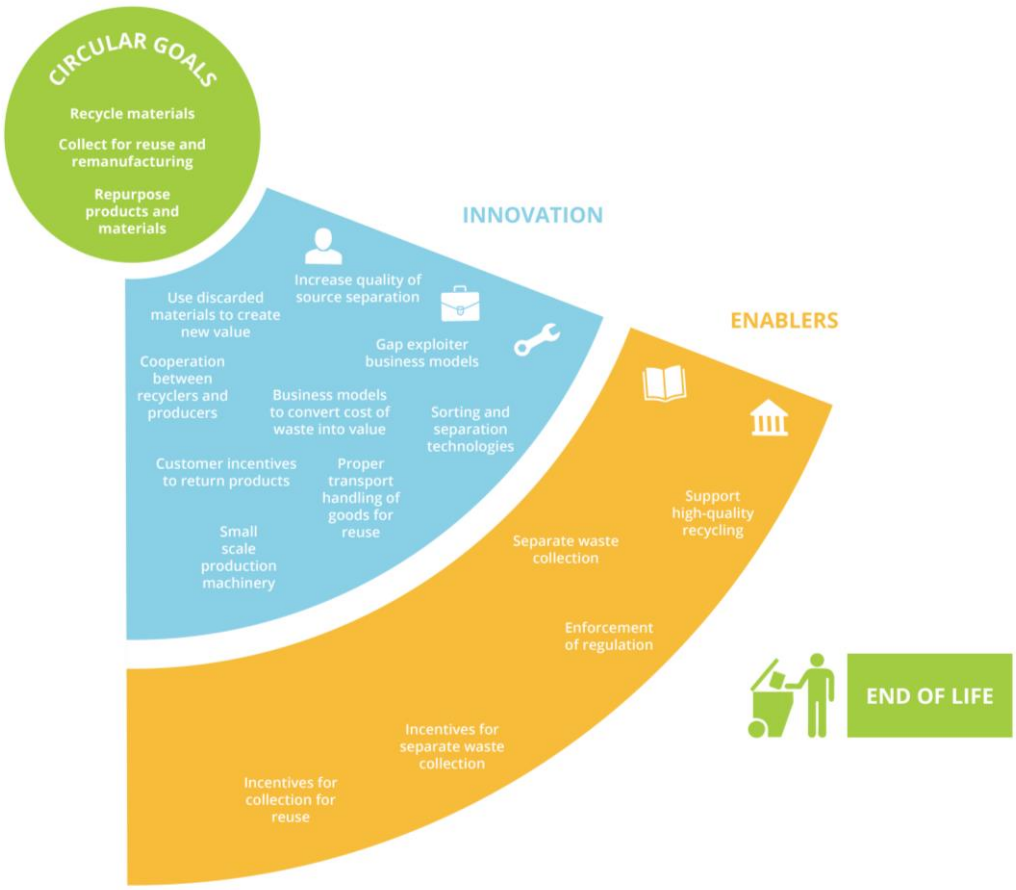
Decades of waste policy in Europe have provided economic incentives to create a recycling industry. Some materials, such as precious metals, have intrinsic economic value to stimulate recycling over disposal, but for most materials, assigning a cost to waste disposal or incineration higher than the costs of sorting and recycling is a prime example of how policy measures can stimulate business model innovation in favour of circularity. Furthermore, changing people's behaviour to sort waste at the source is another accomplishment of waste policy that has greatly benefited the business case for recycling. Although waste sorting and separation technologies have evolved rapidly, avoiding the mixing of waste fractions is often more effective than separating them after collection although trade-offs with increased transport need to be considered. Nevertheless, the recycling industry today is mainly based on high volume recycling into lower quality applications rather than closed-loop recycling in which the recycled material is used for the same purpose as its virgin counterpart. Closed-loop recycling is very difficult to accomplish because:

(1) materials are mixed in products in ways that make them too costly or impossible to separate in the recycling process;

(2) the vast diversity of materials makes it virtually impossible to set up separate collection and transportation systems in a cost-effective manner.

Increased cooperation between recyclers, designers, producers and consumers is crucial to further increase the quality and quantity of recycling.

Figure 9 Overview of key innovation and enabling action to stimulate circular business models in the end-of-life phase



Source: ETC/WMGE

As already highlighted in Section 3.3, the end-of-life phase is crucial to enabling reuse and remanufacturing. Appropriate incentives are needed to ensure the efficient take-back of products that can still be reused or from which parts can be salvaged. This can be enforced by policy measures such as extended producer responsibility schemes, which is the case for the reuse of electronic appliances through collection for reuse measures in the Waste Electrical and Electronics Equipment Directive (2002/96/EC). Specific policy instruments can further promote these business models, by for example seeding or establishing shared logistics systems that companies can join and eventually take over and through easing regulations to allow more efficient door-to-door logistics. But companies can provide economic incentives as well, by offering discounts on new products, such as smartphones and laptops, when old ones are returned. Effective return logistics are a challenge, often requiring the cooperation of retailers, as well as making sure that the handling of goods for reuse or remanufacturing during transport does not destroy their value.

Business model innovation can capitalise on the residual value of products or materials not captured by the producers themselves, allowing other parties to exploit this value gap (Box 5) (Whalen, 2019).

Although end-of-life circular business models for reusing, remanufacturing and repurposing products are not new, they are still only a niche market addressing a limited number of consumers. Behaviour change needs to be triggered through information and easy access to specific return services. Information needs to address specific behaviour and target a change towards a new normal. This is because everyone is influenced by the people around them: family, friends, social class and culture all play a key role in defining what people think and how they act. Giving consumers information about what others are doing tends to be more effective than telling them what they should do. An example is when companies work with influential individuals (influencers) to make specific behaviour aspirational while reinforcing people´s sense of identity. Other tools use incentives, both economic and/or environmental ones, to nudge people

towards practical steps that can help effect a gradual shift in attitudes, such as deposit systems and pay-as-you-throw schemes.

Box 5 Repairing and reselling electronics: capturing value ignored by others

In the electronics sector, the high speed of innovation and product renewal has created major opportunities for circular business model innovation by actors outside the value chain. Reuse shops and online platforms for smartphones and tablets have been stepping into the value gap created by consumers buying new products while their old ones are still functional. They capture the value that still resides in older electronics, often after some repair or refurbishment, and share it with their customers. A particular example of such a gap-exploiter model is the model used by a reuse company in Sweden that offers smartphone repair and replacement services to insurance companies (Whalen et al., 2018). The insurance companies used to provide a new product without even checking the customer's claim because doing so was too expensive for them. Now, all insurance claims are handled by the reuse company; they check whether the claim is real, and if so, they repair the smartphone if possible. The customer can opt to receive a refurbished phone immediately instead of waiting for the repair of their own product. This model has resulted in fewer insurance claims, providing a direct cost saving to the insurance companies while the reuse company captures additional revenues from selling refurbished models that were not claimed by their original owners.

Furthermore, collaborations between companies and municipalities could further mainstream behaviour change towards the end-of-life of products by, for example, supporting second-hand businesses in shopping malls to which consumers can bring their own waste items to be upcycled and resold by craftsman in the various shops. Similar models could equally be made available by companies in existing regular stores. Enabling such initiatives could be extremely important in encouraging a normalisation not only of pre-owned, remanufactured, upcycled products to consumers who otherwise never purchased such products and/or make us of such services, but more broadly in mainstreaming behaviour which actively encourages circular end-of-life processes.

3.6 Reflections

The main goal of the brief and general analysis in this chapter is to illustrate the factors that support circular business model innovation throughout the different phases of a product's lifecycle. A first important observation is that it is important to make a distinction between circular goals – the goal to achieve with the circular business model – and business models – how to achieve the circular goals. Not all circular goals are equally feasible to achieve in all lifecycle phases. Consequently, when attempting to implement circularity in a business context, it is important to use a perspective that spans the entire lifecycle, as often the value created by implementing circular goals can only be captured in another part of the lifecycle. Identifying where in the product lifecycle value is created from circularity, for whom, and where it can be captured and by whom, is a necessary prerequisite for the development of successful circular business models. Furthermore, the analysis shows why it is important to distinguish between business models and social and technical innovation. The successful development and scaling up of circular business models depend on the alignment of technological developments, social practices and fitting business models – technologists, sociologists and business economists all have their parts to play. Finally, the important enabling role of policy and education to help mainstream and guide circular business model development is also illustrated. Policy development, just as business model innovation itself, needs to consider the interplay between different lifecycle stages. Enforcing circular design requirements, for example, needs to go hand in hand with proper supporting measures for collection and recycling to enable businesses, that invest in creating sustainable value through circular design, capture this value as well.

4 The role of business models in the transition to a circular textiles system

This chapter provides a deeper analysis of circular business model innovation in the textiles sector. A policy priority for the European Commission, textiles play an important role in the European manufacturing industry, employing 1.7 million people and generating a turnover of EUR 178 billion in 2018 (Euratex, 2019a). The new Circular Economy Action Plan recognises the textile sector as a priority product value chain because of its high use of resources at global level, materials, water, land and chemicals; greenhouse gas emissions; and waste generation (European Commission, 2020a; EEA, 2019b). To tackle these challenges, an EU Strategy for Textiles is being developed with the aim of strengthening the competitiveness of Europe's textile industries by creating a market for sustainable and circular textile products, services and business models. Many small and medium-sized enterprises and other businesses in the textiles and apparel sector are exploring the potential of the circular economy, but they face considerable challenges. While technical bottlenecks, regulation and lack of research funding are most often mentioned as barriers to upscaling, many business also report challenges related to the development of successful business models, such as improving profitability, increasing market demand, convincing customers of product quality and competitive product pricing (BusinessEurope, 2020).

The 2019 EEA briefing and European Topic Centre report *Textiles and the environment in a circular economy* highlighted that the shift towards a sustainable and circular textiles system requires a profound systemic change, entailing innovative production methods, new business models, more sustainable behaviour, supporting policy measures and education at all phases of the value chain (ETC/WMGE, 2019; EEA, 2019b). As currently most business models in the textiles value chain are designed and optimised to fit the linear system, implementing circular goals in the textiles sector will require a profound change of business models, involving rethinking the logic of the three value dimensions: what value is proposed; how value is created and delivered; and how value is captured. The approach outlined in Chapters 2 and 3 is used to analyse several options for business model innovation that could support the implementation of circular goals in the textile sector. In the following sections, a selection of business models that could help in developing a more circular textiles system are analysed. Furthermore, this chapter identifies which value strategies offer opportunities to create viable circular business models, and what technical and social innovation is required to allow successful implementation. Additionally, policy interventions and education activities that could help to overcome barriers or enable upscaling of these new business models are highlighted, and while doing so, the roles that different actors in the textiles system can play to support the business model innovation process are discussed.

There are several driving forces for companies in the textiles system to explore circular business models. In a survey across 22 Nordic companies deploying circular business models in the field of textiles, Elander et al. (2017) found that the main motivator for companies to engage in the circular economy is to reduce the environmental impacts of textiles consumption as part of their corporate social responsibility policy. Other motivators are the creation of closed textile loops to ensure future raw material supply and reduce the pressure on virgin resources; profit-making opportunities; an aspiration to create a more sustainable mindset, including reduced consumption, among their customers; the creation of green jobs; and responding to direct customer demand, for example for repair services.

There are many ways to describe and classify different business models for textiles in relation to their approach towards circularity (Elander, Watson, et al., 2017; Fontell and Heikkilä, 2017; Ellen MacArthur Foundation, 2017; Bocken et al., 2016; SITRA and Circle Economy, 2015). While different literature sources differ in focus and in the way models are clustered, they follow similar lines of thought. Building on the classifications made in the literature, the subsequent sections discuss the following business model options that could support the shift towards a circular textiles system.

- **Longevity and durability**: selling durable textile products, focused on delivering a long product life. This approach is often combined with reparability and the offering of maintenance and repair

services to customers. Product personalisation can also be a feature to ensure consumer-attachment.

- **Access-based models, based on renting and leasing (business-to-business/business-to-consumer) or sharing (mostly consumer-to-consumer)**: in these product-as-a-service models, the textile products remain the property of the company running the system, while the customer pays for having access to their use. Access-based models can lead to lower resource use by increasing the use rate of the product stock.
- **Textile collection and resale**: business models related to resale focus on extending the useful life of textiles beyond the first user. The collection of used textiles can be limited to brands taking back only their own, usually high-quality, products for re-sale in the second-hand market or as vintage collections; or it can be aimed at general collection, regardless of brand and condition, mostly aimed at re-selling to the global textile market for reuse and recycling – mostly done by third parties or charity organisations.
- **Recycling and material reuse:** this model focuses on closing the loop, by turning waste textiles into raw material for new textiles production chains. It can be pre-consumer waste such as unsold clothes, or post-consumer textile waste, and the material reuse can be of product parts, for instance involving small product adjustments or the reuse of fabric in new products; or of fibres, producing recycled fibres and using recycled materials in new products.

4.1 Longevity and durability

To preserve the product and material value of textiles, the first objective is to use textile products for as long as possible. In this way the consumption of textiles can be **reduced** (sufficiency), as a **longer active use** of products reduces the need for the production of new textiles. Also, the generation of waste is decreased. Maintenance and **repair** activities can support longer product lifetimes.

Technical, high-end fashion, such as outdoor clothing, is one area in which business models already support longer product life. Traditionally, the customer segment those companies target consists of active people who enjoy sport, travel and outdoor activities, and who can afford high-quality gear. For these customers, timeless, durable clothing made out of high-quality materials that can be trusted to offer comfort and functionality in harsh conditions is an appealing value proposition. Such a value proposition is often supported by premium branding and attractive storytelling, including adventures in the wild, exotic travel and high-level sport performance. More recently, sustainability claims are often added explicitly as a side story to address the more eco-conscious population of this customer segment. Some brands have gone even further, offering repair kits, maintenance products and user manuals to support customers in prolonging product lifetimes (HNST, 2020b; Patagonia, 2020a). Repair services are often offered through partnerships with third parties (iFixit, 2020; The Renewal Workshop, 2020), together with take-back schemes for worn-out products that go to recycling (Goworek et al., 2013). These additional customer services not only improve product lifetimes but also increase customer loyalty.

The slow-fashion trend addresses customers who want to wear clothes that have been manufactured with respect to people and the environment, involving local artisans, transparent supply chains and the use of eco-friendly or recycled materials. These brands focus on trans-seasonal and durable clothing, often combined with originality and a personal style independent of industrial fashion. Some brands work with pre-ordering systems to avoid overproduction (ArmedAngels, 2020; Twothirds, 2020), support social initiatives (GEA Waldviertler, 2020) or engage in environmental projects, such as tree planting (Tentree, 2020). Storytelling, or a personal connection with the designer or producer, are important motivators that create emotional attachments, and encourage people to keep and cherish these products for a long time (Fjallraven, 2020; PeopleTree, 2020; Stella McCartney, 2020).

Product design is a key enabler to long product life and the following design strategies for textiles relate to it (Policy Hub - Circularity for apparel and footwear, 2020a; Circular Fashion, 2019; Bocken et al., 2016; Bakker et al., 2015).

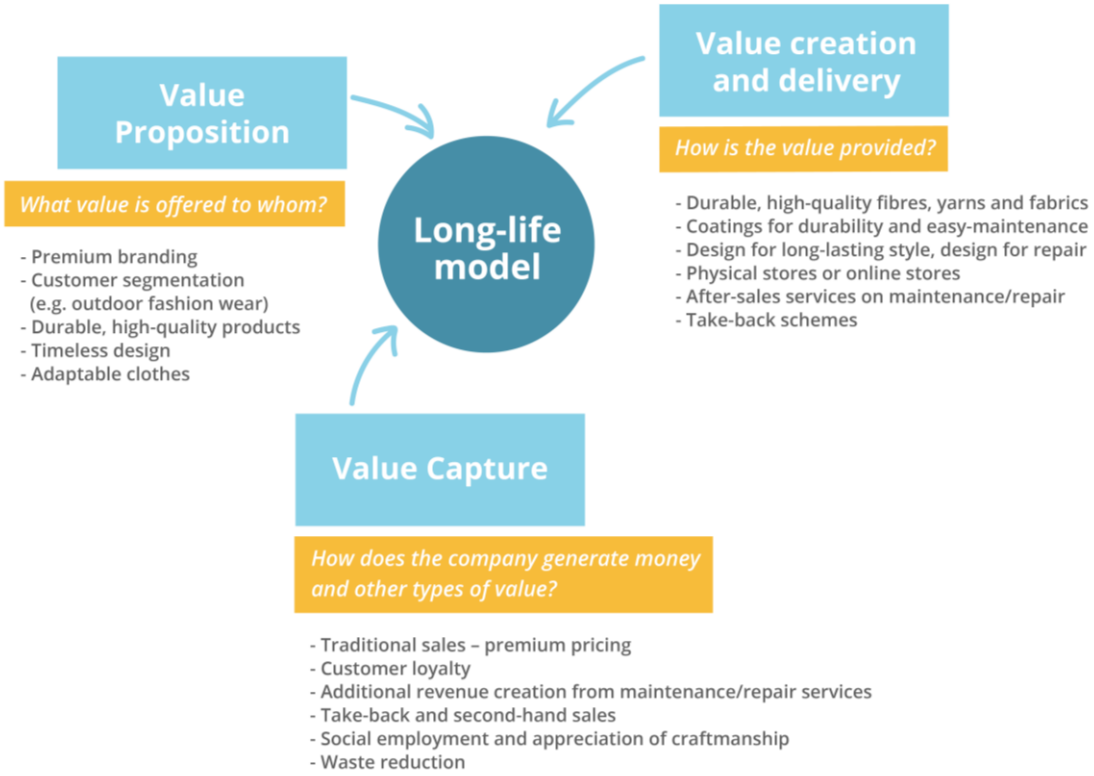
- **Design for attachment and trust:** create textiles that will be loved and kept by their owners through, for example, personalisation options, such as tailoring, including name tags or customer-led designs, all of which increase a user's emotional attachment to items, stimulating longer product lifetimes and repair, rather than disposal (Mugge et al., 2005).
- **Design for durability:** choosing durable, high-quality fabrics and sturdy construction methods to ensure product can withstand wear and tear and keep their functionality for a long time.
- **Design for long-lasting style:** choosing timeless colours and designs that are less susceptible to fashion trends and easy to combine with other items.
- **Design for ease of maintenance and repair:** creating products that are easy to clean, wash and repair, including the provision of adequate user instructions, maintenance kits and spare parts.
- **Design for dis- and reassembly:** the construction of products in such a way that they can be easily disassembled for maintenance or repair by, for example, stitching rather than gluing, using removable zippers and buttons, providing detachable textile covers on furniture and eliminating rivets in jeans (Ellen MacArthur Foundation, 2019), …
- **Design for holistic impact:** design products with their full lifecycle in mind, for example by choosing low-impact materials, minimising waste and increasing potential for reuse and circularity in each step of the lifecycle.

Also, the provision of services that facilitate longer product lives are sometimes included in these business models, such as offering tailoring, personalisation, maintenance and repair services or selling replacement parts. Nevertheless, the challenge designers face is to navigate among potential trade-offs since tensions that can arise between the above-mentioned principles - such as something that is designed for durability using methods that mean it cannot be disassembled.

To address the increased cost of product design for durability, durable, long-life products are premium branded and sold at higher prices than more conventional products. Customers are made aware that by buying high-quality they avoid underperformance and save early replacement costs. Brands aim at customer satisfaction and loyalty. The main revenue model is a traditional sale, but this can be complemented by additional after-sales services, such as maintenance or repair services. Some brands actively encourage and facilitate a second-hand market for their products, prolonging product life beyond the initial customer and serving customer segments with less buying power.

Figure 10 shows examples of value strategies used in business models enabling product longevity and durability.

Figure 10 Value strategies used in business models enabling product longevity and durability



Source: ETC/WMGE

Notably, business models built on longevity and durability have some **challenges** that need to be overcome. From a company perspective there may be higher production costs due to more expensive high-quality raw materials, such as fibres with high wear/tear resistance, protective or easy-maintenance coatings or dyes that hold their colour. Production processes may also be more expensive or labour-intensive when stitching is used instead of gluing or tailor-made designs are offered leading to fewer economies of scale, especially if the business model puts a focus on local production chains. Technological innovation, such as 3D printing technologies, new materials such as antimicrobial and ultra-violet resistant fibres, could enable tailor-made production of highly durable clothing. On the other hand, timeless designs reduce the need for ever-changing designs, preserving product value.

Higher production costs and lower production volumes result in higher sales prices. This poses a competitive disadvantage compared to more low-cost brands, fuelled by mass production and cheap labour, particularly from Asia. Consequently, customers have to be convinced that the product's quality, performance and durability are superior to other brands, legitimising the higher price. Building this level of customer trust and loyalty, however, takes investment and time. While reduced sales volumes are a desired consequence of this approach, it may challenge profitability. From a customer-perspective, buying durable products is often seen as a long-term investment, justifying the higher initial price with the prospect of less frequent replacement. Nevertheless, although the long-term cost of more durable and expensive products may eventually be lower than low-quality, cheap products, the high initial purchase price may reduce affordability for a wide range of consumers, creating limitations in terms of market reach. Additionally, the notion of fashion, involving fast changing trends, is, to a certain extent, contrary to a shift to more durable, long-life products with timeless style. There is a need to change the concept of fashion to more sustainable practices and lifestyles, supporting longer product lives.

One potential route to overcome this barrier, is to design business models that are based on access rather than ownership, such as renting, leasing or sharing. Such models could offer high-quality, durable products at a low periodic fee, assuring access for a much broader audience (Section 4.2). However, more fundamental enabling actions are required to support the growth of circular business models based on

long product lives in the textile sector. While durable, long-lasting products used to be the norm in a not-so-distant past, the shift to a more consumerist lifestyle has made fast changing fashion trends and the use of (semi-)disposable products the predominant paradigm. Awareness building is needed to move consumers to a more sustainable lifestyles, involving longer product lives, embracing repair and reuse, and reducing waste.

The textile industry also has an important role to play in making fashion trends less volatile and increasing interest in durable products without the fear of them being out-of-fashion quickly. Textile maintenance and repair skills, such as sewing, mending and darning, need to be rebuilt, and maintenance guidelines, repair instructions and spare parts should be conveniently accessible. At the same time, a network of repair shops and services should be available and affordable. Such services are sometimes offered by product brands directly but can also be taken up by third parties. An important barrier to repair services is the cost relative to replacement, in addition to the inconvenience caused by taking and collecting products to and from a repair shop.

Policy interventions can be an important tool in making repair services more affordable for consumers, and more profitable for companies. An example is the introduction of schemes or reduced VAT on repair services, as Sweden has recently introduced (Finansdepartementet Skatte- och tullavdelningen, 2015), or wage subsidies for employees working in maintenance, repair and reuse activities (Watson, Gylling, et al., 2017). Other incentives to encourage a shift in demand towards greener choices and circularity include subsidies for promoting demand for circular business models or for green vouchers, such as Belgium's EcoCheques, for consumers, and incentivising green public procurement. Existing initiatives in EU Member States include the Dutch Ministry of Defence which has committed to buy textiles containing at least 10 % recycled material (Policy Hub - Circularity for apparel and footwear, 2020b). Alternatively, durability standards and labels could be developed, setting a baseline for product quality and durability, in combination with a tax on waste or disposable textile products, thereby setting incentives for increasing resource efficiency and reducing resource consumption.

Figure 11 gives examples of innovation and enablers needed across the product lifecycles to support business models that aim at durable, long-lasting products.

Figure 11 Enabling longevity and durability models across product lifecycles

Source: ETC/WMGE

4.2 Access-based models: renting, leasing and shared use of textiles

A second main pathway towards increased circularity in the textiles system is focusing on the shift from ownership to access. Access-based business models provide access to services that meet a customer's needs, without the necessity of owning the product itself. As explained in Section 3.4, access-based models have the potential to **reduce** the production of new products, while the intensity by which products are used under a service-system is potentially increased through **shared use** and **reuse**. Whether such models actually decouple the generation of profit from the production and sales volume depends on the presence of the right conditions and incentives for lifetime-extension and resource-saving strategies, such as more durable products, maintenance, reparability, design-for-repair and take-back systems.

Service models exist in different textile markets – business-to-business, such as carpet and workwear leasing; business-to-consumer, such as tent rentals and clothing libraries; or consumer-to-consumer, such as the sharing of camping gear, through online platforms. Revenues can be financial, for example, when rental fees are charged, however, the rental fee could be substituted by alternative revenue sources such as advertising, selling complimentary services, etc. Even a non-commercial sharing service (without fees) would still be able to provide social and environmental value, such as community cohesion, the prospect of getting the favour returned and reduced consumption. These service models, whether they are commercial or informal exchanges, offer an alternative to the traditional linear model based on sales and product ownership.

They offer a value proposition of user experience and product performance, without the (cost of) ownership. This model makes products accessible and affordable to a wider audience, because there is no need to make the upfront investment of product ownership; a much lower, periodic use fee is charged instead. This value proposition is already common for expensive products that are only used for a limited amount of time or on special occasions, for example the rental of festive clothing or camping gear.

In many cases, the focus on performance during use as value proposition creates an incentive for the servicing companies to design highly durable and reparable products, so they can guarantee quality and performance without the need for frequent interventions and replacements. In the case of renting and sharing models, the products need to survive wear and tear by multiple users and be easy to clean. Also recyclability or the potential for subsequent reuse in different applications can be an important driver as it conserves product value and avoids waste treatment costs (Lindström, 2019).

For textile products with longer use periods, such as carpets or building interiors, access-based models typically come with complementary services, such as installation, maintenance and repair. In this case, the main value proposition is not price as service-models are often more expensive than ownership in the long run, but rather convenience and guaranteed, hassle-free performance. This is especially relevant in the business-to-business context, as companies can save on investment budgets and replace them by recurring working costs.

Many companies offer workwear or household textiles as-a-service to industries, restaurants and hospitals (business-to-business), including laundry services and repairs. Even some degree of personalisation can be offered, for example the adding of the company's logo. From a business-to-consumer perspective, more recently, a new societal trend has emerged attaching less importance to ownership as a status symbol and thus creating the emergence of access-based value propositions – which before were mainly used in other areas such as mobility or music) – for a wider range of textile products through clothing libraries, fashion rental systems and subscription models for children's clothes (Bundlee, 2020; Front Row, 2020; Lena Library, 2020).

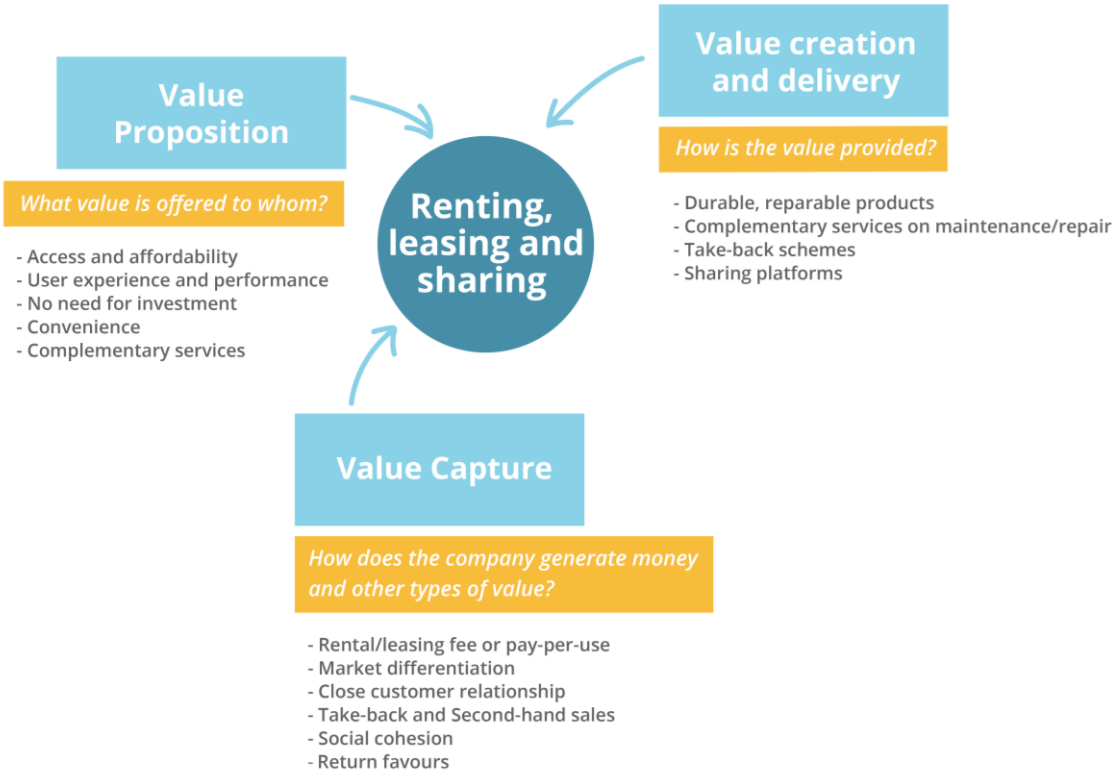
In these access-based business models, money is earned by charging a periodic rental or leasing fee, or by the pay-per-use principle. Additional revenues can be obtained by providing complementary services, such as maintenance or repair, either as part of the use contract, or at an additional cost. Since the products

are owned by the service company, products for which the lease period has ended return to the company. Depending on the type of product and the shape it is in, it can be prepared for a new lease, sold on the second-hand market or send to recycling.

Figure 12 shows examples of value strategies used in business models based on access and product-services.

Some companies combine a traditional product sales model with new access-based models, such as lending or renting, in their value proposition portfolio, allowing them to differentiate between customer segments (Lena Library, 2020; My Wardrobe HQ, 2020). However, the development and implementation of an access-based business model comes with several challenges. First of all, it represents a fundamental change in the role and key activities of the company. The traditional linear focus on producing and selling products shifts to providing logistics, maintenance and repair services. This not only changes the type of activities to, amongst others. keeping track of product whereabouts, timely execution of maintenance and repair programmes and delivery and take-back logistics, but also comes with a closer, long-term customer relationship. Leasing household linen to hospitals, for example, does not only entail the supply of bed linen and towels, but also includes take-back logistics, sorting, stock tracking, laundry, quality control, repair and replacement and appropriate waste handling.

Figure 12 Value strategies used in access-based business models: renting, leasing and shared use



Source: ETC/WMGE

Moreover, setting up a product-service model requires a significant upfront investment in sufficient products, while payback times are longer since use fees are spread out in time. The main drawbacks for clothing libraries or rental services are the building of a sufficient membership base, combined with high start-up costs to buy the clothes and significant operating costs for maintenance, repairs and logistics. A handful of libraries exist in Germany, the Netherlands, Belgium, the Nordic countries and the United Kingdom. The main clientele are young women, living in an urban environment. Their drivers may be both a greater environmental awareness and a smaller budget (Elander et al., 2017). However, sustaining the library model is challenging, and many initiatives stop or shift their activities after a while. Often, services based on shared use are only profitable in parallel with traditional retail models based on sales, or with

support measures, such as voluntary work, in the case of charities, or the provision of free materials (Elander et al., 2017). The provision of start-up or transition funding to companies developing access models could overcome the challenging starting phase of high initial investments and long pay-back times. Ideally, such funding schemes should be supported by business coaching and circular knowledge hubs in order to provide inspiration and guidance on new business models and ensure informed decision making (Watson, Gylling, et al., 2017).

Although access-based models can lead to reduced consumption, they are not inherently circular or more sustainable than more traditional models (Kjaer et al., 2019). A lifecycle assessment of a clothing library system has shown that there are potential environmental benefits as long as the clothes' service life is substantially prolonged and results in reduced consumption of clothes overall (Zamani et al., 2017). However, the affordability of access-based models such as clothing libraries or rental may also lead to additional consumption such as the renting designer clothes that the customer would never wear if they had to buy them; more frequent replacements to keep up with style; or going on a skiing trip because you can borrow skiing gear from a sharing platform which makes the trip affordable. In addition, the increased logistics involved could result in additional transport emissions, while hygiene considerations could lead to more washing and disinfecting, which can outweigh the benefits of reduced consumption.

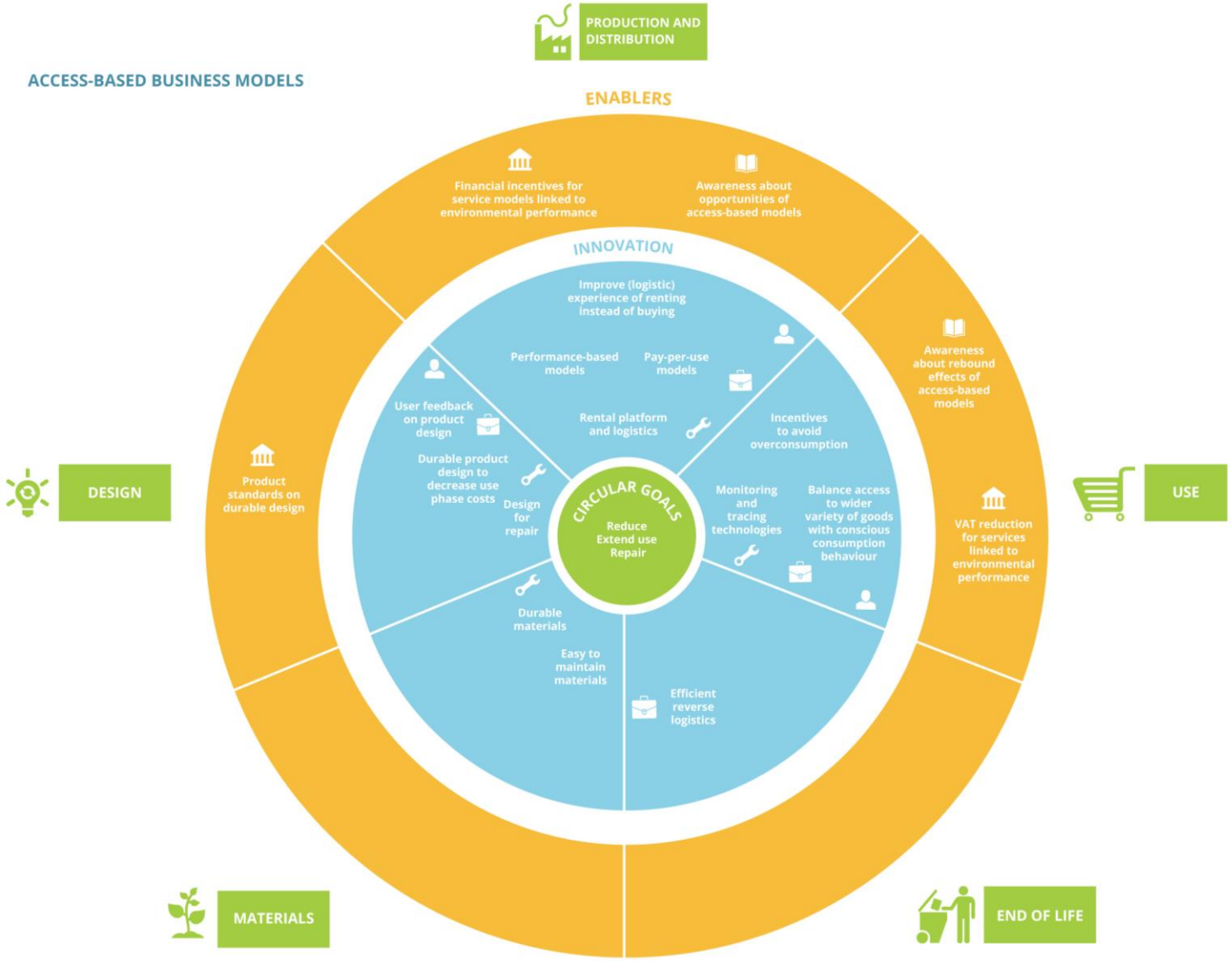
On the other hand, since the textile products remain in the ownership of the service company, this presents incentives for companies to choose more durable products that are easy to maintain, service and repair. This may increase upfront investment costs but saves on servicing and replacement costs in the longer term. The fact that the products are owned by the servicing company also offers opportunities for a more professional and efficient end-of-life handling once products no longer suitable for reuse. The rental companies could eventually become large suppliers of textile waste to the collection and recycling industries: their volumes are larger, the quality is more homogeneous and the product lifecycle history more transparent, which makes it an easier source of recycling materials compared to the consumer market (Fontell and Heikkilä, 2017). In the case of carpet leasing, multiple companies exist that combine the leasing with replacement services and take-back programmes for carpet recycling (Desso, 2019; Interface, 2019).

Although access-based models are often mentioned as an interesting route to a circular economy, the scaling of such models is still quite limited. One technological innovation that could support the further development and scaling of access-based models is the development of user-friendly matching platforms for product sharing, swapping or lending. Product monitoring and tracing technology would provide potential cost and impact savings by minimising transport during the use phase. A legislative challenge for shared use models is the management of liabilities and warranties: who is responsible for the product's performance, and how should defects or damage be handled? To overcome the financial barriers to setting up a service-model, policy measures involving tax reductions on maintenance activities, VAT exemptions for sharing systems and start-up investment support could help to increase the profitability of service companies.

A shift to consumption patterns based on access instead of ownership requires a fundamental mind shift among customers. While access-based models can increase convenience through, for example, scheduled maintenance, guaranteed performance and instant replacements, they can also require customers to make extra efforts or commitments that can act as a barrier, such as making a reservation for camping gear for a fixed date, collecting and returning clothes to a library or embarking in a leasing or subscription model for baby clothes. Additionally, distribution or transport costs may be involved, which may make the access-model more expensive and cumbersome than just buying (Watson et al., 2017).

Figure 13 gives examples of innovation and enablers needed across a product's lifecycle to support business models that aim to provide access and product services.

Figure 13 Access models: renting, leasing and sharing business models across a product's lifecycle



Source: ETC/WMGE

4.3 Collection and resale

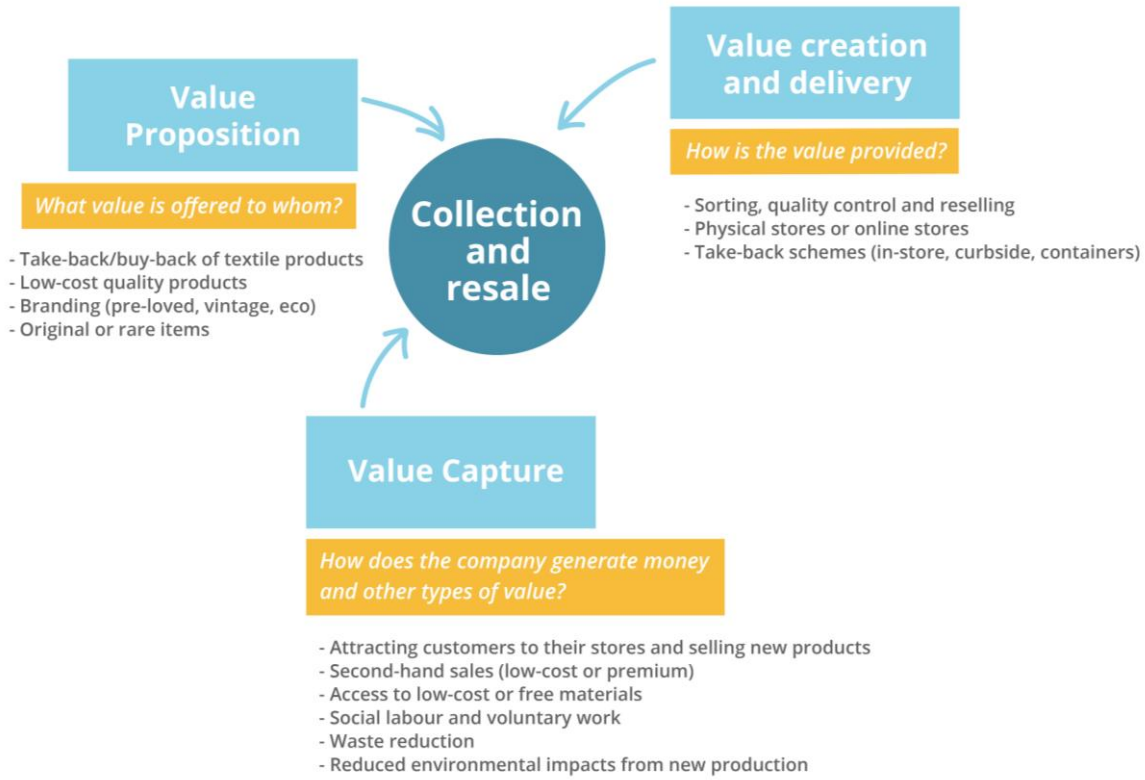
Closing material loops is a fundamental principle of the circular economy. Business models that target the closing of loops aim to exploit residual value by collecting waste products and preparing them for reuse. There are several business models built around the collection and resale of textiles. A distinction can be made between companies that do selective take-back only, and companies collecting all textiles. In both cases, the aim is to exploit the residual value of the textile products, by reuse or recycling. The circular goals that can be achieved through these models are **reuse,** selling second-hand, within Europe and beyond, and also **recycling** those products that cannot be reused (Section 4.4). The reuse of products reduces the need new ones, which also contributes to the **reduce** circular goal. However, it is challenging to estimate to what extent reuse actually replaces new consumption, or rather enables consumers to purchase additional products that they would not buy at full price. Based on customer surveys, it is estimated that on average about 60 % of clothing reuse replaces new purchases and thus contributes to reduced consumption (Farfetch, 2020; Farrant et al., 2010). Main motivators for consumers to buy pre-owned textile items are a better price, rarity, environmental concerns and positive past experiences (Farfetch, 2020).

Selective take-back initiatives exist for high-quality or exclusive clothing brands. The take-back can be operated by the brand itself, often through a partnership with a collector, that only accepts their own brand (Havep, 2020; Patagonia, 2020b); or by a third party, such as private second-hand shops or solution providers that apply their own selection system of popular high-quality brands, designer pieces or vintage garments (I:CO, 2020; The Renewal Workshop, 2020). The aim is to select and prepare the items for second-hand reuse and resale. Typically, customers that bring or send their used items to the shop receive a voucher or a buy-back fee for the items that are accepted – generally after they are resold. Articles that do not sell are returned to their owner or are donated to charity. The quality of collected garments is often very high. The items are checked and resold in second-hand stores or online platforms at reduced prices. In this model, the products that are sold for reuse are typically high-quality and durable, or they are original pieces, such as designer clothing. Such value propositions attract customers looking for high quality or originality at lower prices. Reuse activities are also popular for baby clothes, which are worn for a very short time and suffer little wear and tear. Ample reuse shops specialized in baby clothing exist, some of which actively search the market for reusable products that are in high demand (Mic Mac Minuscule, 2020). Several branding labels, such as pre-owned, pre-loved, vintage and eco, are often attached to the items offered to increase their appeal.

Companies engaging in general collection schemes collect clothes, shoes and household textiles regardless of their condition or brand. Many popular clothing brands regularly organise clothing or shoe collection campaigns, raising awareness among customers about textile waste and sometimes motivating them to bring in used items by offering discount vouchers for new purchases (Esprit, 2020; H&M, 2020; Levi's, 2020). Such discounts may increase collection rates for reuse but may also encourage increased consumption of new resources. Furthermore, curb-side collection or collection though textile waste containers is a common practice operated by waste industries or charities. The textiles, mainly clothes, in these take-back systems can be any brand and their quality is generally much lower, but the collector benefits from getting the materials for free. The collected textiles are graded by professional textile sorters or charities and sold on the global textile market. Often social labour or volunteers are involved in the sorting and reselling with revenues going to the organising charity or community initiatives. A small fraction is reused locally, for example in thrift shops that offer low-cost textiles for reuse. The majority is exported, for reuse outside Europe, recycling or disposal. Some brands do selective collections of specific items, such as trainers, with the aim of recycling specific materials (Section 4.4).

Figure 14 shows examples of value strategies used in business models based on collection and resale.

Figure 14 Value strategies used in collection and resale business models



Source: ETC/WMGE

Business models based on the collection and resale of used textiles are challenged by the costs of collection logistics and sorting in relation to relatively low revenues. In the case of second-hand shops, margins on used items are relatively low compared to what can be achieved by outlets for new fast fashion, while the handling costs for checking and sorting are high. Also, many customers tend to prefer new items over used ones. As a result, many shops offer a combination of used and new items. To overcome the barrier of sorting costs, separate collection of high-quality items for reuse should be balanced with the development of more automated sorting technologies for those waste streams meant to go to recycling, together with labour subsidies or tax reductions on sorting and reuse activities. In the EU, the Seventh VAT Directive (2006/112/EC) ruled that second-hand sales should be taxed on the basis of the difference between the purchase and the resale price, rather than the full resale price. For those items that are not fit for reuse, cost-efficient, automated sorting processes are needed to create homogeneous textile flows that are suitable for industrial fibre recycling.

From the customer perspective, cultural factors are very significant in determining in how reused products are perceived. In some groups, reused or vintage items can be considered original and cool, while in other cultures their perceived low quality or cheap image act as a barrier to second-hand sales. Also, despite lower sales prices, the overall transaction cost of second-hand products increases considerably when the time and effort that customers spend in finding what they need is included. Second-hand clothing items typically only come in one size and colour, with no option to order, and second-hand retailers are typically located outside main shopping areas (Watson et al., 2015; Svengren Holm and Holm, 2010). The development of user-friendly reuse platforms that provide the easy matching of customers and retailers, for example by combining the inventories of different stores, could ease the hurdle of searching for the right products. Another promising option to improve the competitiveness of second-hand stores is enabling them to locate in central shopping areas through rental support or by dedicating part of the shopping area to stores selling second-hand goods. A more visible and attractive reuse market could also help to create a mind shift among customers and retailers, potentially stimulating regular stores to allocate some of their space to second-hand sales (Watson, Miljø, et al., 2017). For technical textile products, such as workwear or safety gear, an additional drawback is the difficulty of giving quality or safety warranties

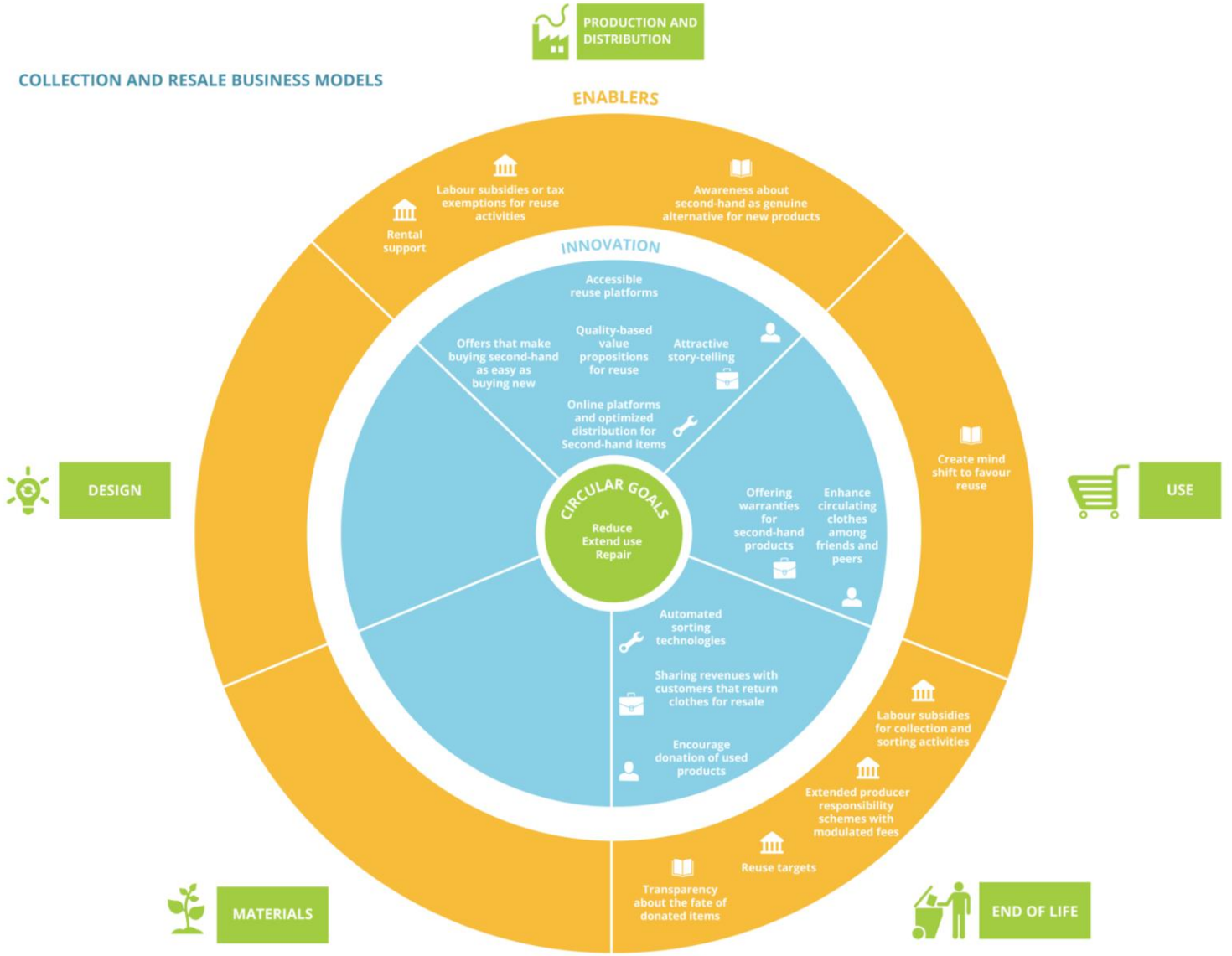
for used items as the history of such items is not always known or there may be invisible defects. Clear protocols on how to check and warrant product performance would be helpful.

With respect to donating used items for reuse, such as to charities, consumers are often reluctant to donate because there is a lack of transparency about what happens to the clothing they have donated. Consumers also have difficulties to adequately distinguish between re-usable and non-reusable textiles. Increased consumer awareness and convenient collection schemes, whether in-store, in curb-side, containers, or by return mailings, can encourage consumers to hand over their waste textiles to collection schemes. Some online stores sell their goods in returnable packaging, which can be used by customers for returning old textiles for recycling by mail (Repack, 2020; Fontell and Heikkilä, 2017).

To stimulate collection, the EU adopted an obligation for the separate collection of textile waste by 2025 (Directive (EU) 2018/851). Additionally, the EU Waste Framework Directive stipulated a combined target for reuse and recycling, and some Member States are establishing more specific reuse targets (RREUSE, 2016). Extended producer responsibility schemes with eco-modulated fees can be introduced to raise funding to support investment in collection and recycling capacity, as well as in research and development to develop more efficient textile sorting and recycling processes (Hardy, 2020). Extended producer responsibility systems should, however, allocate responsibilities clearly to all stakeholders in proportion to their role within it and their sphere of influence; establish robust mechanisms of monitoring, control and surveillance with equal rules for all stakeholders and provide proportional financing with optimal transparency (Policy Hub - Circularity for apparel and footwear, 2019).

Figure 15 gives examples of innovation and enablers needed across a product's lifecycle to support business models that aim at collection and resale.

Figure 15 Collection/take-back and resale business model across a product's lifecycle



Source: ETC/WMGE

4.4 Recycling and material reuse

Products that cannot be reused for their original purpose can be turned into new raw materials for (re)manufacture. Material reuse can be done at the level of fabrics, such as the reuse of truck tarpaulins for the production of handbags, or at the fibre or material level, after industrial fibre recycling as in the production of recycled denim. Circular goals that can be achieved are **remanufacturing,** which in the context of textiles means the **reuse** of fabrics in new textile products, often referred to as upcycling, and the **recycling** of textile fibres. Both result in a reduction in the need for virgin raw materials and a reduction in textile waste generation.

Remanufacturing or upcycling is particularly popular in the field of textiles and fashion. Most upcycling activities are performed at home, for non-commercial purposes. Creating clothes, furniture and accessories from discarded materials is often done as a hobby, giving pleasure, pride and satisfaction during the making process (Hirscher et al., 2018; Sung, 2017). Active involvement in the design and making process increases emotional attachment (Mugge, 2007), supporting longer product life. In recent years, the emergence of online platforms specialising in handicrafts has offered accessible marketplaces for home artisans and small-scale entrepreneurs to sell their products across the globe (Ueland, 2020). Business initiatives around upcycling are mostly small scale, although some companies have managed to grow into popular brands.

The value proposition for upcycled products typically explicitly highlights the fact that waste materials are used in the production process. The designs are often highly creative and the reused fabrics or parts remain recognisable albeit in a new form. There are several brands of handbags, wallets and other accessories that use discarded truck tarpaulins, worn-out workwear or old flags and banners as raw materials (Flagbag, 2020; Freitag, 2020; Pour, 2020; Volverup, 2020). These brands highlight their sustainable image, their distinctive designs, the history of their raw materials and the artisanal production process, often involving local, social labour. Some brands also draw attention to the potential health benefits of reused textiles in comparison with virgin textiles. An example is the production of children's blankets and towels from used household textiles that, due to numerous previous washing cycles, contain a much lower chemical load then new textiles (Stormie Poodle, 2020). This eco-, health- or designer-branding allows these companies to sell their products at premium rates, while getting their raw materials for free, or at a low cost through dedicated buy-back schemes or partnerships with waste suppliers, such as municipalities; event organisers in the case of waste banners; or service companies that provide waste from textile leasing schemes. Such partnerships in which one company uses another company's waste as a resource is often referred to a *industrial symbiosis*. Upcycling activities are predominantly undertaken by small-scale entrepreneurs or small and medium-sized enterprises focused on sustainability, social entrepreneurship and innovative designs. They target eco-conscious customers willing to pay premium prices for sustainable, yet stylish and sometimes unique products.

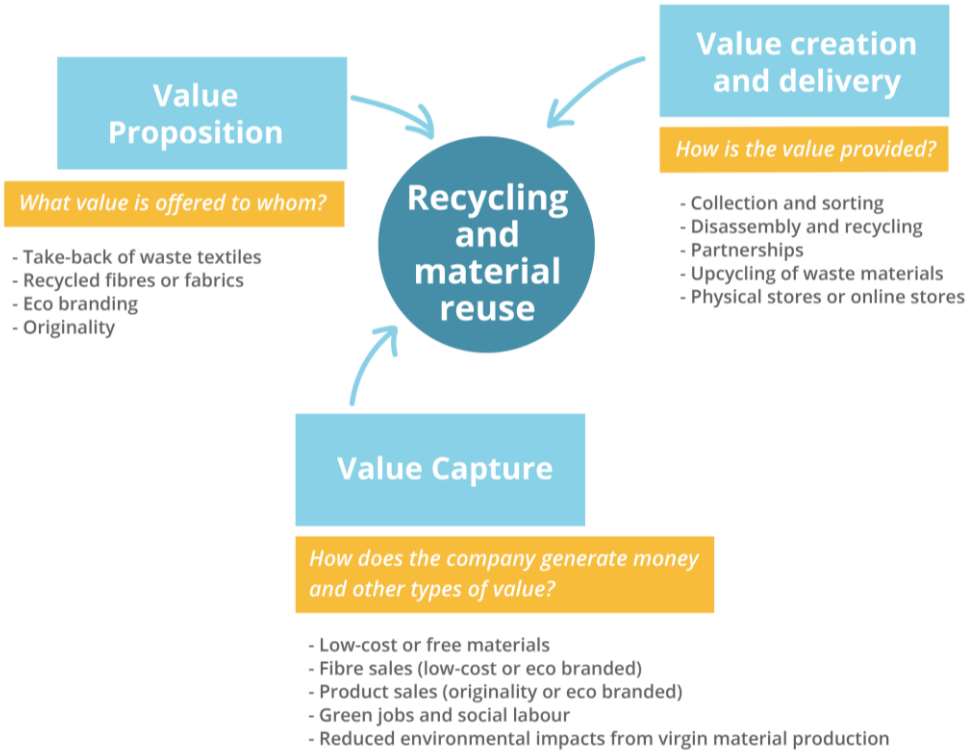
Recycled textiles, on the other hand, look and feel like virgin textiles, but contain a certain percentage of recycled fibres. Textile manufacturers use recycled fibres as a substitute for virgin fibres to lower their environmental footprint. Many brands that use recycled fibres mention this aspect deliberately in their value proposition to attract eco-conscious customers. However, the recycled content is usually not directly apparent and the designs are more mainstream. Also, production processes are not fundamentally impacted by the use of recycled yarns or fabrics. Examples are numerous in the clothing industry, including jeans with up to 50 % recycled fibres and sportswear made from recycled polyester from PET bottles and recycled nylon from fishing nets (Adidas, 2020; Econyl, 2020; HNST, 2020a). The use of recycled fibres is also common in the production of non-wovens, such as felt (BNP, 2020; Wolkat, 2020).

To achieve material reuse or recycling, accurate textile collection and sorting processes are needed to achieve textile streams that are sufficiently homogenous for further disassembly and processing. Sometimes, this requires very selective collection campaigns of specific items, such as trainers and jeans, through in-store collection boxes at large retailers (Levi's, 2020; Nike, 2020), by direct take-back or buy-

back schemes for tarpaulins, promotional flags and banners and used workwear, for example (Freitag, 2020; Havep, 2020); or by waste clean-up activities such as the collection of discarded fishing nets from the ocean (Nofir, 2020; Parley Global Cleanup Network, 2020)). In some cases, the waste material collection and recycling are done by the brands themselves, while in other cases the recycled yarns and fabrics are bought ready-made from a yarn producer.

Figure 16 shows examples of value strategies used in business models based on recycling and upcycling.

Figure 16 Value strategies used for recycling and upcycling business models



Source: ETC/WGME

Although environmental awareness caused an increasing interest in upcycling in recent years, upcycling activities are still largely considered niche practices (Singh et al., 2019), with small-scale upcycling activities facing some key challenges. Unlike standardised mass production, the manufacturing process of upcycling is highly customised and labour-intensive; requires specific skills and tools; and the tailor-made designs offer less opportunities for economies of scale. The material sourcing for reuse is characterised by uncertainties and risks related to reliable supply, quality, safety and complex legislative requirements, especially if post-consumer materials are reused. Upcycling activities require production and storage space, specific skills or skilled staff, and equipment. Profitability is often low because of time- and labour intensity and the cost of renting production/storage space and marketing (Singh et al., 2019). The availability of facilities, such as maker spaces, material databases, collection centres and tool rental services would alleviate some of the barriers that prevent the general public and small entrepreneurs from engaging in upcycling activities. In addition, the provision of education and training in technical skills, sewing, mending, quality testing, etc.; in business management skills, feasibility, risk assessment and market identification; as well as on financial and legal knowledge would encourage small-scale upcycling entrepreneurs to start businesses. Also, the promotion and facilitation of collaboration and network formation among upcyclers, for example, through events, community workshops, local competitions, and knowledge hubs, would allow the sharing of infrastructure, skills, resources, knowledge and workload peaks (Singh et al., 2019; Sung, 2017). Local authorities and national circular economy organisations can play an important enabling role in creating favourable conditions for the development of an upcycling business community. Notably, many upcyclers lack the motivation to expand their businesses (Sung, 2017).

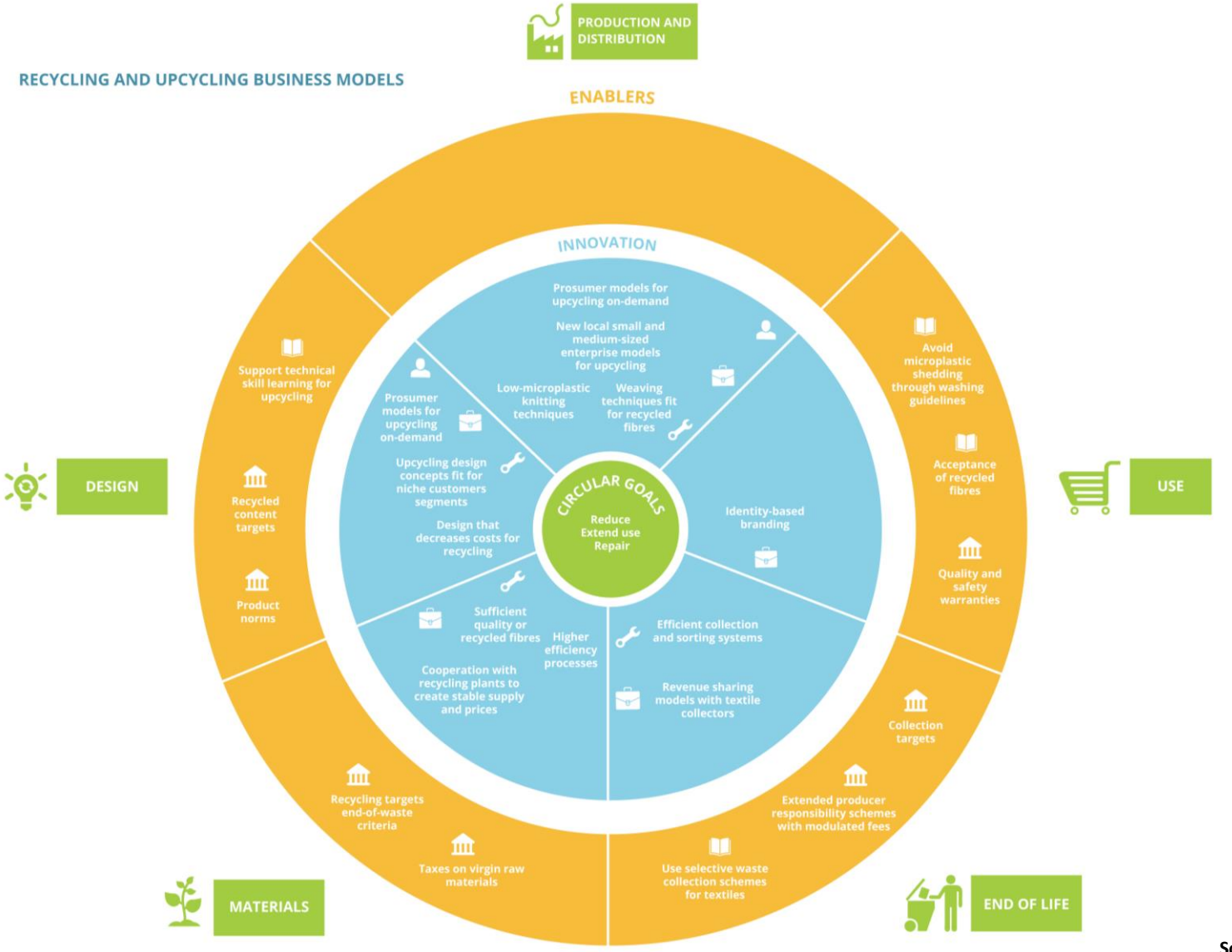
Recycling-based business models face considerable challenges as well. While recycling technology, when fully implemented, would allow the use of recycled fibres in new textiles without many changes to current yarn spinning and textile manufacturing processes (Fontell and Heikkilä, 2017), other technical barriers prevent economies of scale. Small and medium-sized enterprises face difficulties in finding materials that meet their quality standards and minimum quantities at the same time, while larger companies face barriers because recycled post-consumer textile fibres are currently not available in the necessary quantities. Furthermore, there is a lack of specialised suppliers of recycled fibres and a lack of accessible information and standards (Global Fashion Agenda, 2019). There is a huge need for high-capacity identification, sorting and recycling processes that can handle poor quality and mixed textiles, as well as the efficient removal of accessories such as buttons and zips. Moreover, textile recycling technologies are not yet fully developed, especially for chemical recycling. In spite of some small and medium-sized enterprises and big companies manufacturing recycled fibres and yarns, they still only service niche markets and need larger market uptake. At present, mainly mechanical recycling takes place on industrial scales which almost always requires virgin materials to be mixed with recycled fibres to create new yarns, for example in a 50/50 ratio, to make up for loss of fibre quality due to the recycling process.

Economic policy incentives that can support businesses engaging in upcycling and recycling are subsidies or tax benefits for material reuse and recycling activities, as well as grants and awards for promising start-ups. Internalising the environmental costs of virgin fibres by introducing taxes on virgin raw materials, possibly in the form of refunded virgin payment schemes, or extended producer responsibility systems with eco-modulated fees could be effective in creating an economic advantage for recycled fibres and material reuse. Revenues from such schemes could be refunded to those producers that use recycled fibres in their products, possibly in proportion to the share of the recycled content in their produce (Elander, Tojo, et al., 2017).

Another issue relates to the market uptake of recycled products. Research, development and innovation are needed to support the creation of a fully functioning recycling sector for textiles, while stimulating market demand for upcycled and recycled fibres and yarns, both within the textiles industry and other industries such as plastics. On the one hand, targets for recycling and recycled content could be used to stimulate demand and help develop a market (Euratex, 2019b). On the other hand, customers are often reluctant to purchase these kinds of products and currently only a small number of customers purchase them. The reasons are diverse and range from a lack of guarantee on the quality of the materials used and hence fear of failure, through high prices compared to similar products, to a limited number of available options in terms of size and colour, for example, for upcycled textile products. Thus, raising awareness of the environmental impact of textile production and the benefits of upcycling are key to increasing customer interest. Inspirational media campaigns, television shows or the engagement of popular artists can all help spread the message to a broad audience (Sung, 2017), not only by leveraging the environmental benefits of upcycled products but also highlighting their uniqueness in order to reinforce the feeling of distinctiveness amongst customers. To convince customers, however, awareness building needs to go hand-in-hand with quality assurance, effective marketing, convenient shopping experiences and affordable prices. Legislative changes can facilitate the handling, storage and reuse of waste materials, while quality and safety standards for recycled and upcycled products would help to create customer trust. But governments are also an important market player and can support recycling and upcycling , leading by example through green public procurement.

Figure 17 gives examples of innovation and enablers needed across the product lifecycle to support business models that aim at recycling and material reuse.

Figure 17 Recycling and material reuse business model across a product's lifecycle



Source: ETC/WMGE

4.5 Reflections

Each of these four pathways towards circularity taps into different societal opportunities and, at the same time, faces different systemic challenges.

The main benefit of the recycling and material reuse pathway is that it fits rather well in current business models in the textiles system and customer behaviour. Mainstreaming textile fibre recycling would not require extensive behaviour change or social innovation on the consumer side. However, this pathway heavily depends on technological innovation to ensure high quality, closed-loop recycling and efficient logistics systems. These changes require business innovation in the industry to align the economic interests of waste collectors, recyclers and fibre producers. Supporting policy measures for this pathway would include substantial investment in new textile fibre value chain development.

The collection and resale pathway largely operates outside the raw materials and product design phases. Existing activities show that even without the cooperation of producers, circular business models in the textiles system can be implemented. Mainstreaming this pathway, however, would require a fundamental shift in consumer behaviour and social innovation. The reuse of clothing would need to be separated from the perception that it is something for either people who cannot afford new clothes or for people who buy second-hand clothing as a moral statement. High-quality reuse would also benefit from more durable clothing design, which is difficult without the cooperation of producers. Policy measures to support the collection and resale pathway would therefore need to focus on ensuring collection targets and product standards, as well as on local labour incentives to support the highly labour intensive business cases that drive this pathway.

The access-based models' pathway is one that holds promise for a more structural solution to circularity in the textiles sector, because it would reorient business drivers for product design from cheap, single-use items to durable, robust ones. Nevertheless, transitioning from selling products to providing them as a service presents a huge challenge for current stakeholder in the industry. It not only requires overhauling design and production processes, but also the sales and retail departments as well. Moreover, the customer segment willing to rent clothes instead of buying them remains very small. Still, following the COVID-19 crisis, changing trends are emerging. More than 70 % of consumers indicate they are more inclined to invest in higher quality garments and would be interested in circular business models such as resale, rental or refurbishment (Global fashion Agenda, 2020). Consequently, aligning technical, business and social innovation is paramount for this pathway break through. It will require broad and concerted policy and behavioural change interventions throughout the lifecycle of textiles.

Finally, the longevity and durability pathway could be an outcome of the advanced access-based model pathway because access-based models would lead to durable products with long lifetimes. Nevertheless, this analysis shows that even within more traditional sales models, the lifetime of textile products could be significantly increased if the right business context were provided. The key to mainstreaming this pathway is to make durable clothing more affordable to customers and/or for producers. For the former, policy measures could provide tax breaks for durable clothing. For the latter, tax measures should make non-durable clothing more expensive, levelling the playing field for producers that choose high quality, durable designs. Additionally, design requirements and comparable labelling schemes on durability could also be considered for leverage.

Other ways of encouraging consumers to change their behaviour away from fast fashion to slow, conscious fashion would help, but require tremendous cultural shifts.

Overall, mainstreaming circular business models in the textiles system seems to be possible through different pathways. The analytical perspective provided in this report allows an assessment of the advantages and difficulties for each pathway, and identifies the requirements and consequences of focusing on one or another. Furthermore, it shows that to provide a clear perspective for stakeholders

working on circular economy transitions it is important to discuss the role of business model innovation in the wider context of social and technical innovation, and of key systemic enablers such as policy and behavioural change. In policy making, the challenge is to define and combine policy interventions that are ambitious while being open to the various business models and value strategies presented in this report rather than imposing specific ones. A balance needs to be found between mandatory requirements and voluntary options to improve the overall sustainability of textiles.

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