



Money makes the world go round

(and will it help to make the economy circular as well?)

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Working Group
FINANCE

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Preface from the WORKING GROUP

Businesses are increasingly aware of the context in which they operate.

Companies are increasingly aware of the society in which they operate - aware of their impact and their possible contribution. Such awareness is not only seen as a social responsibility apart from their core business, but also as one that is intimately connected to it. Financial institutions are no exception. We see and respond to changes in society, even if they do not yet directly interfere with our business.

This context is fast changing...

Significant global developments include technological disruptions, fast emerging markets, a rapidly growing middle class with accompanying increased consumption, and worsening environmental degradation. These developments highlight the downsides of an economy that is based on short product life cycles and which destroys value at the end of a product's life. This waste is expensive today and unaffordable tomorrow. However, it is hard to change the ingrained way of generating revenue based on the linear take-make-dispose model.

...and has an impact on the core business of the financial industry as well.

Physical waste is financial waste as well. Turning the economy from one that is linear to one that is more circular is necessary, but this is not only a mission for entrepreneurs in the real economy. The financial sector should also be part of this quest. More important that the corporate responsibility argument is the fact that, as with the coming of the internet, the shift to a circular economy will affect the financial industry's clients and therefore the financial industry itself.

The circular economy offers large potential economic gains...

From an economic perspective the upsides of the transition are numerous. It is a call for resource efficiency: lowering material costs and mitigating the impact of volatility in materials prices. There are also potential macro-economic gains. The shift will for instance be visible in the labour market since the economy will to a certain extent become less materials intensive and more labour intensive. If resource dependency diminishes then the risk of economic instability from geopolitical tension will likely fall. Last but not least, if we use materials more sensibly, the depletion of scarce, non-renewable resources will be mitigated.

...that the financial industry should be able to capitalise on.

The success of the financial industry is often narrowed to the minimisation of risk and maximisation of return. This can also be applied to the shift to a circular economy. The financial industry should aim to support companies that are successfully making the transition ('circular opportunities') and avoid those that cannot or are in a shrinking sector ('linear risks').

But real life is tougher...

To move from a linear economy to a circular one is easier said than done. To start with, we need a substantial shift in the economic order. This shift has to cover everything from the design of products and the circularity of material flows (including the accompanying reverse logistics) to creating the right incentives and legal structures to stimulate circular economy business ideas. A shift in consumer mindset is essential to enable such business ideas to succeed – without consumer demand the transition towards a circular economy will not gain momentum. Just as crucial is the investment capital needed to alter business practices. The uncertainties and lack of experience of the new business paradigm imply huge challenges for the financial industry and suggest a need for new financial product offerings.

... and finance is not automatically an enabler.

We see flows of money changing in a circular economy. For instance, the pay-for-use model has a very different cash flow structure to the traditional pay-for-ownership approach. This directly impacts the cost structure of the company and hence its financing requirements. If financiers see the economy from a linear perspective this can be a disadvantage for a circular company seeking finance. While money can be an enabler of the transition pathway to a circular economy, this is not automatically the case.

We need to understand the new reality and adapt to it.

Understanding the changes in the economy is essential. Even without a desire to contribute to these developments, an appreciation of the changing principles of doing business is a necessity. The presence of new opportunities, new business models and changing risks due to resource scarcity will have consequences for the financial industry, including the way their products are assessed and how their advice is offered.

This is the ambition
of the FinanCE
working group.

This is why we collaborate in this working group. The first step is to work together to understand the implications of the new economic paradigm. Not only to passively anticipate, but also to actively contribute to guiding this necessary change. The next step will be to perform a more in-depth analysis on how our business is influenced by circularity, what this implies for our current and future clients and how we can adapt to these developments. The aim is to work together to benefit from our joint network and our collective intelligence and creativity.

Happy reading and
an inspirational
follow up!

I wish you all a very pleasant time reading this report and hope the findings are useful for your business. We actively invite you to engage with the working group and to send us your comments and criticism. You can reach us at CE@PGGM.NL.

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PART I

The fast-changing global context is our starting point. In a world increasingly dominated by new technologies and shifts in demographics and the global economy, new challenges arise. One is how to cope with the legacy of a linear economy, in which products are consumed and largely get turned into waste, diminishing the stock of non-renewable natural resources. A more circular economy that creates economic value is also an answer to the resource challenge, both because it is a more effective system than the linear economy and mitigates its risks whilst creating positive capital-building opportunities.

In the first part of the report we describe the context, provide a systematic framework in which money is one of the enablers of the transition to a circular economy, and lay out our ambition as a financial sector in contributing to this transition.

PART II

In the second part of the report we focus on three important components of the financial perspective of the transition to a more circular economy:

- First are the changes we see in business models that accompany circular ways of working. The report analyses various case studies of circular economy businesses to determine the concrete financial impacts of going circular.
- Second is a deep dive into the financial considerations of circular economy businesses, covering risks and opportunities and the detailed consequences for revenue and cost structures, cash flows, balance sheets and financing requirements.
- Third are the macroeconomic consequences of circular economy business models being more widely adopted. This extends the assessment of the circular economy approach beyond the commercial considerations of individual businesses. Macroeconomic analysis is an important consideration for potential investors deciding where to invest.

PART III

In the second part of the report we focus on three important components of the financial perspective of Finally, we look beyond this report. This first step, to understand the financial implications of circular economy business models, is only the first the working group will take. The next phase, to assess the impact and consequences for financial institutions themselves, is crucial: actions speak louder than words.

PART I

these are transitional times

ONE: The road to Circular Economy

The Industrial Revolution brought us unprecedented prosperity and led to the consumption of an ever-increasing variety of goods and services. During this period of accelerated economic development both natural resources and the space needed to dispose of waste were effectively considered inexhaustible. This resulted in a linear economic approach, the so-called 'take, make, dispose' model where the majority of feedstock used to make products was eventually thrown away. In the present era, the costs and supply risks surrounding non-renewable natural resources are high, and the negative externalities associated with their use, such as climate change and biodiversity loss, are clearly felt. New global megatrends such as the advent of disruptive technologies, a rapidly growing middle class, and the blurring of the traditional roles of governments, businesses, and citizens, serve not only to further increase such risks, but also to provide tools to move to an alternative economic model. The destruction of the value inherent in the linear economy has become clear and the potential for an alternative circular approach, one that is regenerative and restorative by design, is increasingly appealing. The finance industry can play a key role in the transition to a circular economy.

1.1. The legacy of the industrial era is an economy which is linear by design

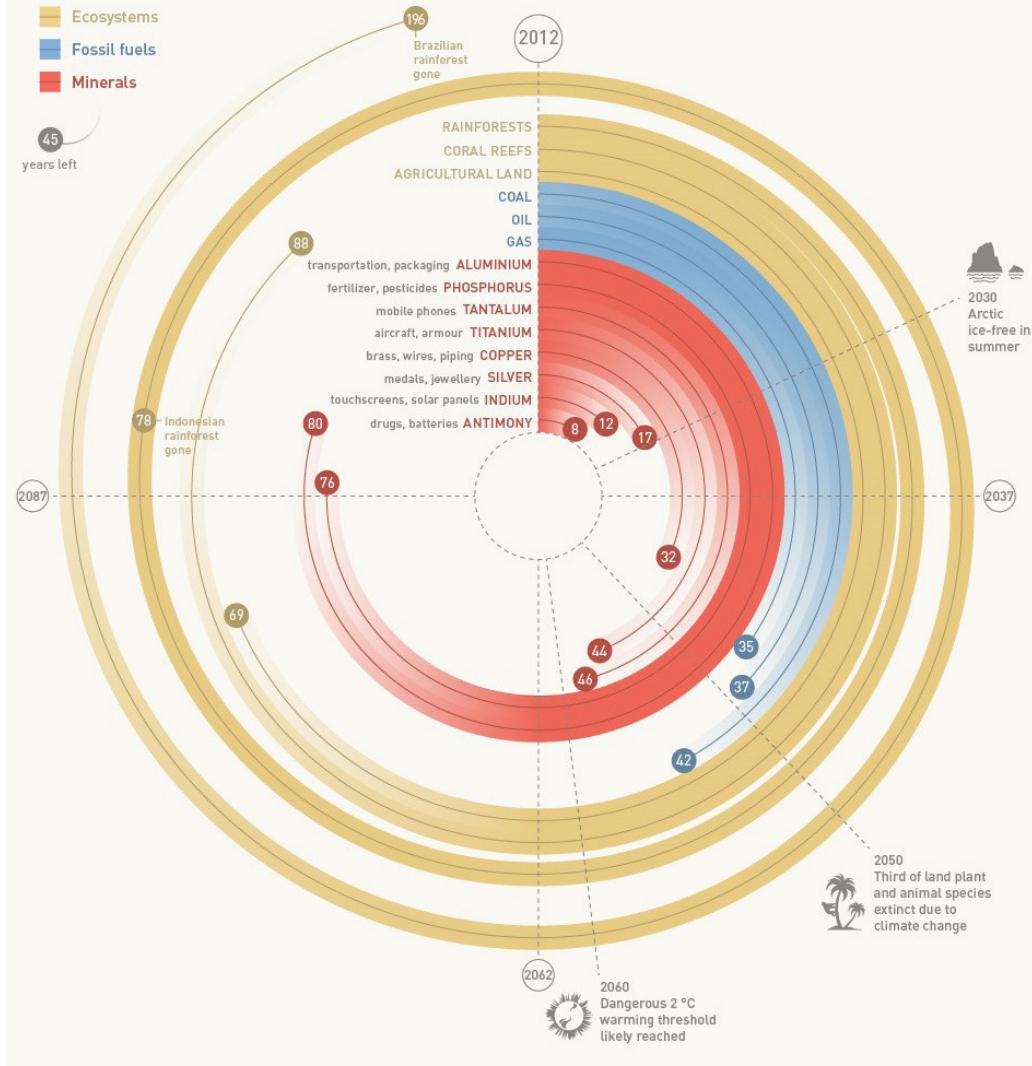
Our present linear economy can be explained historically. The Industrial Revolution increased prosperity substantially by radically increasing the productivity of the economy's factors of production – land, labour, and capital – through breakthrough technological advances. Incentives stimulated increasing sales and economies of scale through operational excellence, efficiency, and innovation. The fact that the stock of non-renewable resources was being depleted to keep up with the increasing consumption was not taken into account since that stock was considered – for foreseeable future demand – to be inexhaustible. Three underlying factors threaten the sustainability of this linear model:

Non-renewable resources will reach limits to affordable supply

First, as can be seen in Figure 1, we see the limits of the proven reserves of certain important resources such as

Stock Check

Estimated remaining world supplies of non-renewable resources



Sources: UN TEEB, US Geological Survey, BP, Worm et al (2006), London Metal Exchange. Figures are worldwide. Living natural resources dates are worst-case based on published estimates. Minerals and fossil fuel data based on known reserves currently economical to extract, assuming fixed % increase in usage per year. No provision made for changes in demand caused by new technologies, discoveries of new reserves or market forces. Agricultural land means land suitable for rainfed cultivation net of other land usage. Thirty year historic agricultural expansion rates are applied.

iibstudio

Figure 1: Global stock check.

metals in a 'business as usual' scenario.¹ There is a link between stocks of such resources and waste. In 2013, the average annual per capita waste production in OECD countries was 522 kg², and by 2011 global annual waste production had reached 12 billion tonnes.³ Such a volume of waste can become a resource in itself. A UN report concluded that, for example, only 16% of all electronic waste is recycled. The other 84% ends up as waste that, according to UN under-secretary-general David Malone, rector of the UN University, can be seen as 'a valuable "urban mine" – a large potential reservoir of recyclable materials.' The UN estimates that in 41.8 million tonnes (Mt) of electronic waste there is 16 Mt of iron, 1.9 Mt of copper and 300 tonnes of gold, plus other precious metals such as palladium, with a combined value of \$52 billion.⁴

Environmental externalities are increasing and are largely unpriced

Figure 1 also shows the projected lifespan of some natural resources such as rainforests. It has been shown that the current level of consumption to support living standards in developed countries in a linear economy exceeds the carrying capacity of the earth's natural systems. Continued environmental degradation is a threat for generations to come. This state of affairs is a logical consequence of the incentives in the current economic system. In their 2007 article, Braungart, McDonough and Bollinger concluded that, in a linear economy, the concept of long-term economic growth is inconsistent with the concept of long-term ecological effectiveness.⁵ Negative environmental externalities are largely unpriced despite recent efforts in some countries to, for example, set a price for permits to emit greenhouse gases. Incorporating the cost of externalities into the prices of goods and services incentivises producers and consumers to move away from environmentally damaging products towards those that are less damaging, and thereby leads to a reduction in environmental degradation and its associated social costs.

¹ www.bbc.com/future/story/20120618-global-resources-stock-check (18 June 2012).

² OECD, *Environment at a glance* (2015).

³ Source: MVO NL.

⁴ BBC news, *Microwaves and dishwashers dominate e-waste mountain* (19 April 2015; <http://www.bbc.co.uk/news/technology-32353659>).

⁵ M. Braungart, W. McDonough, A. Bollinger, 'Cradle to cradle design: creating healthy emissions – a strategy for eco-effective product and system design', *Journal of Cleaner Production* (15, 2007), 1337–48.

There is ever-increasing demand for resources:

In the past 100 years the global population has quadrupled. In the twentieth century prosperity – GDP – increased by a factor of 25 and the demand for construction materials by a factor of 34. The annual global demand for energy doubled in the last 40 years and is expected to grow an additional 50% in the coming 20 years.⁶ Such increased demand in the face of limited supply has put a strain on resource prices and increased their volatility. This leads to increased uncertainty about costs and prices, in the end reducing economic stability.

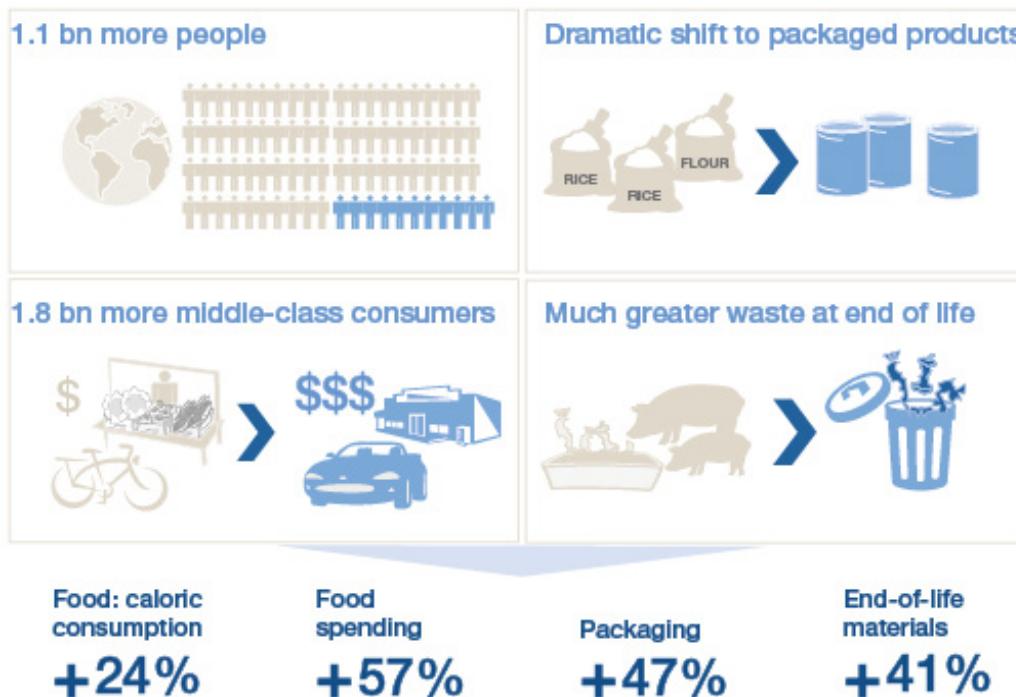


Figure 2: Consumer effects (source: Ellen MacArthur Foundation).

⁶ MVO NL.

1.2. Current trends both exacerbate the problem and offer new opportunities

This phrase ‘This is no era of change but a change of era’ is used to describe the period in which we live. There has always been change in our societies. Every day new solutions provide further progress. But a change of era arises when several fundamental developments reinforce each other and significantly change the way we live and work. In hindsight the invention of the steam engine caused the change from an agricultural to an industrial society. Many suggest that we are living through a similar transformation, to what is often referred to as the digital society. This transformation is not heralded by a big bang, but it can be seen that since the beginning of the 1990s with the development of the Internet, mobile information technology, and increasing computing capabilities the development of digital technology has become a dominant driver of our society. This shift in paradigm has an impact on citizens, businesses, and governments.

These megatrends are important ingredients for this transition:

- 1) **New technology.** 3D printing and the Internet of Things, for instance, provide new solutions, transparency, and disruptive distribution potential, together with an ‘easy entrepreneurship’ model that has low capital needs and faster growth potential.
- 2) **The global rise of the middle class, increasing longevity and other demographic changes.** These trends result in a large group of households with more spending power and fast-growing levels of consumption. The second development is that the number of consumers, and therefore consumption, is increasing substantially. The size of the ‘global middle class’ will increase from 1.8 billion in 2009 to 3.2 billion by 2020 and 4.9 billion by 2030. The bulk of this growth will come in Asia: by 2030 Asia will represent 66% of the global middle-class population and 59% of middle-class consumption, compared to 28% and 23% respectively in 2009.⁷ These new consumers tend to buy washing machines, vehicles, and other consumer goods. This new buying behaviour has an enormous impact on consumption and on the total amount of waste.

⁷ Mario Pezzini, OECD Observer, *An emerging middle class* (www.oecdobserver.org/news/fullstory.php/aid/3681/An_emerging_middle_class.html#sthash.VQT3leZN.dpuf).

5 MEGATRENDS

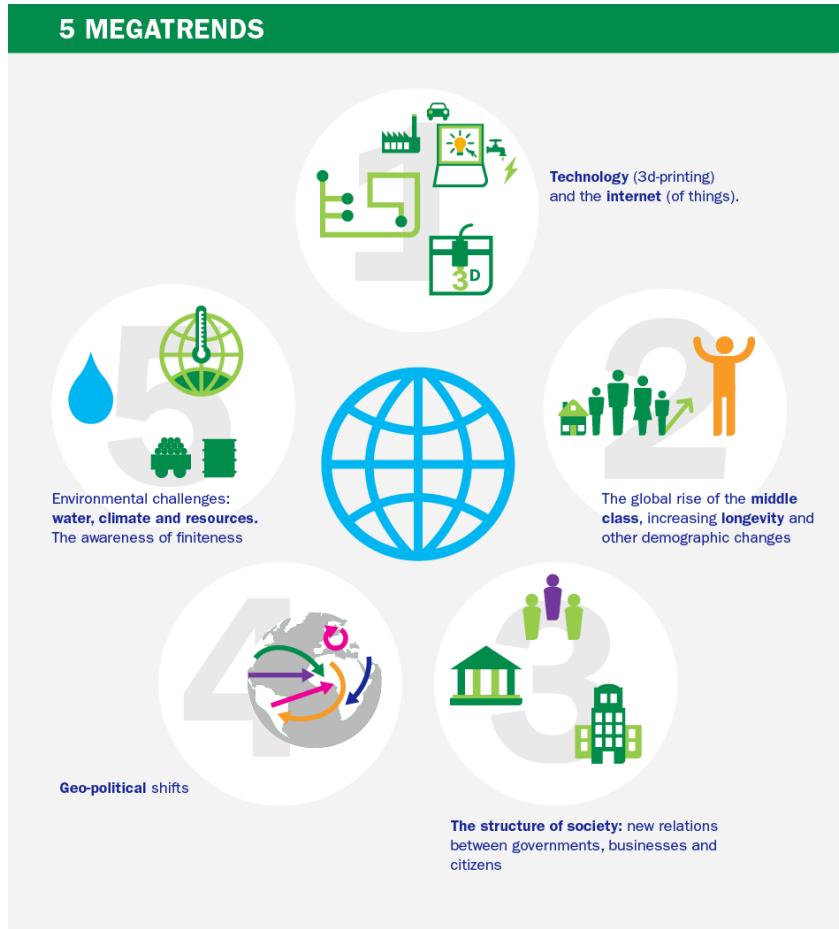


Figure 3: Megatrends.

3) **New relationships between governments, businesses, and citizens.** The traditional roles of the state, the market, and the household are becoming more blurred. Governments increasingly involve civil society in the public discourse. Some consumers turn into co-producers (for instance in the field of energy) and some businesses redefine their core focus to that of solving societal challenges.

4) **Geopolitical shifts.** Changes in international relations and the security landscape have been brought about by the recent rise of large, emerging economies.

5) **Awareness of environmental challenges: water pressures, climate change, biodiversity loss and resource scarcity.** Recognition of the finite nature of the earth's resources and the limits to the resilience of the planet in the face of human activities has grown. This has led to an increasing sense of urgency to act now rather than tomorrow.

One of the characteristics of *a change of era* is that the impact is visible in many aspects of life. With major transformations new challenges arise, providing opportunities and risks, demanding resilience from people, organisations, and society. For instance, demographic alterations put pressure on the welfare states of developed countries. Economic growth in BRIC countries leads on the one hand to new markets for existing multinational companies, but on the other challenges governments to secure prosperity for all citizens.

These developments also have an impact on the rules of doing business. We see start-ups growing rapidly and threatening incumbents. In the past a company needed capital, distribution power, and brand awareness (and persistence) to succeed. Today a large amount of capital is not always necessary to start a global business. For instance, AirBnB, the biggest room rental company in the world, was started only four years ago, has no real estate on its balance sheet, and is now bigger than established hotel chains like Hilton and Marriott, institutions that are almost a century old.

Uncertainty for entrepreneurs has also increased. What will happen when products can be 3D printed in large numbers for low cost? How can incumbent manufacturers respond? If online sales diminish physical retail sales, how does this affect the real estate sector? To what extent would a sharing business model reduce product sales and can the shortfall be offset by increased revenue from 'product as a service'-type contracts?

1.3. A circular economy alternative

If linear economic principles remain the norm of business practices and consumption patterns, the outcome is likely to be shortages of certain materials, growing price volatility, and continued environmental degradation. While society can withstand some economic shocks, there remains the spectre of economic ‘collapse’, described by Jared Diamond as a situation where we live on in a linear way and exhaust the planet’s natural systems beyond repair.⁸ The necessity to transition to an alternative economic model therefore seems evident. To quote Herman Wijffels: ‘People developed themselves to linear oriented creatures with a circular context in reality. Life is circular and we behave linear. Operational excellence of the industrial era brought us plenty, but this is an evolutionary moment where we need to turn back to circular principles.’⁹

A circular economy helps decouple economic growth from resource constraints. This is done by creating economic activities that make more effective use of materials, thus retaining as much of their value as possible by circulating them at their highest value at all times. The economic benefits of products and materials cycling through the system will not be coupled with the degradation of natural capital, since stocks of non-renewable resources are controlled and renewable resources are used whenever possible. A circular economy also addresses some of the externalities mentioned earlier as it reveals and designs out waste, pollution, and toxic materials. A transition to a circular economy may also generate positive externalities as it will likely spur innovative technologies and business models. Consequently, a circular economy aims at decoupling the creation of wealth and jobs from the consumption of non-renewable resources by maximising resource productivity and minimising waste generation.

A circular economy entails deep transformations of supply chains and consumption patterns so that the value of products, components, materials and resources is maintained throughout the product’s useful life. Such transformations are not straightforward and switching to a waste-free economy means changes right along value chains from product design to production techniques, ownership/‘user-ship’ models and reverse logistics.

⁸ Jared Diamond, *Collapse: How societies choose to fail or survive* (Allen Lane, 2005). A study of how certain societies in the past disappeared when in hindsight the collapse was evident: ‘How on earth could a society make such an obviously disastrous decision as to cut down all the trees on which it depended?’

¹⁰ Interview with Herman Wijffels (2014).

Whilst the transition to a circular economy makes economic sense, production processes will not automatically become circular. The transition needs to be supported and the required changes stimulated and guided.

These systemic changes will only occur when supported by business models and enabled by consumer behaviour, legislation, flows of money/finance, and education. If they work in the same direction, these enablers can reinforce each other and accelerate the change. Imagine these actors as the roots of the 'circular economy tree', enabling it to grow.

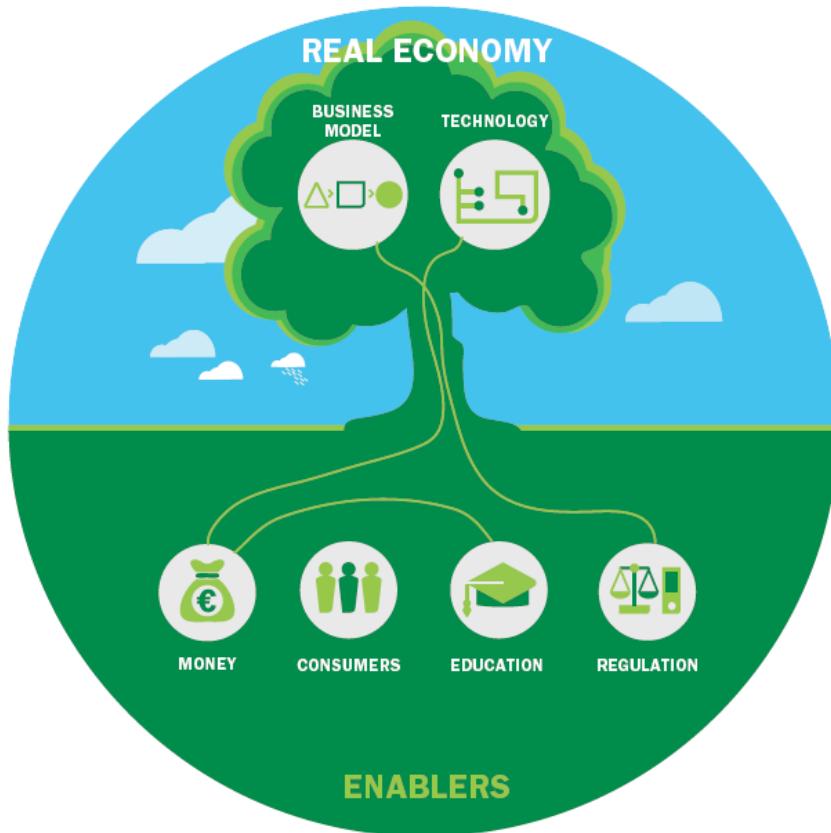


Figure 4: Enablers of the Transition to Circular Economy.

Circular economy in a nutshell

Most sustainability concepts are all in one way or another concerned with using fewer resources and producing lower emissions, i.e. being more efficient. They start from the status quo of a linear model with a one-way flow of materials. Materials are extracted from the earth, made into products and after being used are incinerated or landfilled.¹⁰ In the current economic model growth is linked to increasing production – which means using more materials and creating more waste at the end of the journey.¹¹ The figure below shows a visualisation of a linear supply chain ending in incineration or landfill.



Figure 5: Linear supply chain.

Not only does this linear system result in waste, more importantly the value captured in products is destroyed (see Figure). From an economic standpoint this is not desirable.

In contrast to the status quo of a linear ‘cradle-to-grave’ material flow, a solution can be found in the cyclical metabolisms of a circular economy.¹² In a circular economy economic activity is based on the continuous circulation of products and materials. It is a complete break from the current ‘linear’ economy, which not only results in the waste of resources, but also fails to capitalise on the full potential of resources and the added

¹⁰ M. Braungart, W. McDonough, A. Bollinger, ‘Cradle to cradle design: creating healthy emissions – a strategy for eco-effective product and system design’, *Journal of Cleaner Production* (15, 2007), 1337–48.

¹¹ Ibid.

¹² Ellen MacArthur Foundation, *Towards the Circular Economy Vol. 2: opportunities for the consumer goods sector* (2013).

value embodied in products. A circular economy both eliminates the concept of waste and aims to maximise the capture of this added value.

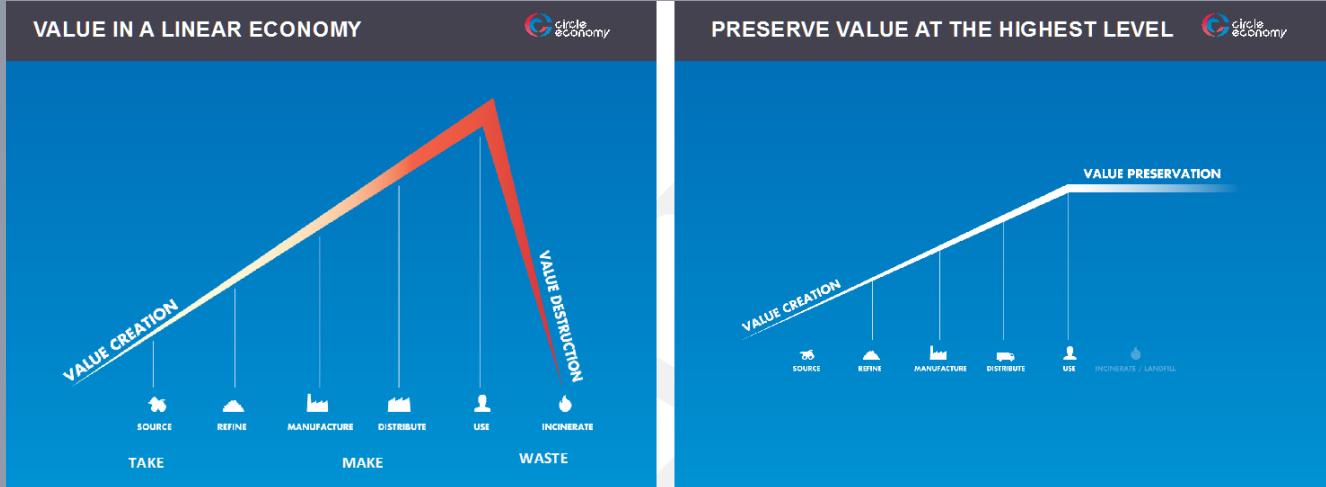


Figure 6: Value in linear versus circular supply chain (source: Circular Economy).

A circular economy is an industrial economy that is restorative by intention and design. One of the main principles of a circular economy is that 'waste is food'. This means that all materials and products can be seen as temporary repositories of materials (or nutrients) that will subsequently become the inputs for new products. In a circular economy the concept of waste is eliminated by carefully designing products and industrial processes in such a way that materials are nutrients in a perpetual flow in either the biological cycle or the technical cycle. The two cycles are separated for the reason that technical nutrients, such as plastics and metals, can be repurposed by human action whereas biological nutrients serve as inputs for new organic matter, such as crops and forests. A circular economy is often displayed in the butterfly chart of the Ellen MacArthur Foundation (Figure 7).

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
ReSOLVE levels: regenerate, virtualise, exchange

Renewables    Finite materials

Regenerate Substitute materials Virtualise Restore

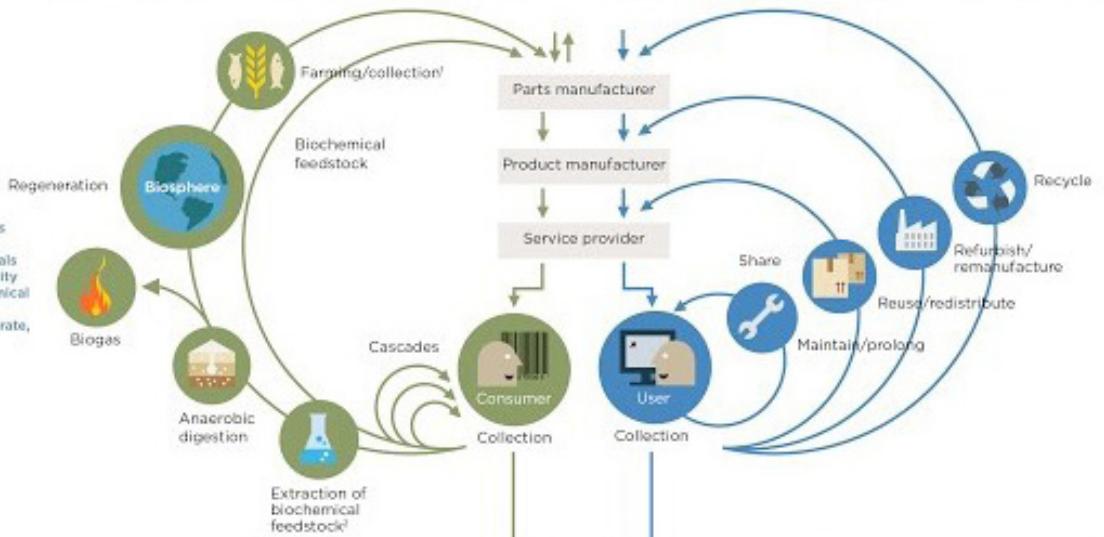
Renewables flow management

Stock management

PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
ReSOLVE levels: regenerate, share, optimise, loop



PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
All ReSOLVE levels

Minimise systematic leakage and negative externalities

1. Harvest and fishing
2. Can take both post-harvest and post-consumer waste as an input
Source: Giles MacArthur Foundation, GfN, and McKinsey Center for Business and Environment. Drawing from Graunig & McDonough, Cradle to Cradle (CC2C).

Figure 7: Visualization of a circular economy (source: Ellen MacArthur Foundation).

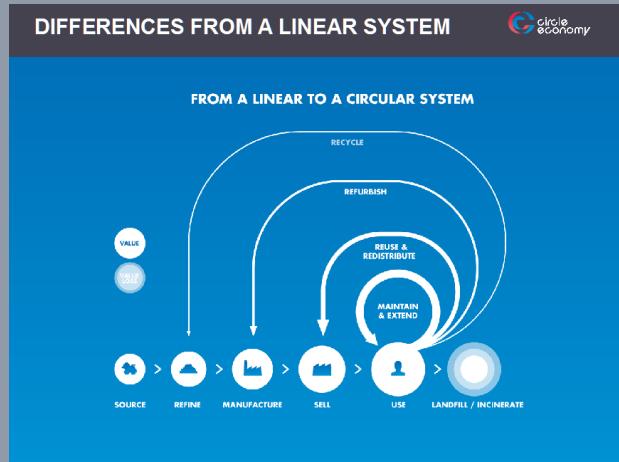


Figure 8: Visualization of circular economy (source: Circle Economy).

	Characteristics of a linear economy		Characteristics of a circular economy
Attitude towards nature	Forcing nature to produce more	→	Doing more with what nature can produce
Attitude towards production	Take, make and waste	→	Reduce, reuse and recycle
Closing loops	One lifetime use of products, components, materials and energy	→	Materials and energy flow infinitely in cycles through the economy
Product life extension	Products become obsolete while they are still usable	→	Product life is extended in new applications or products serve as valuable inputs for other products
Performance economy	Consumers buy goods	→	Accessibility and performance instead of ownership are leading in many consumption markets. Consumers increasingly share products
Earnings model	Producers determine sales price of products	→	Producers charge price for the use of the product
Multiple values and principles	Money is the dominant value in business models	→	Business models are based on multiple values (financial alongside environmental and social values)
Supply chain	Companies improve efficiencies in isolation of each other	→	Companies work together to increase value along the supply chain. Risk and benefits are shared upstream and downstream

Table 1: The different characteristics of a linear and a circular economy.¹³

¹³ ING, *Rethinking finance in a circular economy* (June 2015).

¹⁴ Ibid.; Fridah Ntarangwi, *Circular economy: business models and financing needs* (July 2015).

Characteristics	Conventional business models with a linear orientation	New business models with a circular orientation
Principles for value creation	Business continuity and profit optimisation are the overriding principles.	Business continuity and profit optimisation are the overriding principles. Value creation opportunities are sought by looking at business through a circular economy lens.
Product life	Exhaustive in nature (take, make, use and dispose).	Prolonged life through refurbishing and maintenance. Products are passed to the next user.
Materials	Merely consumed and disposed.	Resource efficiency, the quality of the product emphasize.
Ownership	Customers are buyers who own the product and dispose it after using it.	Access to a service is more important than ownership of a product that delivers the service. Customers are users in a closed loop system creating a cycle of passing on products to other users and at the end returning the used products to the production process as raw materials
Transaction	Transactions emerge in B2B or B2C markets with money as medium of exchange.	New market segments arise in which consumers interact with other consumers (C2C) and in which economic agents act both as manufacturer as well as consumer (C2B). Money is the main medium of exchange.
Collaboration	Relationships limited to the traditional buyer-seller relationships.	Supply chain collaboration creates a web of shared values. Companies in circular supply chains often cooperate beyond traditional buyer-supplier relationships that characterise linear supply chains. Instead they operate in a network of companies and institutions that often involve a strong element of collaboration and co-creation.
Success measurement	Success is measured in a financial cost benefit analysis for the parties involved in the transaction (seller and buyer).	Success is measured in a cost benefit analysis primarily based on financial value for the stakeholders involved, but which can incorporate non-financial values to stakeholder and society.

Table 2: The impact for business models under a linear or a circular orientation.¹⁴

1.4. The role of the financial industry in a circular economy

The financial system is often accused of focusing on short-term profit over long-term stability. However, while it can be seen as 'part of the disease' it can also be 'part of the cure'. Finance can be an important enabler. The sector's social responsibility and its own interests go hand in hand. Because next to the downsides of increasing linear economy risks are the opportunities of the circular economy.

The primary focus of financial institutions, the co-authors of this report, is on finance and money. Its reasons to engage actively in the transition to a circular economy are:

- To understand the economic impact of a circular economy
- To accelerate value creation through innovation
- To anticipate linear risks in the economy
- To contribute to economic growth opportunities and other positive macroeconomic impacts
- To mitigate economic instability
- To be responsible entrepreneurs and contribute to sustainability goals

Financial institutions can contribute in two ways: first by enabling companies to make the transition to a circular economy on a financial level; and second by looking at their own business models and product offerings. The latter may need to be adapted to better suit the needs of a circular economy.

1.5. The role and ambition of the Co.Project Finance

The FinanCE Co.Project is a collaboration project under the banner of the CE100 programme of the Ellen MacArthur Foundation. Co.Projects are initiatives driven by CE100 members (in this case Intesa San Paolo, PGGM and Rabobank) and where appropriate complemented by other organisations (in this case ABN AMRO, Circle Economy, Circularity Capital, European Bank for Reconstruction and Development, European Investment Bank, ING, KPMG and Nederland Circular). The participating organisations in the FinanCE Co.Project include financial institutions, academia and non-profits and are shown in Figure 9.



Figure 9: Members of the Working Group FinanCE.

The starting point of the group is that a transition to a circular economy is inevitable and necessary. Therefore it is necessary to investigate how financial institutions, in a broad sense, can play a role in the transition.

The objectives of the Co.Project are:

1. To understand the implications of a circular economy on the business and financing models of companies.
2. To determine how a transition to a circular economy can be supported and accelerated by the financial system.
3. To co-develop and share communication strategies and tools to make the transition clear and tangible to our colleagues, clients, and academics.

This report specifically addresses the outcomes of the first goal: to understand changes in business and financing models of companies. To date, most literature on the circular economy, the associated business models, and the economic impact is very theoretical or uses limited examples. This report shows the more practical implications of circular business models, to describe the opportunities and barriers and link these to the financial side of doing business.

This report also provides an agenda for future steps to be taken in order to close the gap between finance and circular business models. In 2016 work will be initiated on the second part of the goals of the Co.Project: determining how a transition to a circular economy can be supported and accelerated by the financial system. A second report will be published to communicate the findings of this effort.

The fast-changing global context is our starting point. In a world increasingly dominated by new technologies and shifts in demographics and the global economy, new challenges arise. One is how to cope with the legacy of a linear economy, in which products are consumed and largely get turned into waste, diminishing the stock of non-renewable natural resources. A more circular economy that creates economic value is also an answer to the resource challenge, both because it is a more effective system than the linear economy and mitigates its risks whilst creating positive capital-building opportunities.

In the first part of the report we describe the context, provide a systematic framework in which money is one of the enablers of the transition to a circular economy, and lay out our ambition as a financial sector in contributing to this transition.

In the second part of the report we focus on three important components of the financial perspective of the transition to a more circular economy:

- First are the changes we see in business models that accompany circular ways of working. The report analyses various case studies of circular economy businesses to determine the concrete financial impacts of going circular.
- Second is a deep dive into the financial considerations of circular economy businesses, covering risks and opportunities and the detailed consequences for revenue and cost structures, cash flows, balance sheets and financing requirements.
- Third are the macroeconomic consequences of circular economy business models being more widely adopted. This extends the assessment of the circular economy approach beyond the commercial considerations of individual businesses. Macroeconomic analysis is an important consideration for potential investors deciding where to invest.

In the second part of the report we focus on three important components of the financial perspective of Finally, we look beyond this report. This first step, to understand the financial implications of circular economy business models, is only the first the working group will take. The next phase, to assess the impact and consequences for financial institutions themselves, is crucial: actions speak louder than words.

PART II

Core concepts in financing
the circular economy

TWO: The impact on business models

As mentioned in the previous chapter, two major shifts occur when businesses move away from linear practices and use more circular principles. The first shift concerns **the flow of products** from materials to consumer (and back); the result of changes to design, technology, and logistics. The second shift concerns **the business model**; the flow of money and the way the activities of the business are organised. While the first of these is more important for the holistic approach, from the perspective of money and finance the impact on the cost structure and financing the company is crucial. This is the subject of Chapter Four (corporate finance) and will be made concrete in Chapter Three (case studies).

This chapter examines how the organisational changes affect the business model. Previous analyses of the circular economy and business models, mainly based on the Accenture report, are developed.¹⁵ There is a deep dive into the link between the sharing or collaborative economy and the circular economy, followed by the business rationale for the need for new business models when moving into production based on more circular principles. The different business models are grouped into clusters according to the different financial questions they pose. The chapter concludes with the use of a well-known framework to describe business models and to plot the differences between linear and circular business models.¹⁶

A business model is an “abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives”.

Al-Debei, M. M., El-Haddadeh, R., & Avison, D. (2008). “Defining the business model in the new world of digital business.” In Proceedings of the Americas Conference on Information Systems (AMCIS) (Vol. 2008, pp. 1-11)

A business model “describes the rationale of how an organization creates, delivers and captures value”.

Osterwalder A. and Pigneur Y. (2010), “Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers”

¹⁵ Accenture, *Circular advantage; innovative business models and technologies to create value in a world without limits to growth* (2014).

¹⁶ A. Osterwalder and Y. Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (John Wiley and Sons, 2010).

2.1. Towards circular business models

The discussion of the changes in business models when businesses become circular was described thoroughly in the *Circular advantage* study by Accenture in 2014. They connected value chain optimisation strategies to the changes in business models. Four areas of value creation of circular economy are described: (1) lasting resources; (2) liquid markets/multiple users at the same time; (3) linked value chains/next life opportunities of resources; and (4) longer life cycles.

These areas of value creation lead to the following business models:

Business Models

Circular Supplies: Provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs

Resource Recovery: Recover useful resources/energy out of disposed products or by-products

Product Life Extension: Extend working lifecycle of products and components by repairing, upgrading and reselling

Sharing Platforms: Enable increased utilization rate of products by making possible shared use/access/ownership

Product as a Service*: Offer product access and retain ownership to internalise benefits of circular resource productivity

* Can be applied to product flows in any part of the value chain

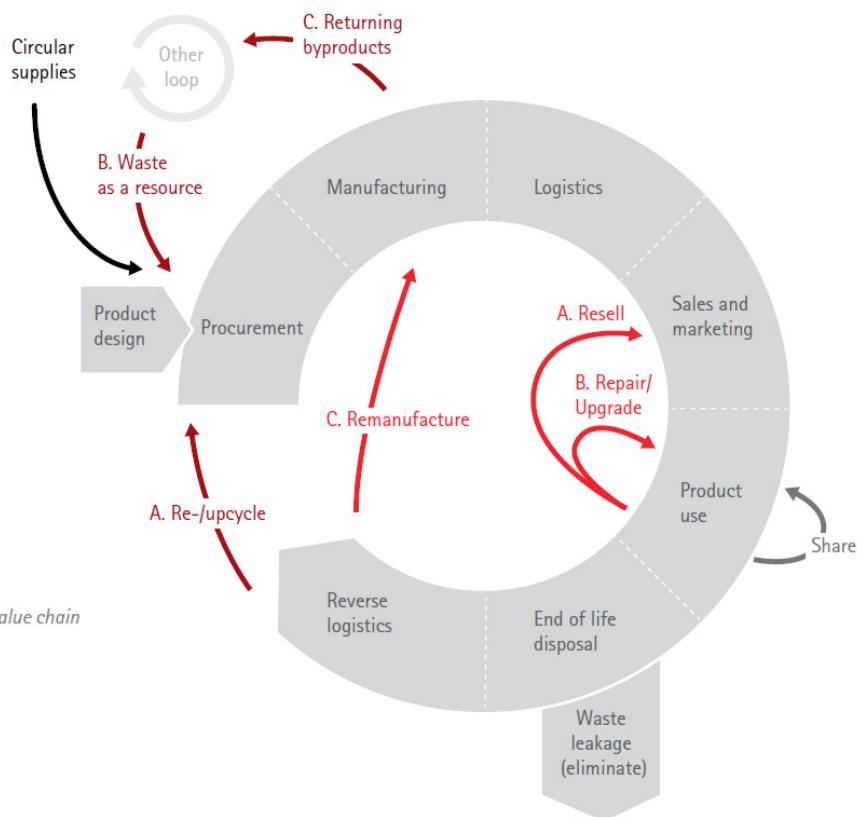


Figure 10: Circular business models (source: Accenture, 2014).

2.2. The link between the sharing economy and the circular economy

The Accenture report, and others since, have included consumer-to-consumer sharing platforms (e.g. Zipcar) and business-to-business sharing platforms (e.g. Floop2) as types of ‘circular business models’. The report *Growth Within* also claimed that the economic benefits of optimising automobile usage contributed to the €1.8 trillion value creation of a circular world in 2030.¹⁷ However a distinction can be made between sharing and circularity because it is conceivable that only one consumer might buy a circular product, or that a sharing platform might jointly acquire a fully linear product that ends up as landfill. While sharing and circularity can develop in parallel, and even reinforce each other, they are not necessarily interchangeable.

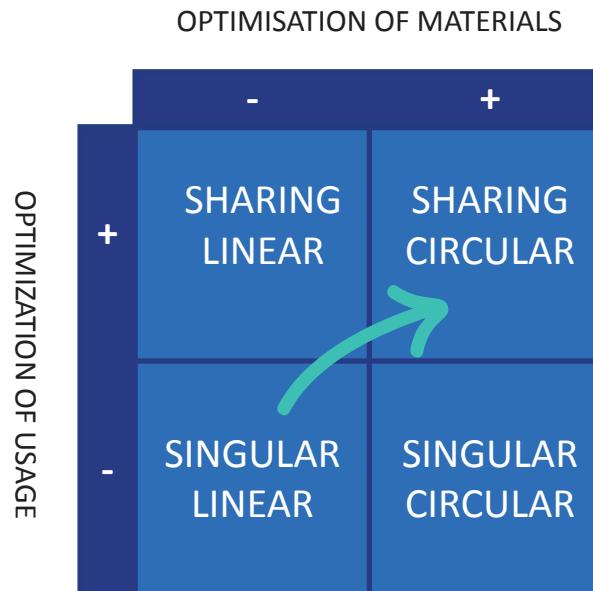


Figure 11: Optimizing materials and usage.

¹⁷ Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: A Circular Economy Vision for a Competitive Europe* (2015).

In this report, we define a circular economy as **‘the optimisation of material use’**: a product and/or its components are never wasted, ideally staying in the cycle infinitely. We define a sharing economy as **‘the optimisation of usage’**, implying that the waste of other important values such as time (e.g. with sharing cars or tools) or space (e.g. Airbnb) is minimised. Both developments increase the efficiency of the economy and are therefore favourable. For example, if a household decides to pay for the services of Bundles (paying per use of a washing machine instead of owning the washing machine), the machine still sits idle for a considerable proportion of the time. We will call this ‘singular circular’, because the machine is (partly) used at the end of its first life cycle. Both – optimisation of materials and of usage – are needed to increase the efficiency of (natural) resources and prevent the depletion of scarce resources. In this report we will focus on circularity.

2.3. Why does the circular economy require new business models?

Going circular has a substantial impact on the way businesses organise their activities. Often this is narrowed down to the way money flows, but aspects like value proposition, infrastructure, partnerships, and technology are also important for the business model. In this report we will focus on the changes to the business model when moving from linear principles towards circular principles. The business models of entrepreneurs are influenced by the following elements regarding value creation in a more circular economy:

a. **Resource control: accessing materials downstream**

Linear businesses are not concerned with a product after it is sold. Whether it ends up in landfill or sits in a closet is not of interest. For a circular business it matters: the product consists of valuable materials, especially if the components/parts can be easily taken apart and reused as feedstock in the production process. This means that control over resources downstream is essential, because downstream is the new upstream, especially when the alternative is virgin feedstock, with associated price volatility.

The consequences for the business (and its model) is a desire to maintain control of resources and added value. An often proposed model is to remain the owner of the product, which therefore guarantees access to the materials. But other solutions, including deposits or ‘first right to refusal’, are also options. Different business challenges arise, for instance technological (e.g. tracking where products are), and logistical (e.g. getting products back, and increasing the residual value of after-use products).

b. Collaboration within the supply chain

The traditional economic model is based on downstream cost reduction, resulting in a more competitive relationship with suppliers. By contrast, circular business is much easier when all the actors in a supply chain work together, because the added value is the joint process of assembling and disassembling. For instance, the demolition company was involved in the planning of the construction phase of the circular Park 20|20. Their involvement at this early stage means that the materials used in the park can be recovered more easily when the buildings are no longer in use. This also contributes to the residual value in the product and materials. Of course, collaboration can add value to linear businesses as well, but the necessity is greater in a circular model.

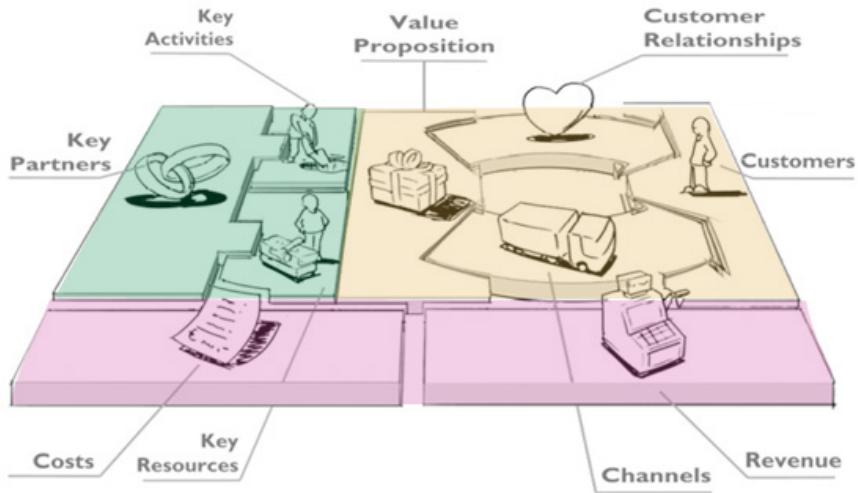


Figure 12: Business model canvas (source: Osterwalder & Pigneur, 2010).

c. Services that capture products

The circular economy changes the hierarchy between products and services, with the latter becoming the driver of transactions. Increasingly the carrier of a transaction is a service and a product (or multiple products) is a means. This development is also known as ‘servitisation’ – selling the service of using a product instead of selling the product itself.¹⁸ Servitisation is based on the premise that by integrating services with products (mainly through increasing opportunities offered by the Internet of Things), companies can create bundles that are more valuable than products alone – ‘It brings businesses closer to their customers, and helps to effectively lock out competitors.’¹⁹ – people want light instead of light bulbs, holes in the wall instead of a drill, and clean clothes instead of a washing machine. Circular business is better equipped to respond to these changes, because a more efficient product (resource efficiency) benefits the producer. Hence, circular business models fit better with service concepts.

d. Supply chain innovation

The circular economy can lead to the appearance of supply chain activities that did not exist in the linear model. These can include new owner platforms, or alternatively the producer remains the owner and the reimbursement is a construction of lease or pay-per-use. It is also possible that new platforms will develop, buying circular products and offering them to the customer as part of a service model. Other new entities in the circular economy are businesses in waste handling, refurbishment, (reverse) logistics, etc. These new entities have their own specific business models.

¹⁸ <https://en.wiktionary.org/wiki/servitization>.

¹⁹ <http://www.marketwired.com/press-release/why-we-should-all-be-selling-outcomes-not-products -2066733.htm>.

2.4. The main changes to business models

Business models are a representation of how the all activities of a business will be carried out, in order to achieve the goals of the organisation. To describe a particular business model it is necessary to use a structure; to highlight the changes between doing business in a circular way and the current linear standard, we are using the business model canvas.²⁰ The business model canvas consists of nine elements, which can be divided into three groups. The orange elements are the value proposition for the customers (and the relation between the business and customer). The green elements are how this value proposition is created and the red elements reflect the flow of money. Figure 13 shows the main changes in the business model.

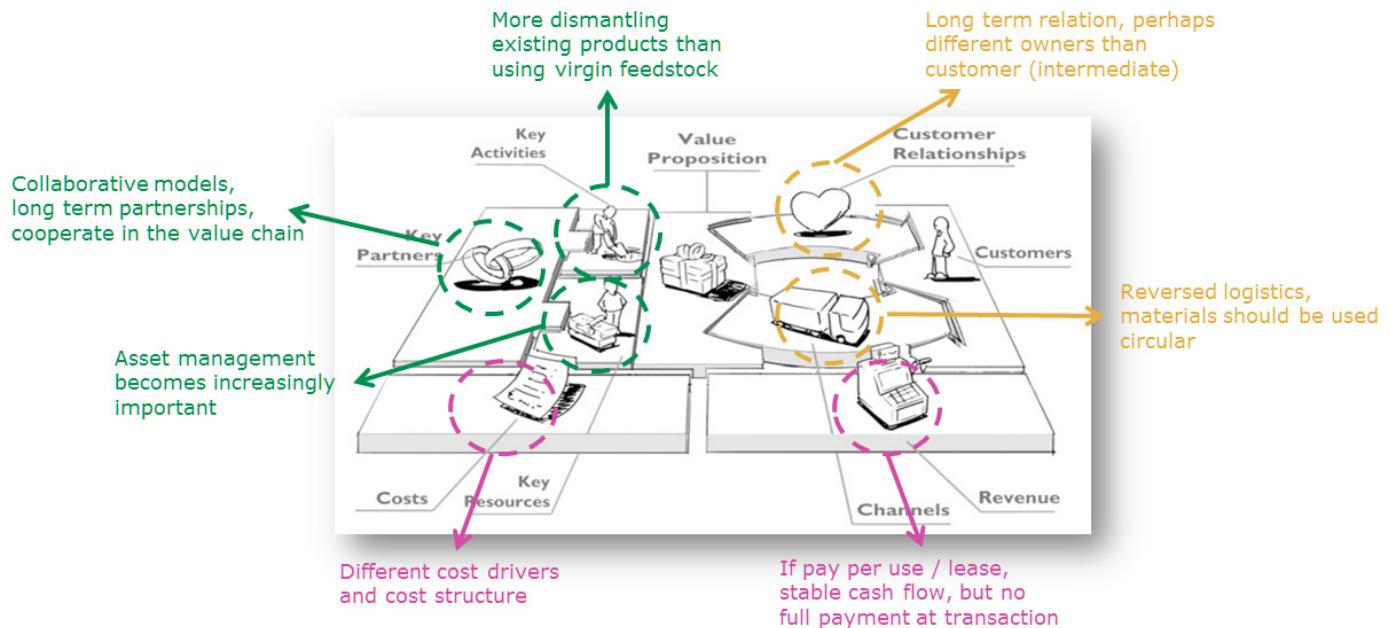


Figure 13: The nine elements of the business model canvas.

²⁰ A. Osterwalder and Y. Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers (John Wiley and Sons, 2010). 66733.htm.

2.5. The three categories of circular business models

Using various sources,²¹ we constructed three main categories of circular business models, which correspond to the different phases of production. The differences in the business activities per phase have a direct influence on the cost and/or finance structure.

- 1. Circular Innovation Models (CIM):** these business models focus on the *development phase*. Products are designed to last longer and/or be easy to maintain, repair, upgrade, refurbish, remanufacture or recycle. Additionally, new materials are developed and/or sourced, e.g. bio-based, less resource intensive, or fully recyclable materials. In the same context, innovative processes are developed to increase the reuse potential and recyclability of industrial and other products, by-products, and waste streams.
- 2. Circular Use Models (CUM):** these business models focus on the *use phase* by optimally using the product and maintaining added value. These business models make it possible to retain ownership of the product (e.g. by servicing a product rather than selling it) and/or take responsibility for the product throughout its useful life (e.g. through maintenance services, or add-ons to extend the life of a product). Product-to-service models entail a (partial or total) conversion from manufacturing (and selling) a product to:
 - Providing leasing and sharing services as an alternative to ownership of products.
 - Extending the useful life of products and components through repair, maintenance, or upgrade.
 - Providing services to facilitate the tracing, marketing and trade of secondary raw materials: e.g. 'product passports' and databases that track and document the quality and status of materials.

²¹ For instance B. Sonerud, *Meeting the financing needs of circular business* (report submitted in partial fulfilment of the requirements for the MSc and/or the DIC, 2014); Accenture, *Circular advantage; innovative business models and technologies to create value in a world without limits to growth* (2014), and SITRA & Circle Economy, *Service-based business models & circular strategies for textiles* (2015). But also TU Delft (*Products that Last*, 2014) and Ellen MacArthur Foundation (*Towards the Circular Economy*, 2013)

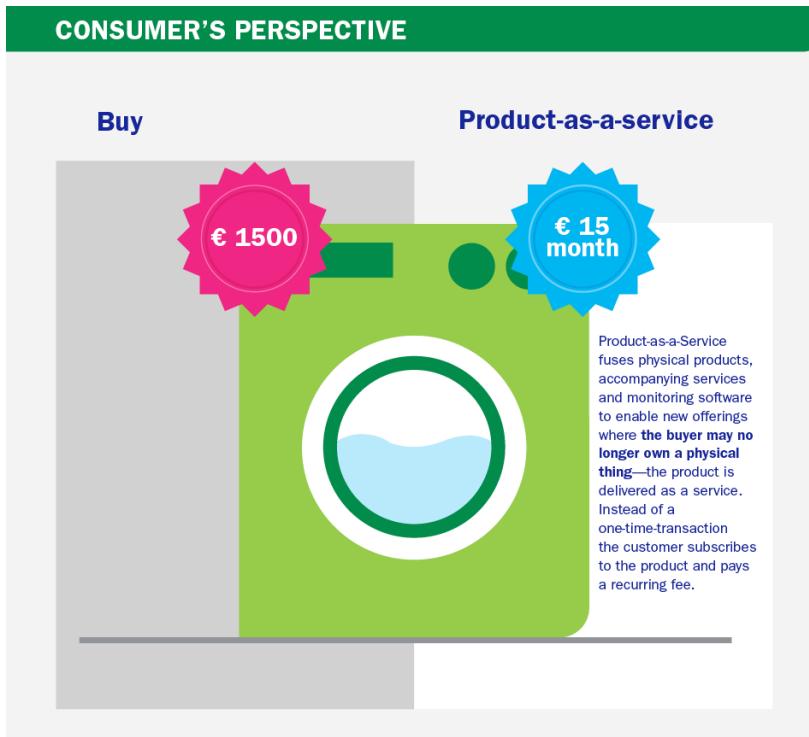


Figure 14: Consumers perspective of 'buy' versus 'lease'.

3. Circular Output Models (COM): these business models focus on the output and added value of a product's *after-use phase*. In these business models revenue is generated through transforming after-use products into new products or useful resources in order to add value, reduce costs, or reduce waste. The development of reverse logistics is essential for this model.

Circular Innovation Models (CIM)	Circular Use Models (CUM)	Circular Output Models (COM)
<ul style="list-style-type: none"> - Product design: Provides products that are <i>designed</i> to make them long and useful life and/or be easy to maintain, repair, upgrade, refurbish or remanufacture. - Process design: Develops processes that increase the reuse potential and recyclability of industrial and other products, by-products and waste streams. - Circular Supplies: Provides input materials such as renewable energy, bio-based, less resource-intensive or fully recyclable materials. 	<ul style="list-style-type: none"> - Product as a Service: Delivers product performance rather than the product itself through a combination of product and services. Ownership of the product is retained by the service provider. Primary revenue stream from payments for performance delivered. - Sell and Buy-back: Sells a product on the basis that it will be purchased back after a period of time. - Sharing Platforms (Access provider): Enables an increased utilization rate of products by enabling or offering shared use/access/ownership. - Lifetime Extension: Extends the useful life of products and components through repair, maintenance, or upgrade. - Tracing facility: Providing services to facilitate the tracing, the marketing and trade of secondary raw materials. 	<ul style="list-style-type: none"> - Recaptured material supplier: Sells recaptured materials and components to be used instead of virgin or recycled material. - Refurbish & Maintain: Refurbishes and maintains used products in order to sell them. - Recycling facility: transforms waste into raw materials. Additional revenue can be created through pioneering work in recycling technology. - Recovery provider: Provides take-back systems and collection service to recover useful resources from disposed products or by-products - Support lifecycle: Sells consumables, spare parts and add-ons to support the life cycle of longlasting products.

Table 3: Circular business models.

The three clusters contain multiple sub-models. Table 3 presents an extensive overview of business models.

Adopting one of these circular business models does not necessarily ensure a circular business. Context as well as chain collaboration must always be taken into account. To be 'fully circular', all three categories of business models have to be implemented across the supply chain. This is not possible without collaboration throughout the chain: designers and suppliers as well as service providers and end-of-life companies need to collaborate to reach a circular state of the economy by sharing not only materials, water, and energy, but also information and services. Similarly, in the case of a *performance provider* (e.g. leasing model), if there is no influence on the design of the product to promote product optimisation (e.g. design for ease of reuse), it can remain a fairly unsustainable model. Additionally, the value of a product at end of life (e.g. residual value) is very important for ensuring the value of circularity. When a product has a very low value at end of life (e.g. it cannot be reused or remanufactured to generate more cash flow and the total cost of recovery of materials is more expensive than the cost of virgin materials), there is no direct financial incentive for the producer to organise take-back schemes at end of life. Therefore there are various factors that determine the restorative level of a circular business model in comparison to traditional business models.

Furthermore, if a product is fully designed and produced according to all circular principles but the customer throws it away after use, the outcome is still linear.

Hence, all parts of the supply chain need to collaborate, proving again that this change is not merely technical, but systemic.

2.6. The consequences of changing business models

When business models innovate in the way described above (Table 1), it has second-order effects as well, sometimes economic, sometimes within the business. The following six consequences are identified:

a. Change in core capabilities

New competences are required for enhanced performance. The Accenture report showed five areas that circular business models should focus on, mainly because they differ from the traditional models: (1) strategy; (2) innovation and product development; (3) sourcing and manufacturing; (4) sales and product use; and (5) return chains. These competences should not only be established within the company but should be organised with the whole supply chain.

b. Better collaboration

Traditional business sees the upstream part of the supply chain predominantly as cost drivers and the downstream part as the source of revenues. Within the supply chain this approach is a zero-sum-game: one's profit is another's loss. Circular business cannot succeed without aligned collaboration, which will benefit the whole chain leading to a positive sum.

c. Lock in leading to higher switching costs

The downside of collaboration and improved relationships is the risk of 'lock in', resulting in higher switching costs. If long-term contracts are used or if parts of the supply chain are intertwined, it is more difficult to switch, if other suppliers offer better solutions or a better price-quality ratio. It is difficult to estimate the economic consequences of the higher switching costs and the impact on the efficiency of the economy.

d. New owner platforms and other value chain entities

The changes in business models will lead to the appearance of new entities in the value chain. It is not clear yet what the role of these new entities will be, but they should be in line with the changing competences previously mentioned, e.g. owner platforms, reverse logistics, and refurbishment specialists. Better insights into these new entities, and their part in adding value to the chain can help to estimate sectorial changes (in labour impact and other economic indicators, like value creation).

e. Changes in incentives

If ownership does not follow the product through the chain, incentives change. When the producer remains the owner of a product, its longevity and easy maintenance become much more important – because the producer bears the costs of failure and repair, in contrast to a linear model where these risks (besides guarantees) are transferred to the user (e.g. owner). As interest in good performance is moved upstream in the chain it can be expected that products will become more durable.

f. Changes in liability

There is a downside to the changing incentives: users are usually more careful with products that they own. When the producer remains the owner of a product, it can be expected that certain ‘fair use policies’ will form part of the transaction. The legal implications of product usage and the accompanied risk premiums will be included in the business models.

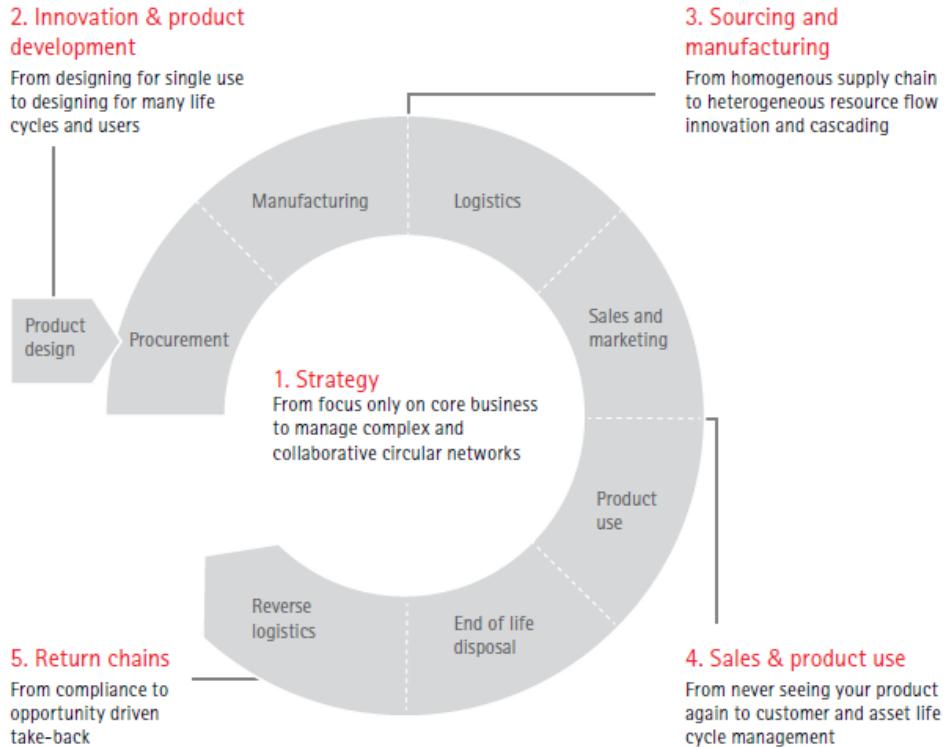


Figure 15: Consequences of changing business models (source: Accenture, 2014).

THREE: Case studies

These case studies aim to give insight into the financial effects of circular business models, specifically the effects of circularity on the balance sheet, cash flow projections, finance requirements, and other financials. These cases contribute to insights on what sources of finance or financial products best fit particular circular business models, and adds to the development of a 'common language' between financial institutions and circular entrepreneurs.

To ensure that these case studies were as useful as possible, companies were chosen that represent variety within these categories:

- Type of business model
- Size of the company (start-up, SME, enterprise),
- Sector
- Financing issues/successes

The business cases were evaluated by various financial indicators: indicators for success (or failure); financial elements of the circular model (with respect to the linear counterpart) such as risk/return distribution; and key enablers/disablers to circular businesses.

In each case study, a description of the company is followed by the challenges posed by the circular business model it employs. A future vision for the company is sketched and the financial aspects of each specific business case are examined.

Sections 3.1–3.5 describe the case studies in detail, and Section 3.6 concludes this exposition with a summary of all case findings.

3.1. Cases

3.1.1. Bundles



Circular Use Model (CUM)



Amsterdam, the Netherlands



B2C: Customers with sustainable intention, or who cannot afford high-quality washing machine



Start-up

Case description

For clean laundry, you need more than a washing machine. Bundles is a start-up that sells washing cycles instead of washing machines. A device is attached to the washing machine in the customer's home to monitor how it is used. These statistics are displayed in the Wash-App, which provides the customer with insights into the overall cost of doing their washing, including energy, water and detergent consumption. In addition, the Wash-App displays tips to reduce costs and gives immediate feedback on the effect of different sorting, dosing and programming schemes. Not only does this reduce costs for the customer, but also extends the lifetime of the washing machine. To stimulate 'good behaviour', customers who use the machine optimally will be rewarded with a reduced monthly fee. Bundles is responsible for the installation, maintenance and repair of the machine, but also replacement if the machine becomes outdated or broken. Moreover, the time that a washing machine is out of order is reflected in a reduction of the customer's monthly fee. This is an extra incentive for Bundles to deliver excellent service. There are three different bundles available, for a small household, an average-size household and a larger household.

Challenge: pre-financing assets with long payback period

Bundles shapes the relationship with its customers as an operating lease, which means that Bundles retains ownership of the washing machine. This means that an investment of around €1,000 is needed for a new machine for every new customer, until the asset base is large enough to circulate machines that are paid off

completely. This upfront investment has a payback period of five to six years and therefore leads inevitably to a funding need. At the moment Bundles is funded through crowdfunding, a couple of informal investors, and equity support from a start-up accelerator. Although this support was necessary for the start up, these structures are relatively expensive and short term, and are therefore not sustainable for the long-run funding of the company. Together with Rabobank, Bouwinvest, a real-estate investor, and Miele, contours of future sustainable financing structures were explored, the results of which are discussed below.

Challenge: No end-of-life company

Miele is currently the main supplier of washing machines and is therefore an important chain partner for Bundles. Miele designs its washing machines as far as possible according to circularity principles. For example, the machines are weighted by cast iron instead of concrete, which is easier to reuse. At the time of writing, however, Miele is not (yet) willing to take back used components for remanufacturing, and therefore other parties are needed to enter the chain and take up the role of recapturing material and refurbishing used machines. This means that the residual value of the machines is still assumed to be zero (or at best scrap value). To increase the residual value, collaboration between the designer of the washing machines and a new end-of-life company is essential.

Challenge: mind set of customer (market)

Another challenge that Bundles faces is the current mindset of customers. In the current economic environment, the leasing of consumer goods is unusual and therefore customer readiness needs to be carefully managed. This can be done by being transparent about the costs of ownership – not only does the customer pay for the purchase of the product, but also for maintenance, repair and replacement; leasing the product unburdens consumers of these responsibilities. In addition, the ‘game’ element of getting the most out of a washing machine through remote monitoring and an accessible app creates awareness and educates users.

Future vision

There are countless ways of innovating and integrating new technologies in the field of washing, or other consumer goods. For example, available technologies could be integrated into the remote monitoring feature, such as signalling the optimal time for a customer to do laundry, for example when the sun is shining if they are using solar energy. It could also be an enabler of different ways to do laundry, for example by bringing people together in washing facilities. For the future, Bundles also could introduce more, differentiated washing bundles to appeal to a broader range of customers.

Financial aspects

There are multiple challenges arising in the case of Bundles. Firstly, the washing machines need to be financed but have a longer payback period than if they were sold, which puts pressure on cash flows. Secondly, the company's balance sheet continues to grow because it retains ownership of the assets, which creates a capital demand to finance long-term ownership. Thirdly, there is no end-of-life company yet in place to remanufacture or refurbish the used washing machines, which makes it very difficult to incorporate residual value into the lease construction.

In collaboration with Rabobank, Bouwinvest and Miele, Bundles has been virtually taken beyond the start-up phase, to explore ways to structure long-term funding. This essentially boils down to the (legal and financial) structuring of relationships within the supply chain.

One way to relieve the burden of owning a large fleet of assets is through collaboration with real-estate investors. Not only because real-estate investors have the financial means to invest in assets, but also because a washing machine can be seen as a key service that the owner of the house may want to provide to renters. In this way, Bundles can access an existing real-estate rental market, with existing customer relationships. However, such a construction would transfer ownership of the assets to the real-estate investor, which could lead to leakage of materials out of the supply chain which, from a circular perspective, is not desirable. Therefore it needs to be ensured that the real-estate investor cannot sell the washing machine without consulting Bundles. Currently this is structured as 'right of first refusal'. In addition, to ensure the best maintenance and preservation of the assets, agreements on service need to be established between Bundles and the real-estate investor. There might be asset-investors interested in participating in this type of structure.

Another way to model such collaboration with other asset-investors is through the structuring of a special purpose vehicle (SPV²²). The operations of such an SPV are limited to the acquisition and financing of specific assets, in this case washing machines. The SPV has the form of a subsidiary company with an asset/liability structure and legal status that isolates the financial risk. However, for an SPV to be put in place, the total value of assets of the SPV should reach a minimum of around €10–€25 million. In this scenario an SPV is not yet feasible.

²² A special purpose vehicle is a legal entity (often a BV) with an asset/liability structure that makes its obligations secure, even when the parent company goes bankrupt.

Before a bank will participate (provide debt) in such an entity (either an SPV or existing entity), the following risk factors will be taken into account:

- Value of collateral (assets), including residual value
- Stability of parties involved with the exploitation of the assets (Bundles, real-estate investor)
- Stability of the customers who use the assets (duration of contracts, credit risk)
- Strength of contracts with customers
- Market demand of collateral throughout the lifetime of the asset
- Other market-related factors, such as size, growth estimation, and reach of collateral market
- Financial leverage of the SPV

A future scenario to enable Bundles to progress beyond the classic start-up problems is given below (Table 4). It is assumed that Bundles will exist for 7.5 years with steady growth up to 10,000 customers, and that the washing machines are serviced and very well maintained during this period. In this scenario Bundles has a funding need of €5 million. The residual value of the total of all assets amounts to €2.5 million, which could therefore be financed through debt (assumed is a 0% haircut), with the washing machines as collateral. This means that the remainder of €2.5 million needs to be financed with equity.

Number of customers	10.000
Average lifetime of washing machine	15 years
Price of washing machine	€1.000
Assumption: Average age of washing machine	7,5 years
Assumption: Average residual value after 7,5 years	€250 ²³
Total investment needed for 10.000 customers	€10 million (= 10.000 * €1000)
Funding need (assumed that half of the washing machines are already paid for)	€5 million
Total value of collateral (all 10.000 machines)	€2,5 million (= 10.000 * €250)

Table 4: Future scenario for Bundles.

²³ Based on figures published by Miele occasion Centre, which sells second-hand washing machines starting at €280 <http://www.mielewitgoedcenter.nl/occasions/>.

In this scenario an SPV is not yet feasible. An alternative financing structure would be to finance Bundles directly *per washing machine*. In that case, it would be possible to fund a larger part of the loan, as the residual value (and thus collateral value) at the start of the lifetime is much higher. However, the financing of an asset per customer demands intensive administrative work.

In general, the financing (and circularity) of Bundles would drastically increase if the supplier could take back washing machines, or another company could guarantee any residual value. Additionally, the supplier of the washing machines could contribute by giving procurement discounts. Or a no-claim discount, as it is likely that the service risk guarantee (paid to supplier) will not be required because of the remote monitoring of the assets. In return, Bundles provides its supplier with new market segments, such as to those who could not previously afford a Miele washing machine, as well as the 'circular' market.

There are many other strategies that could strengthen Bundles' business case, e.g. offering additional products as a service. Increasing equity capital could reduce financing challenges. Factoring and securitisation of receivables would also increase the financing options available to Bundles.

Collaborating with partners with solid financing structures could also mitigate risks and influence cash flows. Partners that benefit from the expansion of Bundles or are in any other way related to the exploitation of washing machines could fulfil this role.

3.1.2. Dura Vermeer



Circular Output Model (COM)



Rotterdam, the Netherlands



B2G: Local, regional and national government



Enterprise

Case description

Dura Vermeer is a Dutch family business operating in construction, infrastructure and engineering in the Netherlands. Dura Vermeer employs approximately 2,400 people and has a revenue of roughly €1 billion. In this case study the focus was on the infrastructure division, and more specifically on the production and maintenance of asphalt roads.

Asphalt production changed in the 1990s for two reasons. The used tar-holding substance used at the time was toxic and the use of it became regulated. Moreover it was costly to dispose of the rubble from broken-up roads. Creating asphalt with non-toxic bitumen²⁴ created the opportunity to reuse the material from old roads to build new ones. Currently asphalt roads are constructed with a bottom layer of rubble: this rubble functions as a stabiliser, and provides an alternative to the rubble becoming waste. Nowadays theoretically 99% of old roads can be reused in new roads. In this way, Dura Vermeer decreased its amount of unsorted waste to 3%²⁵ and has a long tradition of reusing materials in new asphalt roads.

Challenge: reusing more than 60% of old roads demands substantial investment.

In reality, however the reuse percentage is around 60%. Not only are there simply not enough old roads to provide the material needed, but also 60% reuse of materials is what can be achieved with the machinery currently available. Reusing a higher percentage would require substantial investment in technology. Moreover reusing high ratios of rubble demands a higher input of energy than creating asphalt.

²⁴ Bitumen is made from sulphur, a waste product from the oil industry.

²⁵ Dashboard MVO Dura Vermeer 2014.

Another reason for not reusing 100% is because the stability and safety of the road depends on the top layer being of very high quality. The required quality cannot currently be achieved with reused asphalt, so the top layer is still made from virgin bitumen.

Challenge: Governmental budgeting structures

At the moment the official requirement is that asphalt roads function for six years (i.e. they are under warranty for six years). Dura Vermeer actually has the technology to create asphalt that can last up to 15 years. This asphalt costs 10%, but lasts more than twice as long.

In the Netherlands, governmental budgeting structures have proved a barrier to investing in this appealing proposition. The budget for road construction is often separate to the budget for maintenance. In addition, civil servants are judged on their budget meaning that there is an incentive to opt for the least expensive option.

A new structure is appearing that makes Dura Vermeer responsible not only for building the road, but also for its maintenance. For example, the contract for the Coen tunnel stipulated a five-year construction period and twenty years of maintenance. The responsibilities for the maintenance creates the incentive for Dura Vermeer to use the highest possible quality of asphalt in order to minimise maintenance costs. This structure is very similar to the product-as-a-service (PSS) model, because it includes not only the road itself, but also the responsibilities for maintenance and repair.

Future vision

Besides the reuse of asphalt, Dura Vermeer is working on a 'systems approach' to the roads they build. This approach does not only concern the actual asphalt road, but also the surrounding elements that influence the road and its activities.

Firstly, existing old asphalt roads in the area will be used to construct the new asphalt road. Instead of using current methods of road construction, in which the carrying capacity is contained in the expensive top layer, a ground stabilisation method is used. This method creates a stable under layer using the existing soil, resulting in a massive reduction in the volume required of the top layer. This not only leads to a reduction in virgin material use but also a reduction in the transportation of materials, substantially lowering CO2 emissions and costs.

Moreover, Dura Vermeer is looking into including elements, such as lighting, into the road construction. Dura has developed modified bitumen for the top layer for the road that will reflect more light and thus require less street lighting. This technology is combined with LED lighting as a service (i.e. collaboration with a service provider for the lighting). Combining reflective asphalt roads with LED lighting not only creates a symbiosis between the

elements but, because of the reinforcing PSS construction (i.e. Dura Vermeer and the lighting company jointly providing the service of safe road use), the incentive is to provide the best quality and to collaborate in order to succeed.

An additional element is the use of plants that have been genetically modified to absorb a relatively high percentage of CO₂. Placing these plants next to the road will substantially improve the air quality. When harvested, these plants can be used either to make bio-fuel (not the highest value added from a circular economy perspective) or the fibres can be used for other products.

Such a systems approach can generate a cost-effective system because of the synergies and aligned incentives. Due to the newness there lies a challenge to structure such collaborations legally and financially. Dura Vermeer aims to tackle this challenge by collaborating with different stakeholders, including financial institutions.

Public administration issues

One of the main challenges is the financial accounting of the asphalt roads on the balance of Dura Vermeer's customers, which are governmental bodies. Investments made by (national, regional and local) governments are accounted for as today's costs – durability and depreciation are not fully taken into account. This can negatively impact the long-term view of governments.

It would be worthwhile to further explore the financial accounting of durable investments made by governments and possible other public actors or public-private partnerships. Aspects worthy of investigation include: how roads are displayed on balance sheet, how procurement methods within the government influence their investment choices, and what strategies exist to overcome these barriers to long-term investments by governments.

3.1.3. Dutch aWEARness

	Circular Innovation Model (CIM) / Circular Use Model (CUM) / Circular Output Model (COM)
	Nijmegen, the Netherlands
	B2B: Businesses with a focus on corporate social responsibility (CSR)/sustainability
	Start-up

Case description

Dutch aWEARness provides circular workwear and corporate wear – 100% of garments can be upcycled into new garments. The garments are made from a polyester fabric which was developed in collaboration with the supply chain and with additional European funding. This business model centres on offering performance-based high-quality workwear. The advantage for the consumer is the high quality and the absence of any responsibility for maintenance and repair.

The workwear is offered in collaboration with existing resellers. This is done through a licensing system that provides the guarantee that the circular principles are followed. Track and trace software in the garments provides information on the location of garments, but also shows the added value of different chain partners. Consumers can see data that is relevant to them – where the garment is from, and the life cycle assessment (i.e. input of materials and energy in the production process). Current customers include major organisations, such as Rijkswaterstaat (a Dutch government department), Dura Vermeer, and GEA.

Dutch aWEARness also provides training and consultancy services on PSS models.

Future vision

To provide the incentive to keep materials cycling, Dutch aWEARness envisions sharing ownership of materials across the supply chain. When materials are owned by the supply chain, the incentives of the different supply chain partners will be aligned. Companies are currently hesitant to share information with the rest of the supply chain due to the risk that other companies will use this information for their own agenda, sharing ownership

across the chain will create a situation where all companies benefit when the cycling of products and materials is optimised. In this system an innovation at one point in the chain will benefit all chain partners, therefore creating leverage to share risks and benefits. Moreover this would enable the financing of a whole supply chain instead of a single company, which can be another driver in collaborating and optimising circularity.

Challenges

The problem for Dutch aWEARness is that there is currently no legal structure to accommodate the ownership of a product in the supply chain. To fix this problem in the short run, Dutch aWEARness has created contracts with distributing parties and consumers stating that Dutch aWEARness retains ownership of the materials. This is not an optimal solution in the long run since sharing the costs and benefits of ownership is likely to result in the strongest incentive to keep materials cycling in the supply chain. Moreover, sharing ownership will align the incentives of supply chain partners to collaborate and create products of the highest possible quality.

Financial aspects

The strength of the model is that recycling is a cost-effective way of producing new garments. This is illustrated in Figure 15, which compares linear and circular scenarios, demonstrating the benefits of the circular scenario.

As stated above, ownership of the garments stays with Dutch aWEARness, resulting in performance-based contracts with consumers. This means that instead of a single transaction in which garments are bought, a contract is created in which the usage terms and (financial) obligations of both parties are set out. In such contracts the following aspects are delineated:

- Upfront investments are needed to manufacture the garments
- The product ownership remains in the supply chain, there is not a short sell-and-buy process. Since there is no transaction of ownership the garments stay on the balance sheet of Dutch aWEARness.
- Due to the payment of periodic fees for performance-based garments cash flows start slowly, but will continue for longer (throughout the contract period).

Difficulties in structuring these legal aspects result in issues in financing the business model. This has effects on the liquidity of the company and has implications for attracting investments and loans. The type of cash flow – slow, long-term – means that it will take longer for a company to pay back a loan from a financial institution. Since financial products have a relatively short term they are not compatible with business models that have cash flows that start low but increase over years.

Dutch aWEARness argues that the way to get companies to make products with a longer lifetime is through the use of performance-based contracts. But with the current set-up of financial institutions, performance-based contracts are difficult to manage. These issues are currently resolved by customers paying the contract fee upfront.

To conclude, Dutch aWEARness is still experiencing difficulty financing all their projects. But with the cooperation of all the actors of the supply chain, they have developed a profitable circular model to recycle and produce clothes. Collaboration on developing financial products that enable the financing of PSS models and creating the possibility to share ownership of materials across the supply chain are important for taking the circular model to the next level.

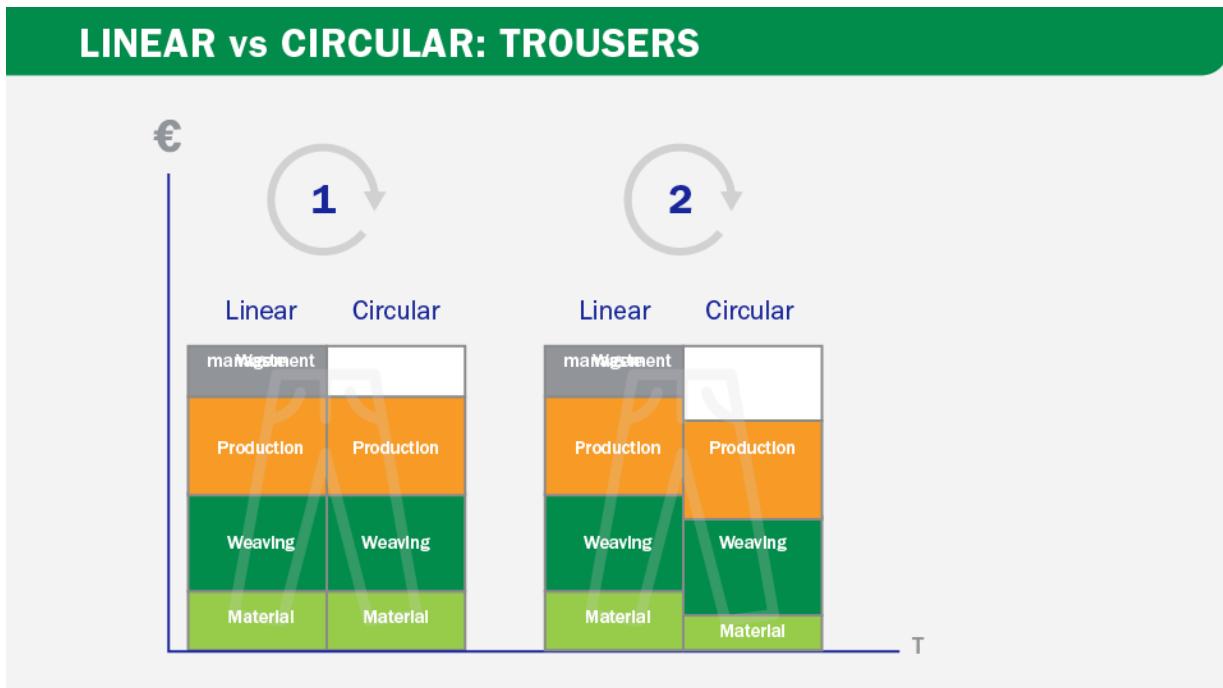


Figure 16: The production of trousers: linear vs. circular scenario.

3.1.4. Circle Design

"I am too poor to buy cheap products" – Hugo van der Kallen (CEO Circle Design)



Circular Innovation Model (CIM) / Circular Use Model (CUM) / Circular Output Model (COM)



Nijmegen, the Netherlands



B2B: Businesses in hotel and catering industry
B2C: Customers with focus on sustainability/
access to high-end designer furniture



Start-up

Case description

Circle Design gives an impressive insight into the workings of an innovative circular player. What they put on the market is much more than a brand of furniture. Circle Design generates additional economic value by enabling the consumer to not only become a customer of a circular brand, but to become a key link in the circular process itself. This is done by providing the customer with designer furniture made of high-quality and durable wood and metal elements that can be added, interchanged or reshaped at any time.

Challenge: high-end expensive product

However, like many circular companies, Circle Design faces challenges. They sell high-end products, and like all products of comparable quality they represent an investment for the customer. In addition, as the products are designed for ease of reuse and redesign, it would be lucrative to structure the upstream of the materials. For this reason Circle Design has opted to, in addition to simply selling their products, work with other business models such as buy with buy-back guarantee, operating lease and finance lease. These models serve both the company and the customer: the customer has easy access to a durable design product and the company can retain ownership of the product or otherwise ensure the return of the product for reuse at the end of the life cycle.

Challenge: pre-financing

The market reality thus makes lease constructions of bigger benefit to the involved parties. However, this requires pre-financing, and for a small company like Circle Design this can be problematic. External financing is expensive for these types of business models. To attract external capital, capturing the available market demand would be desirable, but to scale up operations requires resources including labour, physical assets, knowledge and expertise, which require financial resources. Having financial partners who support these strategic decisions is critical.

Challenge: access to funding requires specific legal and financial knowledge

It is fortunate that governments recognise the value of having financial partners that support the circular leap forward, which is why there are subsidies available. However, in spite of these good intentions, smaller players in the circular field are not yet optimally supported. Getting access to these types of subsidies requires a great deal of specific legal and financial knowledge. Small companies do not have the means to invest in these, and so they tend to miss out.

Future vision

Nonetheless, the future looks bright for Circle Design. With new 3D-printing technologies starting to appear on the horizon, CD is exploring ways to print metal and plastic corners to optimise resource use and reduce labour costs. Also, the more experienced and successful Circle Design becomes and the more products are returned to them, the higher the benefits of renting out and leasing will become. There are plenty of market opportunities, the remaining challenge now is to figure out how to fit all the pieces of the puzzle together to create the greatest amount of value for all those involved.

Financial aspects

As mentioned previously, the pre-financing of lease constructions and finding the means to grow are challenging for Circle Design. Circle Design approached a Dutch bank for a credit account, but the owner would have been required to offer his house as collateral. Circle Design is now exploring options to seek support from a crowdfunding platform.

The various difficulties will be set out by business model in the following sections.

Selling products

At the moment, straight sales comprise the majority of total revenue. However, in the future, a combination of the models below will replace the sales model. Although materials still need to be pre-financed, which could

pressure the cash-flow structure of Circle Design, this holds only for large orders. As this is not specific to circular businesses, this will not be explored here further. The selling price of designer furniture is relatively high, meaning that purchase will be too expensive for some customers – leasing the product will be the preferable option.

Sell with buy-back guarantee (percentage of revenue)

The sell with buy-back is structured as a regular invoice where a paragraph is added that the customer can *always* resell the product to the seller. This buy-back guarantee is valid for five years. The minimum buy-back price is €50 per piece of furniture, but the actual price will be dependent on the state and age of the product as well as the residual value of the material and labour. The advantages are obvious: the customer receives a guaranteed price for unwanted, ‘waste’ furniture and Circle Design can produce new designer furniture of the same quality but saving on its (costly) material and labour expenses.

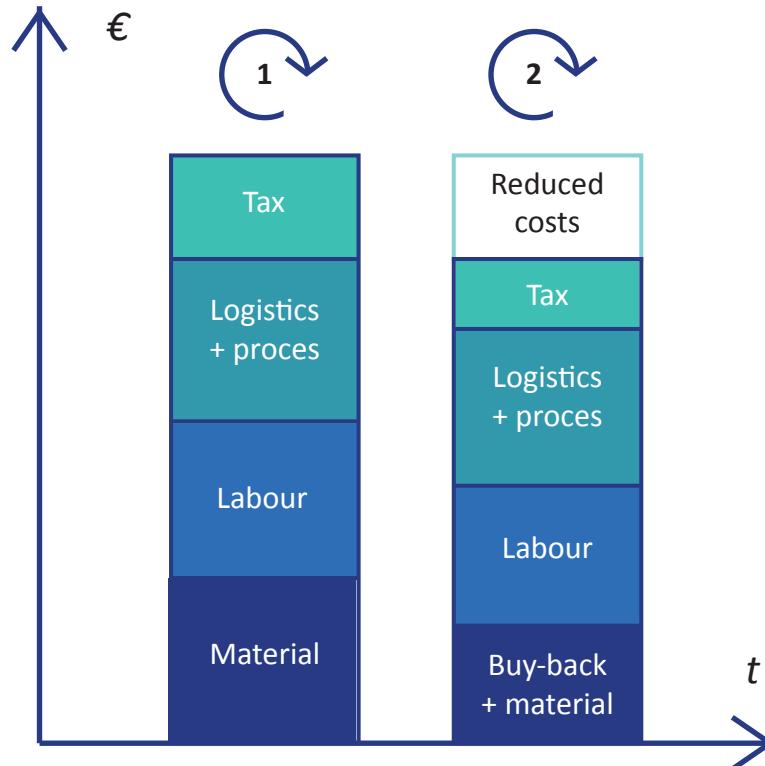


Figure 17: Circle Design: saving materials.

Through buying back used furniture, Circle Design is able to produce the same designer furniture while saving on material and labour expenses.

The challenge with this type of business model is to fix a buy-back price that is high enough to ensure the return of the material (what is perceived as reasonable will differ between customers) and low enough that it does indeed reduce material and labour costs. As the materials are high quality, and form by far the highest production expense, these costs are easily reduced.

Operating lease

In an operating lease, Circle Design retains ownership of the product and is responsible for its preservation and maintenance. For the maintenance and preservation of the product, 10% is added to the sales price. The lease is based on the annuity model with financing costs of 7%, of which 3.5% is the interest rate and 3.5% covers administration and processing costs. After the five-year lease period, the product is fully written off and paid for by the customer. If the customer continues leasing the product after this period, then this cash flow is, with the exception of maintenance and preservation costs, pure profit. The customer is able to buy the product within the lease period for the original price minus the amount of depreciation that has already been paid by the customer, or through finance lease (see below).

Finance lease

Finance lease is similar to buying on account. Circle Design takes responsibility for the preservation and maintenance of the product during the two-year lease period. For maintenance and preservation of the product 10% is added to the lease sum. The lease is based on the annuity model with financing costs of 7%, of which 3.5% is the interest rate and 3.5% covers administration and processing costs. After the lease period, the product is fully written off and paid fully by the customer and ownership is transferred to the customer. If the customer fails to pay the regular lease fee, the piece of furniture is claimed.

Although the finance lease construction puts more pressure on the cash flows of Circle Design than plain sales, this business model is not explicitly circular, because ownership will eventually be transferred to the customer. Finance lease enables customers who perceive the sales price as too high to purchase the product on account. While the product in itself is still designed for circularity, the end-of-life treatment in this business model is not controlled.

3.1.5. Brambles



Circular Use Model (CUM) / Circular Output Model (COM)



Sydney, Australia



B2B: Pooling of returnable pallets, crates and containers



Multinational Corporation

Case description

Brambles is a supply-chain logistics company operating in more than 60 countries, primarily through their CHEP and IFCO brands. They have over 14,000 employees. They own around 470 million pallets, crates and containers across a network of 850 service centres.

The group specialises in the pooling of returnable pallets, crates, and containers. Brambles predominantly serves the consumer goods, grocery, fresh food, retail, and general manufacturing industries. In addition, the group has specialist businesses serving the automotive industry, aerospace, and oil and gas sectors. Brambles was one of the first companies to create a circular business model in the form of pooling assets instead of selling them.

The reusable plastic crates (RPCs) business (under the IFCO brand in Europe, North and South America, and under the CHEP brand in Australia, New Zealand and South Africa) provides RPCs to transport fresh produce from producers to grocery retailers. The container business provides intermediate bulk, automotive and chemical and catalyst container pooling and repair across different industries. CHEP Aerospace provides the pooling of and repair solutions for cargo-carrying units in the commercial aviation sector. Pooling services for the offshore oil and gas industry are delivered through Ferguson group.

The pooling goes beyond sharing. Brambles' size means that it can share assets in the supply chain in the most efficient manner. Empty equipment is always collected, repaired and delivered over short distances, minimising empty miles and the impact on the environment. Brambles' unique position in the supply chain enables it to collaborate with many of its customers (Carrefour, Nestlé waters, Coca-Cola, P&G etc.) to share road transportation and eliminate empty miles. This programme reduces transportation costs and CO2 emissions in the supply chain. Moreover, Brambles manages all waste streams related to pallet pooling activities, including

wood, corrugated iron, steel and plastics. RPCs recycles 100% of its crates by grinding up all damaged containers and reprocessing the granulate for use in new crates.

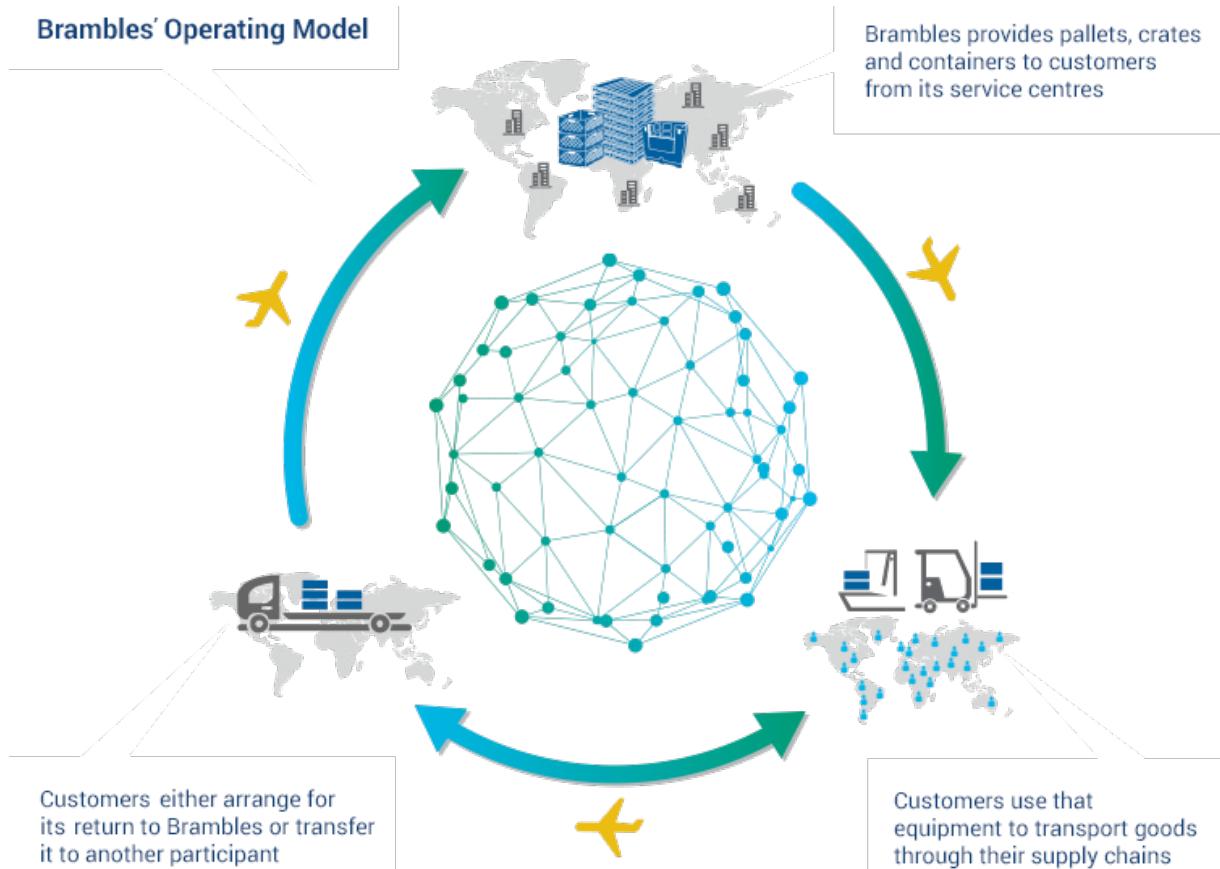


Figure 18: Brambles' operating model.

Challenges

The Brambles business model depends on the successful recovery of their assets once they are empty. Thousands of locations worldwide receive Brambles equipment for collection. A thorough asset tracking system (based on customer EDI (Electronic Data Interchange) data) and a state-of-the-art collection system allow Brambles to collect their products from virtually any location in the countries where they operate.

A circular pooling model can only work if empty assets are collected quickly and made available for use by the

next customer. Long cycle times would require the manufacture of additional assets to 'replace' non-productive assets, which would require new raw materials. Complex logistics planning through algorithms as well as a very close commercial relationship with all players in the supply chain allow Brambles to efficiently manage the balance between asset recovery cost and availability.

Brambles' assets can be of high value and can serve many purposes outside the supply chain (like a nice garden fence made out of wooden pallets). Asset control is crucial for a successful asset productivity model. Brambles has control systems in place that include unannounced audits as well as a large field-based team whose main purpose is to protect their assets from fraudulent and illegal use.

Financial aspects

Brambles Limited is a public company, listed on the Australian Securities Exchange since 1954 and funded through a mix of shareholders' equity, and debt (comprising corporate bonds and bank loans). Brambles shareholders, bondholders and lending banks are, in the vast majority of cases, financial institutions. The group has many long-standing and strong relationships with such institutions that support its funding model.

The group's business model has historically generated sufficient cash flow to fund capital expenditure to support the replenishment and growth of its business, while also enabling dividends to be paid to shareholders and debt obligations to be serviced. Additional equity funding has generally only been sought to fund large acquisitions (e.g. a rights issue in June 2012 was linked to the funding of the acquisition of IFCO Systems).

Through clear articulation of its operating model, business strategies and financial performance, Brambles provides financial institutions (whether shareholders, bondholders or lenders) with adequate information to support their circular investment decisions.

3.2. Summary case findings

As stated at the beginning of this chapter, the companies discussed in the case studies were selected based on their diversity in sector, size and business model. Therefore it is not surprising that these businesses encounter different barriers to circularity. Given these differences, circularity, and specifically keeping control over products and materials, may be optimised in different ways for different sectors. This also emphasises the high granularity in issues, as stated by Sonerud.²⁶

There are two common aspects across all the case studies. First, it is clear that the emphasis is on the whole supply chain, instead of a single company, when circularity is being established. In all the cases circular activities could only come into being when different supply chain partners, from input (CIM) to use (CUM) to output (COM), collaborate to make the circular product cycle effective and efficient. Moreover, problems concerning the financial structuring of PSS models are most likely to be overcome by sharing risks and rewards across the supply chain. The ultimate expression of this is shared ownership of products and materials across the supply chain,

which creates the opportunity to finance chains instead of single companies. How this affects risk will be further analysed in chapter Four. Sharing ownership across the supply chain can generate the right incentives to optimise the circular model in terms of capitalising on added value while generating a continuous cash flow with PSS models.

The second common aspect seen in these case studies is the role that PSS models play in these circular businesses. It seems as though PSS models are seen as a requirement to make the circular supply chain function. The reason for this lies in the fact that in order to have a circular supply chain it is essential to receive products back after they have been used. When ownership is transferred to the consumer (i.e. products are sold) the company – or supply chain for that matter – loses control over the product. The most effective way to create an incentive to return the product is not to sell it at all, but provide the service of using the product. Additional services, such as maintenance and repair, included in the service fee will increase the attractiveness of the PSS model for consumers.

²⁶ B. Sonerud, Meeting the financing needs of circular business (2014).

Four: Finance

There currently exists a vast array of financial offerings that provide companies with financial flexibility in strategic, operational, and financial decisions. These offerings have their own specific requirements and terms but are based on the underlying principle that the financier will be able to recoup their capital back with a premium (interest or dividend) that is commensurate with the risk profile of the counterparty.

In this report, financing circular business models is based on this traditional economic framework that rewards risk with economic return. As a result the current suite of financial products can be transformed and tailored to the economic decisions made by circular economy businesses. These business models need financial products suitable for the specific criteria of each investment opportunity in order for the underlying principle of rewarding risk to remain a valid assumption.

There are many different types of financial products required to fully exploit circular business models. For instance in the transition phase when a business is moving from a linear business model to a circular business model the risk profile may be more suited to higher-risk capital through the injection of equity or internal capital. Once the transition is complete the move to lower-risk capital through specialist asset lending and generic debt facilities may be more appropriate. An overview of funding sources is given in Figure 18.

Assessing whether a certain financing structure is appropriate requires consideration of factors including the strength and maturity of the business and its risk profile. The level of risk will then be reflected in the risk premium.²⁷ When risk is high the premium has to be high, for the financier needs to be compensated for the risk being taken.

Section 4.1 sets out the differences between circular and linear risks. Financial implications of the three main business model categories are elaborated in Section 4.2. Possibilities for financing the circular economy are explored in Section 4.3, followed by concluding reflections in Section 4.4.

²⁷ Risk premium is the premium you receive for the risk being taken. In the case of debt, this is the interest rate (minus the risk-free interest rate), in the case of equity, this is the return on equity.

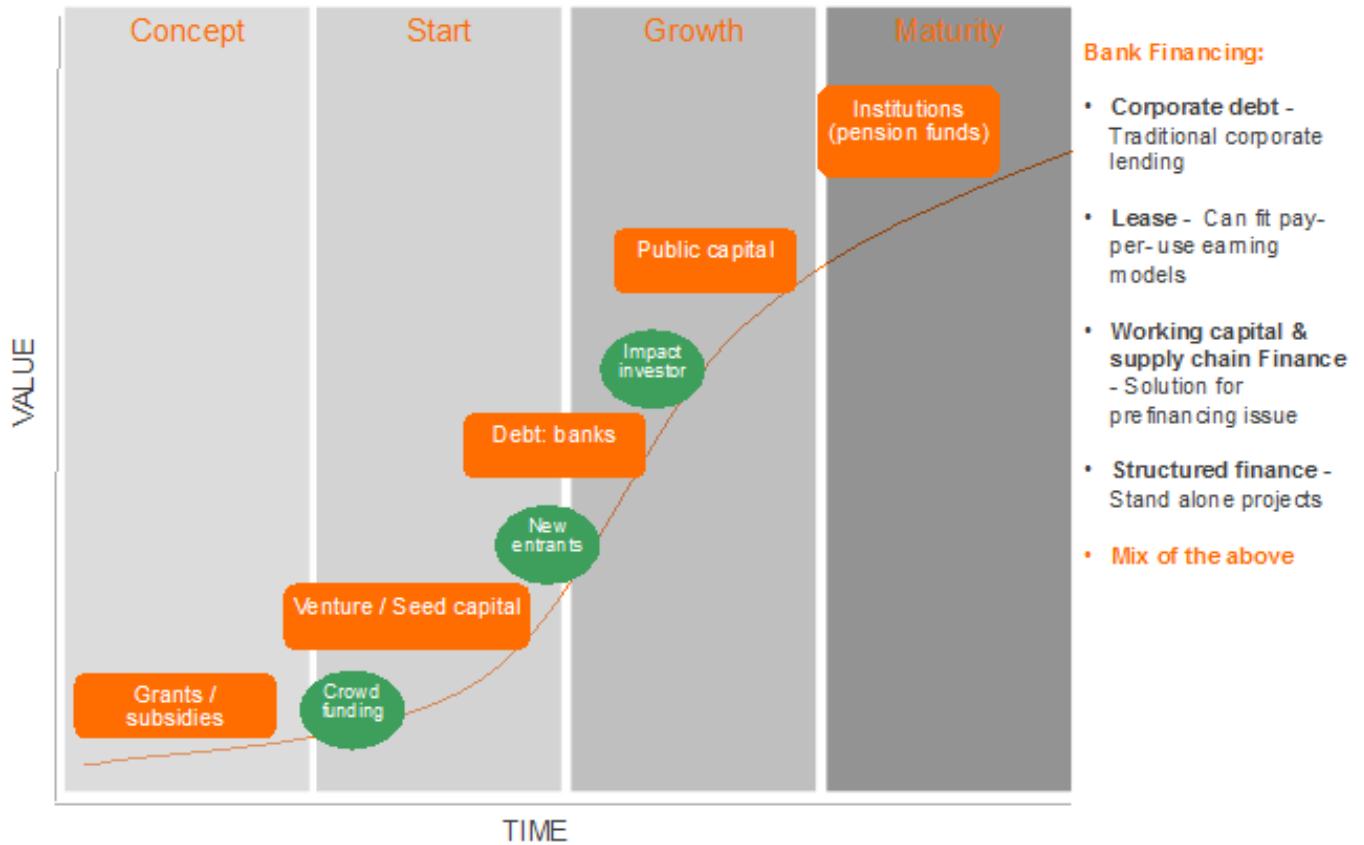


Figure 19: Funding sources (source: ING).

4.1. Risk

When measuring risk there are two main factors taken into account: the creditworthiness of the borrower and the value of the collateral (underlying assets, contracts, or both). The creditworthiness of the borrower is calculated by consideration of, amongst other factors, the financial position of the business, its track record, the sector of the business and skills of the management. The value of collateral, usually in the form of assets, is measured by its market value at a specific time; if in the form of contracts it is measured by the stability of the clients and the strength of the contracts. As risk plays an important role in aligning the financial sector to circular business, the differences between circular risk and linear risk are discussed below.

4.1.1. Circular risk

When circular businesses in need of financing are start-ups or relatively young small- and medium-sized enterprises (SMEs), they are often considered not to be sufficiently creditworthy. They are often characterised by short track records and have a limited financial position. In addition, they are either marketing existing products in new ways, for example servicing consumer goods, or have developed totally new products.

Therefore, circular businesses can be easily marked as highly risky. However, conclusions on the riskiness of circular business should be handled with care. The perceived risk can be partly down to a lack of information and the traditional ways in which financial institutions model risk.

As was highlighted in Chapter Two, circular businesses are – in one way or another – concerned with resource control and retaining added value. In this process a shift of mindset takes place: (used) products are seen as a valuable source of modules and/or materials rather than as waste. This has major consequences for the business case: independency from virgin resources and potential additional (second, third, etc.) markets produce stronger and more stable longer-term margins and improved return on capital through enhanced resource productivity and asset utilisation. However, the required initial investment can cause deterioration in short-term margins. The resulting process of balancing short-term margin and long-term stability could impact on third-party perceptions of creditworthiness and the stability of the underlying business.

As well as the benefits of moving to a circular business models, there are also potential negative risks that need to be considered. Firstly, there has to be market demand for the offered products. Customers are currently used to owning products and have not yet adjusted to considering a product's value for further cycles (either as a product, modules or input materials). However, this is changing rapidly, as shown by existing models, including ZipCar and SAAS (software as a service), which demonstrate a shift to using products in the form of a service. Another potential risk to consider is the fact that the full potential of a circular economy cannot be reached without the collaboration of supply chain partners. Therefore, there need to be new companies creating new markets for (used) products, materials, and developing the innovations needed to effectively use end-of-life products in new cycles.

Without demand for used products (i.e. the added value captured in products), the residual value of products will remain zero – at best there may be scrap value, but in some cases the value will be less than zero due to the costs of disposal. Not only is this a problem from an economic perspective, but also it does not support keeping products and materials in closed loops. When the transition to a circular economy advances with more circular business models, supply chains and increased demand for end-of-life products with added value, it can be expected that the residual value of many products will increase. However, the pace of this increase in demand/value is unclear. Currently there are not many sectors (besides highly technological sectors like automotive and plane engine manufacturers) that value end-of-life products accordingly. This makes it hard to put a price on assets and their residual value.

To estimate the residual value of products, existing (online) second-hand markets can serve as a proxy. But it is important to note that this is the residual value in a linear system. If the circular system takes off, residual value is expected to increase because the number of cycles that products and materials can make will increase.

Currently, the valuation of assets in a circular economy is a catch-22 situation. As there is no information on what the value will become in a closed-loop system, value cannot be attributed,²⁸ which therefore obstructs the creation of closed-loop supply chains. On the other hand, in many sectors chain actors are hesitant about investing in circular economy assets if they do not know the residual value.²⁹ There are some sectors where closed-loop supply chains have already led to increased residual value of assets, as will be further explained in Section 4.2.2.1.

^{28, 29} B. Sonerud, *Meeting the financing needs of circular business* (2014).

4.1.2. Linear risk

The flipside of circular risk is businesses' increasing dependency on virgin resources and corresponding exposure to price volatility. Moreover, environmental legislation can be expected to increase in the coming years, which will put the current linear system under stress. This raises another concern in risk analysis, one that so far has been neglected: the opportunities of circular economy provide a solution to what can be called 'linear risk'.

Linear risk refers to the current developments in the world that will have an impact on the macroeconomy. The growing population and increasing level of wealth means that the current linear economy is unsustainable in the long run. The urgent need for change is clearly demonstrated by volatile resource prices and the effects of climate change. This growing sense of urgency will lead to stringent legislation concerning resource use and greenhouse gas emissions.³⁰ Moreover society is increasingly demanding environmentally sound products. This has already resulted in businesses altering their processes and searching to reduce their negative impact on the environment. This trend to develop technological solutions, combined with societal and political pressure, can lead to a new order of winners and losers. In this scenario the winners are the businesses that manage to alter their processes and products in line with environmentally sound business practices. The losers will be the businesses that cling onto old linear business practices, rendering their business model and products obsolete. Given this future state of affairs, financials could be exposed to linear risk through investments in businesses that retain linear business processes. Stakes in linear business run the risk of becoming stranded assets, i.e. assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities. The reasons for this include factors relating to the environment, regulation, evolving social norms, and new technologies.

At this moment it is difficult to estimate the quantitative magnitude of linear risks. But without change we can expect supply chain disruption, limited availability of raw materials (*putting pressure on business activities*), and price volatility. These all represent risks and therefore additional costs. This is particularly a problem for large companies that have a substantial interest in the linear status quo. If these companies collapse due to the large-scale adoption of circular business models this may have a catastrophic effect on the financial industry and the global economy.

³⁰ KPMG International Cooperative, *A New Vision of Value: Connecting corporate and societal value creation* (2014).

Circular risk	Linear risk
Shift of mindset needed to see (used) products as valuable sets of modules and/or materials instead of waste.	Dependency on virgin resources (risk of supply chain disruption).
Required initial investment can cause deterioration in short-term margins.	Exposure to resource price volatility.
Balance of short-term margin versus long-term stability.	Increasing environmental legislation.
Market demand for the offered products: customers and companies are currently used to owning products.	Growing population and increasing financial wealth.
Dependency on supply chain collaboration.	Effects of climate change.
Unknown residual value of many products, due to small market of circular output companies (i.e. companies that upcycle, re-use, remanufacture or refurbish).	Demand for environmentally sound products.
Supply chain lock-in risk.	Businesses/products that become obsolete by holding onto old linear business practices (stranded assets).

Table 5: Summary of circular and linear risks.

4.2. The financial implications of circular business models

The financial implications of circular business models differ per business model category and therefore are treated accordingly. The main aim of circular businesses is to keep control over resources and at the same time preserve value added. This is expressed in three business model categories, each of which focuses on a different phase: designing and sourcing products (CIM), the use phase (CUM), and treating products after use (COM). Note that in a perfectly circular economy the beginning and end become the same thing as the loop is closed.

For easy reference the business model categories set out in Chapter Two are repeated here:

- **Circular Innovation Models (CIM):** these business models focus on *the development phase*. Products are designed to last longer and/or be easy to maintain, repair, upgrade, refurbish, remanufacture or recycle. Additionally, new materials are developed and/or sourced, e.g. bio-based, less resource-intensive, or fully recyclable materials. In the same context, innovative processes are developed to increase the reuse potential and recyclability of industrial and other products, by-products, and waste streams.
- **Circular Use Models (CUM):** these business models focus on *the use phase* by optimally using the product and maintaining added value. These business models make it possible to retain ownership of the product (e.g. by servicing a product rather than selling it) and/or take responsibility for the product throughout its useful life (e.g. through maintenance services, or add-ons to extend the life of a product). Product-to-service models entail a (partial or total) conversion from manufacturing (and selling) a product to offering the product in the form of a service contract.
- **Circular Output Models (COM):** these business models focus on the output and added value of a product's *after-use phase*. In these business models revenue is generated through transforming after-use products into new products or useful resources in order to add value, reduce costs, or reduce waste. The development of reverse logistics is essential for this model.

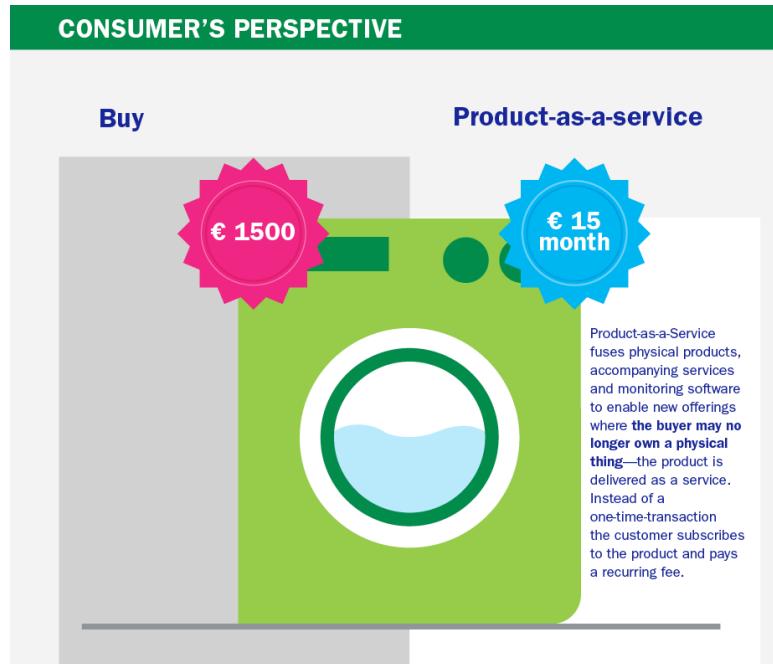


Figure 20: Consumer's perspective of 'buy' versus 'lease'.

4.2.1. Circular Innovation Models

These business models are about innovation in existing products or developing new products and processes that seek to optimise circularity. As stated in Chapter Two this entails new product *design, materials* and the optimisation of *processes* to increase the reuse potential and recyclability of products, by-products, and waste.

These business models are characterised by significant technological and operational risk. In the case of process-related risks, some processes are based on specific inputs and would not be guaranteed if the feedstock were modified. New technologies have no proven performance track record and hence entail ramp-up/construction risks, to which can be added the related uncertainty about operational costs. In addition, investments related to product innovations are also characterised by business risks such as:

1. Competition with existing/alternative materials/products;
2. Uncertainty of feedstock specifications and flexibility in operation;
3. Uncertainty about product specifications, performance, customer acceptance, and related regulations;
4. Uncertainty about the residual value of the new products (when applicable);
5. Risk that a company will not achieve cost-effective repair, reuse, and remanufacturing (when applicable).

These projects often require significant upfront investments destined to reduce the raw material needs or to increase the residual value of the products at the end of their useful life. However, such investments have a risk profile that declines very slowly with time. While implementation and performance risks are extremely high right from the start, the risk level drops only gradually following project implementation.

There are nevertheless differences between process and product innovation. Existing evidence,³¹ however, suggests that process innovation is the best known form of green business model innovation within a company's long-term cost reduction plans. Companies perceive this type as requiring a lower level of upfront investments in comparison to product or service innovation. The investments related to a new product are considered to be substantially larger (as they also involve costs for market research, product design, new production technologies, and marketing).

In addition one needs to make a distinction between (i) large upfront investments that yield fast results right from the start of the production process (for instance after the retooling of a plant) and (ii) investments that target resource efficiency (where the reduced cost of goods sold gradually offsets the investments).

Figure 21 presents a preliminary summary of the opportunities and risks (threats) associated with intensified and targeted circular development models.

³¹ Nordic Innovation, *Green Business Model Innovation, Empirical and Literature studies* (5 November 2012).

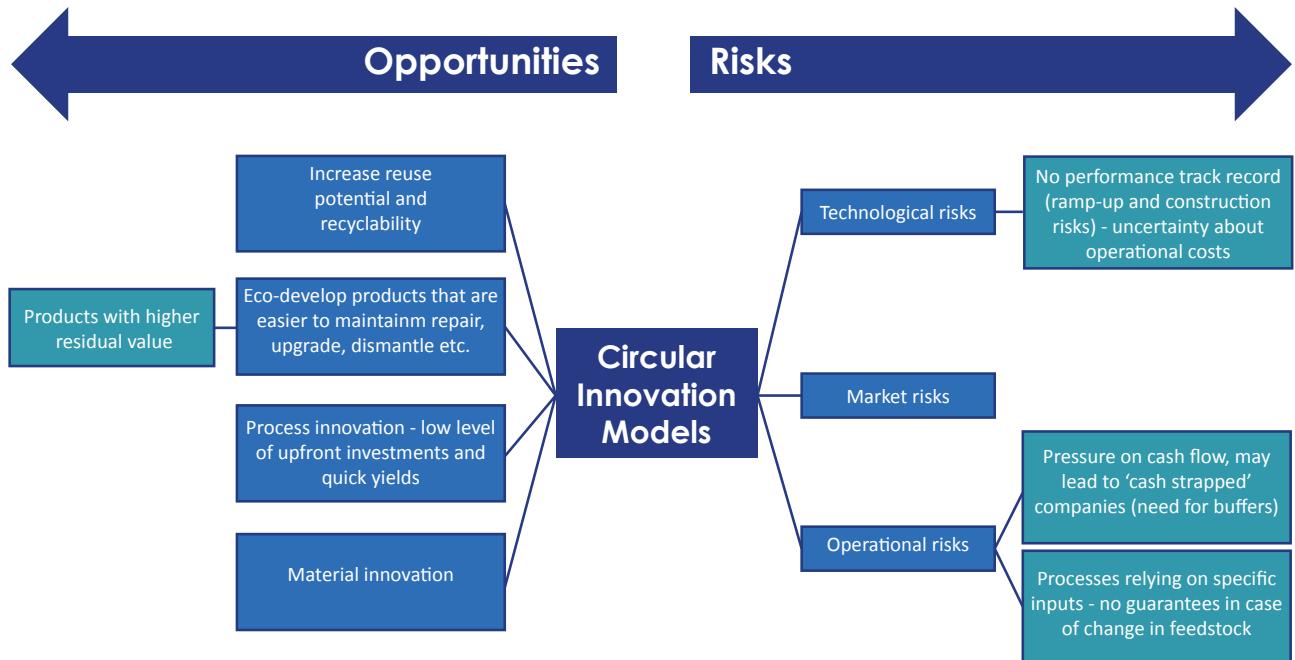


Figure 21: Summary of opportunities and risks related to Circular Innovation Models.

4.2.2. Circular Use Models

Circular use models focus on the use phase by optimally using the product and preserving its added value. These business models involve retaining ownership of the product and/or taking responsibility of the product throughout its lifetime.

There are currently two general models identified that enable retaining control of materials:

- 1) Retaining ownership of assets through Product Service System (PSS) models
- 2) Sell and buy-back models

Providing the service of using a product, instead of transferring ownership, has financial consequences for both businesses and consumers. In general, the financial implications of PSS models come from the changing nature of cash flow: increasing (working) capital is needed to pre-finance clients, the balance sheet grows and the view

of residual value is revised. Related challenges lie in product tracking and legal issues surrounding ownership of collateral and its value. Furthermore, there are specific risks associated with the behaviour and creditworthiness of the customer, or in a broader sense, market-related risks.

In view of the importance of returning the end-of-life products and the importance of PSS models in incentivising this behaviour a range of different aspects and considerations are discussed below. As sell and buy-back models are not ideal for creating a circular economy (see box) these models are not discussed in detail here.

Box: Sell and buy-back Model

The difficulties associated with financing PSS models have in some cases resulted in a decision to create a sell/buy-back construction where the product is paid for upfront, rather than over a period of time (see for example 3.1.3. Dutch aWEARness and 3.1.4 Circle Design). Although this solves the financial difficulties associated with PSS models, it implies that ownership of the product is transferred to the consumer. This reduces the likelihood of the product being returned at the end of its useful life, since the consumer may choose to sell the product on the second-hand market or to a scrap dealer if that will result in a higher price than the buy-back price.

Furthermore, this construction has implications for the quality and circularity of the product. If the company is not responsible for the performance of a product this reduces the incentive for the company to create a product with the highest possible quality or maintain and preserve the product in the best condition possible.

Product Service System (PSS) model structures

- **Finance lease:** The International Finance Reporting Standards Foundation (IFRS) defines a finance lease as transferring 'substantially all the risks and rewards incidental to ownership of any asset'.³² Finance lease is often done for highly costly assets, such as specialised machinery. In finance lease the ownership of assets is transferred to the lessee after the end of the leasing contract. This means that a finance lease equates to buying an asset in a structured way, paying for it over an extended period of time, with the help of a financial institution as intermediary who owns the assets during the leasing period.
- **Operating lease:** IFRS defines an operating lease as simply 'a lease other than a finance lease'.³³ In operating lease the lessor retains ownership of the asset.
- **Full service lease:** A full service lease is an *operating lease* in combination with a maintenance and preservation service for the asset.
- **Pay-per-use:** In a pay-per-use construction, an *operating lease* is combined with periodical fees that are flexible and are dependent on the use (performance) of the asset.
- **Rent:** Renting differs from leasing in that rental is generally for a shorter period, varying from one day to one year. It is often the case that maintenance and insurance are included in the service. This model is often used for products that are used only for a short period of time, for example expensive equipment.

When talking about the financial side of PSS models, terms as operating lease, capital lease, finance lease and rental are used interchangeably. The main differences are set out in the box above on PSS model structures. In general, the operating lease model is best suited for PSS models in the context of a circular economy, as ownership of the asset is retained by the lessor and is easily combined with service or performance-based business models. Therefore, when the term 'lease' is used throughout the rest of this chapter, it is referring to operating lease. The interested reader is referred to Appendix A, where a more in-depth exposition can be found on the effect of different accounting definitions on the balance sheet.

Depending on the circumstances, leasing an asset can be more expensive than buying the asset, due to the risk premium priced into the leasing fee. However, in a PSS model not only depreciation costs, but maintenance and replacement costs (depending on service conditions) and the value of 'unburdening' need to be taken into consideration. It is only worthwhile leasing a product when the cost of leasing is less than the sum of

^{32, 33} International Accounting Standard 17 (IAS 17): Leases.

depreciation, maintenance and replacement costs (i.e. cost of ownership), and the value of unburdening (i.e. not being responsible for the product). However, it is a challenge to calculate the (future) maintenance and replacement costs and to express the value of unburdening in the price.

One way to lower expected maintenance and replacement costs is by using monitoring devices to track the use and condition of the assets. For example Bundles (Section 3.1.1) introduced the Wash-App to educate its customers about optimally treating its washing machines. Figures 22 and 23 illustrates the comparison between buying the asset and leasing it fully serviced.

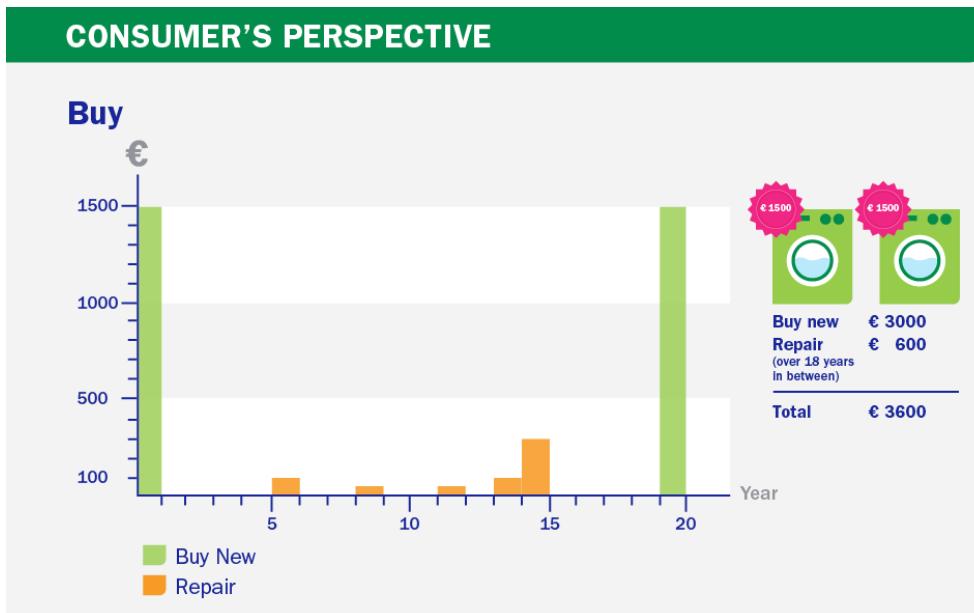


Figure 22: Buy versus lease; consumer's perspective.

Product-as-a-service

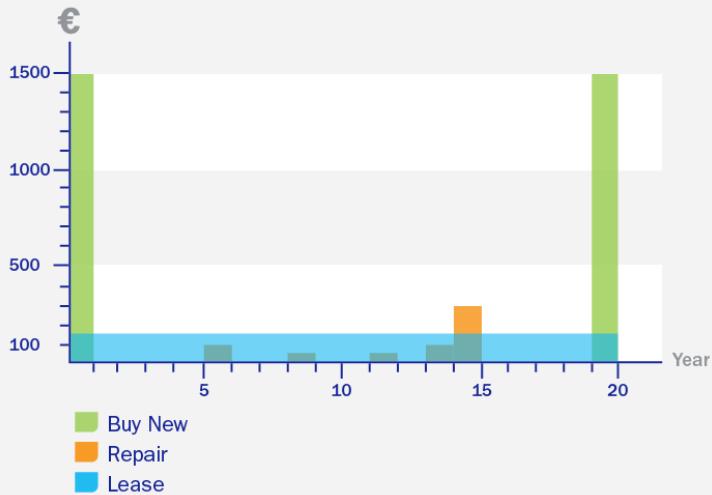
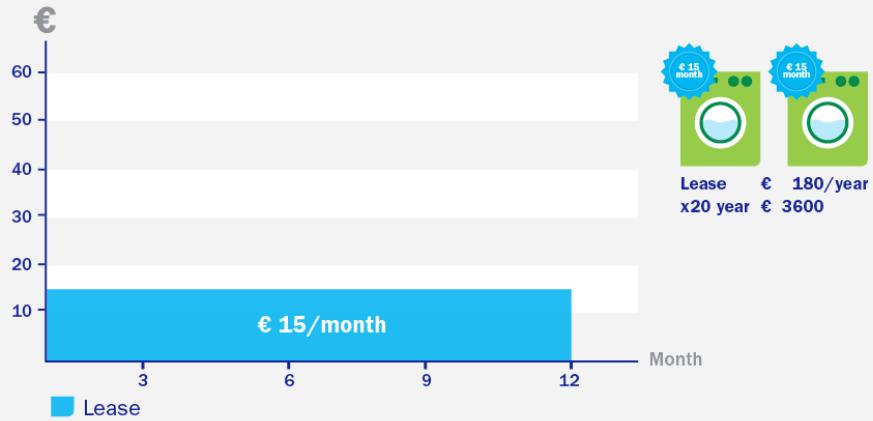


Figure 23: Buy versus lease; consumer's perspective.

4.2.2.1. Balance sheet implications and value of assets

Traditional product sale businesses that transition to the circular economy through PSS models will shift to a business model where physical assets are retained on the balance sheet. Retaining assets on the balance sheet (rather than selling them to customers) creates a capital demand to finance the long-term ownership of these assets and potentially a requirement for third-party funders if internal funding solutions cannot be found. Long-term asset finance solutions can help client businesses unlock the long-term return on capital benefits.

As opposed to the various benefits that consumers will enjoy with PSS models, the business case for companies wanting to transition to this type of model is harder to make. Products that were previously sold would, in principle, remain on the company's balance sheet. The leasing of such products would translate into operating leases which would, in most accounting systems, be recorded on the lessor's balance sheet as if the product were still in the lessor's possession. A direct consequence of this type of transition is a marked increase in the size of the company's operating assets. From a traditional corporate finance perspective this is an undesirable change. The collateral of assets is on the balance, but not accessible, since the assets are leased to consumers. In most cases such an increase in the size of the operating assets also leads to a decrease of the average liquidity of the company's overall assets. Lower asset liquidity seems to be generally associated with an increased cost of capital.³⁴ Should the company want to finance the transition through debt, it should expect an increase in its borrowing costs, which in turn could be passed on to consumers.

A possible counterargument to the above hypothesis is that having more assets on the balance sheet provides the possibility of offering more security to a lender (therefore decreasing the borrowing costs). Moreover, it enhances the quality of assets through direct control over maintenance. This results in significant improvements in the capacity to retain and reuse the assets for future use cycles.

However, in the case of new asset classes, such as consumer goods, which are explored in the circular context, the underlying value of the asset is low, or the residual value of the asset is unclear and therefore considered too low. Additionally, this would involve taking into account the depreciation of the operating assets. The value of the assets proposed as collateral would drop over time and a lender will want the security cover ratio to remain constant. Therefore, the depreciation rate of the operating assets should be equal to/slower

³⁴Hernán Ortiz-Molina, Gordon M. Phillips, *Asset Liquidity And The Cost Of Capital*, Working Paper 15992 (The National Bureau of Economic Research, 2010), available at <http://www.nber.org/papers/w15992>),

than the loan repayment rate. However, it is difficult to control the gradual drop in the residual value of a leased product, as this will depend on the conditions of its use and whether the lessee respects the regular maintenance requirements. A periodic evaluation of the relevant assets should be undertaken, and if, following such evaluation, it is confirmed that the security cover ratio has decreased, it may be necessary to request additional security. Moreover the residual value of products is likely to increase as the number of companies with circular business models increases and demand increases for these products and for using their modules with their retained added value instead of scrap (and corresponding scrap value).

A worst-case scenario would involve taking into account only the value of the materials that can be recovered once the relevant assets are scrapped (scrap value). This requires a solid understanding of the materials contained in the respective assets, of the associated recovery costs, and of the market price for the materials. Commodity prices are highly volatile and this will add an important element of uncertainty in the equation, so appropriate hedges must be put in place. In addition it is unknown when the assets may have to be scrapped (they will be scrapped only if the borrower defaults on the servicing of its debt and if the assets are either no longer functional or the component materials are more valuable than the complete asset). Hedging will likely be expensive and this will translate into an increase in the borrowing costs, perhaps even beyond the cost of an unsecured loan (assuming that there are lenders willing to provide loans on an unsecured basis).

For example, the residual value of Bundles' washing machines is their scrap value, because washing machine manufacturers do not reuse the added value of the technology in their machines. Instead they take back the washing machine and sell it against scrap value. When manufacturers begin to reuse modules in new machines (after remanufacturing) the value of these end-of-life machines will be greater due to increasing demand.

This is already happening in the IT, automotive, aerospace and medical sectors. IBM, for instance, has a whole business unit called Global Asset Recovery that recovers IBM products from customers at the end of their useful life, remanufactures them, and resells them as 'as-new products'. This shows modularity is not new and is used successfully in highly technological sectors. The reason for this is the high added value in these products. High residual value triggers supply chain activities that increase control over resources. These activities are more for B2B products, since the logistical concerns for tracing and returning assets are relatively low compared to B2C products. The challenge will be for B2C offerings and low technology sectors to improve modularity and residual value.

An effect of this residual value increase can be that the risk premium for PSS models will decrease, resulting in

a more attractive proposition for consumers (also see Section 3.1.1, Bundles).³⁵ Not only does this go hand-in-hand with a product-as-a-service proposition but it also enhances the asset quality through direct control over asset maintenance. This results in significant improvements in the capacity to retain and reuse the asset for future use cycles.



Figure 24: Residual value and risk premium.

³⁵ B. Sonerud, *Meeting the financing needs of circular business* (2014).

4.2.2.2. Cash flow implications

There are both positive and negative cash flow implications for leasing in PSS models. Leases put pressure on the lessor's cash flow. On the other hand, the PSS model binds clients, which provides cash flows in the long term.

Manufacturers that want to transition to a PSS model need significant cash buffers to deal with the longer cash-to-cash cycles which characterise the model. Instead of purchasing the product for its full price in one transaction, customers will pay a series of smaller subscription/rental transactions. Therefore, the transition requires considerable financial resources, which can lead to a higher borrowing cost if the company does not have the means to finance the transition through its own resources.

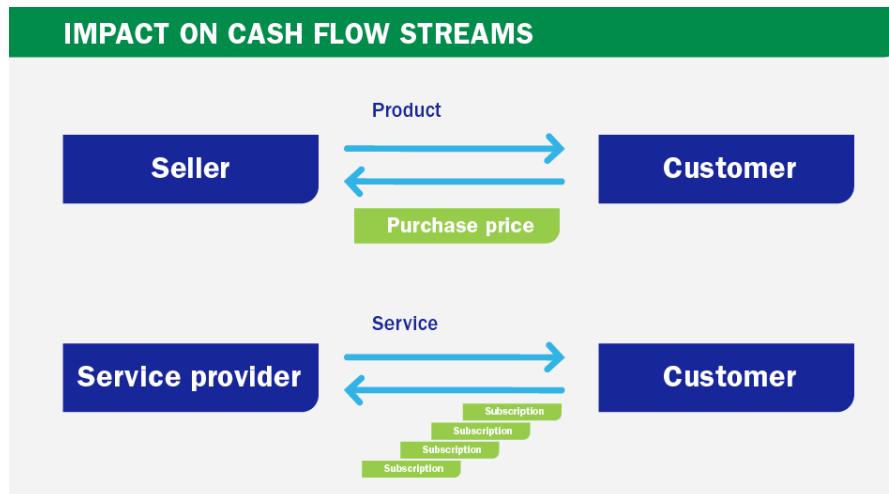


Figure 25: Impact of PSS model on cash flow streams.

This pressure on cash flows not only requires access to external finance sources in many cases, it may also increase the reluctance of banks to lend to a cash-constrained company, which presents perhaps a solid balance sheet but a discouraging cash flow statement.

However, businesses transitioning from product sales to PSS models can make a fundamental and positive change to their customer proposition through the development of longer-term, service-oriented customer relationships. This offers the potential to secure long-term customer contracts, incorporating both the offer of a product-as-

a-service and the mutual benefits of associated maintenance, refurbishment, and reuse. The resulting increase in 'customer stickiness' and contractual underpinning of future sales enhances the quality of earnings, provides improved visibility of future revenues, and results in a more robust debtor book.

This transition to a PSS model should therefore provide third-party finance providers with greater confidence in the business and create the opportunity to provide incremental funding solutions to support the transition. The ability of PSS models to improve the quality of income is established through enhanced contractual revenues, stability of margins, visibility of operational costs and scalability, driven by capturing the transition to the circular economy. An additional result will be an increase in the underlying valuation of the company.

Software-as-a-service

The transition to PSS models can be compared with the shift in the software sector from software licence sales to software as a service (SAAS). Today software licence sales businesses trade at an average of 3.1x EV/Revenue, whereas SAAS businesses trade at an average of 5.4x EV/Revenue. The 1.7x valuation premium that SAAS businesses attract relative to licence sales businesses is due in part to the enhanced stability, visibility and scalability of their financial performance. Although this shows the advantage of service models, the difference between SAAS and PSS must be noted: the hurdle for SAAS is the investment required to develop the software, and the accompanying overhead costs; once developed, the software costs no more. In contrast, the physical assets being offered in PSS models have to be acquired before they can be provided to consumers. Therefore, PSS models are likely to encounter more difficulties in overcoming cash flow issues than SAAS models.

The following section discusses the issues concerning capital requirements for PSS models.

4.2.2.3. Working capital requirements

Working capital is needed to buy new assets when new lease contracts are signed with consumers. However, since the company has to acquire the asset at the start of the lease period (i.e. in the form of an upfront investment), long before the accumulative lease fee will be able to cover the acquiring costs, working capital requirements are exceptionally high, compared to the normal buy-sell business model.

4.2.2.4. Legal considerations

As stated above PSS models suppose an extensive and prolonged contact with consumers. The leased asset must be maintained periodically and taken back at the end of the lease. As opposed to the classic buyer–seller model, where the relationship is relatively short and the seller’s liability only covers the guarantee period, a lessor–lessee relationship is much longer and involves more obligations on both sides. The lessor must guarantee the functioning of the asset throughout the duration of the contract, which may involve repair, maintenance, or replacing the asset if it ceases to function. In return the lessee must store and use the asset with the stipulated standard of care, follow the operational requirements of the manufacturer, and respect the maintenance requirements. The lessor will have to deal with lessees who have different attitudes to their obligations to the leased assets (meaning that maintenance costs will vary between individual assets), while ensuring that the residual value of the assets is as high as possible. The legal risks deriving from these lengthier relationships, which also involve a higher diversity of obligations than a regular sale, increase the overall operational risk of the lessor.

4.2.2.5. Client-related risk

As stated above, businesses adopting PSS models will have a different relationship with their customers than those using classic buyer–seller models, in the form of contracts. As opposed to the classic model, where once the product was paid for ‘client risk’ disappeared, the service model entails a continued risk that the customer cannot respect their end of the deal, the product gets damaged or maintenance costs exceed the initial estimates, or the contractual fee is not paid (credit risk).

Firstly, there is the risk that consumers are less careful with objects they lease than with objects they own. An example can be found in the housing sector: homeowners tend to take good care of their home, whereas renters tend to be less careful about house maintenance.³⁶ However, Fischer found that including kitchen appliances, like fridges, in the rent of social housing did not result in misuse of the assets by renters.³⁷ Therefore, consumer behaviour is an uncertain risk which is difficult to value. The fact that consumer behaviour is part of the risk equation sets it apart from the classical (buy) model. This risk can be compared with the risks involved in car

³⁶ For example SEV, *Owning a house, a better life*, Report 1 (p.43), 2008 (in Dutch).

³⁷ A. Fischer, *Institutional Incentives in Circular Economy; The case of material use in the Dutch textile industry* (MSc Thesis, Wageningen University, 2015).

hire, hotel rooms etc. In these cases these risks are priced in – the issue is solved by an extra risk premium. However one may expect a somewhat different behaviour on the part of the consumer towards an object that is rented once, for a short period, than towards an object that remains, long term, in the consumer's home as if it is owned. As there has not yet been relevant research into how consumers treat leased PSS products, the level of this risk is to a certain extent unclear.

Another risk is credit risk: lessors must be aware that some of their customers will be cash-constrained companies (B2B) or individuals (B2C), which introduces an entire category of specific risks. When customers fail to pay the contractual fee, this results in an interruption to the lessor's cash flow. If the customer is a company (B2B), a failure to pay may imply that the company is experiencing financial difficulties. It is important that the contract safeguards the payment of the service fee in the event that a customer becomes bankrupt. This is a legal issue that needs to be structured in a way to give priority to the payment of PSS creditors above other parties (like banks) seeking to get their money back. However, PSS models are able to monitor payments every month, which results in a short feedback period on the payment behaviour of its clients. A clause stating that (for example) three missed payments will result in the asset being taken back and a cancellation of the contract can protect the lessor from an unacceptable level of risk.

When the customer is an individual (B2C), the risk is lower (since it concerns only one asset rather than a collection of assets being leased by a company). However, it is more difficult to oversee the credit risk, due to privacy issues. For instance, credit ratings can be consulted for certain deals, like credit cards, or car lease, but it is (currently) unthinkable that credit ratings will be provided to decide whether a customer can lease a coffee machine. Hence the risk of customer default (both of taking care of the asset and meeting the payment requirements) needs to be factored into the risk analysis.

4.2.2.6. Market-related risk

Another category of risks is those relating to the market. Firstly it is unclear whether acceptance of paying for the service of using a product will grow sufficiently to generate a substantial demand. While there is an increasing shift towards access rather than ownership (such as leasing cars, mobile phones, and providing software as a service), consumer acceptance still needs to grow and the uncertain evolution of the customer base is a significant risk. Moreover PSS models provide services like maintenance and unburdening, which are not included in existing lease models. It is not clear whether consumers will appreciate the value of these services, which are specific to PSS models.

A final challenge is setting appropriate contract prices for the provided service. There is a risk that the net present value of the total fees consumers will pay for the service in the future will not exceed the price they would have paid for the product had they purchased it. Associated to this is the risk of the uncertainty in correctly setting contract prices, the ‘contracting risk’,³⁸ as there is uncertainty related to operating and maintenance costs. Modelling the costs is more challenging for longer-lived products, especially where ‘track records’ are non-existent. Moreover, if PSS models become more common, the technology and organisation of using end-of-life products will become more efficient. This may result in declining costs incurred by increased residual value.

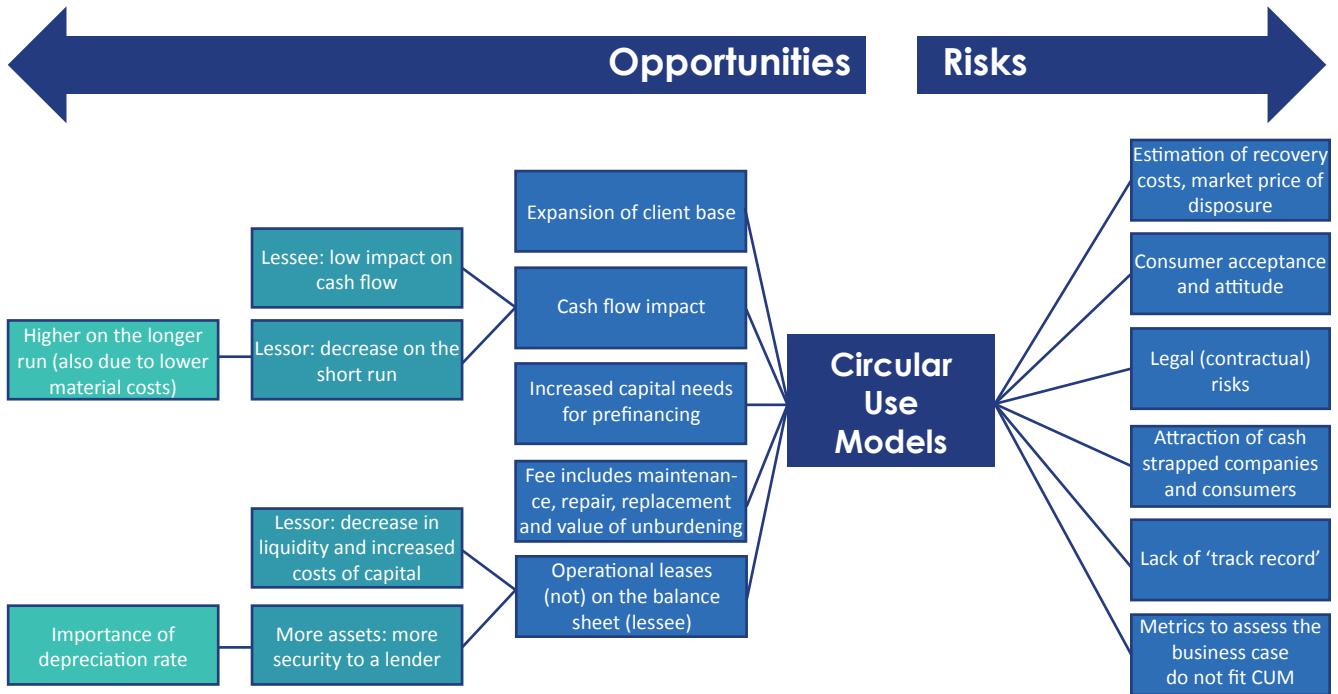


Figure 26: Summarizing overview of opportunities and risks related to Circular Use Models.

³⁸ B. Sonerud, Meeting the financing needs of circular business (2014).

4.2.3. Circular Output Models

Circular Output Models focus on the *after-use phase* of products. The characteristics of these business models can vary. A recycling facility can have a highly technological nature when extracting raw materials from waste. Therefore highly technological recycling facilities are similar to Circular Innovation Models in the sense that they are also exposed to technological and operational risk. Obviously, it is a prerequisite that the costs associated with extracting raw materials from used products are lower than the costs associated with the extraction of virgin materials. In contrast, a recaptured material supplier, repaired/refurbished product supplier, or a second-hand trading platform, creates something out of nothing by taking back used products and transforming them – with minimum effort – into usable (new) products. In general, the costs associated with implementing these business models are much lower than the costs associated with creating a product from virgin resources.

Besides the fact that these business models are different as they source their input materials from used products, no specific financing problems have been found for this business model category.

Example: Recover-e

ICT equipment is the fastest growing waste stream in the world; it is generally disposed of rather than being recovered or recycled. Recover-e is a company that takes back ICT equipment and delivers chain management throughout the ICT life cycle. The revenues are

- Environmental (lower impact),
- Economical (earnings from used hardware),
- Social (preserve reserves for next generations and job creation) and
- Informational (sharing knowledge and providing a track-and-trace software system LogIT).

Recover-e is a joint effort by Royal Haskoning DHV and SiSo and has been made possible through the European Regional Development Fund (ERDF).

4.3. Financing possibilities

The financial implications of PSS models include issues concerning the balance sheet, working capital requirements, and cash flows. The following paragraphs discuss possible solutions to these issues.

4.3.1. Factoring and reverse factoring

A potential solution to mitigate perceived risks is the securitisation of the future receivables from the subscriptions purchased by the clients. In principle, this would allow a lowering of the borrowing costs but would require that banks have the appropriate tools to model the expected revenues. The lack of a relevant track record could be substituted by analogies with comparable companies, but only if companies offering comparable services actually exist. This may create difficulties when the service in question is innovative, which is likely to be the case in most CE-related contexts. When appropriate metrics are lacking, such securitisations might increase the borrowing costs beyond acceptable levels.

A possible solution for a company attempting to transition to a PSS model would be to partner with a bank willing to share such risks by providing customised products such as factoring and reversed factoring adapted to the specificities of a service-based model. For instance, a bank could finance the company's customers and advance to the service provider the equivalent of several months' subscription in order to reduce the impact on cash flows and reduce the customer-related risk.

Figure 27 illustrates how a factor could help reduce the impact of a subscription-based service on cash flows. Reverse factoring could have the same impact upstream, with respect to the service provider's relationship with the suppliers. In this case, by providing support both upstream and downstream, a bank acting as a factor could significantly help in reducing the pressure on cash flows.

However, this supposes that commercial banks will be willing to absorb the risks involved. As discussed below, this could be a potential area where the public sector could intervene to enhance commercial banks' tolerance of risk.

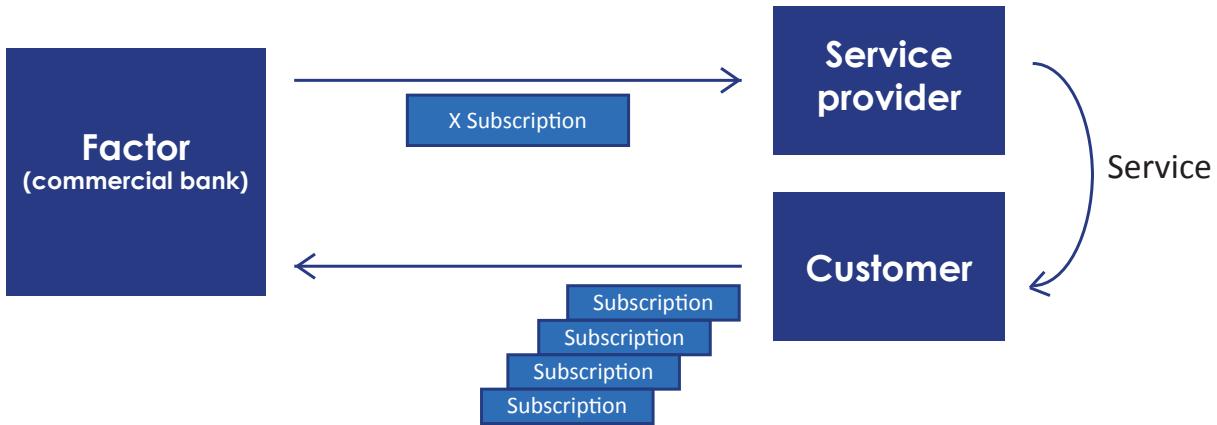


Figure 27: Illustration of the potential 'buffering' effect of factoring, downstream.

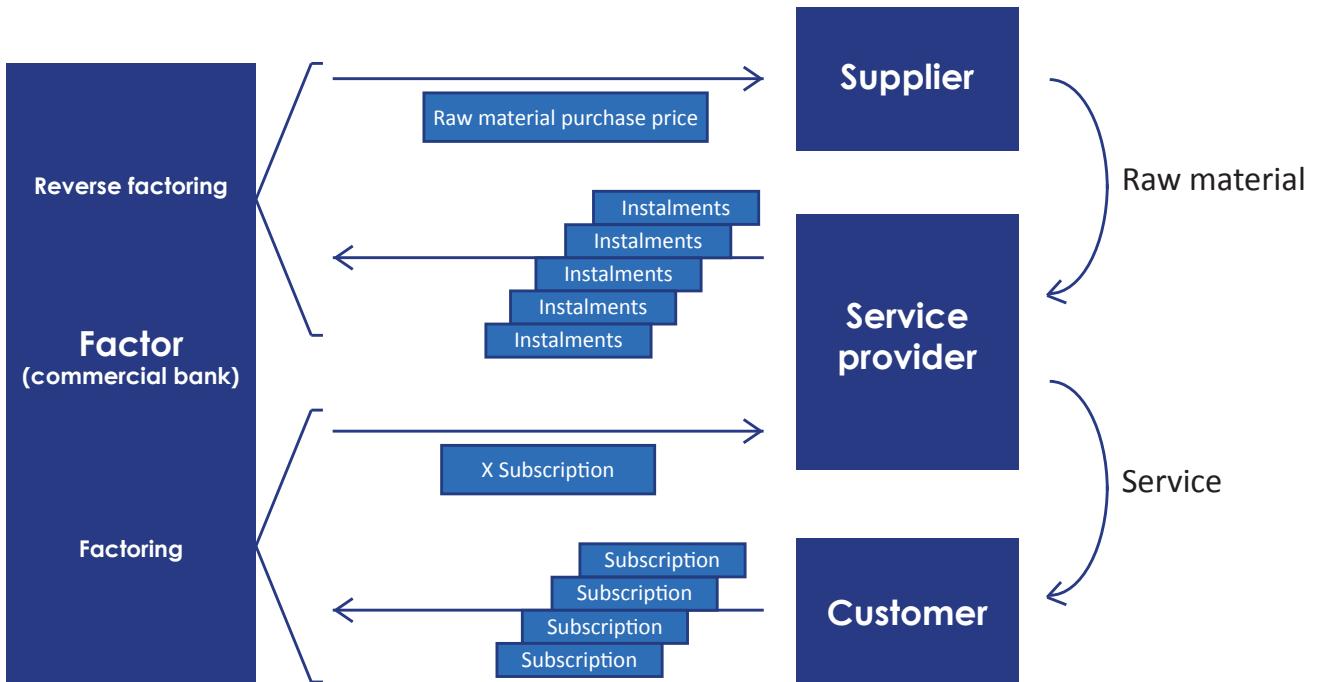


Figure 28: Illustration of the potential 'buffering' effect of factoring, both downstream and upstream.

4.3.2. Financial solutions for PSS models

As seen in the Bundles case, financial solutions for PSS models can help to relieve the asset and service provider to solve the cash flow issues around PSS models. Currently there is an existing market of leasing capital-intensive assets to businesses (B2B), but we observed an increase in the need of servicing (leasing) lower-capital assets to a customer market (B2C). An example of this is Bundles (3.1.1) where an SPV was proposed in order to create a legal entity that owns the assets (washing machines). However, the costs of constructing an SPV will only be covered when exceeding a minimum of €10–€25 million in assets.³⁹ It is unlikely that PSS models with underlying low-capital assets and active in a B2C market will be able to attain the scale needed for setting up an SPV.

This results in the need for financial solutions tailored to leasing low-capital assets and consumer markets. Such solutions should comprehend a longer-term horizon, as long-term, service-oriented customer relationships are developed. Additionally, such financial solutions should be more flexible to account for the varying need for finance, for example in the case of Bundles, funding need arises for each new customer. This could take the form of financing *per asset*, through a revolving loan or credit card construction.

DLL (formerly known as De Lage Landen) specialises in offering asset-based financial solutions. Their customers include companies (vendors) who want to lease their products to their customers in the B2B market. Many asset classes include capital-intensive machinery (e.g. cranes for a construction company), but also electronics (e.g. tablets for a conglomerate of schools). Another example of low-capital assets leased by DLL is the leasing of carpet tiles. As the tiles can be reused or recycled, a residual value can be included in the lease. In providing leases to customers, financial institutions will not only assess the creditworthiness of the customers, but also the value of the asset through its life cycle. In this way the first customers of the asset can benefit from the secondary use of the asset, for example through refinancing, remarketing, refurbishment, or reuse of materials.

DLL perceives ‘full service lease’ to be the most common PSS model in the current market.⁴⁰ This is a form of operating lease with services like maintenance, repair and replacement included in the periodic fee, either

³⁹ J. Verheijen, Rabobank, interview (2015).

⁴⁰ S. Van der Zee and E. De Jong, DLL interview (2015).

as one bundled amount, or unbundled. This lease construction consists of two contracts: one between the lease company and the end user, and one between the lease company and the manufacturer and/or service provider. In the so-called 'cooperation agreement' between the manufacturer and service provider the roles and responsibilities of all parties are stated, such as clauses concerning the return of assets and agreements on the return flow to the original manufacturer. These agreements can be used in circular business models to ensure that assets flow back in the supply chain (reverse logistics). However, if dealers can get a better price for assets on the second-hand market manufacturers can lose their grip on the assets.

In the current linear system, it can be difficult to incorporate a residual value in a leasing structure for low-capital assets, as there are not markets ready to get the true value out of the assets during its secondary (reuse) life. However, DLL is experiencing a slight increase in residual value for products that are increasingly circular.⁴⁶ This strengthens the statement that adaptation to circularity will lead to increased residual value. Moreover, this implies that the fee for these lease structures may decrease over time, since assets which are currently low value will no longer be written off to zero or scrap value. This can result in a more attractive proposition for consumers. Value increases are influenced by the capacity to retrieve and reuse modules from products (developing COM models) and linked to this, designing products in a way that allows for easy disassembly (developing CIM models).

In conclusion, lease structures for low-capital assets on the consumer market, needed for cases like Bundles, are not yet in use. The challenges that arise are the relatively low collateral value of the assets and the credit risk related to the client pool. The adaptation to a circular economy has a positive influence on the residual value, and therefore collateral value of the assets. Additionally, the aggregation of conglomerates of consumers could be a possible solution to overcome the credit risk tied to consumer markets.

4.3.3. Collaborative chain financing

In order to offer a truly circular product, all models (CIM, COM, CUM) have to be aligned in order for assets to flow in cycles, capturing the potential value of the circular economy. Adjusting different companies within the supply chain to the circular model requires alignment of incentives. This proposition works best when the supply chain collaborates so that all the companies in the chain are equipped to make the product move through the chain in multiple (theoretically infinite) cycles, providing added value for the consumer and for all chain partners.

For example, if companies are able to make products that are easy to disassemble and refurbish (which might require product and process innovation), their production costs may decrease and they may be able to offer products for lease at a lower cumulated cost to the customer than buying the relevant product. To make this work, collaboration between service provider, producer, product designer, and manufacturer is essential.

This means many of the opportunities to increase resource efficiency can only be realised by chain collaboration. A company's ability to innovate and change is often dependent on the capacity of its upstream and/or downstream partners to follow suit. The relationship between the various actors in the supply chain can be an important driving or limiting factor in the realisation of circular economy opportunities. There is thus a clear value proposition to be made, but the key question is how to define this proposition.

More importantly, companies that want to form a circular supply chain (or at least seek some form of advanced cooperation) will do so based on the long-term prospects of cooperation. The changes required might entail that the company undertake investments that will diminish its capacity to act opportunistically on the market (because its products are specialised for a particular kind of process downstream or because its processes can only accept a particular type of secondary raw material input from upstream). Such loss of flexibility needs to be compensated through long and secure business relationship(s) with the relevant partner(s) in the supply chain or mitigated by the existence of many other potential partner(s) in the same ecosystem (or material loop). This would increase the possibility that existing partners could be replaced. Ideally, the collaborative model would involve several upstream and downstream partners for each company, thus spreading the risk. As the numbers of supply chain actors increases, so does the challenge in aligning interests and incentives to realise circular economy opportunities. In that sense a balance has to be found between more resilience and the ease of aligning incentives amongst chain partners.

It is difficult to trigger this kind of change. A powerful actor in the supply chain can initiate circular innovations and can stimulate other actors to take steps towards the circular economy as well (e.g. European Investment Bank (EIB), exploratory interviews). In supply chains without a particularly powerful actor to act as a catalyst, there may not be sufficient incentives or opportunities for the various entities to cooperate simply because becoming too reliant on a supplier or a customer can have a significant impact on a particular company's power within the supply chain. Therefore chain collaboration requests trust and openness between supply chain partners. This model can only work when companies are willing to share information on the costs of their part in the functioning of the circular chain. If all the numbers are clear the value proposition can be made and all chain partners can receive a fair share for their input. Moreover, possessing all the information would decrease the risk

of setting the wrong price (as mentioned in the paragraph on market risks). To reach this level of collaboration will require a lot of work, since companies do not normally share these numbers.

Financing the adjustment to a circular supply chain will require extensive analysis not only of the borrower but also of the supply chain. Loan pricing is currently based on the creditworthiness of the borrower rather than on the solidity of the supply chain it belongs to. Once entered into a collaborative model, the borrower's creditworthiness will be strongly correlated with the solidity and reliability of the supply chain. Circular supply chains entail longer relationships between business partners, and the legal framework to support such relationships. One is to expect longer-term intake/off-take agreements needed to mitigate the downsides of specialisation, and various other legal arrangements destined to add more certainty to longer-term cooperation between the various partners.

As companies' incentives and economic realities change, these longer-term agreements add a significant number of variables that need to be factored in when assessing credit risks. It is important to consider that collaborative models between actors within or across supply chains will be instrumental in the move from a product to a service business model (cf. above). The main uncertainty will be whether the relationship with the supply chain partner(s) will last long enough to pay off, and whether it is legal under competition law. This will likely lead to an increased cost of capital unless appropriate purchase/supply commitments can be put in place to mitigate the supply chain risk.

Given that products flow in cycles through the supply chain, it may be desirable to finance this supply chain mechanism rather than a single company. This means the borrower would become a collective of companies, gathered around a specific product (or range of products). This would result in incentive alignment, since all chain partners are responsible for the risks taken and share the gains when the project is successful. Another aspect closely linked to this idea is to transfer ownership from a single company to the supply chain. This would again have certain effects on the balance sheet etc. (as described above). However, in this situation it would become the shared balance sheet of the supply chain. When financing the entire supply chain it would make sense that the collateral (assets and receivables) is owned by the same entity as the one granted the loan/investment.

4.3.4. Equity Finance

The starting point for this report is the firm belief that the transition to the circular economy is both inevitable and necessary. Indeed this transition has been under way for some time as evidenced by both the large number of global corporates and SMEs already adapting their existing business models and the scale of earlier-stage innovation across the circular economy.

The potential rewards of this transition are clear for businesses. The economic rewards include:

- The opportunity for enhanced resource productivity
- Improved asset utilisation
- Strengthened customer relationships and greater revenue visibility
- Margin stability and improvement in quality of earnings
- Enhanced return on capital invested

Intrinsically linked to these is a positive impact on both environmental and social capital. The potential economic rewards of the circular economy combined with the associated positive impact make this an attractive investment theme for both private and institutional capital and across the capital structure, from debt to equity.

Any such transition requires change and this inevitably involves both challenges and opportunities, not only to the underlying business models, but also to the financial sector supporting the businesses at the heart of that transition.

Traditional debt and asset lending solutions cannot support this transition on their own. The delivery of growth and the related risk requires both the availability of equity capital and appropriate strategic and operational support.

A variety of types and sources of equity capital exist to support businesses at each stage of the business life cycle (see table 6).

Notwithstanding the positive impact of circular economic business models, the approach to the appraisal and assessment of investment opportunities to support circular economic business models has to be no less rigorous and robust than that undertaken in relation to more traditional linear businesses. Indeed, the risks and

Stages in Business Life Cycle	Source of Equity Capital
Start-up	Friends & Family / Angel
Early stage	Angel / Venture Capital
Growth	Venture Capital / Private Equity
Buy-and-Build / M&A	Private Equity
Buyout	Private Equity
Later stage	Private Equity / Listed Equity Markets

Table 6: Sources of equity capital.

challenges identified throughout this report require very careful evaluation as part of the overall investment decision-making process. Central to this assessment are:

- Management strength and track record of the level of strategic and operational support required to complement this
- The underlying growth opportunity and the impact on this of external market factors
- The extent of the changes required to the existing business model (if any) and the associated implementation risk
- For businesses in the earlier stages of the life cycle, the development and commercialisation challenge, risk and roadmap
- The alignment of strategy and stakeholder objectives

Over and above the provision of risk capital, equity investors are uniquely positioned to support and positively influence the development of the underlying business strategy. In the case of ‘private’ capital this influence is possible, through active participation at investee company board level, and perhaps with certain specialist equity providers, additional support covering, for example, operational best practice and market development opportunities. However, this requires specialised knowledge, as in the case of private equity fund Circularity Capital.

This level of support and positive engagement in strategy will provide a positive influence on the success of the transition of the business model and/or product and process innovation; this is complemented by the long-term nature of equity capital.

In the listed equity arena there are two primary mechanisms that could support the financing of the circular economy. Firstly through investment policy, i.e. using the lens of the circular economy to identify and select businesses that will benefit from the adoption of the circular economy within their own business and/or enable the development of the circular economy in other businesses. Secondly through the active engagement of shareholders to exert influence on the strategy of businesses, encouraging the adoption of circular economy principles. Recent evidence of the power of shareholder lobbying (e.g. the influencing of major oil and gas companies investment strategies) suggests that this is effective.

The availability of the right combination of equity risk capital and positive strategic and operational influence will not only support the businesses at the core of the transition to the circular economy, but will also help de-risk the proposition for other funders.

4.4. Concluding reflections

In this corporate finance chapter the financial issues around the circular economy have been dissected. The ‘newness’ of circular business models does not necessarily imply that financial implications are specific to circularity. For instance in the case of Circular Innovation Models (CIM) financing of innovation carries a certain amount of risk, but this would have been the case for any innovation. Therefore this is not a financing issue that is specific for circular business models. Financial issues are particularly manifest in circular use models (CUM). These models aim to keep control over assets and retain added value. The change from selling assets to providing them as a service (PSS models) has consequences for a company’s balance sheet, working capital, and cash flows. Combined with the uncertainties concerning the residual value of the assets, uncertain consumer demand and the absence of legal structures, the risks of PSS models are currently high. This means that financial institutions are unable to price these risks adequately, which can result in high interest rates or a refusal to grant a loan at all.

However, the societal trends and resource issues at hand (linear risk) do provide an incentive to look at the possibilities of the circular economy. Although there are various associated barriers which need addressing, circular business models do show a long-term profitable business case. This business case will increase in profitability as circular supply chains develop. When supply chains can align incentives in order to keep products and materials within the chain, residual value will increase.

Financial institutions determined to stimulate the transition to a circular economy can start by redefining risk. It is not only the risks of the new circular model that need to be assessed, but also the risks posed by the existing linear model. Moreover it needs to be realised that circular risk is mainly due to the newness of the circular economy concept. Since circular business models are sustainable by design (i.e. excluding any linear risks), investing in circular businesses will lower the risk.

There is both a responsibility and an opportunity for financial institutions not to wait for this to happen, but to actively assess the companies in which they invest, evaluating their societal and environmental purpose and their resilience to meet the challenges that the future will bring. In that sense linear risk can be mitigated by coming to terms with 1) the unsustainability of the current situation, 2) the financial implications in the form of stranded assets, and 3) a proactive attitude in stimulating circular business activities.

It is essential that shareholders, customers, suppliers and third-party finance providers, including banks and asset lenders, understand the longer-term objectives and the benefits that will arise from investment in circular businesses. This will provide the businesses the support they require to make the transition to a more circular model and lock in those future benefits.

In helping circular supply chains to align incentives, financial institutions could invest time in creating the appropriate financial and legal structures to 1) invest in circular supply chains and 2) place ownership of assets/receivables within supply chains.

FIVE: Macroeconomic impact of the circular economy

5.1. Impact on society

When the economy becomes increasingly circular, these effects are visible not only within the business community, but also in wider society. For instance the changes in waste handling, reverse logistics platforms, and economic structure cause a broader effect than just a product or process innovation. The circular economy entails deep transformations of supply chains and consumption patterns so that the value of end products, components, materials, and resources is maintained throughout the supply chain and products' useful life. Consequently, the circular economy aims to decouple the creation of wealth and jobs from the consumption of resources (e.g. natural resources, primary raw materials, energy, and water), by maximising resource productivity, and minimising waste generation and resource extraction. The transition to a circular economy is expected to create an important disruption and transformation in the existing industrial supply chains and will require multiple, simultaneous changes in various parts of the production and consumption system.

Such a decoupling between economic growth and resource consumption is already taking place, albeit at too slow a rate. According to the Organisation for Economic Co-operation and Development (OECD), 'between 1980 and 2010 the material productivity of the global economy improved by almost 30%, rising from \$0.70 per kilogram [...] in 1980 to \$1 per kilogram by 2010 – meaning that the global economy generated 30% more economic value with a kilogram of material resources in 2010 than in 1980'.⁴¹ However, the usage of material resources continues to increase. According to the same OECD study, the average person consumes 29 kilograms of resources per day, but the consumption per capita in OECD countries is 60% higher than the global average.

Therefore, steering Europe towards a circular economy is expected to boost recycling and prevent the loss of valuable materials by designing for longevity (design for reuse and remanufacturing). This is likely to stimulate job

⁴¹ OECD, *OECD Green Growth Studies: Material Resources, Productivity and the Environment* (12 February 2015, <http://www.oecd.org/env/material-resources-productivity-and-the-environment-9789264190504-en.htm>).

creation and innovation and reduce greenhouse emissions and environmental impacts by using raw materials, energy and water more efficiently. The circular economy does not entail only a reduction of the negative environmental impact of economic activity and resource consumption. In addition, it involves an increased emphasis on restoring natural capital and increasing it in a manner that is consistent with economic principles.

However, while the environmental benefits deriving from a transition to a circular economy seem intuitive, this is not the case for the economic and social gains. As mentioned in the introduction to this report, various studies have indicated that circular economy transitions could lead to significant savings and job creation. However, creating new jobs in the circular economy also entails destroying jobs in linear businesses and the net effect of the circular economy in creating jobs still needs to be quantified. Some economies will be the winners and others will be the losers of this trend and the individual impact that this may have on individual EU member states and regions needs to be taken into account. This topic goes beyond the scope of this study and merits more study by policymakers and economists in the coming years.

As an example, a recent study conducted by Rabobank's Economic Research Department examines the possibility of measuring the benefits that could be created by the transition to a circular economy in the Netherlands.⁴² One of the base scenarios described in the study leads to the conclusion that the GDP and job growth resulting from the circular economy transition would more than offset the GDP and the jobs lost as a result of abandoning linear models. However, this entails an important detail: 'note however that the number of jobs elsewhere in the world would most likely decline.' This would probably also hold true in the EU: in a generalised transition to circular economy, at least in the short term, some EU regions would win while others would lose.

There are several important reasons to study the macroeconomic impact of the circular economy: (1) to analyse the claims of positive effects of the transition to a circular economy; (2) to establish possible linear risks; (3) to look for effective and efficient transition paths; (4) to forecast whether we should expect shifts in the economy; and (5) to guide investment decisions of governments, (institutional) investors, and companies.

⁴² Hans Stegeman, *The potential of the circular economy* (Economic Department, Rabobank, 2015, <https://economics.rabobank.com/publications/2015/july/the-potential-of-the-circular-economy>).

5.2. Macroeconomic indicators

A macroeconomy consists of the different economic perspectives of a society. We've chosen to examine three important macroeconomic indicators: (1) the GDP, being the monetary outcome of the economy; (2) the labour market; and (3) resource dependency. This does not mean that other domains are not faced with changes due to an economy that is increasingly based on circular principles. The other macroeconomic changes will be analysed in future reports, along with economic modelling of the various impacts.

Table 7 shows the different indicators which may be affected by an economy moving from linearity towards circularity.

1. **Efficiency of the economy**
 - a. Productivity
 - b. Products as material banks
2. **Economic stability**
 - a. Price volatility
 - b. Resource dependency (geopolitical dependency/trade deficit)
 - c. Impact on equity, inflation and discount rate
 - d. The (societal) cost of inaction
3. **Economical order**
 - a. Effect of a growing, sharing economy
 - b. Purchase power impact ('credit card' society)
 - c. Impact on the labour market impact
 - d. Healthy working conditions
4. **Regulation**
 - a. Regulation on resource usage and 'waste' handling
 - b. Tax and other financial legislation implications
 - c. Supervision

Table 7: Indicators effected by circularity.

5.2.1. Impact on GDP

If the efficiency of the economy increases because materials are not thrown away but enter new production processes, a positive effect on GDP is to be expected. The estimation is rather difficult: the conditions and changes in the economic order, labour markets, and the cost of new elements in the supply chains are all hard to forecast.

Several studies have tried to analyse the effects. The Ellen MacArthur/McKinsey reports showed increasing economic advantages in terms of GDP.⁴³ The *Growth Within* report estimated a gain of 7% of GDP, but this also included the effect of a collaborative/sharing economy.⁴⁴ Other studies showed an impact ranging from 0.3% (in a scenario with a slow transition pace) to little over 2%. The studies showed no real negatives, despite the intuitive negative impact of two of the four value creation areas: liquid markets/multiple users and longer life cycles. These result in a lower number of required products. A closer look at the volume of sales is therefore necessary. Additionally, the assumptions of the changes in spending patterns of consumers should be studied.

On the other hand, Stegeman, for example, argued that merely looking at GDP does not give the whole story.⁴⁵ In the case of repair (instead of buying a new product) the monetary value is lower and this has (in this isolated case) a negative effect on GDP, although the societal impact is positive. In his study he distinguished between the societal value and the GDP, both calculated in the same way, but the negative economic (GDP) effect of repair and reuse is calculated as positive in the societal value. In his linear bow (slow) scenario the societal value increased 1.0% compared to the 0.3% GDP increase. In the circular flow (fast) scenario the respective increases are 5% and 1.4%.

The Stegeman study is the only study where scenarios show that acceleration has a positive effect when compared to a more autonomous scenario of the linear bow model. Between 2016 and 2030 the cumulated difference between the linear bow model and the circular flow scenario are estimated at €60 billion for the Netherlands (and growing rapidly).⁴⁶ It is important to compare these figures to the estimated transition costs.

⁴³ Ellen MacArthur Foundation, *Towards the Circular Economy*, vols 1–3 (2012–2014).

⁴⁴ Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: A Circular Economy Vision for a Competitive Europe* (2015).

^{45, 46} H. Stegeman, *The potential of the circular economy* (Economic Research Department, Rabobank, 2015, <https://economics.rabobank.com/publications/2015/july/the-potential-of-the-circular-economy>).

Report	Area	Impact on GDP [2030]	Impact on jobs [2030]
TNO (2013)	Netherlands	- 1,4%	+ 0,7%
Wijkman & Skanberg (2015): CE	Sweden	> + 2%	+ 1 - 2%
Ibid: CE and energy efficiency	Sweden	> + 3%	+ 2 - 4%
Stegeman (2015) Scenarios	Netherlands		
	Linear bow:	- 0,3%	+ 0,2%
	Circular go:	- 0,4%	+ 0,3%
	Curcular flow:	+ 1,4%	+ 1,2%
EMF/McKinsey (2015)	Europe	+7%	+ +

Table 8: The impact of circularity on GDP and jobs.

5.2.2. Impact on Labor Market

The transition to a circular economy is expected to create jobs in circular businesses, but destroy jobs in linear businesses. New sectors will appear, for example reverse logistics, refurbishment, remanufacturing, and recycling, and it could be anticipated that these new jobs in particular would be accessible to less-educated workers. On the other hand jobs in sales and retail (given the fact that fewer products would be sold) and in waste handling companies are expected to diminish. However, the net effect seems positive, mainly because of an increase of labour intensity at the expense of material intensity. This shift is reflected in the different studies mentioned in Table 8. These positive effects on the labour market have a second-order effect as well, because as employment rises, the cost of supporting the unemployed (benefits and allowances) should decrease.

5.2.3. Impact on resource dependency

The last of the three macroeconomic indicators is resource dependency. As a large proportion of raw materials, in particular rare materials, are imported, most Western countries are dependent on the global geopolitical situation (see Figure 29). This is a risk that needs to be considered. In addition to reducing a country's dependency on other countries/regions, using materials that are already in the country – but in existing products – means that local value is being used and not imported. Therefore the trade deficit will be lower.

Production concentration of critical raw mineral materials



Figure 29: Production concentration of critical raw materials.

5.3. Transition paths and scenarios

From the perspective of the private sector, a transition to the circular economy is a matter of cost-benefit analysis. If the total investment cost of a circular economy transition is higher than the overall price of the raw material saved over a certain defined time interval, businesses have no (financial) incentive to undertake the necessary investment other than to increase their certainty of supply of raw materials and to guard against future price volatility.

Cost CE TRANSITION > **Price** SAVED RAW MATERIAL

However a circular economy transition would make business sense if the relevant commodity price increased to such an extent that the relationship depicted above is reversed, i.e.

Cost CE TRANSITION < **Price** SAVED RAW MATERIAL

Alternatively, even if there were no changes in commodity prices, the raw material savings can be increased through innovation up to the point that the cost of the circular economy transition becomes lower than the price of the total saved raw material. Therefore, not only anticipated increases in commodity prices can lead to a circular economy transition, but also advances in innovation, thus underlining the very strong relationship between the circular economy and innovation.

However, innovation is in many cases driven by demand. As commodity prices increase, so will the demand for innovations that increase resource efficiency. Therefore, without disregarding innovation's role, commodity prices still play a key role in driving circular economy transitions. Relying exclusively on market forces to prompt a generalised circular economy revolution entails waiting for such increases, which would expose the European economy to unwanted potential shocks. Public support is therefore necessary to encourage a long-term view of commodity price evolutions in order to pre-empt potential supply crises and to reduce the EU's dependence on external resources.

How should such public support manifest itself? As underlined in the *Scoping study to identify potential circular economy actions, priority sectors, material flows and supply chains*, the transition to the circular economy ‘requires a mix of complementary instruments and approaches’ such as ‘regulatory measures, economic incentives, targeted and increased funding, efforts to engage and link actors along the supply chain and initiatives to raise awareness of the benefits of the circular economy and available solutions’.⁴⁷ The exact impact of each of these measures applied separately will likely be difficult to quantify and the cumulative impact will be greater than the sum of the separate impacts of these various measures. Therefore, it is difficult to assess how financial instruments could drive a transition to the circular economy on their own.

Following Stegeman’s study, it would be valuable to undertake a scenario analysis of different transition paths, looking both at corporate finance and macroeconomic impact.⁴⁸ The investments needed for a transition to a circular economy are enormous and the benefits (and the prevention of risks) are in the future. Therefore we need further research and analysis to support the concept that investing in a circular transition will be beneficial from a financial perspective, benefiting the resilience of our businesses and society as a whole.

⁴⁷ IVM Institute for Environmental Studies, Policy Studies Institute, EcoLogic, Bio Intelligence Service, and Institute for European Environmental Policy for the European Commission, *Scoping study to identify potential circular economy actions, priority sectors, material flows and supply chains* (2014, http://www.ieep.eu/assets/1410/Circular_economy_scoping_study_-_Final_report.pdf).

⁴⁸ Hans Stegeman, *The potential of the circular economy* (2015).



PART I

The fast-changing global context is our starting point. In a world increasingly dominated by new technologies and shifts in demographics and the global economy, new challenges arise. One is how to cope with the legacy of a linear economy, in which products are consumed and largely get turned into waste, diminishing the stock of non-renewable natural resources. A more circular economy that creates economic value is also an answer to the resource challenge, both because it is a more effective system than the linear economy and mitigates its risks whilst creating positive capital-building opportunities.

In the first part of the report we describe the context, provide a systematic framework in which money is one of the enablers of the transition to a circular economy, and lay out our ambition as a financial sector in contributing to this transition.

PART II

In the second part of the report we focus on three important components of the financial perspective of the transition to a more circular economy:

- First are the changes we see in business models that accompany circular ways of working. The report analyses various case studies of circular economy businesses to determine the concrete financial impacts of going circular.
- Second is a deep dive into the financial considerations of circular economy businesses, covering risks and opportunities and the detailed consequences for revenue and cost structures, cash flows, balance sheets and financing requirements.
- Third are the macroeconomic consequences of circular economy business models being more widely adopted. This extends the assessment of the circular economy approach beyond the commercial considerations of individual businesses. Macroeconomic analysis is an important consideration for potential investors deciding where to invest.

PART III

In the second part of the report we focus on three important components of the financial perspective of Finally, we look beyond this report. This first step, to understand the financial implications of circular economy business models, is only the first the working group will take. The next phase, to assess the impact and consequences for financial institutions themselves, is crucial: actions speak louder than words.

PART III

next steps

6. Conclusion

A circular economy can mitigate the effects of our current linear way of living. We have seen that the linear way is not sustainable. It leads to the depletion of natural resources and a destruction of value in our economic system.

In a circular economy business activities are created differently, using resources and materials more effectively and employing new design and a new view on cooperation in supply chains.

The transition to a circular economy requires a system change in which all actors – companies, consumers, regulators, academia, and financial institutions – must play a role. Only collaborative action will enable and accelerate the necessary transition.

A circular economy will require new business models, business models that enhance resource control, enhance collaboration, and enable new structures such as providing access to products as a service instead of providing the products.

In this report three generic business models are identified: Circular Innovation Models, Circular Use Models and Circular Output Models. Each model relates to a specific stage in the life of a product. The specifics of these business models make them enablers of a transition to a circular business. However, using one of these models is not necessarily enough to ensure a circular business. A collaboration between the different actors in a value chain is essential as the full benefits of the business models can only be achieved through collaboration.

In this report a number of case studies are presented, showing the different elements of each company and the associated opportunities and risk in going, or being, circular. We have also shown some financials for selected cases.

It is possible to draw a number of conclusions from these case studies:

- The traditional way of financing a company can be a barrier for businesses adopting a circular model. In particular, the perceived residual value of a product needs further attention; we do not know yet how residual value contributes to the business model, but it plays an important role in the attractiveness of going circular.
- The current mindset of consumers is a challenge to some circular business models. Consumers need to become used to not throwing away products, instead keeping them in the loop; and move towards using products rather than owning products (decoupling use from ownership).
- Regulation and the way in which public finance is spent can be a barrier for businesses seeking investment for the transition to circular and a challenge for governments wishing to effectively stimulate the transition to a circular economy.
- Collaboration across the value chain is a large enabler of achieving a successful transition to circularity.
- Product design is an enabler.

There is currently a vast array of financial offerings that can help to provide companies with financial flexibility in their strategic, operational, and financial decisions. A change to a circular business model may however include a need for new offerings, or a different view on the elements of existing offerings. The evaluation of the 'risk' of a company will need to change if the transition is to be successful because a circular business model has a different risk perspective to that of a linear business model. This is partly due to innovations, such as replacing product sales with PSS models. This has implications for both the cash flow profile and balance sheet of a company. On the other hand, financial institutions may need to take a different approach in assessing the risks of a traditional linear company. These risks may be higher than currently perceived, for instance because externalities may need to become included in pricing in the future.

Another new approach will be the analysis of supply chains instead of individual companies. As companies move towards a circular business, collaboration within chains becomes more important. This can also have implications for a financial view, where one can envisage financing chains instead of companies. The total risk of a supply chain can be significantly lower than the risk of one company within that chain. This may also drive a need for specific 'vehicles' to be used in the actual financing of a chain. The legal framework used in financing companies will need to be adapted to enable and support these changes.

The transition to a circular economy will also have effects at a macroeconomic level. This report examined the circular economy's impact on three important indicators: GDP, the labour market, and resource dependency.

There are positive and negative effects on GDP but all studies showed a positive net effect, despite some of the circular usage models resulting in lower purchases of products, leading to a positive impact on purchase power. How households might alter their spending in a circular economy will also have a big impact on GDP. As the economy is expected to become more labour-intensive (instead of resource intensive) as it becomes more circular, it is expected that more jobs will be created than are lost. The effects of less resource dependency is also positive, resulting in less dependence, less exposure to price volatility and increased capture of local value instead of buying virgin resources from other regions and countries .

6.1. Next steps

This working group has set three goals: to understand the changes in the transition to a circular economy; to determine how financial institutions can support and accelerate this transition; and to communicate its research and findings.

This report gives an overview of the group's findings and conclusions on the first of these goals. In 2016 the group will take these findings, and compare and contrast them to the current models of finance. The group will investigate these models and establish to what extent they are enablers of the transition to a circular economy. The group will also suggest changes that will enable the financial sector to truly support and accelerate the circular economy.

In addition the group will continue to follow and investigate the changes taking place within companies and supply chains as they move towards more circular models. These developments are ongoing, and future insights will be taken into account in the group's next steps and reports.

Furthermore, the group will take a closer look at the transaction costs and benefits from accelerating the transition (compared to a passive strategy). A macroeconomic scenario study is a suitable next step.

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Appendix: Lease structures

When looking purely to the financial aspects of finance lease it would, in most accounting systems, trigger a recording on the balance sheet of future lease receipts and of any sale value of the asset at the end of the lease term as a receivable (as if the product were sold).⁴⁹ According to the IFRS, a finance lease transfers to the lessee 'substantially all the risks and rewards of incidental ownership'.⁵⁰ So there may be some incentives for lessors to structure their offering to the customers in ways that would allow them to categorise the leasing of their products as finance leases. Moreover, lessors will likely be inclined to offer such finance leases over longer time periods, as these would increase their recorded profits.⁵¹ If a lease term covers the most of the leased asset's useful life, chances are that it will qualify as a finance lease.⁵²

Operating lease means the lessor leases an asset to the lessee for a periodical amount, and also assumes the residual value risk of the asset. At the end of the operating lease ownership of the asset does not pass to the lessee, but remains with the lessor. This form of lease is currently often used for car lease. The lessee does not own the car, but pays for using the car during an agreed period of time. The duration of operational lease contracts is relatively short compared to the useful life of a product.

The consumer's perspective I (B2B)

In B2B contexts, companies may prefer to lease assets rather than purchase them, because operating leases do not have to be included on their balance sheets. Moreover, some companies may prefer to lease some assets because leasing puts less pressure on their cash flows.⁵³ The table below shows the different impacts that operating leases and finance leases would have on various financial ratios, but the impact of finance leases can also be extrapolated to capital expenditure. Therefore, the changes to financial ratios mentioned in the second column also reflect the impact of purchasing an asset. Note however, that it is assumed that the asset is purchased with debt, and therefore interest is imputed.

^{49, 53} Ricardo-AEA for the European Commission, DG Environment, *The Impact of Accounting Rules and Practices on Resource Efficiency in the EU*, December 2014, http://ec.europa.eu/environment/enveco/resource_efficiency/pdf/accounting%20rules.pdf).

^{50, 51, 52} International Accounting Standards 17 (IAS 17): Leases.

The effects of operating leases and capitalised finance leases from the consumer's perspective (B2B).⁵⁴

Ratio	Effect of Operating Lease	Effect of Finance Lease (i.e. purchasing asset with debt)
Return on Capital (ROC)	<ul style="list-style-type: none"> - Decreases EBIT through lease expense - Capital does not reflect leases - ROC is higher (assumed EBIT effect outweighs capital effect) 	<ul style="list-style-type: none"> - Decreases EBIT through depreciation - Capital increases through present value of operating lease - ROC is lower (assumed EBIT effect outweighs capital effect)
Return on Equity (ROE)	<ul style="list-style-type: none"> - Net income lowered by after-tax lease expense - BV of Equity Unaffected - ROE effect depends on whether lease expense > (imputed interest + depreciation) 	<ul style="list-style-type: none"> - Net income lowered by after-tax interest expense and depreciation - BV of Equity unaffected - ROE effect depends on whether lease expense > (imputed interest + depreciation)
Interest Coverage	<ul style="list-style-type: none"> - EBIAT decreases - Interest Exp. unaffected - Coverage ratio generally higher 	<ul style="list-style-type: none"> - EBIAT decreases - Interest Exp. unaffected - Coverage Ratio generally lower
Debt Ratio	<ul style="list-style-type: none"> - Debt is unaffected - Debt Ratio is lower 	<ul style="list-style-type: none"> - Debt increases (to account for capitalized leases) - Debt Ratio is higher

Table 8: Clarification of acronyms: EBIT – Earnings Before Interest and Tax; EBIAT – Earnings Before Interest After Tax; BV – Book Value;

⁵⁴ Aswath Damodaran, *Dealing with Operating Leases in Valuation*, undated, <http://people.stern.nyu.edu/adamodar/pdfiles/papers/oplev.pdf>).

As can be seen from the table, apart from improving the cash flow, an operating lease may make more sense than purchasing an asset when there is an interest to keep the debt ratio lower and/or the ROC higher. On many occasions though, the most important consideration will be given to the lease expense and how it compares with depreciation plus the imputed interest compared to buying that same asset.

The transition to a circular economy is often described as a systemic change, much more than process innovation in real economy businesses. One of the decisive elements in a successful transition to a circular economy will be a committed financial sector, prepared to adapt to fit the changing requirements of (more) circular entrepreneurs.

In December 2014, the working group ‘finanCE’ was founded by Dutch pension service provider PGGM and joined by twelve other financial organisations – banks, investors and knowledge institutes. The first objective of the working group was to understand the way money and finance will change in a circular economy. In this first report we present our findings, concentrated around three core themes: the impact on business models, corporate finance, and macroeconomic implications. In the next phase the working group will analyse how they, through their businesses, can contribute to the transition to a circular economy.

