

Business Models for the Circular Economy

Opportunities and Challenges
from a Policy Perspective



POLICY HIGHLIGHTS



Business Models for the Circular Economy

Circular business models represent fundamentally different ways of producing and consuming goods and services. They have the potential to drive the transition towards a more resource efficient and circular economy and, in doing so, significantly reduce the environmental pressure resulting from economic activity.

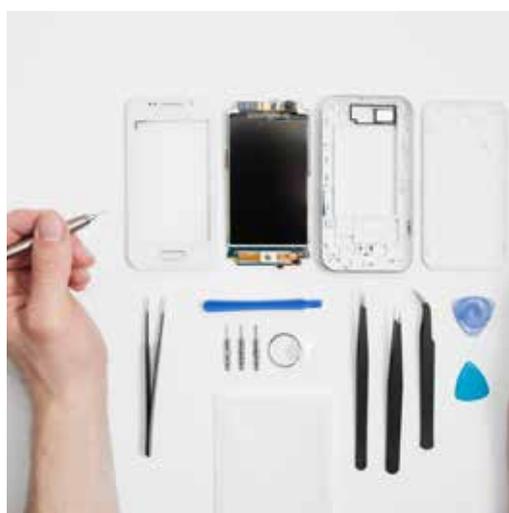
Key messages

- Circular business models serve to reduce the extraction and use of natural resources and the generation of industrial and consumer wastes. They represent the key activities required to transition to a more resource efficient and circular economy.
- Circular business models use already existing materials and products as inputs and therefore their environmental footprint tends to be considerably smaller than that for traditional business models.
- The environmental outcomes of circular business models also depend on their market penetration. However, the market share of these business models is currently limited. Recycling, remanufacturing and repair, the sharing of spare capacity, and the provision of services rather than products typically only account for up to 15% of production in any given sector.
- Some circular business models have experienced rapid growth in recent years, largely in response to the emergence of new technologies. For instance, Airbnb has gone from being a curiosity in the accommodation sector ten years ago to being the largest single supplier of short term stays today. Most other circular business models – recycling and repair being good examples – are relatively mature.
- In some cases, the emergence of enabling technologies, more supportive consumer preferences, or new business risks will drive increased adoption of circular business models. Public policy also has a role to play. In particular, governments could focus on addressing widely cited barriers such as:
 - i. the mispricing of natural resources that results from under-priced externalities and the provision of subsidies for extractive sectors;
 - ii. the transaction costs that hinder collaboration within and across value chains;
 - iii. the trade policies that restrict cross border flows of used products and secondary material feedstock, and;
 - iv. the status quo biases that are often inherent in investment and consumer behaviour.

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Key characteristics of circular business models

Circular business models modify the pattern of product and material flows through the economy. By doing so, they can reduce the adverse environmental side-effects resulting from the extraction, use, and eventual disposal of natural resources and materials. This results not only from facility level improvements in material productivity, but also from more fundamental changes in production and consumption patterns. For example, instead of using natural resource inputs more efficiently, renewable energy generation and the production of raw materials from scrap do not use them at all.



Five headline business models for a more circular economy:

- Circular supply models, by replacing traditional material inputs derived from virgin resources with bio-based, renewable, or recovered materials, reduce demand for virgin resource extraction in the long run
- Resource recovery models recycle waste into secondary raw materials, thereby diverting waste from final disposal while also displacing the extraction and processing of virgin natural resources
- Product life extension models extend the use period of existing products, slow the flow of constituent materials through the economy, and reduce the rate of resource extraction and waste generation
- Sharing models facilitate the sharing of under-utilised products, and can therefore reduce demand for new products and their embedded raw materials
- Product service system models, where services rather than products are marketed, improve incentives for green product design and more efficient product use, thereby promoting a more sparing use of natural resources.

Circular business models do not operate in isolation

The distinction between different circular business models is clear in theory, but may be less so in reality. In some cases, firms adopt combinations of business models. For example, the adoption of product service system model – and the retention of a product ownership that goes with it – may serve to incentivise the parallel adoption of product repair or remanufacturing. In other cases, the decision to adopt a particular circular business model by a firm or group of firms can facilitate the adoption of a related business model by others.

Not all circular business models are necessarily new

Recycling, reuse, and repair have existed for millennia. The sharing of under-utilised household possessions also has a long history, and the provision of access to products, rather than ownership of them, is not so different from traditional product leasing. What is new is the growing diversity and sophistication of these business models, as well as the range of sectors they are adopted in. In the context of personal transport, vehicles containing a significant proportion of recycled materials or remanufactured parts are now available. Alternatively, where access to mobility is preferred to ownership, ride sharing, car sharing, or short term car rental have become potential solutions.

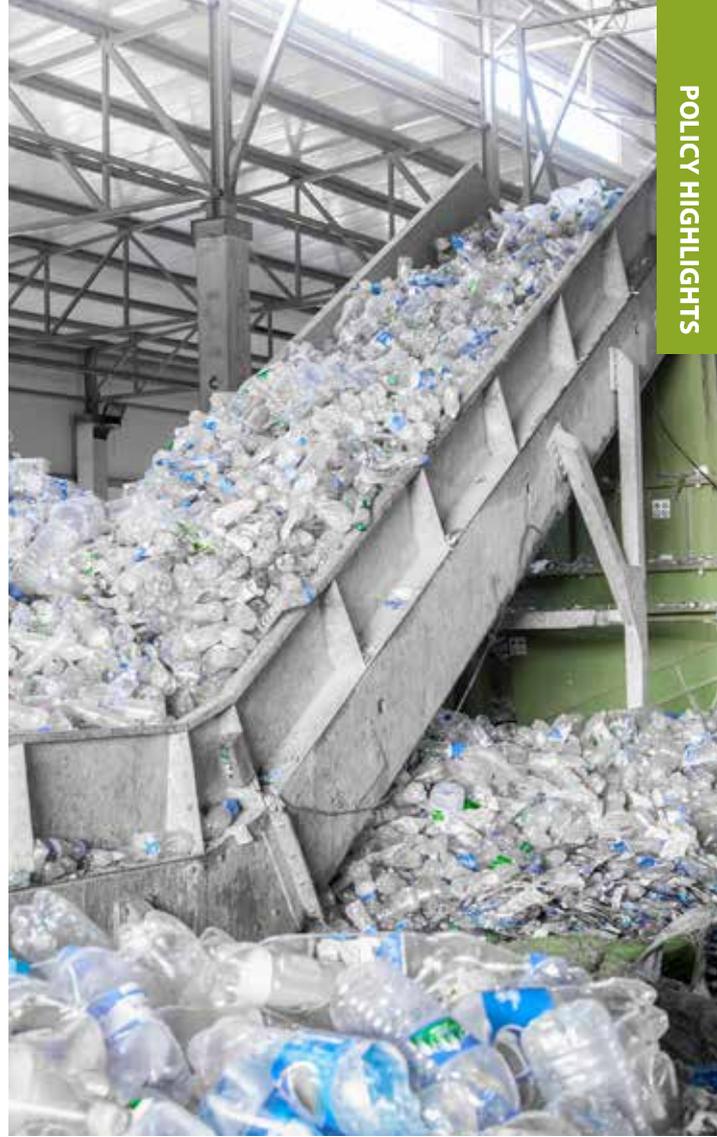
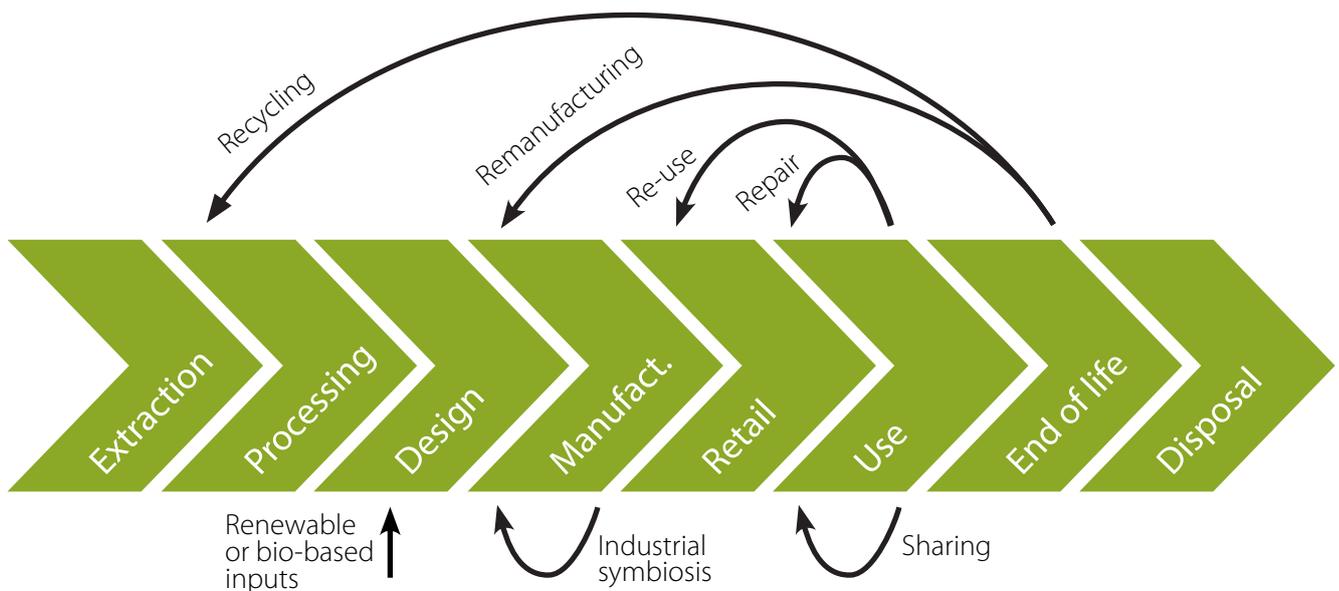


Figure 1. **Circular business models operate in different parts of the value chain**



Source: Adapted from Accenture (2015)

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The environmental potential of circular business models

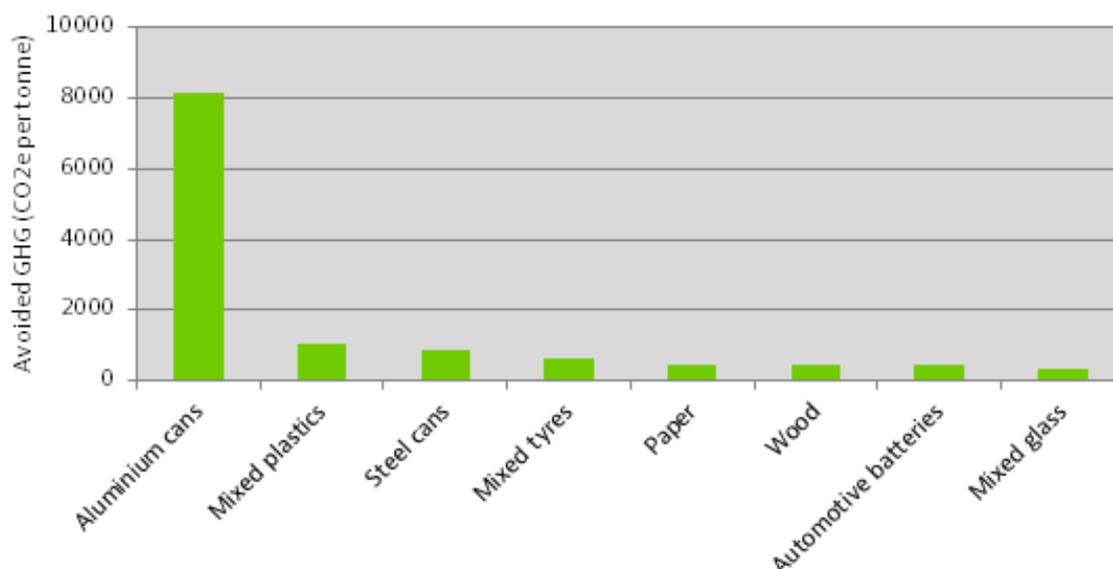
Circular business models, by closing resource loops and by slowing and narrowing resource flows, can reduce the environmental footprint of economic production and consumption.

These environmental benefits can be significant. In the case of the resource recovery business model, producing raw materials via recycling, rather than from non-renewable natural resources, can reduce greenhouse gas emissions by as much as 90% (BIR, 2008). The magnitude of emissions reductions involved varies across materials, but is significant in almost all cases (Figure 2).

Other circular business models also have considerable environmental benefits. Remanufacturing products that have reached their end of life can reduce the extraction of natural resources and generation of waste by up to 80% relative to manufacturing new products. Reduced extraction, processing, and transport of natural resources also translates into energy savings, often in excess of 50% (Table 1).

Although relatively little empirical data is available, the sharing or leasing of already existing products also seems likely to lead to lower environmental burdens. A switch from ownership to access creates a new set of incentives around product design, product use, and product disposal. For product manufacturers, the retention of ownership can incentivise the design of products that are both relatively long-lasting, and more amenable to remanufacture or recycling at their end of life. For consumers, paying for the service provided by the product, rather than the product itself, can lead to behavioural changes. A number of studies find that members of urban car sharing schemes typically reduce their vehicle kilometres travelled by 15-40%.

Figure 2. **Avoided GHG emissions per tonne of recycled material**



Source: Turner et al. 2015

The environmental potential of circular business models is clear, but risks remain.

Some of these risks are business model and sector specific:

- The adoption of the circular supply business model in the form of increased production of bio-based materials could stimulate land cover change and place additional pressure on ecosystems and biodiversity.
- Without appropriate controls, more widespread material recovery and recycling could increase society's exposure to harmful chemical substances contained in secondary materials.
- The continued emergence of collaborative modes of consumption could trigger a shift away from green substitutes (in the transport sector for example, where consumers may choose car sharing or pooling over public transport).



More generally, the emergence of rebound effects could negate some of the first order environmental benefits of circular business models. For example, in the context of sharing models, it has been shown that Airbnb rooms are typically 15-20% cheaper than equivalent hotel rooms. The consumer savings that this generates may well be allocated to additional consumption, with a corresponding environmental footprint.

Table 1. **Avoided resource and energy use from remanufacturing**

Author	Study type	Product focus	Change in sectoral resource extraction	Change in sectoral energy consumption
Kerr and Ryan (2000)	LCA	Photocopiers	-19% to -25%	-27%
		Photocopiers (modular)	-39% to -48%	-68%
Smith and Keolian (2004)	LCA	Engines	-26% to -90%	-68% to -83%
Steinhilper (2006)		Various	-	-85%
Neto and Bloemhof (2009)	LCA	Personal computers	-	-80%
Gutowski et al (2011)	Meta-review	Clothing	-	-64%
		Computers	-	-57%
		Electric motors	-	3%
		Tires	-	9%
		Appliances	-	75%
		Engines	-	-4%
		Toner cartridges	-	-6%
Warsen et al (2011)	LCA	Gearbox	>50%	-33%
Liu et al (2014)	LCA	Engines	-95%	-66%
Wilson et al (2014)	LCA	Turbine blades	-	-36%
Gao et al (2017)	LCA	Turbochargers	-	-82.50%

Note: Life Cycle Assessment (LCA)

Source: Data taken from various sources – refer to McCarthy and Borkey (2018) for more information.

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The current scale, and potential scalability, of circular business models

The market share held by circular business models is limited. Some circular business models have achieved significant market share, but typically only in restricted economic niches. Examples of such niche market penetration include product service systems in automotive coatings and resource recovery in the steel sector.

Elsewhere, the market penetration of circular business models remains limited (Table 2). Reuse and remanufacturing, the sharing of under-utilised capacity, and the provision of services rather than products accounts for only a small fraction of output in most sectors (generally no more than 5 to 10% in economic terms). As such, there remains considerable potential for the scale up of circular economy business models in many sectors.

Table 2. **Market share of circular business models in selected sectors**

Business model	Sector	Market penetration
PSS: result-oriented (chemicals)	Automotive	50 - 80%
PSS: result oriented (digital content)	Music	50%
Waste as value: recycling	Pulp and paper	38%
PSS: result oriented (digital content)	Books	25 - 35%
Waste as value: recycling	Steel	25%
PSS: result-oriented (chemicals)	Aerospace	5 - 15%
Waste as value: recycling	Plastics	13%
Product life extension: refurbishment	Smartphones	4 - 8%
PSS: result-oriented (lighting & heating)	Various	4 - 8%
Product life extension: remanufacturing	Machinery	3 - 4%
Product life extension: refurbishment	Various	2 - 3%
Product life extension: remanufacturing	Aerospace	2 - 12%
Idle Capacity: co-access	Lodging	1% - 6%
Product life extension: remanufacturing	Automotive	1%
Product life extension: remanufacturing	Consumer and electrical and electronic equipment (EEE)	0 - 1%
Was as value: recycling	Rare earth element (REE) metals	<1%
PSS: user-oriented (car sharing)	Transport	<1%

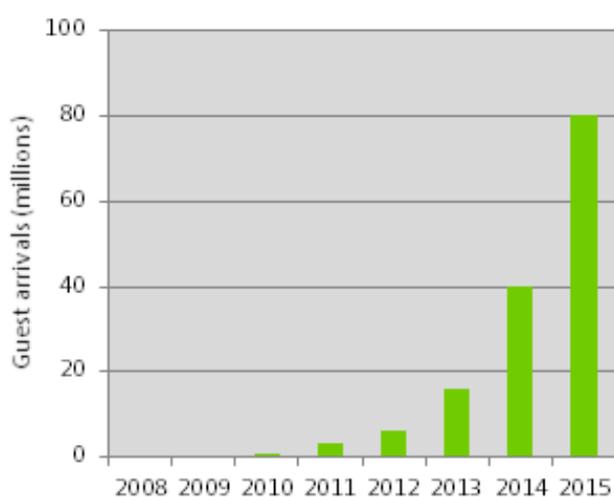
Source: Data taken from various sources – refer to McCarthy and Borkey (2018) for more information

Some circular business models are scaling rapidly, mostly in response to technological drivers.

For the circular supplies model, technological innovation in manufacturing technologies along with an increased consumer willingness to pay for green products have been important drivers. For sharing models, and for certain variants of product service system models, it is the emergence of the internet, mobile phone technology, and the development of referral and reputational systems that have allowed certain products to be shared more widely than ever before.

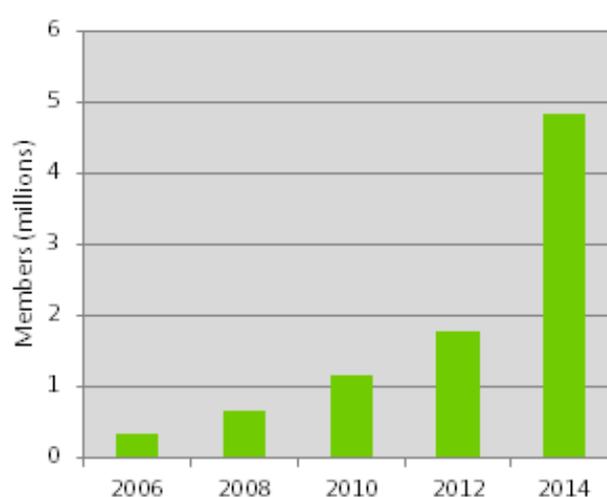
Airbnb has gone from being a curiosity in the accommodation sector ten years ago to being the largest single supplier of short term stays today (Figure 3). Similarly, global membership of urban car sharing schemes is growing at an annual rate of up to 65% (Figure 4).

Figure 3. **Growth in Airbnb arrivals: 2008 - 2015**



Source: Recode (2017), based on Airbnb data

Figure 4. **Growth in membership of urban car sharing schemes**



Source: Shaheen and Cohen (2016)

Other circular business models are relatively mature but the business case for further adoption is lacking.

Most other circular business models – resource recovery and product reuse and repair are good examples – have a long history and are relatively mature. In the context of resource recovery, the proportion of recycled production in the global supply of industrial metals has, with some variation, remained between 15 and 35% for the last four decades.

Achieving higher rates of market penetration for mature business models will require significant changes to existing policy frameworks. In some instances, this is already happening; the recent adoption of a comprehensive strategy on plastics in the European Union is one such example.

The emergence of enabling technologies, more supportive consumer preferences, and new business risks will also offer opportunities for the adoption of relatively mature circular business models. The appearance of technologies associated with the so-called Fourth Industrial Revolution - robotics, artificial intelligence, sensor technology, and 3D printing among others – seem particularly promising, but require further investigation.

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Key policy messages

Policy interventions are required to create the conditions for the wider adoption of circular business models.

Ultimately, transitioning to a markedly more circular and resource efficient economy – one where the environmental pressures associated with economic production and consumption are significantly reduced – will require more widespread penetration of circular business models.

Policy can play an important role by addressing the market failures, policy misalignments, and status quo biases that currently hinder the competitiveness of these business models.

Policy can help to:

- ensure that the full environmental costs of production and consumption activities are reflected in market prices;
- improve collaboration within and across sectoral value chains. Fostering industrial symbiosis clusters, promoting online material marketplaces, establishing secondary raw material certification schemes, and, more generally, facilitation of cooperation within and across value chains may be worthwhile initial steps;
- ensure that existing regulatory frameworks are coherent and fit for purpose, and not serving to preserve an existing status quo;
- improve existing educational and information programs to provide individuals with a better understanding of the unintended consequences of their consumption choices. The use of behavioural insights and nudges, such as through labelling requirements, may be a promising way forward;
- promote the supply of circular products (“supply-push measures”) or demand for them (“demand-pull measures”). For the former this includes eco-design standards, strengthened extended producer responsibility (EPR) schemes, and the provision of targeted R&D funding. Examples of the latter include differentiated VAT rates, recycled content mandates, product labelling standards, and green public procurement.



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Further reading

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RE-CIRCLE is an OECD project providing policy guidance on resource efficiency and the transition to a circular economy.

The aim of the RE-CIRCLE project is to identify and quantify the impact of policies which increase resource efficiency and further the transition to a circular economy.



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For further reading on business models for the circular economy see the OECD Environment Working Paper on which these Policy Highlights are based:

OECD (forthcoming), *Business Models for the Circular Economy: Opportunities and Challenges from a Policy Perspective*, OECD Publishing, Paris.

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