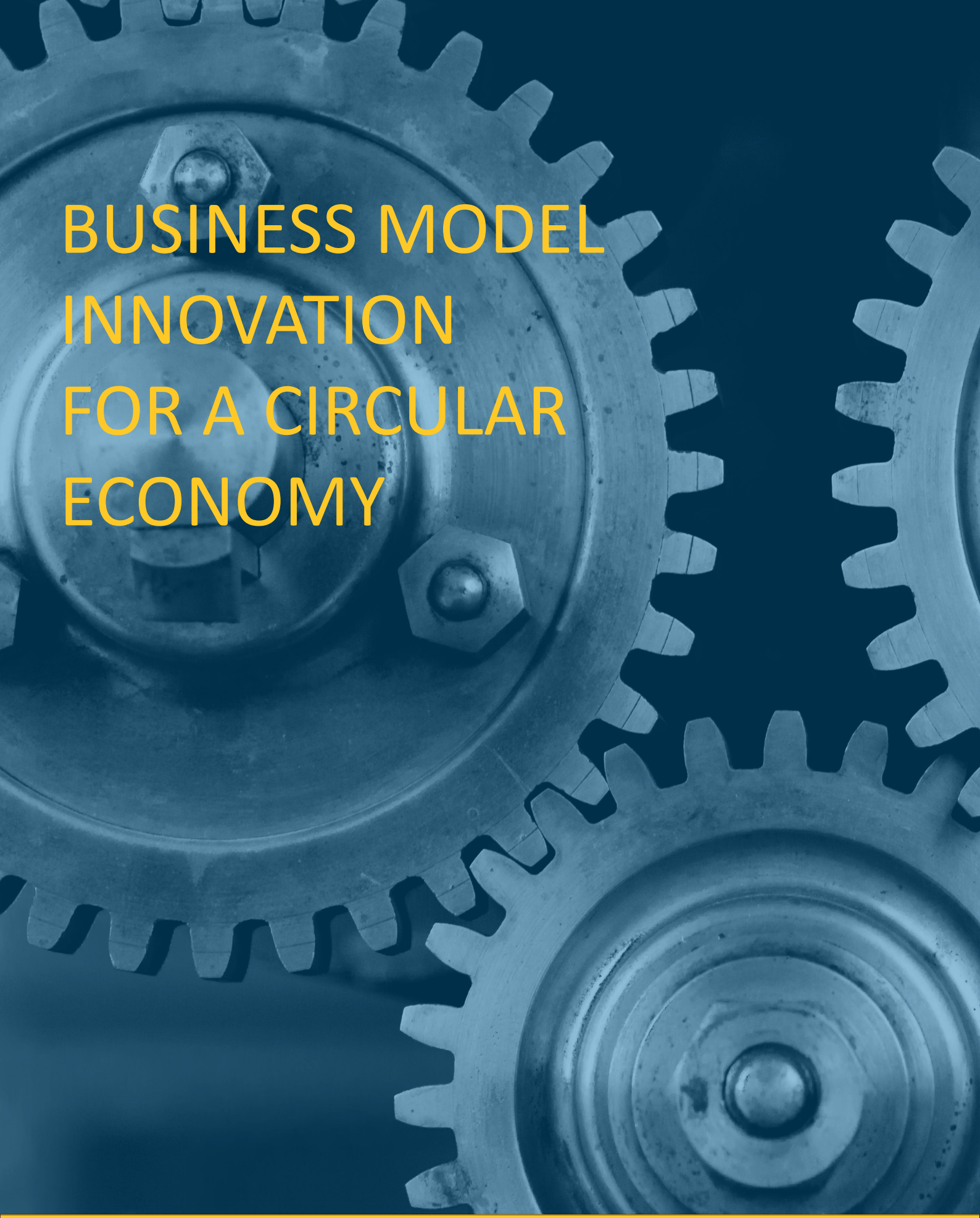

BUSINESS MODEL INNOVATION FOR A CIRCULAR ECONOMY

Drivers And Barriers For The Swedish Industry:
The Voice Of REES Companies

REES
Mistra
Resource-Efficient and Effective Solutions
based on circular economy thinking

Business model innovation for a Circular Economy.
Drivers and barriers for the Swedish industry – the voice of REES companies

A report from the International Institute for Industrial Environmental Economics, Lund University.

Authors:
Oksana Mont
Andrius Plepys
Katherine Whalen
Julia Nussholz

Design by:
Katherine Whalen

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This report is targeted at Swedish companies and organisations who are interested in or are in the process of innovating business models for a circular economy. It may also be relevant for local and national policy makers who are interested in supporting the transition towards Circular Economy.

Why read this report?

The idea of Circular Economy is gaining a momentum among companies, households and policy makers. In order to support a smooth transition to this idea, new ways of producing and using products and services are needed, which in turn require innovative business models.

Such business models may help companies capitalise on closed resource loops and maintain or improve their competitive position in the world haunted by growing resource scarcity, deteriorating environmental sinks and increasing competition for natural resources.

However, devising business models that operationalise and create a business case for different resource efficiency strategies that close resource loops is not straightforward. Companies in different manufacturing sectors have different drivers, but experience diverse barriers to innovating business models.

This report aims to help supporting the idea of business model innovation for a circular economy among companies in Swedish manufacturing industries and beyond by offering an introduction into the basic concepts and principles of what is called circular business models.

In addition, the report highlights the main drivers and barriers that companies experience when employing circular business models and provides some illustrative ideas and examples for how barriers can be overcome or reduced, while drivers can be enhanced.

Why do we need a Circular Economy?

Although products are becoming more resource efficient, growing consumption levels and the linear nature of the economic system have led to increasing throughput of resources and associated environmental degradation. Indeed, globally only about 20 metals are being recycled with a recycling rate of 25% or more (UNEP 2011).

In the current linear system, goods are produced and replaced at a fast pace, filling up landfills and fuelling extraction of virgin resources, leading to environmental emissions and resource scarcity.

The environmental and social costs associated with the production of products are largely not internalized, which further encourages the flourishing of the 'take-make-consume and dispose' economy. In addition, up to 60% of the total waste generated in Europe is not reused, recycled or composted (Eurostat 2011).

Moreover, many products are used inefficiently by consumers and are discarded with underutilised functional potential. This is because of the historical orientation of the business on increasing the productivity of manufacturing and decreasing production costs rather than on improving consumption efficiency and resource recovery from post-consumer waste.

We have created a linear economic model based on the premise that resources are limitless, easily sourced and accessible, cheap to extract and dispose of.

Since the reliance of the current economic system on unrestrained growth of resource-intensive economic activity is unsustainable on a finite planet and threatens the long-term competitiveness of companies, regions and countries, ideas for various alternative ways to organize production and consumption are emerging. One such alternative is the concept of circular economy, which mimics the circular flows of resources in nature.

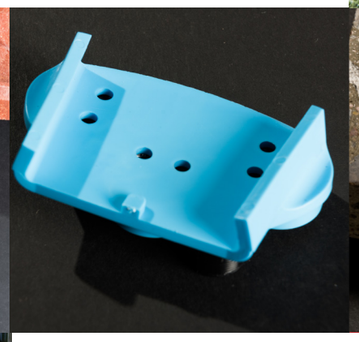
The idea of circular resource flows has been applied at the level of the entire economy, in large industrial constellations where companies exchange resources and by-products and at the level of business models that operationalise and capitalise on circular resource flows. On the consumer side, alternative forms of access to and ownership of products and services can increase the efficiency of use of already manufactured products and thus reduce the demand for new production.

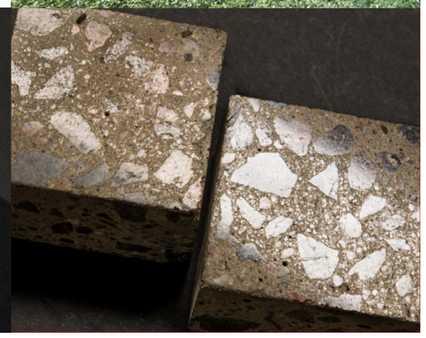
What is a Circular Economy?

The key aim of the Circular Economy, as suggested by Kenneth E. Boulding (1966) and further developed by Walter Stahel and Genevieve Reday (1976/1981), is the reduction of aggregate throughput of resources by closing material loops and designing material goods for durability, reuse, upgrade and repair.

Some authors set specific goals and distinguish specific features, seeing a circular economy as a regenerative system, in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops (Geissdoerfer 2016).

This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.





Circular Economy is defined in general terms as "an industrial economy that is restorative or regenerative by intention and design". - *Ellen MacArthur Foundation, 2013*

The principles behind Circular Economy

In the Circular Economy, four types of closed loops for technical nutrients can be distinguished (EMF 2013: 24). Below, these four types of circular loops are listed in the decreasing order in terms of their prevailing economic and environmental value.

Product maintenance - products undergo several or many cycles of maintenance, thereby their life cycle is optimised or extended.

Product reuse or redistribution - products are reused for the same purpose. As with the first cycle, their primary physical qualities and functions remain unchanged.

Product repair, refurbishment or remanufacture – since products with time may lose some of their performance levels due to wear and tear and thus become downgraded, their main components need to be repaired or refurbished and their appearance might need updating.

Products may also enter a remanufacturing system, in which they are taken back and dismantled and their parts and modules used as input in other products and/or for different uses.

Product recycling – when neither products nor their parts can generate value in the economic system, they enter the recycling system, where the value of materials is recovered either for original purpose or for other purposes, fully or to a lesser extent, thereby downcycling takes place with materials being used for lower functionalities. Alternatively, products' functionalities and quality may also be enhanced through upcycling – a process thereby the value of product is increased.

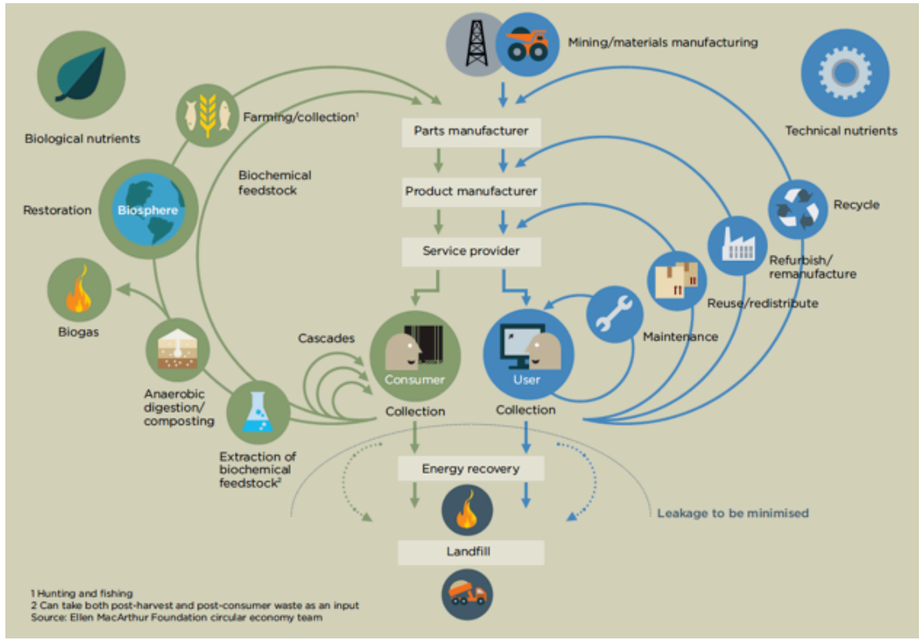


Image from Towards a Circular Economy (Vol. 1), Ellen MacArthur Foundation
www.ellenmacarthurfoundation.org

€630 billion in annual savings estimated

The business case and potential for Circular Economy

In a circular system, the input of raw materials is drastically reduced due to increased reuse and recycling of materials, by-products and products in similar or other application areas.

Provided that closed loop production and consumption systems replace primary production from virgin raw materials, closing material loops may potentially reduce the pressure on virgin natural resources by extending the use time of products, their parts and materials; decreasing the amount of energy use and pollution from the production of new products, and cutting production and post-consumer volumes of waste.

The time is ripe for the circular economy to advance faster with the help of innovative business models and the disruptive technologies.

Of course, this is all under condition that circling material flows does not come at the expence of excessive use of energy and material resources.

Some studies suggest that up to 70% of materials can be saved in a long run compared to resource extraction in the linear economy (EMF 2014).

EMF and McKinsey (2015) estimate that circular economy could potentially increase Europe's resource productivity by up to 3% per year, generating a primary net resource benefit of €0.6 trillion and €1.2 trillion in non-resource and externality benefits annually by 2030. In terms of emissions, it may lead to a reduction of 48% CO2 emissions in 2030, and up to 83% in 2050 (EMF and McKinsey 2015).

Many companies already recognise the strong business case for improving resource productivity. Indeed, overall savings potential from a better use of resources for European industry could be as high as €630 billion per year (Europe INNOVA 2012).

European Commission believes that circular business models would help dealing with the rising insecurity of supply, cut waste and improve competitiveness and resilience of the economy. Overall, circling resources could help decoupling economic growth from resource use and associated impacts and enable more sustainable growth (European Commission 2014).

What are circular business models?

Circular business models are a collective term for a great variety of business models that capitalise on residual value of products and materials by closing material and product loops (EMF 2013). Circular business models are seen as better equipped than traditional business model to address the challenges of economic and physical resource constraints.

Their aim is to offer products and services, which can provide the same function as conventional offerings, but in a more resource-efficient manner, so that the overall speed of resource throughput in the economy (Lewandowski 2016) and the extraction of virgin resources is reduced (Lieder and Rashid 2016).

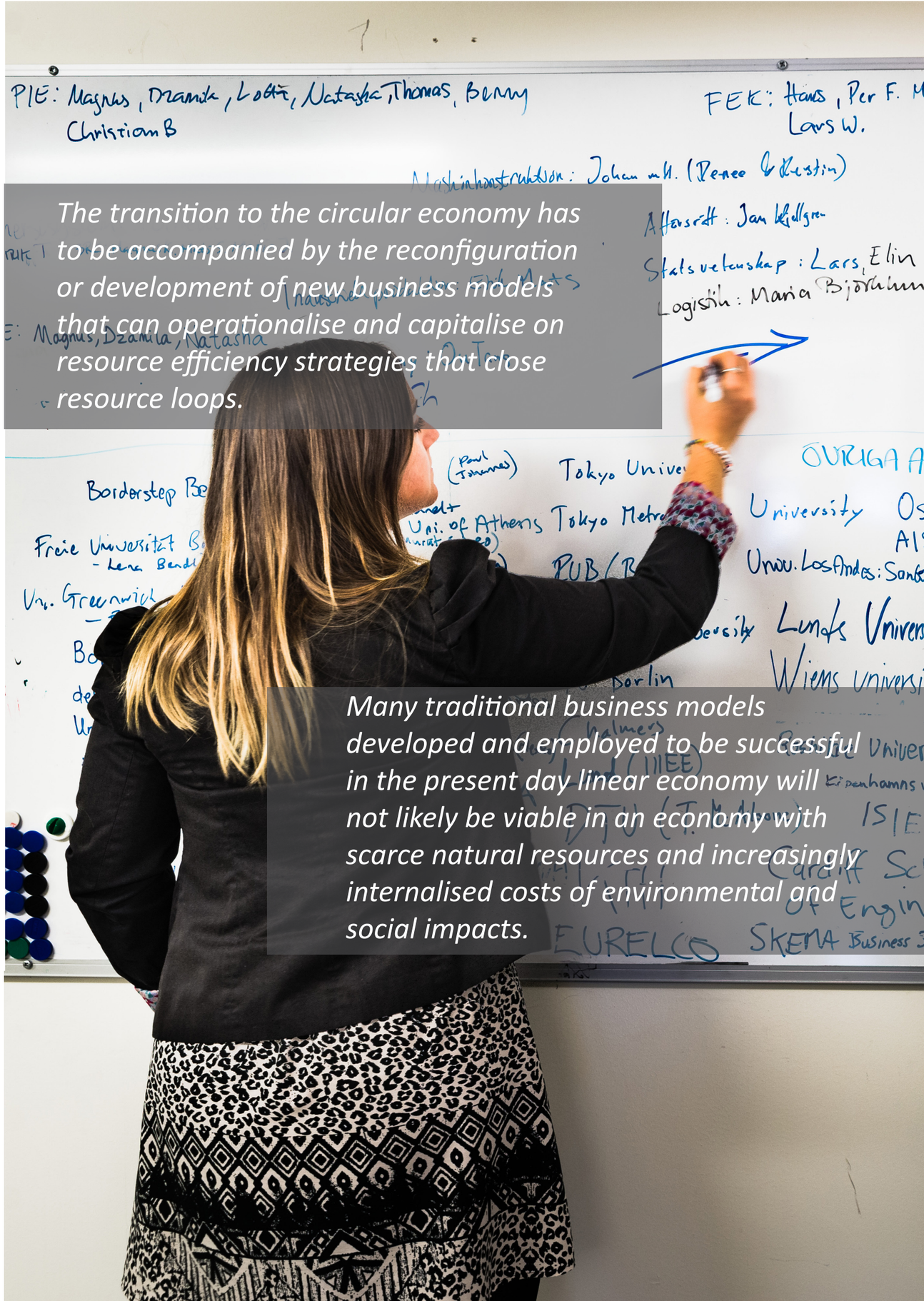
As value is normally 'destroyed' when products are disposed of, circular business models employ product life extension and material cycling strategies to maintain and capitalize on this embedded value.

To enable and facilitate the circulation of products in more than one life cycle, products may be designed to be durable, easy to disassemble and repair, reuse and remanufacture (Allwood, Ashby et al. 2011).

Alternative new models of product ownership and/or access to product's function can also facilitate a more efficient use of products during their lifetime. Services enabling take back of products and reverse logistics may also be a part of a circular business model value proposition.

Often, circular business models capitalise on new revenue streams from product or material cycling e.g. by selling company's waste or by-products, or by reducing costs for virgin raw material procurement when they are substituted by secondary materials (Moreno, De los Rios et al. 2016). Companies may also capitalise on post-consumer markets, capturing value by repairing and reselling products, or by reusing and upcycling them.

Circular business models aim to maximize the preservation of the economic and environmental value embedded in products during production.
-Velte and Steinhilper 2016



Innovating business models means making adjustments to a business model's configuration, either by changing some or all of its elements or changing relations between the elements.

-Massa and Tucci 2013

Business model innovation

Business models can be a vehicle for innovation or they can become a source of innovation in themselves (Massa and Tucci 2013):

- As a vehicle for innovation business models help bring to the market outcomes of different types of innovation in products and services, processes and/or in different organisational settings (Zott and Amit 2008, Teece 2010).
- As a source of innovation business models help bring to the market existing products and services in novel ways (Chesbrough 2010, Afuah 2014).

Business models may also simultaneously play both roles - as a vehicle and source of innovation - when both products and services, processes and organisational structures are being innovated and ways to deliver them to existing or new markets are being devised.

A business model describes how a company creates, delivers, and captures value for its shareholders (Richardson 2008, Osterwalder, Pigneur et al. 2010). Each of these value creation dimensions consists of specific business model elements.

Value proposition
What value is provided and to whom?
Consists of the following elements: product and service; customer segments and relationships and value for the customer

Value creation
How is value provided?
Consists of: activities, resources, distribution channels, partners and suppliers and technology and product features

Value capture
How does the company make money and capture other forms of value?
Consists of: cost structure and revenue streams, value capture for key actors and growth strategy

The range of change differs depending on whether the company aims to reconfigure its existing business model, which is often the case for incumbent companies (Sommer 2012), or whether an entrepreneur or a start-up company is looking for ways to develop an entirely new business model, in which case many elements need to be invented and designed from start (Hockerts and Wüstenhagen 2010).

The highest potential for capitalising on sustainability strategies is when business model innovation takes place in all the three dimensions of value creation (Short, Bocken et al. 2014), i.e.:

- when value proposition comprises new products and services or is offered to new groups of customers;
- when value creation system comprises new technology and production processes and new activities and relationships; and
- when new sources of value capture, e.g. new revenue streams, are identified and exploited.

Circular business model innovation opens up opportunities for organising business activities with the goal of delivering value from resource efficient and circular resource flows to the market.

Types of circular business models

In determining the various ways circular business models may create and capture value, Bakker, den Hollander et al. (2014) have distinguished five types of circular business models as shown below. The models distinctively create value in post-consumer loops via different channels and to different customer segments. In reality, however, companies often have combination of elements from different business model archetypes.

Five types of circular business models.

Types of circular business models	Value created and delivered through...	Value captured through the primary revenue stream from...
Classic long life	Durable products	Sales of high grade products with a long useful life
Hybrid model	Combination of a durable product and short-lived consumables	Repeat sales of fast-cycling consumables
Access model	Access to product rather than product ownership	Access to product via diverse payment schemes, the most widespread is pay-per-use
Performance model	Product performance rather than product ownership	Product performance via diverse payment schemes, the most widespread is pay for the final result
Gap-exploiter model	Third party exploitation of leftover product value	Reselling repaired, refurbished, and upcycled products

CLASSIC LONG LIFE MODEL

The classic long life model delivers value of durable product and captures value through a primary revenue stream generated by sales of this high-grade, long-life product.

HYBRID MODEL

The hybrid model offers the combination of a durable product and short-lived consumables, capturing value by combining revenue streams from sales of durable goods with repeat sales of the fast-cycling consumables.

ACCESS MODEL

The access-based model creates value by charging for gaining access to products instead of generating value through product ownership, often through pay-per-use or per function.

PERFORMANCE MODEL

The performance-based model is similar to the access-based model, with the difference being that value is generated from charging for final result. In the performance-based model the extraction of value is done by the service provider.

GAP-EXPLOITER MODEL

The gap-exploiter model describes when a third party exploits left-over value in product systems by for example repairing, refurbishing, remanufacturing or upcycling products.

Examples of circular business models

Inrego is a Swedish firm specializing in refurbishment of ICT equipment such as laptops, PCs, monitors, and smartphones. Inrego's business model centers on two value propositions – one for the supply of used ICT and one for the distribution of the refurbished ICT. On the supply side, Inrego sources used ICT for refurbishment by offering private and public organizations hassle-free ICT collection; additionally, monetary compensation is also provided. Inrego then refurbishes and resells the refurbished ICT to new customers at a lower than new price point. Customers of the refurbished ICT include private organizations, public sector, and private individuals. Inrego may also lease the refurbished ICT to some customers through special arrangements.

Stapeln (STPLN) is a maker-space in Malmö that hosts a co-working facility, a venue for performing arts, a space for exhibitions, performances and workshops and several do-it-yourself-workshops for textile printing, sewing, carpentry, digital production, bicycle service and construction (a "bike kitchen"), and creative reuse/recycling of waste materials from industry. STPLN is about creating new lifestyles for people by engaging them in creative activities and promoting sustainable and circular thinking through workshops and studios on repairing bikes, and making crafts from recycled materials. It is open to citizens from all socio-economic backgrounds and offers access to new technologies and tools, so that all have an equal chance to learn, and develop skills and competences needed for introducing circular thinking and reuse-repair and upcycling of household products.

Off2Off is a business that offers an Internet based service to organisations in the public sector in Sweden by matching their supply and demand in goods and resources. Public organisations use this service by exchanging primarily within the organisation but also between organisations the information about goods and resources that they have a need for as well as about those they have a surplus of. All customers have their accounts and access to Off2Off web support. Off2Off business model extends products' useful life by creating new opportunities for their use, repair, repurpose and upcycle by users. 100% of value is generated by offering the online marketplace. While similar markets exist on a peer-to-peer basis (e.g. eBay, blocket.se), this is a truly innovative business model and service provision in the public sector in Sweden.

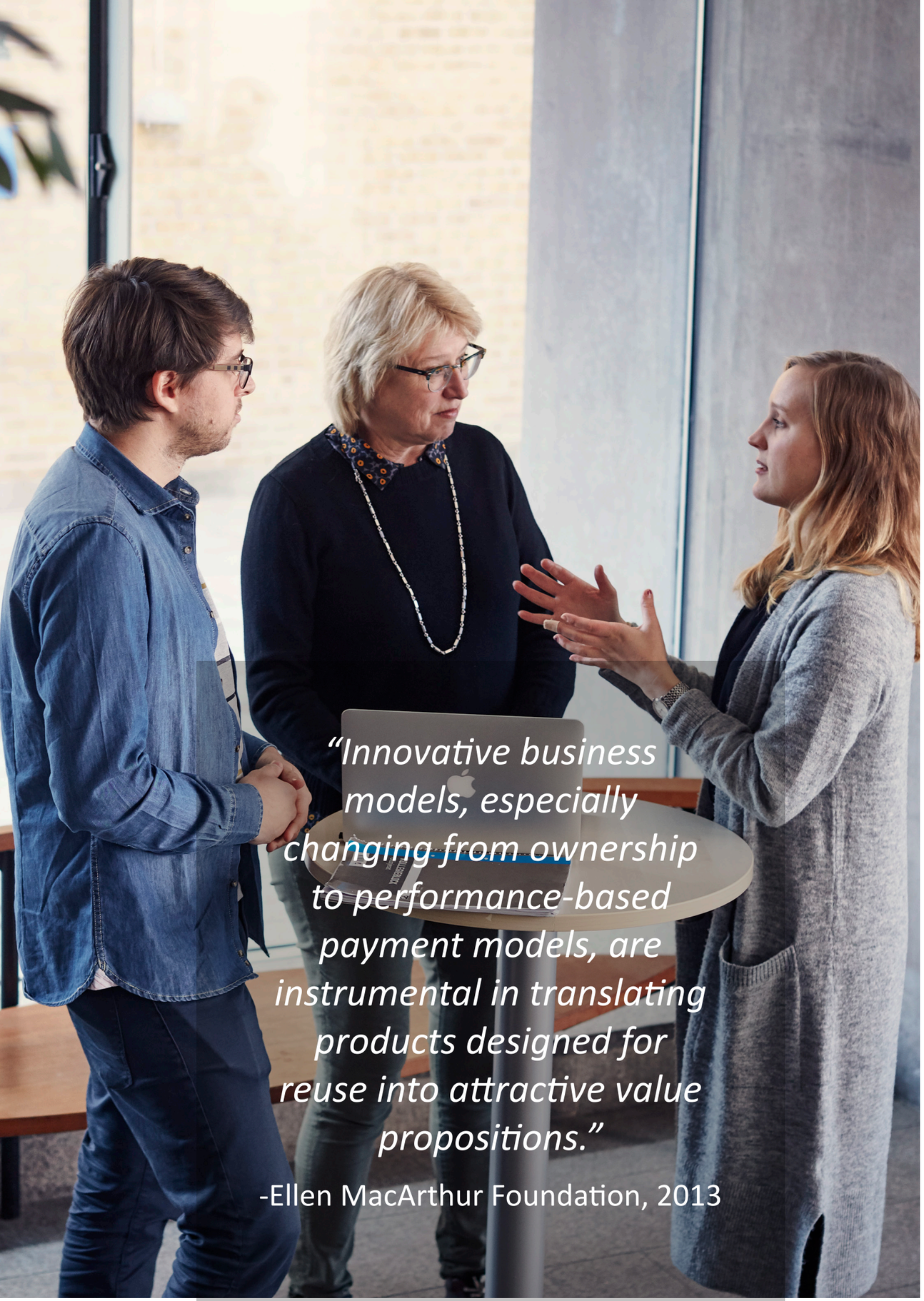
Volvo Cars is engaged in several remanufacturing activities for its vehicle parts, operated by Volvo Reman. One example is a world-wide system for remanufacturing diesel particle filters. The logistics of an exchange system with central inventory in Maastricht is facilitated by different subcontractors and unites over 2500 Volvo car resellers, parts OEMs and Volvo car workshops. The responsible remanufacturer is UBD Cleantech in Höör Sweden, which is able to restore up to 95% of filters technical capacity. Remanufacturing of particle filters reduces the demand for virgin rare metals, which have significant environmental loadings and require large amounts of raw materials and energy. It also offers considerable economic gains for Volvo clients. Although markets for new and remanufactured filters are separate, there strong demand for remanufactured filter due to their much lower price and performance identical to new particle filter. A small share of used filters is still not captured and is recycled by materials recyclers.

Examples of circular business models (cont.)

GIAB offers repair services for ICT items submitted through insurance claims (predominantly mobile phones) to several Swedish insurance companies. ICT items, which are unable to be repaired, are sent to a remanufacturing company who, in return, sends GIAB refurbished phones. These phones are given to the insured individuals as replacements and their unfixable phones are used for parts in the creation of new refurbished phones. Revenue is generated from invoicing the insurance companies for costs associated with repair. By collecting and repairing or replacing phones, GIAB has helped insurance companies to reduce the number of (fraudulent) insurance claims by almost 30%, which has translated into significant financial savings for the insurance companies. Occasionally, GIAB also works with businesses to take-back used professional ICT and resell it to other organizations or individual users.

Polyplank offers products from a recyclable, toxic free and long-life material composite made from by-products of the wood and plastic industry. One product line is plank profiles, which are used for fences, terraces, and noise walls. Customers include public housing organisations, who benefit from the reduced environmental footprint and the low life-cycle costs, due to the long-life and low maintenance requirements of Polyplank's products. Polyplank addresses the end-of-life of their products by designing for recyclability (either hazardous substance-free input for waste-to-energy processes or as input material for their own production) and labelling each product with a resource passport and company contact information. Revenue is generated from the sales of the product (at a slightly higher price than the non-recyclable alternatives from virgin materials).

Volvo Group's main business models for trucks and busses are based on direct sales and different forms of leasing. However, the upcoming 2019 changes of the International Financial Reporting Standards (IFRS 16)[1] imply that all leases will be treated as debt entries on balance sheets for Volvo customers, which will negatively affect their credit ratings, narrow down their borrowing capacity and thus limit purchasing power. In response to this Volvo Group is developing new business value proposition. Instead of offering access to particular vehicles through direct sales or renting/leasing, the company is planning to sell transport capacity to its clients who will simply contract ton-kilometres per year. Volvo Group would sell this transport service provided by various on-demand vehicles. The benefit for the clients will be avoiding upfront investments, reducing the total costs of ownership, having access to sets of vehicles optimised for particular transport services and, importantly, these services can be reported as operating costs rather than assets on balance sheets.



Benefits of Circular Business Models

Strategic benefits
According to EMF (2013), circular business models may help companies grow, primarily since they identify new profit centres. Circular business models may also help addressing strategic challenges faced by consumer goods and other types of businesses, e.g. new-comers on the market such as second-hand companies, new distribution channels and informal exchanges EMF (2013).

Reliance on secondary materials reduces companies' dependence on virgin raw materials and may "cut net material costs, reduce price volatility and supply risks" (EMF 2013: 85). Indeed, there are many companies that have made commitment to changing their business models into a more circular direction and they are now reaping the benefits of being market leaders.

Environmental benefits
The Environmental potential of circular business models also depends on the economic sustainability - only if resource efficiency strategies are operated in economically viable ways, the reliance on virgin raw materials can be reduced and waste can be designed out of society (Zink and Geyer 2017).

Theoretically, retaining the greatest value of the product or components through reuse or remanufacture of products should be economically viable for many products (Stahel 1982, Nasr and Thurston 2006, PWC 2014).

Ultimately, the question about environmental sustainability potential of circular business models is whether the resulting cycling of products and materials replaces primary production or adds to it.

However, opportunity costs are lower elsewhere in the linear system and the choice of strategy for retaining value depends on the life cycle stage, in which products have their highest environmental impacts. For example, products with the greatest environmental impacts stemming from the production stage should be built for durability (Cooper 2010), reuse (Lang 2011), and remanufacture (Nasr and Thurston 2006), while products that have the highest environmental impact in the use phase should be either upgraded or

Transition to or development of circular business models in companies is not a simple process.

Reuse and remanufacturing may not necessarily displace primary production (Zink and Geyer 2017). For example, recycled materials may cost less and thus lead to increased demand by consumers.

replaced more often (Felton and Bird 2007, Bakker, Wang et al. 2014).

Remanufacturing may potentially, but not necessarily, reduce the need to manufacture new products, thereby reducing raw material and energy consumption, as often natural resource inputs to remanufacturing processes are smaller than the inputs to manufacturing – higher value components enter remanufacturing processes compared to value of materials used in primary manufacturing. For example, manufacturing automotive starters and alternators requires over seven times more raw material and energy than remanufacturing (Tapscott and Williams 2008).

Moreover, if secondary products are not compatible alternatives with primary products, they may shift and increase overall levels of consumption. There are often trade-offs that need to be weighted, for example, positive results on product level, but negative results on societal level (Scheepens, Vogtländer et al. 2016).

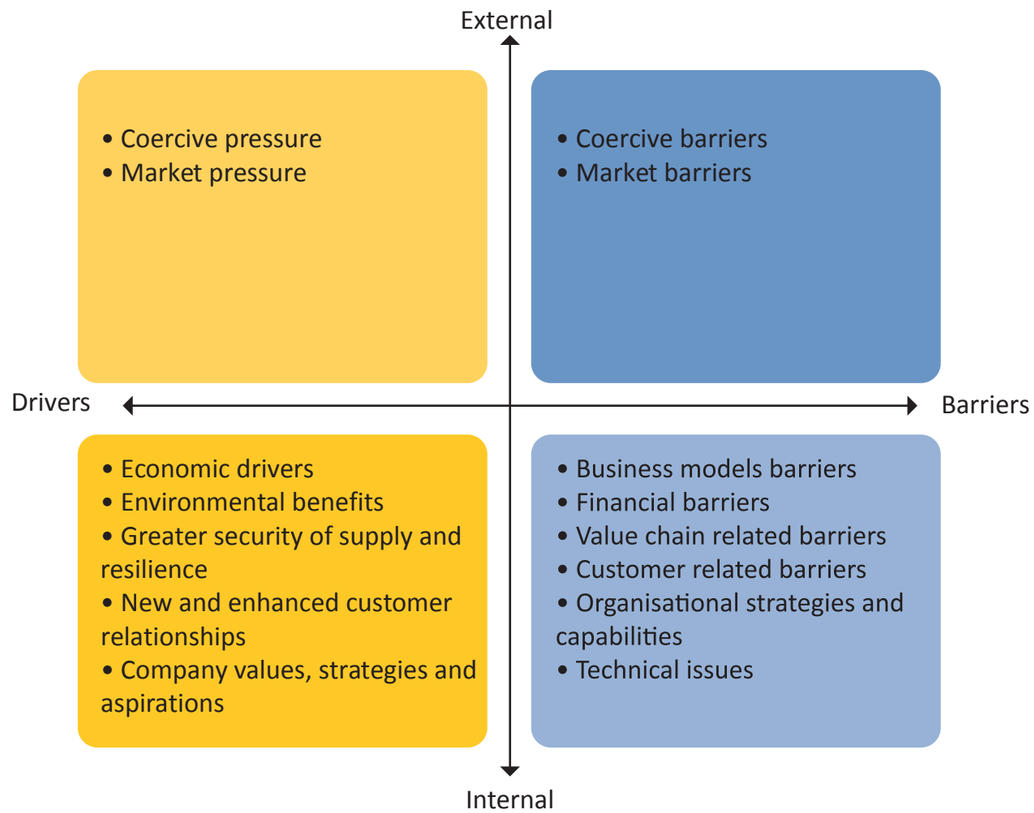
Ensuring benefits

Circular business models can have a clear economic sustainability potential, but to a large degree it depends on the prevailing regulatory and economic frameworks. Unfortunately, the existing policy frameworks, resulting in relatively high taxes on labour and low taxes on natural resources and pollution, are still more favourable for the linear economic model. For this reason, many businesses struggle making the business case for circular business models.

In order to assist companies in moving forward, we need to be fully aware of possible pitfalls and the driving forces that trigger companies to proceed in this direction.

Map of market drivers and obstacles

A number of important drivers and barriers that companies have to overcome when devising circular business models have already been identified and on the following pages we provide a systematic account of this scattered knowledge.



Drivers of circular business models

Businesses that explore opportunities of circular business models are driven by both external and internal drivers. Externally they are often driven by legislative and market pressure, while internally they may be driven by new profit opportunities.

EXTERNAL PRESSURES

Coercive pressure

1. Increased range of product groups subject to Extended Producer Responsibility regulation
2. Legal pressure to decrease the use of certain material resources in society (e.g. chemicals)
3. Tighter environmental policy standards, especially on waste prevention, recycling and recovery targets
4. Taxes on natural resources that promote resource efficiency and/or substitution of resources

Market pressure

1. Increasing competition from low-cost countries puts Swedish producers under pressure to find new business propositions and alternative ways to organise business
2. Demands for new business models from business partners and customers
3. Consumer preferences in some product groups are shifting away from ownership towards increased acceptance of renting, sharing and leasing business models
4. Risky/uncertain access to virgin raw materials, price volatility.

INTERNAL DRIVERS

Economic drivers

1. Cost savings in manufacturing (Stahel 2010, Walsh 2012) and in waste management by reusing and recycling waste
2. Improved margins, e.g. stemming from reduced price for secondary materials that substitute supply of virgin raw materials
3. Revenue growth from recovering wasted economic potential of products and finding alternative sources of value, e.g. from resale of used products or parts harvesting and using in refurbishing and remanufacturing processes
4. Potential to meet low cost competition by creating market differentiation by adding or creating services close to final customers
5. New possibilities for innovation and growth from alternative business models that offer access to products over ownership or sell performance
6. Cost recovery by selling valuable second hand, repaired, refurbished, remanufactured, upcycled products and recyclable materials

Environmental benefits

1. Reduced risk/liability of hazardous materials
2. Reduced waste volumes due to reuse of products, parts and materials

Greater security of supply and resilience

1. Greater security of resource supply is an important driver since the future material demand is difficult to predict. However, resource extraction is expected to triple between 2015 and 2050 if business-as-usual models continue to prevail, which will create both physical risks (quality and quantity) and geopolitical risks (accessibility to e.g. critical metals) (Fischer-Kowalski, Swilling et al. 2011)
2. Security of supply increases resilience of the business system, which is then better equipped to deal with change and withstand economic and financial shock and disturbances (EMF and McKinsey 2015)
3. Reduced price volatility of resources

New and enhanced customer relationships

1. Diversified and customised offering not only attract new customers, but also strengthen existing customer relationships and increase brand loyalty (EMF and McKinsey 2015)
2. Opportunity to offer lower total cost of ownership to customers
3. Improved customer interaction and loyalty

Company values, strategies and aspirations

1. Opportunity to capitalise on and benefit from higher quality and environmentally sound products
2. Increased brand protection and loyalty (EMF and McKinsey 2015)
3. Top management commitment

Barriers of circular business models

EXTERNAL PRESSURES

Coercive barriers

1. Polices that incentivise recycling, incineration, or disposal over other circular strategies such as reuse and refurbishment
2. Regulatory frameworks that target export of waste streams (aimed at reducing the amount of waste sent to developing nations) may also hinder circular business models by preventing cross-border movement of products for reuse (Milovantseva and Fitzpatrick 2015)
3. Difficulty, high cost and long time to gain 'secondary material' status over 'waste' status under the existing environmental permit system.
4. Absence of defined targets for resource efficiency in policy
5. Lack of governmental incentives (e.g. financial) for resource efficiency
6. Legacy product liabilities

Market barriers

1. Products have low residual value at the end of life
2. Low price of many virgin materials is a barrier, especially when the costs of recycled materials are higher
3. Current infrastructure does not support circular offerings, i.e. locked-in infrastructure
4. Lack of networks and/or supply chains for disassembled products and components and recycled materials (reverse logistics)
5. High labour costs
6. Lack of design tools for circular business models and for circular products (Bakker et al. 2014)

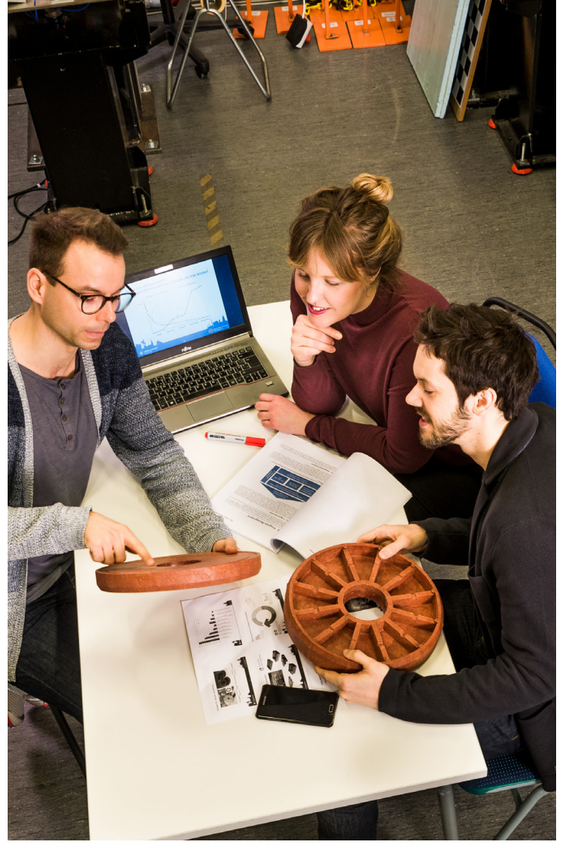
EXTERNAL BARRIERS

Business models related barriers

1. Difficulty to internalize legal risks (i.e. from longer warranties) of extending responsibility beyond point of sale (Prendeville and Bocken 2015)
2. Decreased sales of new products due to increased sales of repaired, reconditioned and remanufactured products (EMF 2013)
3. Lack of supply (or quality) of returned products or resources (Kissling, Coughlan et al. 2013)
4. Difficult to organise takeback logistics (Kissling, Coughlan et al. 2013)
5. Uncertainties about the residual value of the new products, i.e. repaired, reused, upcycled, refurbished or remanufactured (Mont, Dalhammar et al. 2006)
6. Unpredictability of volume of returned products can make it difficult for companies to plan and financially forecast (Linder and Williander 2017)
7. Risks with product performance, increased liabilities for reconditioned products or materials

Value chain related barriers

1. Existing supply chain dependencies and relationships prevent circularity (Boons and Lüdeke-Freund 2013)
2. Difficult to cooperate/collaborate with other companies and/or stakeholders
3. More risks from being dependent on market-unstabile suppliers compared to being dependent on traditional global commodity markets for virgin materials
4. OEMs may risk damaging relationships with their retailers and dealers by offering repair or refurbishment (Prendeville and Bocken 2015)
5. Component producers and other non-OEMs may have limited or unclear opportunities to adopt circular business models because of their position in the value chain (Mont, Dalhammar et al. 2006)



Financial barriers

1. Liquidity risks as cash flows spread over longer periods of time (World Finance Group 2016)
2. High upfront investment costs associated with products with longer lifetimes (Sauvé, Bernard et al. 2016, World Finance Group 2016)
3. Increased (working) capital needs for pre-financing in the case of leasing models (World Finance Group 2016), and relatively lower returs on investments in these models
4. Potential increase of cost of capital as assets are retained on the companies' balance sheets creating a financing demand and thus decrease overall liquidity of the company's asset (World Finance Group 2016)
5. Risk of not achieving cost-effective repair, reuse, or remanufacturing (World Finance Group 2016)
6. High costs associated with takeback of products (Kissling, Coughlan et al. 2013)
7. High labour costs related to product disassembly and source separation of waste (Kissling, Coughlan et al. 2013)

EXTERNAL BARRIERS (CONT.)

Customer related barriers

1. Lack of consumer awareness about offerings or misunderstandings about refurbishment, reuse, servicising, performace sales, etc.
2. Lack of and/or uncertainty about consumer acceptance and/or demand for circular offers/products about product or service acceptance
3. Pre-conceived notions that refurbished products are inferior to new products or lack in their thrill of 'newness' (Ylä-Mella, Keiski et al. 2015, van Weelden, Mugge et al. 2016)
4. Mishandling of products by customers
5. Data security (IP) concerns from customers (Krystofik, Wagner et al. 2015)

Organisational strategies and capabilities

1. Circular business does not align strategically within organisation
2. Diversification of product-oriented businesses with service-focused offerings and lack of expertise in the company (Mont, 2002).
3. Lack of expertise within organisation and increased demand for company resources (Kindström and Kowalkowski 2014)

Technical issues

1. Products are not designed for circular business models, i.e. for easy disassembly, repair, refurbishment and remanufacturing (Berchicci and Bodewes 2005) and thus physical product attributes make it difficult to reuse products (Krystofik, Wagner et al. 2015)
2. Concerns about technical reusability of materials or lower material quality after reuse (Bocken, Rana et al. 2015).
3. Hygienic/safety issues associated with reused or repaired products
4. Lack of spare parts, repair tools, repair guidelines (Sabbaghi, Cade et al. 2017)

ENABLING TRANSITION TO CIRCULAR BUSINESS MODELS

The overview of drivers and barriers of circular business models has demonstrated that development and implementation of circular business models depends on different factors and actors. Thus, the transition towards circular business models can be facilitated by concerted effort of main actors: policy makers, businesses and academia.

Checklist for Policy Makers

1. Introduce material efficiency and durability in product design regulation
2. Revise legal frameworks to facilitate trading with reused and reconditioned goods
3. Introduce economic policy instruments, such as reduced Value Added Tax (VAT) and/or subsidies for repaired, reused and reconditioned products
4. Create favourable climate for capital investments and R&D and reduce risks associated with circular business models
5. Enforce longer warranty periods for consumers and make spare parts available for longer periods after product purchase
6. Develop infrastructure for consumers to hand in used products either at retailers or close to their home, i.e. repair, reuse and upcycling stations instead of recycling points
7. Reform taxation policies in favour of labour costs and natural resource conservation

Checklist for Companies

1. Build competencies in circular business models to facilitate and capitalise on product reuse, repair and remanufacturing
2. Consider prioritising access over ownership: build products and business models and create and educate markets for performance based offerings and payment schemes
3. Build up the capabilities and infrastructure for value chain collaboration in order to move towards more circularity
4. Develop effective cross-chain and cross-sector collaboration, such as REES, to share knowledge and ideas
5. Advocate for industry standards for circular business models and products and services

Checklist for Academia

1. Develop methods and tools for designing and implementing circular business models
2. Assist companies and policy makers in disseminating knowledge about circular business models, pioneer companies and good practices
3. Develop tools for creating market acceptance of circular business models and products
4. Support the development of and contribute to cross-chain and cross-sector collaboration
5. Advance research and offer policy recommendation facilitating circular business models

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MISTRA REES

Mistra REES - Resource-Efficient and Effective Solutions based on a circular economy thinking is a 4-year program run by a consortium of leading Swedish universities, large and small companies and community actors.

The vision of the program is to accelerate the transformation of the Swedish manufacturing industry towards a circular and sustainable economy. The program started in 2015.

Mistra REES
Linköping University
581 83 Linköping

www.mistrarees.se

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