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MVO NEDERLAND
CIRCLE ECONOMY

Let's help SMEs to go circular

Part of the project: Boosting the circular economy amongst SMEs in Europe
-
A project of the European Commission – DG Environment

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Introduction

Background

The European Commission has adopted an ambitious Circular Economy Package to help European businesses and consumers to make the transition to a stronger and more circular economy where resources are used in a more sustainable way. With this plan to make Europe's economy cleaner and more competitive, the Commission is delivering ambitious measures to cut resource use, reduce waste and boost sustainable production and consumption.

The implementation of this plan will impact SMEs through: measures to reinforce waste management (e.g.: reuse, recycling), measures on the usage of critical raw materials (e.g.: lithium) and support to implement the circular economy strategies and practices.

Since adopting the Circular Economy Package the Commission has observed an increased uptake by corporations to adopt resource efficiency, eco-innovation and/or circular economy strategies and practices.
The Commission observes that SMEs are experiencing more difficulties in adopting such strategies and practices, due to: their more limited organisational, technological and financial capacity; and less access to (pre-) financing for circular solutions.

With this project the Commission aims to bring assets (e.g. knowledge, networks and tools) via the right support infrastructure, organisations and associations to SMEs so that these enterprises can start to benefit from the advantages of the circular economy including cost reductions, new/increased revenue streams and improved environmental performance.

The overall project consists out of three work streams:

The overall project consists out of three work streams:

1. Training and helping 15 SME support organisations (e.g. chambers of commerce, sector associations) to establish a / improve their programme to help their members with adopting circular economy strategies and practices.

2. Helping 15 highly promising providers of circular solutions to scale-up across Europe.

3. Advising 6 regional authorities across Europe on how they stimulate SMEs to circular economy strategies and practices or remove barriers for them to do so.

An overview of the participants of the project can be found on the website of the Commission.

Introduction

Goals of training sessions

This booklet has been drafted as background and reference materials for the fore mentioned provided training to SME support organisations. These training sessions are aimed to:

'help you to establish a program through which you deliver services related to resource efficiency, circular economy, and eco-innovation to SMEs'.

In which we foresee a program as a combination of services which you can offer to help SMEs, through: sharing knowledge and insights (e.g.: newsletters, seminars), jointly gathering knowledge (e.g.: communities of practice), facilitate access to financial means (e.g.: help to attract EU financing), et cetera.

Structure of the training sessions and materials

To achieve this goal KPMG, CSR Netherlands and Circle Economy have prepared this training document for you and will organize a two-day training session with your representatives from your organization.

During this two-day training session we will go through a series of training modules which cover various topics related to the content of- or aspects of a program focused on helping SMEs to benefit from the advantages of the circular economy.

These modules are divided into five sections:

1. Introduction to the subject;
2. Introduction to existing support channels;
3. Sector deep dives;
4. Case study from one of your members;
5. Core elements of SME support programs;
6. and Implementation support.

For an overview of the training modules per section see p.6-7

Overview of training modules

Section 1: Introduction to the circular economy

Section 2: Introduction to existing support channels

Overview of training modules

Section 3: Sector deep dives

Section 4: Core elements of support programs for SMEs

Overview of training modules

Section 5: Implementation support

Section 1 consists of five modules which will introduce you to the subject of circular economy, resource efficiency and eco-innovation. It will provide you with an overview of what circular economy entails for the members of your organisation.

Module 1:
Master class introduction to the circular economy

Module 2:
Business benefits of the circular economy

Module 3:
Circular business models

Module 4:
Circular supply & value chains

Module 5:
Circular Design

Master class introduction to the circular economy

Introduction

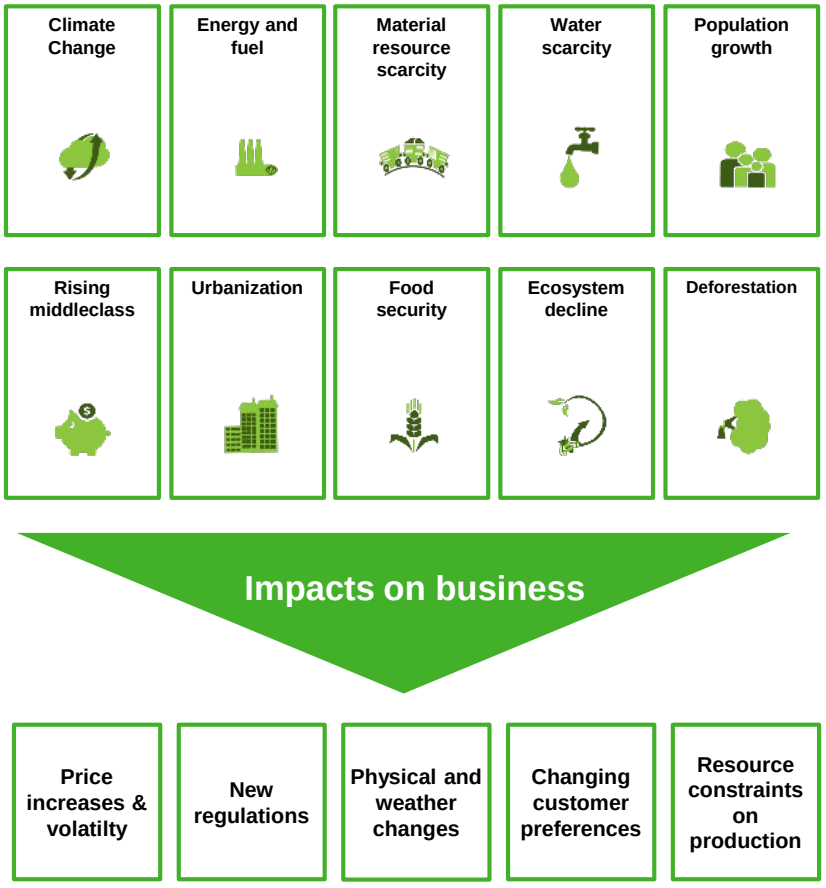
The objective of this module is to introduce the concept of circular economy and explain why circular economy is a relevant concept for SMEs. As stated in the general introduction, non-renewable natural resources are becoming scarce mostly due to: the growing global population, the growing wealth in upcoming economies and the rapidly reducing global stocks of these resources (e.g. oil, natural gas and rare metals). This has resulted in rising prices and increased price volatility. This forces businesses, including SMEs, to use these resources more efficiently. The concept of the circular economy provides a way of thinking on how to increase resource efficiency.

The global business environment is more complex and fast-moving than ever

Globalization, digital connectivity, accelerated consumption and disparate prosperity have combined with ecological decline, a lack of global sustainability governance and resource scarcity to transform the playing field for businesses. As a result, today's global business environment is more complex, uncertain, volatile and fast-moving than ever before.

In 2012 KPMG identified trends which have significantly changed and will continue to change the global business environment: globalization, digital connectivity, accelerated consumption, disparate prosperity, ecological decline and resource scarcity. In addition KPMG identified global sustainability mega forces that in the nearby future will have a strong influence on the business environment and shall force the global business community to become more sustainable (see: figure 1, lefthand side).

Figure 1: overview of global sustainability mega forces (source: KPMG (2012), expect the unexpected)



These global sustainability megatrends are interrelated which creates a more complex and uncertain business environment. The mentioned trends are expected to influence the global business environment through:

- price increases & volatility;
- new regulations;
- physical and weather changes;
- changing customer preferences;
- and resource constraints on production.

Resource scarcity poses a significant risk to businesses

The European economy is largely dependent on the import of raw materials and resources. With increasing scarcity the prices of these materials as well as the volatility of its prices are expected to increase. This poses a significant risk to most businesses since prices of these materials in large part determine their costs base.

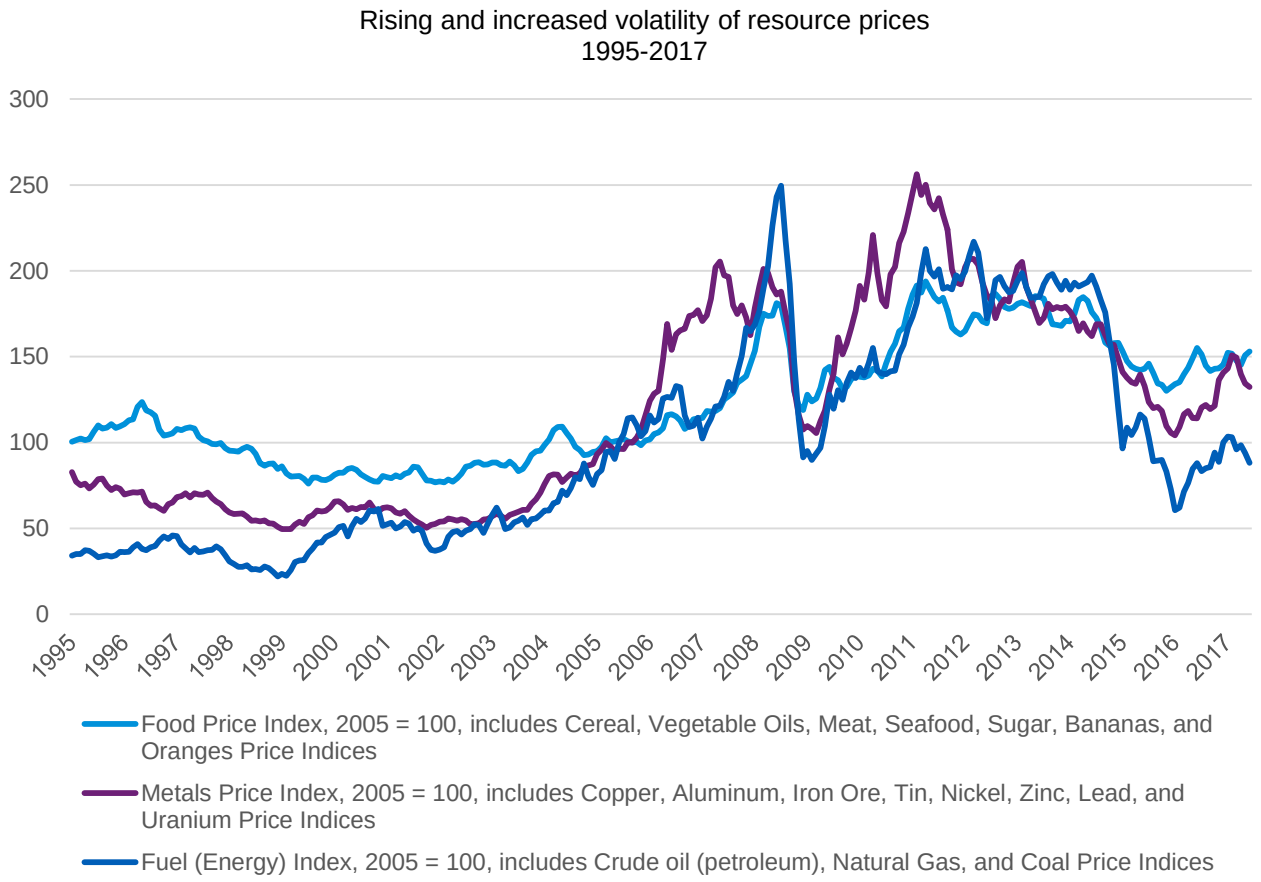
In general the global demand for natural resources has increased exponentially since the second half of the 20th century (see: figure 2). This increase has been driven by population growth and the rise of the middle class (which increases consumption per capita). This increase is expected continue. As the population grows and more consumers enter the middle class, the total demand for resources is expected to reach 130 billion tons by 2050, up from 50 billion in 2014.

Technology is not expected to be able to advance sufficiently during the coming few decades to reduce our demand to a sustainable level.

Therefore rising resource prices and price volatility are expected to become the new normal. The speed and scale of demand growth, which is coupled with short-term but frequent price fluctuations, can lead to higher long-term prices and greater supply insecurity in the future. A lack of anticipation of these changes causes risks and reusing materials longer is becoming more important and an attractive part of the solution.

Master class introduction to the circular economy

Figure 2: Resource prices for fuel, food an metals (source: IMF (2017), Online database)



Increasing scarcity forces businesses to use resources more efficiently; circular provides an answer to this

Increasing resource scarcity forces businesses to utilize resources more efficiently. The concept of circular economy offers a way of thinking that provides strategies and practices to increase resource efficiency.

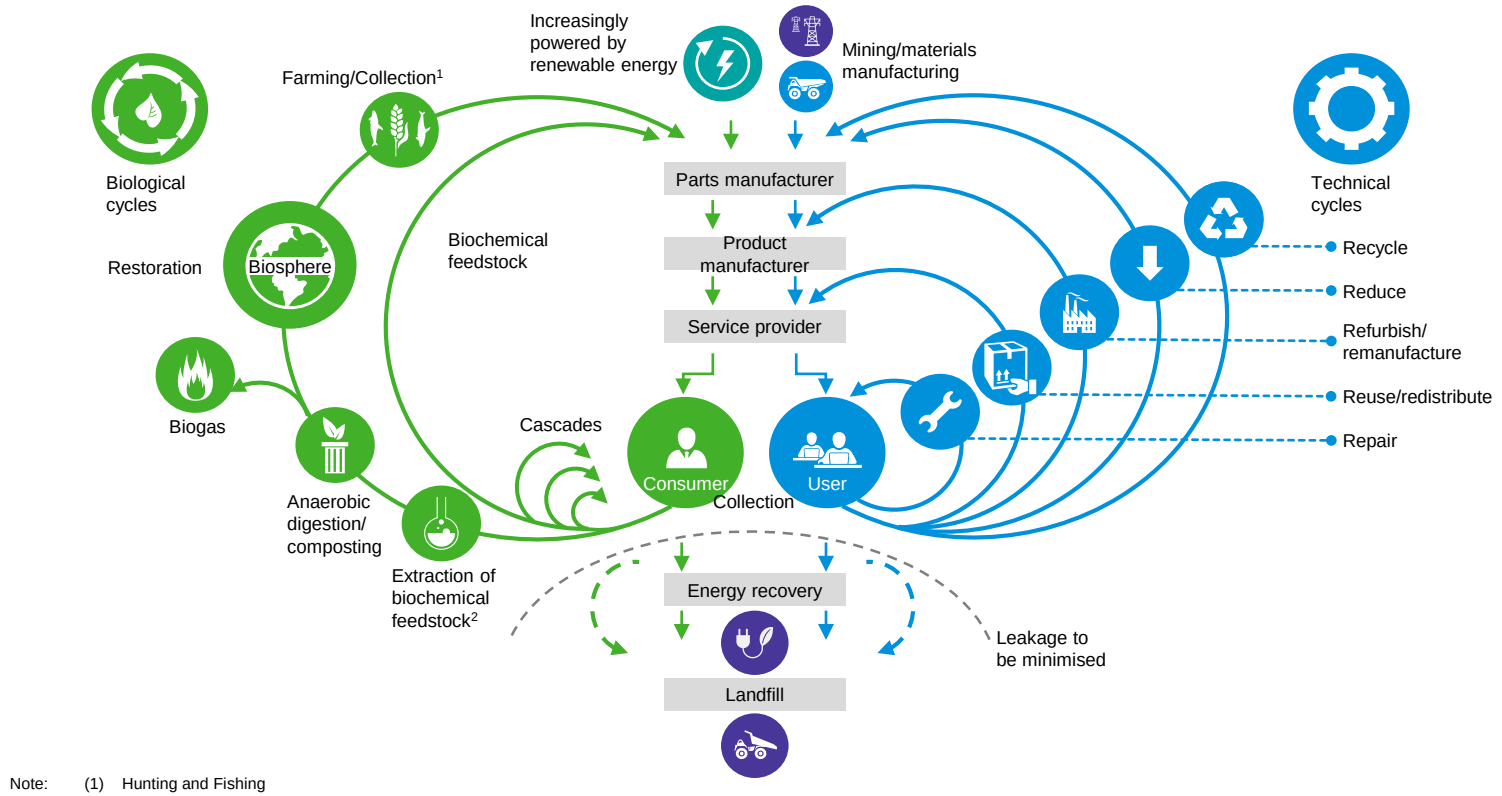
In a circular economy the central goal is to retain as much value as possible from resources, products, parts and materials to create a system that allows for long life, optimal reuse, refurbishment, remanufacturing and recycling – as opposed to a model which can be characterized as: “take-make-dispose”.

On the following page a summary of the theory behind circular economy is shown. Although there are different ways of showing it and there are different schools of thought regarding circular economy, this diagram will be used as the overview of the concept and described in following chapters.

Although it might come across as complicated at first glance the model can be organized into principles which are explained in more detail on the following pages. More information on how to apply these principles is shared in the next modules.

Master class introduction to the circular economy

Figure 3: schematic overview a circular economy (adapted from: Ellen MacArthur Foundation (2012))



Note: (1) Hunting and Fishing
(2) Can take both post-harvest and post-consumer waste as an input

Five principles that are central to the concept of circular economy

As displayed in the schematic overview (see: figure 3), in a circular economy products, components and materials are continuously (re)circulated – as opposed to a linear economy in which products, components and materials are discarded as waste after they have been used. This means that the materials which have been used in these products are no longer available which in turn increases the scarcity of these materials. From a circular economy point of view, discarding such valuable, finite materials is inefficient and corresponds to destroying the economic value of the materials. The following five principles are key in understanding how the value of products, components and materials can be maintained from a circular perspective.

Principle 1: Waste no longer exists

One of the main principles of a circular economy is that 'waste is food'. All materials and products can be seen as temporary repositories of materials (or nutrients) that will then become the inputs for new products. Discarding materials after a user no longer uses a product can be seen as inefficient.

Principle 2: Biological materials are renewable, technological materials not and should therefore be recycled

In the circular economy we make a distinction between biological and technological materials, because biological materials are in general renewable and technological are generally not. This makes it more important to keep technological materials in the recirculation. Therefore we should keep these streams separate. Biological materials should be used in products in such a way that they can re-enter the biosphere safely, whilst technical materials should be used in such a way that they keep circulating at high quality – without entering the biosphere.

Principle 3: Try to reuse the product as a whole, if that is not possible parts of the product, and if that is not possible recycle the materials

The concept of a circular economy is aimed at continuous loops. These loops are reduce, reuse, repair, refurbishing, remanufacturing and recycling. As the loop in the schematic overview enlarges, the loop will focus more on reusing components or materials. Since completed products in general have higher value than the materials they consist of, it is important to keep the loops as small as possible in order to retain as much value as possible.

Principle 4: First repair, then reuse, then refurbish and then recycle

The circular economy model provides for product or material recirculation loops within the product's entire life cycle. By using multiple of these strategies the retention of value can be prolonged. This also means that connections between businesses become important to create optimal reuse of materials. Creating strong connections between businesses creates systems thinking in which returning materials can be optimally used and redistributed to other actors who can gain value from it.

Principle 5: Make use of renewable energy

Another defining principle of a circular economy is that the system is regenerative by design and therefore energy can not be made from non-renewable resources..

Sources: Joustra et al. (2013), Guided Choices towards a Circular Business Model.

Master class introduction to the circular economy

The five strategies to close cycles

In the framework of the circular economy (see: figure 3) five strategies are distinguished to close loops. With these strategies materials that are used in products are being maintained. These strategies are: reduce, repair (maintenance), reuse (redistribute), refurbish (remanufacture) and recycle.

Five strategies to close cycles		
	Business model	**Explanation**
	**Reduce**	Reduction of the amount of material used. Both consumers can reduce the amount of consumption and manufacturers can reduce the amount of material needed in products and the amount of products.
	**Repair/ Maintenance**	Repair and maintenance of products keeps them in high value cycles and only replaces parts that need to be improved
	**Reuse/ Redistribute**	Products can be reused between users or redistributed by the service providers.
	**Refurbish/Remanufacture**	With remanufacturing disassembly and recovery takes place at the subassembly or component level. Functioning, reusable parts are taken out of a used product and rebuilt into a new one. Refurbishing is a process of returning a product to good working condition by replacing or repairing major components that are faulty or close to failure. Any subsequent warranty is generally less than issued for a new or a remanufactured product .
	**Recycle**	Recovery of materials in components of products. From this new parts are produced. This keeps the value of the material but the form is recreated.

Master class introduction to the circular economy

Example of using recycling as a strategy to close loops

Ecovative Design is an American company that produces packaging materials from biological materials, such as mushrooms and agricultural waste. By using these materials the packaging materials are biodegradable and can thus be returned to the soil as a nutrient after use.

Unlike conventional synthetics such as plastics, the myceliated agricultural byproducts used by Ecovative have a positive impact on the planet. In addition, it costs little energy to produce the products as mycelium (the vegetative part of the mushroom) grows throughout the substrate by itself in six days. After taking the grown parts out of the growth trays and putting them in an industrial kiln to dry and kill the mycelium, the product is finished.

Source: Ecovative (2017), link

Example of redistribution as a strategy to close loops

FLOOW2 offers an online platform that allows organisations to share business equipment that is currently underutilized.

Sharing business equipment can be seen as a form of redistribution. In addition because sharing decreases the need for companies to acquire equipment, which reduces the overall amount of materials stalled in business equipment.

The platform is currently operational in Belgium, The Netherlands and Germany with a rapid global expansion plan envisaged.

FLOOW2 sees their platform as a win-win for businesses because companies who have committed the upfront capital investment on equipment can increase their revenue through using the platform to rent out any equipment and personnel not being deployed at full capacity. It also gives other companies access to equipment they need at rental prices that make it worthwhile as an alternative to investing in and owning the equipment.

FLOOW2 world's reset button

Source: Floow2 (2017), link

Master class introduction to the circular economy

Example of reducing to close loops

Levi's launched a Water<Less™ line of jeans in 2011, designed to reduce the use of water. The Water<Less™ process approaches the decisions made in the design process in a different way, reducing the amount of water used in the finishing process. By simply removing water from stone washes or combining multiple wet cycle processes, Levi's can significantly reduce water usage — up to 96 percent for some styles. Since launching the Water<Less™ process in 2011, the company has saved more than 1 billion liters of water.

Source: Levi's (2011), link

Example of repairing to close loops

At Nudie Jeans Repair Shops, jeans can be repaired, resold as second-hand or even donated to the Nudie Jeans recycling program. Every pair of jeans from Nudie Jeans comes with the guarantee of free repairs. If there is no Repair Shop nearby, customers can order the free of charge Repair Kit.

The product life cycle of the jeans is extended by focusing on the smaller circular loops: repair and reuse. Through offering this repair, reuse and recycling program Nudie Jeans had managed to close the loop of the jeans.

Source: Nudie Jeans (2001)

Master class introduction to the circular economy

Example of combining strategies to close loops

Turntoo offers lighting as a service instead of selling lighting. Together with the lighting company Philips, Turntoo has developed a 'pay-per-lux' intelligent lighting system to fit the requirements of the space, at a manageable price. Users pay a fixed periodic fee for the use of the lighting, while Philips remains the owner of the lights and has the obligation to repair and maintain these. At the end of the agreement or when the lights have reached the end of the use period, these are being reused or refurbished.

This solution provides companies with circular and energy efficient lighting at low costs, whereas it enables Philips to retain control over the items they produce: enabling better maintenance, reconditioning and recycling of materials.

Source: Ellen MacArthur (2017), link

Example of remanufacturing to close loops

Desko have completely focused their business model and operations on being more circular through remanufacturing. Unlike the traditional linear business model of extracting resources, making and selling furniture, and letting them be disposed as waste, Desko uses a three-tier buyback scheme. Desko furniture that gets sold is bought back, remanufactured, and resold up to three times, extending its useful life and providing more income for the company for the same amount of desks produced

Source: Desko (2018),

Master class introduction to the circular economy

References to other resources

Publications

- European Parliament Research Service (2017), Circular economy
- World Economic Form (2016), Towards the circular economy: accelerating the scale-up across global supply chains
- World Business Council for Sustainable Development (2017), CEO guide to the circular economy
- Ellen MacArthur Foundation (2012), Towards the Circular Economy Vol. 1: an economic and business rationale for an accelerated transition
- Ellen MacArthur Foundation (2012), Towards the Circular Economy Vol. 2: opportunities for the consumer goods sector
- Ellen MacArthur Foundation (2012), Towards the Circular Economy Vol. 3: Accelerating the scale-up across global supply chains
- KPMG (2012), Expect the unexpected: creating business value in a changing world

Videos

- European Commission (2014), Moving towards a circular economy
- Creating a circular economy: the challenges and opportunities for business
- European Commission (2014), How to become a green SME in a circular economy

Business benefits of the circular economy

Introduction

The objective of this module is to share the business benefits of adopting circular economy practices for SMEs. In the previous module it has been explained that non-renewable natural resources are becoming scarce mostly due to: the growing global population, the growing wealth in upcoming economies and the rapidly reducing global stocks of these resources (e.g. oil, natural gas and rare metals). This has resulted in rising prices and increased price volatility. This forces businesses, including SMEs, to use these resources more efficiently. The concept of the circular economy provides a way of thinking to start increasing resource efficiency. Doing this may result in significant business benefits which are summarized in this module.

Six business benefits of the circular economy for SMEs

The concept of circular economy provides inspiration for businesses to increase their resource efficiency. By adopting circular economy strategies and practices entrepreneurs can realize all sorts of different business benefits. These benefits depend on the adopted strategy, the degree to which the business processes are circular, the environment in which the company is active and the role of the company in the value chain. Nevertheless we have identified six general business benefits for SMEs of adopting circular economy strategies which help to explain why adopting circular economy strategies and practices is beneficial for SMEs.

Reduced exposure to rising and the volatility of resource prices

The increasing scarcity of non-renewable natural resources (e.g. fossil fuels, metals and minerals) results in increasing resource prices and price volatility which in turn results in higher material costs for businesses (see: figure 2). By adopting circular economy strategies and practices businesses can reduce the amount of materials they require for their production and to meet their clients needs. Thereby they reduce their exposure to the risk of rising and more volatile resource prices.

Thinking circular stimulates innovation

The concept of circular economy provides inspiration for businesses to increase their resource efficiency. It provides a new lens to look at a company's business model and operations. Looking through this lens may provide new insights and thereby stimulate innovation. For example, in search of ways to reduce amounts of materials used in construction the Dutch construction company BAM invented new building materials made from plastic waste.

Creates a green image

Consumers, businesses and governments are more and more aware of the environmental impact of the products which they use. They therefore are more tuned in to sustainability when making their buying decisions. Through adopting circular economy strategies and practices businesses can reduce the environmental footprint of their products and thereby differentiate themselves from their competitors.

Business benefits of the circular economy

Opens new markets and opportunities for growth

Circular solutions may also create new markets / niches. For example, in the textiles industry there are various businesses which produce yarns from discarded clothing or from textiles waste. Since consumers are looking for sustainable clothing this has grown into a separate market which exists next to the market for regular textiles.

Increased customer loyalty and more stable revenue streams

Transitioning to circular may be facilitated by adopting a different business model. For example, remaining the owner of manufactured products instead of selling them (e.g. getting paid per wash cycle instead of per sold washing machines) helps to be able to retrieve the parts and materials in the product at the end of the use period. Adopting such business models have the benefit that they increase customer loyalty and provide more stable revenue streams (for more detailed information, see: module 3). A downside is that such models generally require more pre-financing (see: module 6, for information on how overcome this challenge).

For more examples see the case studies on the following pages.

Environmental benefits

Adopting circular economy strategies and practices is not only beneficial to business but also the environment. Becoming more circular requires companies to reduce their environmental impact by:

- reducing their use of raw materials;
- reducing their energy consumption and using solely green energy;
- and reducing their fresh water consumption.

By doing so, becoming more circular is also a proactive way of meeting future compliance requirements.

Business benefits of the circular economy

Case study: Pure Waste Textiles
Producing yarn from leftover materials

Industry: Manufacture of textiles, apparel, leather and related products
Country: Finland
Benefits: Stimulates innovation; creates a green image; opens new markets

Pure Waste Textiles is a clothing company that produces recycled clothes and yarns from leftover materials and fabrics that would else go to waste. The company was founded after the owners, which were already active in the textile industry, looked at their product and industry from a circularity angle. The company is good example how taking circularity point of view can stimulate innovation, creates a green image and can open new markets.

Pure Waste Textiles produces recycled clothes and yarns from the waste of other textile manufacturers, it sorts this waste by colour, tears the waste into raw cotton, spins the cotton into yarns and turns the yarns into textiles products. Their end product is fully made out of materials that else would have gone to waste.

The company has been founded by the owners of the clothing label: Costo. Costo produces clothing out of surplus materials, but the owners wanted to take the next step and produce clothes from discarded materials.

By looking at their product and industry from a circularity angle they have been able to adopt an innovation which allowed them to produce recycled products with a lower environmental impact because less dye is required since the textiles have been sorted by colour.

Since recently consumers have become more aware of the environmental impact associated with producing, especially low costs, clothing. Due to this increased awareness, Pure Waste Textiles has been able to differentiate themselves from other clothing companies. However recently other companies have also started to produce yarns and clothing from textiles waste. Through this process a new market for recycled yarns has been created. Other parties in this market are amongst others: Ecofi and Brentano.

Source: Ovaska Jukka-Pekka (2016), Business models for a circular economy: 7 Companies Paving the Way

Business benefits of the circular economy

Case study: Gispen
Circlar office furniture

Industry: Other manufacturing, and repair and installation of machinery and equipment
Country: The Netherlands
Benefits: Reduced exposure to rising and the volatility of resource prices; stimulates innovation; creates a green image

Gispen is a Dutch office furniture producer that has adopted circular economy strategies and practices to differentiate themselves in the marketplace and reduce their environmental impact. Adopting circular economy practices has provided Gispen with a green image, has reduced the exposure of Gispen to volatile resource prices and has stimulated innovation within the company.

Gispen's circular approach starts with the design of their furniture. When designing their products they take into account that: the used materials are renewable, the products have a long lifespan, their products can efficiently be shipped and transported, their products can easily be repaired and upgraded and their products can dissembled so that the parts/materials can be reused.

This has allowed Gispen to reuse (resell), refurbish, repurpose and recycle their products. It has allowed Gispen to differentiate itself from its competitors with product lines of refurbished and recycled furniture. These product lines have provided the company with a green image.

This approach also reduces Gispen's exposure to the risk of for example rising steel or oil (plastics) prices, because they can reuse/refurbish components from their existing products.

To be able to reuse/refurbish components from their existing products, Gispen even repurchases back from its clients after they have been used. Gispen includes terms about repurchasing its products in its sales contracts so clients are able to keep this value on the books.

For more information, see the Gispen website.

Source: Gispen (2017), website October 25th 2017

Business benefits of the circular economy

Case study: Bundles
Paying per use of a washing machine instead of owning the washing machine

Industry: Other manufacturing, and repair and installation of machinery and equipment
Country: The Netherlands
Benefits: Increased customer loyalty and more stable revenue streams

Bundles is a company that sells washing cycles instead of washing machines. This allows the company to provide consumers with very efficient and that consumers normally would not be able to afford. By adopting this business model the company's revenue streams are more stable.

Bundles does not only provide washing machines, but also detergent and a device that 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 WashApp displays tips to reduce costs and gives immediate feedback on the effect of different sorting, dosing and programming schemes. Not only does this reduces 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.

Bundles shapes the relationship with its customers as an operating lease, which means that Bundles retains ownership of the washing machine and receives a monthly fee from its clients.

These fees form a stable revenue stream, reducing the company's exposure to fluctuations in short-term demand.

For more information on circular business models, see: module 4.

Source: FinanCE (2016), Money makes the world go round

Business benefits of the circular economy

References to other resources

Publications

- World Business Council for Sustainable Development (2017), CEO guide to the circular economy
- Circle Economy et al. (2016), Mastering business value with the value hill

Videos

- Creating a circular economy: the challenges and opportunities for business

Tools

- European Resource Efficiency Excellence Centre
- European resource Efficiency Self-Assessment Tool for SMEs

Circular business models

Introduction

The objective of this module is to explain why adopting circular economy strategies and practices may require businesses to change their business model. As explained in chapter one, shifts occur when businesses move away from linear practices and use more circular principles, which can have a positive influence on societal and environmental challenges. In chapter two the benefits of a circular economy are demonstrated. This module builds upon the previous chapters by bringing the circular thought into the daily operating practice; the business model of organisations.

Adopting circular economy strategies and practices may require businesses to change their business model

When companies adopt circular economy strategies and practices they may also have to change their business model. This is because most of the regular business models are based on adding value to a particular product (e.g. by assembling bicycles from various parts), whereas in a circular economy the focus lays on maintaining value (e.g. remanufacturing bicycles). In order to be able to adopt such a circular model it may be required to keep access to the end product and the parts and materials it consists of. For example, in order to be able to remanufacture bikes the producer needs to have access to the bikes after they have been used. This access can be facilitated by no longer simply selling bikes but leasing them, or by offering a fixed repurchasing price when selling the product.

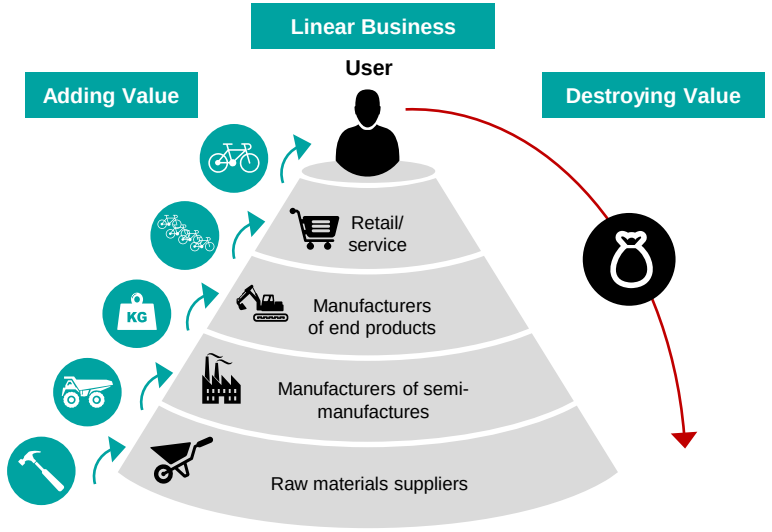
Alternative business models are increasingly being used and developed to combine economic growth while optimising the societal and environmental possibilities. This is a shift in the way business is done from quantity (selling as many products as possible) to quality (creating a business model around a product's longevity and closing resource cycles).

Source: (Ellen MacArthur Foundation, 2015; Bocken et al., 2016; Kraaijenhagen et al., 2016).

New circular business models aim to make products retain the highest level of value for as along as possible. From a business perspective this makes sense: reuse of materials can save costs and service models can deliver new business propositions and revenues.

The model below illustrates value creation in a linear economy in a 'value hill'. Value is added as the products are developed (the left side uphill slope) and once the product reaches the top of the hill, the product's value is at its maximum and the product is being used by the customer. After use products often end up in landfill or incineration, meaning that the product's residual value is lost. Circular business models have in common that they provide an answer to this value destruction.

Figure 4: the value cliff (Circle Economy, et al. (2016))

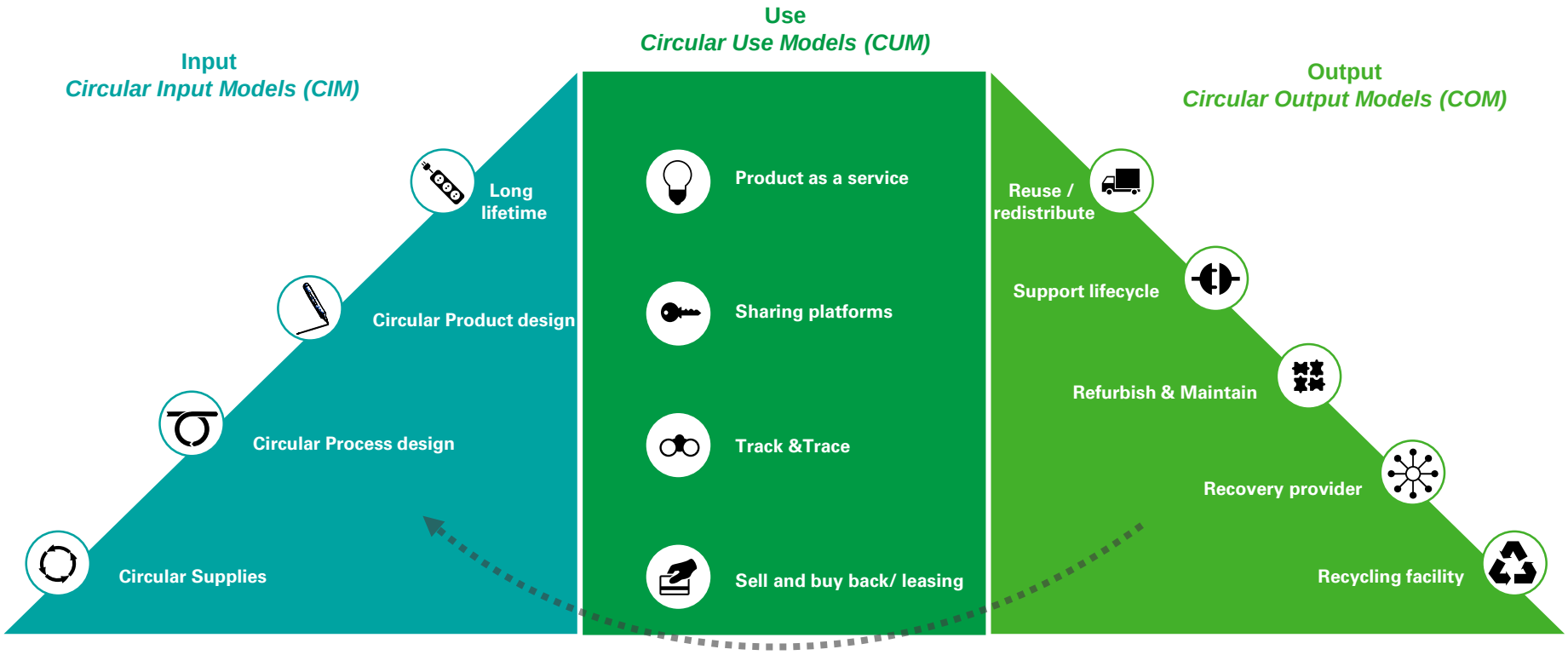


Circular business models

Circular business models along the value chain

The model below connects the 'value hill' previously explained with a categorisation of different kind of circular business models. There is not one 100% circular business model all organizations should aim for, but there are multiple options and combinations possible in order to gain a circular advantages. In the pages following the business models are explained, the chaining cost and finance structure elaborated, benefits showed and examples provided.

Figure 5: the value hill and its connection to business models (source: Circle Economy, et al. (2016), Master circular business with the value hill)



Circular business models

Circular Input Models (CIM)

Circular Input Models focus on input side of production covering design, production process and materials used. The table below provides an explanation of the different business models, how value is created and gives examples.

Circular Input Models (CIM)			
	Business model	**Explanation**	**Examples**
	Circular Supplier	Provides input materials such as renewable energy, bio-based, less resource-intensive or fully recyclable materials.	Smurfit Kappa
	Process design	Develops processes that increase the reuse potential and recyclability of industrial and other products, by-products and waste streams.	Desso
	Product design	Provides products that are designed to make them long and useful life and/or be easy to maintain, repair, upgrade, refurbish or remanufacture.	FairPhone
	Long lifetime	Classic long life business models that sell products with a long life at a high price (Bakker et. al., 2014)	Bundles

Circular business models

Circular Use Models (CUM)

Circular Output Models 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. The development of reverse logistics is essential for this model. The table below provides an explanation of the different business models, how value is created and gives examples.

Circular Use Models (CUM)

	Business model	Explanation	Examples
	Product as a Service (PAAS)	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.	Phillips light, Bundles
	Sharing Platforms	Enables an increased utilization rate of products by enabling or offering shared use/access/ownership.	Zipcar, AirBnB, Floow2, Peerby
	Tracing Facility	Providing services to facilitate the tracing, the marketing and trade of secondary raw materials.	Madaster
	Circular Leasing/ repurchasing agreements / sell and buy back	Sells a product on the basis that it will be purchased back after a period of time.	Desso

Circular business models

Circular Output Models (COM)

Circular Output 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[1]. The development of reverse logistics is essential for this model. The table below provides an explanation of the different business models, how value is created and gives examples.

Circular Output Models (COM)			
	Business model	**Explanation**	**Examples**
	Reuse/redistribute/ recaptured (material) supplier	Sells used products, materials and components to be used instead of virgin or recycled material.	Second-hand stores, koers group building materials
	Support lifecycle	Sells consumables, spare parts and add-ons to support the life cycle of long-lasting products.	Fairphone spares
	Refurbish & Maintain	Refurbishes and maintains used products in order to sell them[1].	Recovery-E, Desko
	Recovery provider	Provides take-back systems and collection service to recover useful resources from disposed products or by-products.	Recover-E
	Recycling facility	Transforms waste into raw materials. Additional revenue can be created through pioneering work in recycling technology.	Parley

Circular business models

Case study: Pharmafilter
Circular Output Model with hospital waste cycles

Industry: Water supply, sewerage, waste management and remediation
Country: The Netherlands
Type of business model: Circular output Model

The case study of Pharmafilter is an example of a Circular Output Model. It is a solution for optimal use of waste from hospitals and improving the quality of water leaving the facility. This system strives for it maximum reuse of raw materials and products minimize value destruction. The Pharmafilter system makes an important contribution reduce residues of the drug in surface water

Pharmafilter is an integral concept for care, waste treatment and water treatment for hospitals, nursing homes and other healthcare institutions. Pharmafilter has important benefits for the patient and the nursing staff. It improves the hygiene and efficiency within the hospital by replacing the cutlery, plates, bedpans and urinals with single-use products. These products, made of biodegradable plastics, are easy to use and reduce the number of contaminated wastes

These products are deposited with the waste from the daily care, including foodstuffs, faeces, gauze, needles and infusion bags in the Tonto®

This is in place of the conventional bedpan washer. The Tonto® is connected to the sewage and together with the wastewater from toilets, showers, washbasins and other sources the grounded waste is discharged via the existing internal sewage to the sanitation plant on the premises of the hospital. In this purification plant, solid and liquid waste is separated, the water is purified and all harmful substances for humans, animals and the environment are removed. The purification plant processes alongside the biodegradable products of Pharmafilter, such as the bedpan Olla®, also conventional plastics.

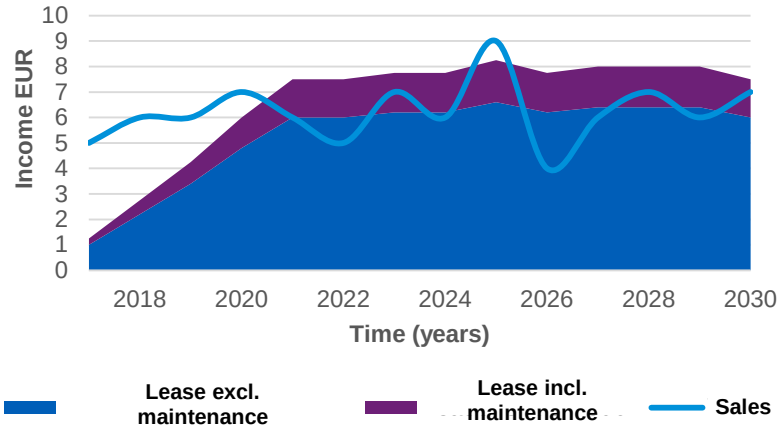
Source: Pharmafilter (2017)

Circular business models

Case study: Forklift Trucks
Circular Use Models and the financial effects

Industry: Manufacturing of machinery and equipment
Country: Possible anywhere
Type of business model: Circular Use Model

Simplified representation of lower production costs by reuse during lease contract.



Fictional income comparison: Lease (use + maintenance) versus Sales.

Source: KPMG (2017)

The figure on the left shows a case study for how a forklift truck can be used in a Circular Use model and its benefits. It aims to give insight into the financial effects of circular business model, specifically the effects of circularity on the balance sheet, cash flow projections, finance requirements, and other financials.

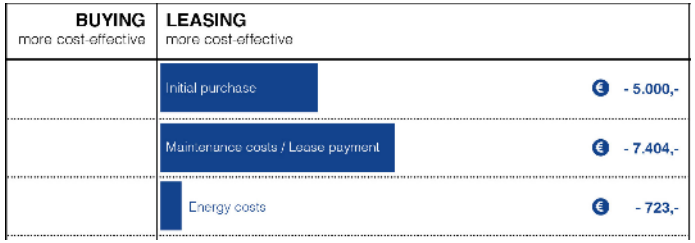
By leasing forklift trucks instead of selling them revenues come in more regularly. Although a higher initial investment is needed the circular business model can increase earnings.

In the figure on the left, the fictional revenue from Sales (Old Business Mode) is offset against Lease's fictional revenue (circular business model). It is apparent that the income in the first few years in the case of Lease is somewhat lower. This is because the producer is still in the so-called transit phase. During this period, the business needs to adapt to the new model and this takes some time. After a few years the income generated with the lease model by periodic use is back at the old level. The entrepreneur can accurately predict his / her income through the terminated lease contracts; The smaller volatility in lease income due to periodic use is visible because the dark blue line is much smoother than the light blue line. The extra lease income due to the sale of maintenance is shown by the purple area.

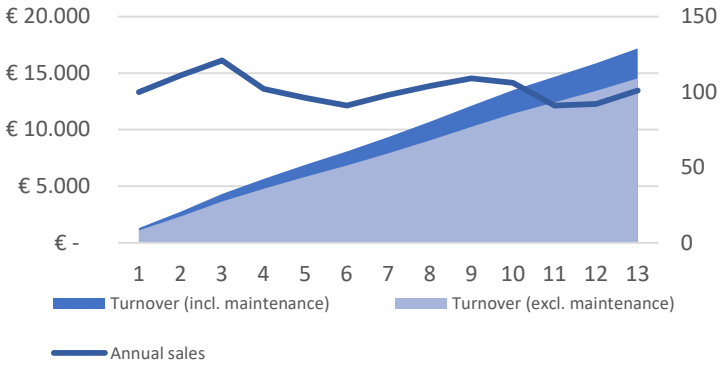
Circular business models

Case study: Elevators
Circular Use Models and the financial effects

Industry: Manufacturing of machinery and equipment
Country: Possible anywhere
Type of business model: Circular Use Model



Simplified representation of financial benefits for clients of a lease construction over product lifetime.



Fictional income comparison: Lease (use + maintenance) versus Sales.

Source: KPMG, 2016

Elevator manufacturers have traditionally supplied elevators on a product sale and ownership model. Under this model, customers make a significant initial investment to buy the elevator and must continue to invest in ongoing maintenance support for the lifetime of the product.

This model is arguably flawed from a sustainability perspective because the supplier's revenue is linked to ongoing maintenance needs. There is no incentive for the manufacturer to ensure the long-term resilience and durability of the product or to minimize product failures and maintenance needs.

This situation could change if customers leased elevators rather than buying them and made their investment decisions based on long-term rather than short-term price considerations. Under a leasing model, elevator suppliers would be incentivized to minimize maintenance needs and build elevators for long-term durability. This more sustainable approach would likely deliver environmental and social pay-offs to society as well as financial benefits for the suppliers and customers.

KPMG has tested this hypothesis for Mitsubishi Elevator Europe (MEE). The results showed that leasing rather than owning elevators makes sense from both a financial and societal perspective.

Circular business models

Case study : MUD Jeans
Circular Input Models with recyclable jeans

Industry: Manufacturing of apparel
Country: The Netherlands
Type of business model: Circular Input Mode

In Circular Input Models products are designed to last longer and/or to easily maintain, repair, upgrade, refurbish, remanufacture or recycle. A case study for this type of business model is MUD Jeans. They design their jeans to last a long time and are continuously developing the designs to be able to recycle more parts of the jeans that are produced. The input is pure cotton and natural dyes. This means that when products are returned they can be recycled. MUD jeans are currently working on chemically recycling the fibers in the clothing instead of mechanically breaking the fibers apart. This provides more possibilities for reworking the material into new textiles

They use certified cotton instead of conventional cotton and are made with up to 40% recycled content, as this has a lower impact on the environment and is easier to recycle after use. They focus on GHG emissions reduction and water use reduction in the production of their fabrics. They look at developing processes to increase reuse potential and recyclability and recyclability of industrial and other products, by-products and waste streams. They use a leasing and long life business model that sells products with a long life at a high price

Next to purchasing the jeans in the conventional way, users can lease Mud Jeans for €7.50 / month. After a year, users can either swap their jeans for a new pair, and continue leasing for another year; keep the jeans and wear them as long as they like; or end the relationship by returning the jeans to Mud and receiving a voucher for a new purchase.

Once the jeans have been returned to the company, they are checked and the materials will continue to flow through one of three loops. If the product is in good condition, it can be cleaned and re-used. While its competitors spend time, money and energy creating a ‘vintage’ look and feel for their products, they state returned jeans have developed this style naturally. When repair is required, the denim is given a stone wash or enzyme wash. When products are beyond repair, the materials are returned to the denim manufacturer to be recycled. Due to the multiple options for buying and re-selling Mud Jeans, the owners see “endless marketing opportunities” around their products, especially around maintaining and re-selling – the smaller loops in a circular economy.

All these aspects regarding the reuse of the products are already taken into account in the design phase of the product.

Source: MUD jeans (2017), website October 30th 2017; Ellen MacArthur foundation .

Circular business models

References to other resources

Publications

- World Business Council for Sustainable Development (2017), CEO guide to the circular economy
- Circle Economy et al. (2016), Mastering business value with the value hill
- FinanCE (2016), Money makes the world go round
- Philips (2016), Circular Lighting White papers
- Accenture (2014), Circular Advantage: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth
- Circle Economy & Sitra (2015), Service-based business models & circular strategies for textiles

Tools

- Delft University of Technology (2016), Circular Business Model Innovation

Circular supply and value chains

Introduction

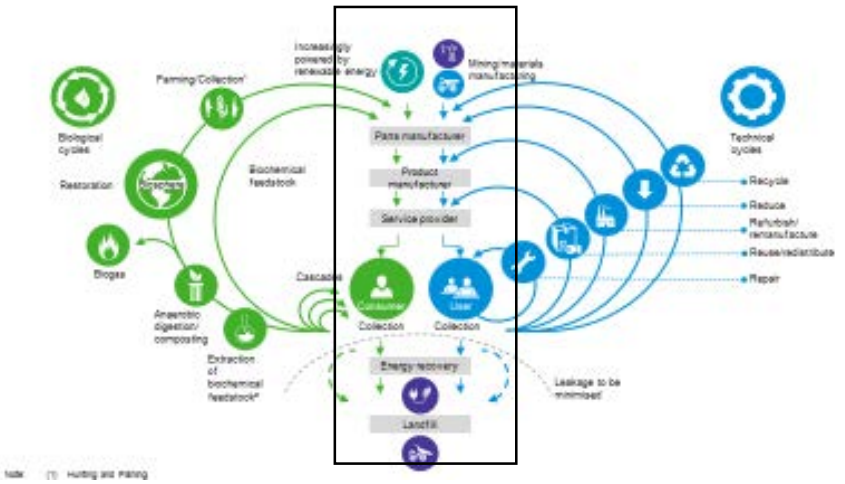
This module will elaborate on circular supply and value chains, it will explain why collaboration along both is a necessity to implement a circular business model and why collaboration will lead to the most societal benefits. For the purpose of this module a circular supply chain is defined as the process of all parties involved in fulfilling a customer request, while the circular value chain focusses on the activities of a individual company to create circular advantages.

Closing the loops of supply chains will increase the value which is preserved and reduce environmental impacts

The Ellen MacArthur foundation found that the European economy is very wasteful, only 40% of discarded material are recycled or reused, and hardly any recycling is very successful at capturing a part of the original value of the material. Meaning that a lot of negative externalities connected to this production are unnecessary and can be prevented. Common examples of negative externalities are: greenhouse gas emissions, traffic congestions, noise and resource scarcity. If the linear wasteful way of production is changed into a circular model throughout all supply chains, the environmental and societal benefits can be enormous. In your neighbourhood there will be less traffics jams, better air quality, and no landfills close to residential areas.

Globally, a circular economy would significantly reduce greenhouse gas (GHG) emissions through better waste management and reduced usage of resources (such as energy, water, land and materials) in manufacturing, with positive impacts on the climate. Large-scale reuse of raw materials could help reduce landscape and habitat disruption as well as marine littering, which would in turn help to limit biodiversity loss.

Figure 6, Visual display of a circular supply chain (source: adapted from Ellen MacArthur Foundation (2015))



The model displayed above is introduced on page 5 of chapter one. The grey boxes in the middle show standard supply chain steps; from raw materials, to manufacturers, wholesalers, retailers and finally the consumers. The blue and green upward arrows are the steps that need to be taken to create an circular supply chain.

Circular supply and value chains

Closing supply chains requires collaboration

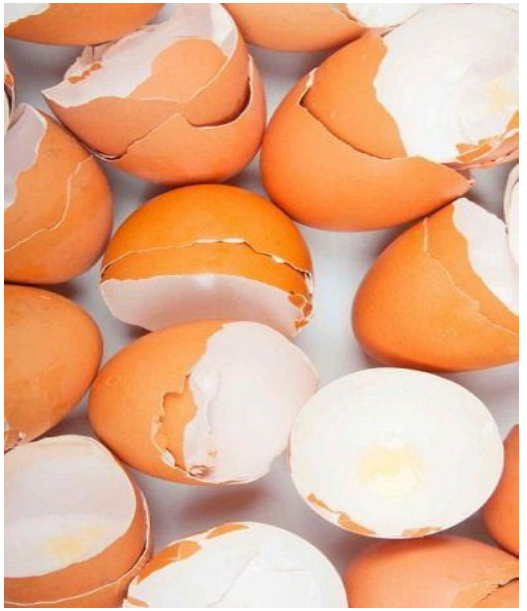
On the previous page a circular supply chain is visually displayed. The blue and green arrows are explained in module 1 and are concrete steps that an individual SME may be able to undertake. However, in order to create a full circular supply chain SMEs will have to collaborate with other partners. This may require a shift since generally a competitive relation with suppliers is common, as based on downstream cost reduction. 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 business Park 20|20 in Amsterdam. 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 as well as the benefits are greater in a circular model.

Depending on the sector and value chain in question, the best opportunities for circular value chains may not always be found within the same value chain. The best option may well be in cooperation with players from an unrelated value chain that may have inputs as a waste stream or could use some waste streams as an input.

Thus, implementing circularity is not just about looking forward and back but possibly looking at neighbours in other sectors. This topic will be covered in module 15.

An example of supply chain collaboration

A producer of liquid bottled egg white had one key waste stream; eggshells. In the original situation this costed the company between €100.000-€200.000 per month on waste management services. With the use of a circular company scan partners have been searched that could use this waste stream as a resource. As a result, extraction of biological materials from the shell could be used by biochemical and extraction of chalk could be used for building materials or agricultural solutions.



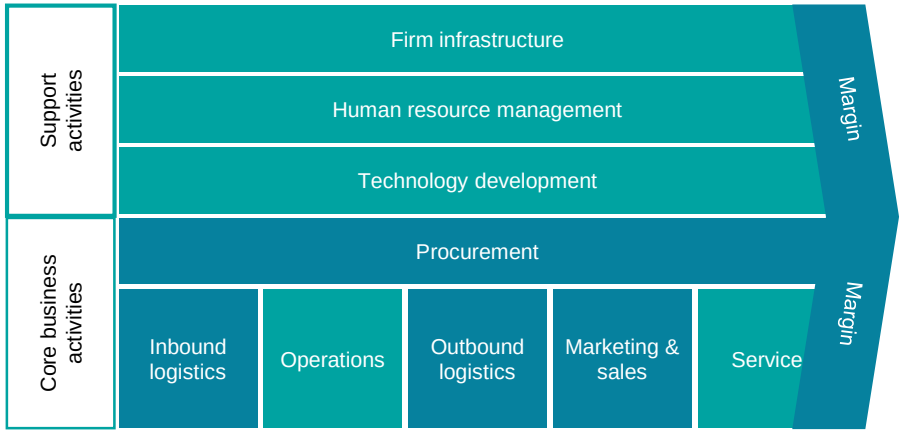
Circular supply and value chains

Adopting circular strategies changes the value chain

A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market. Activities which add product are for instance: procurement (lower procurement costs, increases the margin which adds value) and customer service (clients are generally willing to pay extra for excellent customer service). The set of activities that add value have been summarized in the Porter value chain model (Porter, 1985). This overview provides a good starting point to provide insight into the activities an individual company can undertake to create circular advantages. The activities in blue in the model on the right will be discussed in this chapter; procurement, logistics, marketing and sales.

The green sections are either covered in other modules or are not significantly influenced when adopting circular strategies and/or practices.

Figure 7: Porter value chain model (source: Porter, 1985)



Procurement: the choice of suppliers can be a first step towards circularity

By buying the right raw materials or other inputs, SMEs can improve the reuse or recovery potential of their products, or increase the share of recycled materials used. It can thus be a first step to implement a circular system in an SME.

Implementing this requires close cooperation with existing suppliers but also might require a switch to different suppliers. It may be that suppliers have to change their own production or procurement practices in order to allow for circularity along the supply chain of an SME. Alternatively, networks may have to be built with new suppliers if current suppliers cannot offer the required materials at the quality needed.

Overall, the idea is to take the costs over the product's complete life cycle into account when deciding on where to buy which inputs. But not only that. It also means engaging more closely with customers and inquiring what exactly the use and function of the product is. There might be better input which will change the product the SME sells, while still fulfilling the need of the customer.

Circular supply and value chains

An example of circular procurement

StoneCycling makes bricks from construction, demolition and industrial waste. Not only are the bricks made from 60-100% waste, the firing of the bricks can be done at temperatures 200° to 300° lower than regular bricks which reduces GHG emissions. To make the product a success, the company focuses on creating attractive designs of bricks that architects and developers would want to use regardless of their circular properties.

The greatest challenge for StoneCycling is a stable supply of separated waste streams. To achieve this the company is cooperating with one of the largest waste collectors in the Netherlands (SITA) who in turn encourages its customers to deliver their construction and demolition waste separated by materials. This cooperation thus creates a supply chain link between the waste streams of different companies in the construction sector, back to StoneCycling to make bricks from waste.

Source: Nederland Circulair (2017), link

In- and outbound (reverse) logistics: circularity means moving in circles

Reverse logistics refers to all logistics that need to be set up to allow for remanufacturing or recovery of materials. For example, an approach is that companies organise for products to be returned to the company after they have fallen into disuse. That means establishing a logistics system that allows consumers or businesses that used a product, to return it to the producer easily. The company can then use these returned products to extract raw materials and components and use them again in the production of new products.

Since the company has been involved in the production of the product, it has detailed knowledge on the mechanics of the product needed for dismantling, as well as the composition of materials. It can thus reuse materials much more efficiently and produce recycled materials of much higher quality than when recycling is done for a mix of products of different origins.

Even if a company does not disassemble or remanufacture the products itself, it can still be part of a reverse logistics system by facilitating that materials are returned to where they can be reused. Further, depending on the geographic stretch of value chains, it might not always make sense that parts are returned to the producing company. Remanufacture may take place at a different part of the value chain or from an external actor that then becomes part of the circular value chain.

Circular supply and value chains

An example of reverse logistics

Tale me is a French company that produces, rents and recycles maternity and baby clothing. Those are typically periods in which clothing can only be worn for a relatively short period of time.

Depending on the monthly fee (€19 or €29 for babies and €39 or €55 for pregnant women), consumers can order respectively 3 or 5 different items of clothing per month. The consumers order the clothing online and send them back to the company when they no longer fit. After receiving the clothing Tale Me cleans the items with eco-detergents and rents them out again. If the clothing is damaged, the fabrics are used to make new clothing items.

TALE ME

Source: Tale Me (2017), link

Marketing and sales: a green image sells

Consumers, businesses and governments are more and more aware of the environmental impact of the products which they use. They therefore are more tuned in to sustainability when making their buying decisions. By adopting circular economy strategies and practices the environmental footprint of products can be reduced which allows businesses to differentiate themselves from their competitors.

In addition SMEs will face more and more increased pressure from partners in the supply chain to work with, produce or provide products which meet sustainability requirements. Partially enforced by sustainability schemes which they adopt such as: ISO 14024 and the EU Ecolabel.

Circular supply and value chains

An example of green marketing

A&B Laboratorios de Biotecnología is a technology-based company located in Vitoria-Gasteiz (Spain). The company specialises in the research, design, and manufacturing of chemical and biological products for industrial and institutional use. The organisation has upheld the standard of biotechnology and environmental care for the past five years, and continues to expand its products and services across Europe. The company thrives by complying with the criteria requirements for its EU Ecolabelled products, this label (for more information see: module 8) ensures customers that their detergents and cleaners do not harm or threaten the environment, which supports their green marketing.

The company has set an agenda to produce products and disseminate information that closely aligns with its consumers' environmental values. A contributing factor to A&B Laboratorios de Biotecnología's success is its transparency with consumers. Accordingly, A&B Laboratorios de Biotecnología delivers product information by uploading videos and technical factsheets, which include the products' ingredients, on its website. A&B Laboratorios de Biotecnología has also integrated into its communication strategy a 'Supply Responsible Agreement' through which the company communicates to its clients the environmental and safety improvements of its products, EU Ecolabel licence updates, and results from the eco-design process.

Source: European Commission (2017), link

An example of supply chain collaboration

The first ever Scottish beer to be made from leftover bread has been created using unsold morning rolls in a bid to reduce food waste in Glasgow. It is made from mashed bread with no added fermentable sugars.

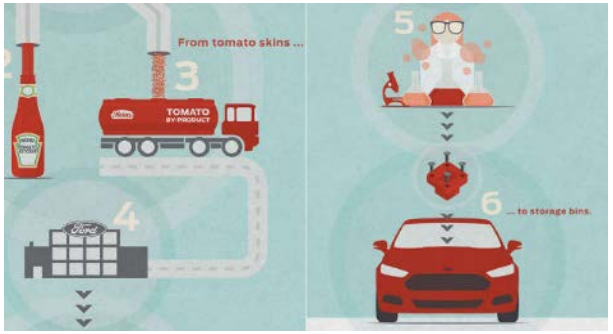
Hardtack is made by Jaw Brew in partnership with Aulds using surplus bread rolls. The collaboration was set up by Glasgow Chamber of Commerce and Zero Waste Scotland as part of an effort to create a 'circular economy' for the city. The example shows how two companies can work together to use waste products and, by adding value through the product development process, make a difference to their bottom line while at the same time helping the environment.

Source: JawBrew (2017), link

Circular supply and value chains

An example of supply chain collaboration

Ford and Heinz are investigating the use of tomato fibers in developing sustainable, composite materials for use in vehicle manufacturing. More specifically, dried tomato skins could become the wiring brackets in a Ford vehicle or the storage bin a Ford customer uses to hold coins and other small objects. Researchers were looking for innovative ways to recycle and repurpose peels, stems and seeds from the more than two million tons of tomatoes the Heinz uses annually to produce ketchup.



Source: Ford (2014), link

Circular supply and value chains

References to other resources

Publications

- Ellen MacArthur Foundation (2012), Towards the Circular Economy Vol. 3: Accelerating the scale-up across global supply chains
- Accenture (2017), Full Circle: Turning waste into value with your supply chain
- Circle Economy et al. (2016), Mastering business value with the value hill
- FinanCE (2016), Money makes the world go round

Videos

- World Economic Forum (2016), Five Circular Economy Business Models – Circular Supply Chains
- UNEP Climare Action (2015), Sustainable Supply Chain Innovation & The Circular Economy

Tools

- EU Ecolabel
- EU Organisational Environmental Footprint

Circular Design

Introduction

The objective of this module is to explain how products can be designed so they can be reused, repaired, refurbished, and/or recycled. In the previous modules it has been explained that in a circular economy the focus lays on maintaining the value of the materials used in products. Generally value is being added to products by transferring materials into parts and eventually whole products, e.g. iron into a bicycle frame and eventually together with other parts it forms a bike. The end-product, a bicycle, is more valuable than the sum of the value of the various materials which have been used and the labour and energy it required to form this into a bike. In a linear system this value would be lost when the bike is discarded and dumped in a landfill. In a circular economy the focus lays on maintaining the value of the materials in the bicycle. For example by repairing the bicycle, reusing parts of the bike in new bicycles and/or by recycling the materials used in the bicycle (this concept has ben explained in greater detail in module 3). However, this requires products to be designed in such a way that they can be repaired, reused, recycled etc. In this modules we focus on a set of principles which can guide SMEs in designing products so that they fit into a circular system.

Principles of Circular Product Design

We refer to product design in a circular economy as 'Circular Product Design'. The following seven principles for circular product design together form a concise guide to what circular product design entails. The order of the principles is based on how much of the value of the product can be retained by applying the principle (descending order).

These various principles can be combined but may not apply to all products dependent on the type of product, the business model through which the product is provided to the user, the supply chain and/or technological constraints.

Principle 1: Design products to last for a long period of time

By designing products to last longer the technical lifetime of a product is extended. Products should be made to be durable and reliable. By taking into account that the product should be usable for a long time choices can be made for suppliers and materials of good quality and assembling products to be reparable and difficult to break.
Good examples of products that meet this principle are: the Nokia 3310 and Swiss army knifes.

Principle 2: Design products so that they will be used for a long period of time

Except for designing products to be durable and reliable they should also be designed so customers are willing to use them for a long time to maintain the highest value for longer. By increasing customers attachment to products the will to keep it and effort they will put in maintaining it is increased.
Good examples of products which meet this principle are: Rolex watches and Levi's jeans.

Principle 3: Design standardized and compatible products/ use standardized and compatible parts

By designing products that are standardized and compatible they become easier to repair or refurbish, if it is not done in a leasing system by the original manufacturer already itself.
Good examples of products which meet this principle are: battery size and hard drives.

Circular Design

Principle 4: Design for ease of maintenance and repair

By taking into account which components will fail first into the design process and making sure that these can be replaced or repaired it becomes easier to maintain the value of the product.
Good examples of products which meet this principle are: Philips lighting and Fairphone.

Principle 5: Design for upgradability and adaptability

This principle incorporates possibilities to change products. By recognizing that customers will want to improve or change some aspects during the design phase this becomes possible during use.
Good examples of products which meet this principle are: Fairphone camera upgrade possibilities and software updates, bugaboo fabric colours

Principle 6: Design for disassembly

To be able to separate parts and materials within a product disassembly is an essential aspect of the design phase.
Good examples of products which meet this principle are: the Sanwichbike and Dell using minimal glue.

Principle 7: Design products that exist out of materials that can easily be recycled

The materials that are used in a product play a large role in how they can finally be recycled. By using materials either in the biological cycle or the technological cycle products do not become complex hybrids of the two. Using materials that can be recycled in standard recycling facilities also improves recyclability.
Good examples of materials which meet this principle are: biological cotton and metal alloys.

When applying these principles it is important to think about the business model

When applying these principles it is important to keep in mind through which business model (see: module 3) the products will be provided to the client since these models may expose companies to particular risks (e.g. paying per use for products which do not last long).

Circular Design

Case study: Patagonia
Clothing

Industry:	Manufacturing of apparel
Country:	Worldwide
Product Design:	Design for reliability and durability , Design for attachment and trust Design for ease of maintenance and repair

Patagonia is a clothing company that designs for durability and repair. They also design for attachment and trust and have their own support on how to repair products on the website which encourages buyers to repair, or reuse products.

They have launched an e-commerce Worn Wear platform where the company sells used Patagonia clothing and gear online, sourced directly from its customers. The retailer launched Worn Wear in 2013 as a way to encourage consumers to take care of their gear, washing and repairing as needed, and eventually recycling once the garment can no longer be used. This website also contains a section with stories of customers and their Patagonia clothing. This expresses the success of Patagonia of designing for attachment and trust. Patagonia's Worn Wear repair facility repairs over 45,000 items per year and the company operates retail repair stations around the world, in addition to providing its customers with free tools for repairing their own clothing.

This benefits for Patagonia include that it allows them to benefits from customer loyalty and a market of customers that find the sustainability of the products they buy important. The Worn wear also makes it possible to earn money by reselling products instead of selling them only once. They increase the chance buyers will return to them after selling through their website. With every repair, the company can provide feedback to their designers to improve future products.

Source: Patagonia link

Circular Design

Case study: Gerard Street
Modular headphones

Industry:	Manufacturing of consumer electronics
Country:	the Netherlands
Product Design:	Design for disassembly, design for ease of maintenance and repair, design for durability

Gerrard Street is a start-up in Amsterdam that produces high quality modular headphones. The headphones are offered through a subscription model, where customers pay either a monthly or annual fee (respectively €7,50 or €70 for the standard headphone, and €10 respectively €100 for the wireless headphone). There is also a completely refurbished model, which costs €6 per month or €60 per year.

The headphones are of high quality and designed to break down less quickly. The headphone is being delivered in separate components and can be easily (dis)assembled. The modular design has the benefit that if any part or component of the headphones is broken, customers can return that part to Gerrard street for repair or recycling – which is included in the fee. Through this service model they can reassure that their clients can always enjoy a perfect sound.

Source: Gerrard Street (2015)

Circular Design

Case study: Agency of Design
Chairs designed for recyclability

Industry:	Household appliances
Country:	United Kingdom
Product Design:	Design for reliability and durability, Design for ease of maintenance and repair, Design for dis- and reassembly

The Agency of Design is a design studio that examines the implications of circular design for products. In their project: 'Design out Waste' project, the Agency of Design employed three very different design strategies to a toaster. The aim was to demonstrate how through considered design of both widgets and systems, materials flows could be optimised.

The first strategy resulted in the Optimist toaster, in which the AoD emphasised longevity, repair and material value. The manufacturing process created a product with imperfections in the casting, adding character to the item.

The second strategy resulted in the pragmatist which was designed to directly connect the manufacturer with the consumer, to create ongoing material flows. This strategy resulted in a toaster which exists out of modular slots which join together to create the size of toaster desired by the consumer, and which could be send back to the producer in the mail (fits through a letterbox) when it fails.

The third strategy resulted in the realist model, which is low-end market model which can be disassembled at very low costs by putting the product in a vacuum chamber.

Source: Agency of Design (2017), link; Ellen MacArthur Foundation (2017), link

Circular Design

References to other resources

Publications

- Conny Bakker et al. (2015), Products that last

Videos

- Ellen MacArthur Foundation (2016)

Tools

- Circular design Europe
- The Circular design guide

This section consists of three modules which give an introduction to various EU, national and regional financial and non-financial instruments which are helpful for the members of your organisation. The purpose of this section is to provide you with insights into how adopting circular business models influences the financing needs of SMEs and to help you in guiding SMEs to funding opportunities and non-financial instruments.

Module 6:
National, regional and market funding opportunities and financial instruments

Module 7:
EU level financial instruments

Module 8:
EU level non-financial instruments

National, regional and market funding opportunities and financial instruments

Introduction

The objective of this module is to explain and demonstrate how adopting circular business models impacts the financing needs of SMEs and to introduce you to funding opportunities to meet these needs. As explained in module 3: Circular business models, it is often necessary for businesses to adopt circular business models so they can retain ownership over their products, parts of their products and/or the materials in their products and are therefore able to reuse, redistribute, refurbish and/or recycle their products at the end of the use-period. However retaining ownership often implies that these products remain on the balance sheet of the company, resulting in the need for additional financing.

Circular business models generally require more financing

Traditional linear businesses sell products or deliver services for which they receive a one-time payment. With this payment they can finance the procurement of new goods from their supplier which they can sell. However in the circular economy businesses often wish to retain ownership over their products, parts of their products and/or the materials in their products so they can reuse, redistribute, refurbish and/or recycle their products at the end of the use-period. They therefore adopt circular business models such as 'product as a service' in which users regularly pay a fee for being able to use the product rather as acquiring the product. For example, Philips offers the possibility to its clients to pay for light as a service rather as buying lamps so Philips can refurbish these and is able to invest in lightbulbs which last a long-period of time.

In such models, products that were previously sold will often remain on the company's balance and the service contract will result in a debt of the user to the company. This increases the company's operating assets.

From a corporate finance perspective this is undesirable because it requires the company to attract additional working capital to be able to produce so many products- and sell so many contracts to the point that it can finance its procurement and operations out of the regular fee from the contracts.

Circular business models are difficult to finance

For most SMEs the logical way to acquire the money to be able to adopt a circular business model is to get a bank loan. However it is difficult for bank to finance circular business models.

Banks transfer money from savers to borrowers in return for a margin between the interest on savings and the interest on loans. To not lose the money of the savers banks must be prudent in their lending. That is why the following aspects are important in banking:

- *Cash flow:* The cash flow of the business which receives a loan determines its ability to be able to pay back the loan and to the interest on the loan.
- *The amount of capital and the reserves of a borrower:* Capital and reserves act as a buffer in situations in which the borrower is not able to pay for its loan via the cash flows.
- *Credit history or track record of the borrower:* The credit history or the track record of borrower substantiate that the borrower has been able to pay for its loans in the past and is therefore more likely to be able to do so in the future.
- *Collateral:* Collateral acts as a security for the bank in the situation where a borrower is not able to pay for its loan (ING, 2016).

These aspects are influenced by adopting circular business models:

- *'Product as a service' and other models in which the user pays a regular fee for being able to use the product reduce cash flows in the short-term.* 'Product as a service' and other models in which the user pays a regular fee for being able to use the product (hereafter: pay per for use models) result in a longer financial relationship between company and the customer. Instead of buying the product the customer pays a regular fee. Therefore the cash flow is spread over time. Since the cash-flows are spread over time the pay back period of an investment becomes very relevant for the risk for the bank.

- *Pay per use models may attract less creditworthy clients.* Ideally businesses and financers want pay per for use models to be used by clients which are creditworthy to reduce the risk that the will not be able to pay the regular fee. However these models may attract less creditworthy clients which are not able to purchase the product and can only make use of it in a pay for use model.

- *The products on the balance sheet can often not be used as collateral.* The products which the business provides to the customer but remains the owner of can often not be used as collateral because the products are not accessible to the business (they cannot be sold-off).
  An additional aspect which makes using the products as collateral difficult is that it can be difficult to determine the end-of-use/residual value of products after they have been used by the customer. Without a good valuation which captures the resale value, the refurbished value or the value of the product as a basis for renewed products the book value may be zero. Which makes it unsuitable as a collateral.

Solutions for financing circular business models

Combining multiple forms of capital and different forms of loans

In order to reduce the overall risk for the bank despite the previously listed risks businesses can raise capital in the form of equity. Par example through crowd funding impact investors, venture capital, private equity or family offices. This reduces the risk for the bank because it acts as a buffer in case the company is not able to pay for the loan via the cash flows. The downside of raising equity finance is that it is relatively expansive and only suitable for businesses with either a high growth or which are quite large.

Another solution is to combine traditional bank loans with other forms of debt finance, par example: lease, factoring & supply chain finance, structured finance and near banks.

Contracts can be instrumental in reducing the risk for financers

There are legal issues that might restrict the finance ability of circular business models. An example is that legal ownership over products and materials might become unclear. Another example is that ownership over the products might be lost in the case that the customer goes bankrupt. These issues can be resolved through contracts. This makes contracts instrumental in financing circular business models.

National, regional and market funding opportunities and financial instruments

Figure 8, Overview of financing instruments for circular economy business cases (source: ING, 2015)

Means to finance circular business models	
Bank finance	Corporate debt
	Lease
	Factoring & Supply chain finance
	Structured finance
	Balance sheet reduction through off balance finance
Capital Markets	Equity finance: Initial Public Offering
	Debt finance: Green bonds
Foundations and Impact investors	
Venture Capital, Private equity, Family Offices	
Near banks like Google, Apple, Amazon	
Crowd funding	Peer2Peer lending
	Equity investment

An example of financing a circular business case

The Dutch mobile device maker Fairphone, which designs modular smartphones with the aim of supporting reparability and encouraging sustainability, has taken in new investment of €6.5 million

The company had used a crowdfunding route to help them build that first device. However, the new investment is aimed at trying to scale its approach to building sustainable electronics “throughout the entire electronics value chain, including material sourcing, production, distribution and recycling”.

The funding is coming from Pymwymic Impact Investing Cooperative, which invests in companies with an environmental or social purpose; along with another social impact investor, DOEN Participates, the investment arm of the Dutch Postcode Lottery (and also an investor in Fairphone from the beginning); plus some unnamed others.

FAIRPHONE

Source: Techcrunch (2017), link

National, regional and market funding opportunities and financial instruments

An example of financing a circular business case

Bundles is a Dutch 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.

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.

Bundles
We love laundry

Source: FinanCE (2016), link

Objectifying the value of products through second hand markets or by taking the end-of-life value into account

Second hand markets can help reduce the risk for the bank because they help to substantiate the value of a product after it used by the customer. Therefore the products do not need to be written-off to zero. In accounting terms this reduces the need for financing and makes the products on the balance sheet more suitable to be used as collateral. A similar solution is to take the end of life value of the products into account. When products are designed for disassembly they may hold a residual value which is higher as the scrap value because their parts/materials can be reused. This also reduces the needs for products to be written-off to zero.

Financial solutions via development banks

Circular economy is one of the topics where multinational development banks can provide financial solutions. Multilateral Development Banks (MDBs) such as European Investment Bank (EIB) or European Bank for Reconstruction and Development (EBRD) offer support in assessing whether a circular economy projects is eligible for financing and which instruments are suitable.

MDBs can have a role on green credit lines for intermediary loans whereas funding initiatives supported/initiated by them can take a role in direct financing of the projects. Moreover the banks provide advisory services to support the development and structuring of circular economy projects as well.

National, regional and market funding opportunities and financial instruments

Other solutions via development banks

European Investment Advisory Hub

The European Investment Advisory Hub, an integral part of the Investment Plan for Europe, is a single point of entry for advisory services for investment projects in the EU. Services available via the Hub include project development support throughout all stages of the project cycle, as well as upstream or policy advice on market studies, sector strategies, and project screening. The circular economy is one of the focus areas of the Hub. Financial advice is also provided to assist managing authorities in establishing financial instruments and enhance companies' ability to access adequate sources of financing. More horizontal assistance can be obtained via process and methodological guidance and training on a number of issues related to investment projects, access to finance and the use of EU funds.

European Bank for Reconstruction and Development (EBRD)

Within the Small Business Initiative, in addition to finance, EBRD also provides business advice to help small and medium-sized businesses grow, succeed, then grow again, becoming genuine catalysts for their local economies and region. They also support business to attract investment by creating business plans, undertaking feasibility studies or raising accounts to international standards.

National, regional and market funding opportunities and financial instruments

References to other resources

Publications

- ING (2015), Rethinking finance in the circular economy: financial implications of circular business models
- FinanCE (2016), Money makes the world go round
- Circle Economy et al. (2016), Mastering business value with the value hill
- Circle Economy et al. (2016), Create a financeable circular business case in 10 steps
- Circle Economy et al. (2016), 6 guidelines to empower financial decision-making in the circular economy

Tools

- European Investment Bank
- InnovFin Advisory
- European Investment Bank Advisory Hub

EU level financial instruments

Introduction

The objective of this module is to introduce a selection of the financial instruments which the European Commission and other EU institutions (e.g. the European Investment Bank) offer to help SMEs to adopt circular strategies and practices. This information can form the basis for SME support organizations to start helping their members to apply for various forms EU funding. First the different types of programs are shortly explained. These programs are then elaborated on to show the direct instruments that can be used by an SME.

The EU has six major programmes which offer instruments to help SMEs adopt circular strategies and practices

Since adopting the Circular Economy Package to help European businesses to make the transition to circular economy, the Commission has implemented various financial instruments. Six of these major programmes include financial instruments are (partially) focused to (also) help SMEs to adopt circular strategies and practices.

These six major EU level programmes are:

- *Horizon 2020:* Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.
- *COSME:* COSME is the EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises.
- *LIFE:* The LIFE programme is the EU's funding instrument for the environment and climate action.
- *European Structural and Investment Funds (ESIF):* The European structural and investment funds have the purpose to invest in job creation and a sustainable and healthy European economy and environment.
- *European Fund for Strategic Investments (EFSI):* The European Fund for Strategic Investments is an initiative launched jointly by the EIB Group and European Commission to help overcome current investment gaps in the EU.
- *InnovFin:* InnovFin – EU Finance for Innovators is a joint initiative by the EIB Group and the European Commission to facilitate and accelerate access to finance.

EU level financial instruments

Horizon 2020

Outline of the programme

Horizon 2020 is the financial instrument for implementing the Innovation Union. This is flagship project of Commission aimed at securing Europe's global competitiveness. It is the largest EU Research and Innovation programme with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition it is expected that this program will attract private investment.

Offered support to SMEs

Horizon 2020 stimulates SME participation in its program via a SME-exclusive instrument and is open to applications from all sectors. Via this instrument over €8 billion support for Research and Innovation activities will find its way directly to SMEs, often to consortia participating in collaborative research and innovation projects. By July 2017, SMEs had received €3,5 billion in grant money. The SME instrument encourages SMEs to put forward their most innovative ideas with an EU dimension that can not find financing on the market, in particular high-potential but high-risk innovative ideas. The instrument provides full-cycle business innovation support from business idea conception and planning over business plan execution and demonstration to commercialization.

How to apply for Horizon 2020 funding

Throughout the year the Commission publishes Calls of its research and innovation programmes on an online portal. Via this portal SMEs express interest in these programmes and can submit their proposal to receive funding. Each call for proposal gives more precise information on the questions that the Commission would like SMEs to address in their proposals.

National contact points have been appointed in each of the EU member states which can provide support to submit a successful proposal. In addition Enterprise Europe Network offers free several days of specialized support to support with Horizon 2020 applications.

Steps to apply for Horizon 2020 funding

1. Find call for proposal
2. Connect with partners (if required)
3. Register your organization on the Participant Portal
4. Submit proposal online
5. Receive evaluation (five months' duration)
6. Receive and sign the grant agreement

EU level financial instruments

COSME

Outline of the programme

COSME is the EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises running from 2014 - 2020. Via this program the Commission aims to promote entrepreneurship and improve the business environment for SMEs. It is expected that 330,000 SMEs will receive loans backed by COSME guarantees with a total value of lending up to €21 billion. In addition 500 firms will receive equity finance trough the program, with an overall investment up to €4 billion.

Offered support to SMEs

COSME aims to make it easier for SMEs to attract financing in all phases of their lifecycle – creation, expansion, or business transfer and is open to SMEs from all sectors. COSME exists out of two separate financial instruments:

- *the Loan Guarantee Facility* which focuses on sharing risks with intermediaries;
- and the *Equity Facility for Growth* which provide direct funding.

In addition to providing financing COSME also aims to support SMEs by:

- *supporting internationalization and access to markets*;
- *creating an environment favourable to competitiveness;*
- and *encouraging an entrepreneurial culture*.

How to apply for COSME funding

For the Equity Facility for Growth the Commission publishes calls for proposals online on the COSME portal. Each call for proposal gives more precise information on the questions that the Commission would like SMEs to address in their proposals. Note: COSME's Loan Guarantee Facility is channelled through local financial institutions in EU Member States.

SMEs can not directly apply for financing through the Loan Guarantee Facility. This form of financing is channelled through local financial institutions.

Steps to apply for COSME funding

1. Find call for proposal
2. Connect with partners (if required)
3. Register your organization on the Participant Portal
4. Submit proposal online
5. Receive evaluation (five months' duration)
6. Receive and sign the grant agreement

The application process via local financial institutions differs.

EU level financial instruments

LIFE

Outline of the programme

The LIFE programme is the EU's funding instrument for environment and climate action. The general objective the instrument is to contribute to the implementation, updating and development of EU environmental and climate policy and legislation by co-financing projects. Since 1992, LIFE has co-financed more than 4,500 projects. For the 2014-2020 funding period, LIFE will contribute approximately €3.4 billion to the protection of the environment and our climate.

Offered support to SMEs

LIFE funds innovative projects that demonstrate new techniques and methods. For SMEs interested in circular economy, the sub-programme for "Environment" is highly relevant. This sub-programme co-finances projects to develop, test and demonstrate policy or management approaches, best practices and solutions in resource efficiency.

The related sub-programme for "Climate Action" with the priority area "LIFE Climate change Mitigation" may also be relevant. This sub-programme co-finances action grants for best practices, pilot and demonstration projects that contribute to the reduction of greenhouse gas emissions.

How to apply for LIFE funding

A call for proposals is published every year, meaning that every 12 months SMEs can apply for LIFE funding by using the application packages that provide help to prepare proposals. National contact points have been appointed in each of the EU member state which can provide support to submit a successful proposal.

EU level financial instruments

ESIF

European Union
European Structural and Investment Funds

Outline of the programme

Over half of the EU's budget is channelled through the five ESIF funds. The purpose of all these funds is to invest in job creation and a sustainable and healthy European economy and environment. These five funds are:

- *European regional development fund (ERDF):* promotes balanced development in the different regions of the EU;
- *European social fund (ESF):* supports employment-related projects throughout Europe and invests in Europe's human capital;
- *Cohesion fund (CF):* funds transport and environment projects in countries where national income is less than 90% of EU average;
- *European agricultural fund for rural development (EAFRD):* focuses on resolving challenges facing EU's rural areas;
- and the *European maritime and fisheries fund (EMFF):* helps fishermen to adopt sustainable fishing practices.

Offered support to SMEs

Support for SMEs is one out of the key priority areas of ESIF. Most of the budget is spent on "research and innovation", "competitiveness of SMEs" and "low-carbon economy. Some ERDF resources (12-20% depending on region) must be channelled specifically towards low-carbon economy projects.

How to apply for ESIF funding

ERDF (as well as the other four funds) are managed by the EU member states. Most countries have implemented multiple ERDF projects. Funding opportunities under ERDF can be found through national authorities. Applications for funding need to be done through these national ERDF managing authorities. The major funding requirement is that the applicant's funding request is in line with the priority areas and themes defined under the ERDF.

EU level financial instruments

ESFI

Outline of the programme

EFSI is an initiative launched jointly by the European Investment Bank and European Investment Fund and the Commission to overcome the current investment gap in the EU. It aims to mobilise private investment in projects which are strategically important for the EU by offering financial guarantees. Through this instrument the Commission aims to unlock €315 bn of investments by 2018. The focus lies on the following sectors:

- *Strategic infrastructure* (including digital, transport and energy);
- *Education, research, development and innovation*;
- *Renewable energy and resource efficiency*;
- and *SMEs*.

Offered support to SMEs

EFSI addresses SMEs mainly via financial intermediaries who will in turn lend to local companies. The EIF supports SMEs by working with a wide range of funds, banks, guarantee and microfinance institutions across Europe. These act as EIF's financial intermediaries and provide financial products to SMEs. Midcaps and SME with less than 250 employees can apply for growth finance or intermediated lending, and may benefit from EIF's equity, loans (debt) or guarantee products. Projects supported by EFSI shall typically have a higher risk profile than projects supported by EIB normal operations.

How to apply for ESFI funding

EFSI is demand-driven and provides support for projects everywhere in the EU. There are no geographic or sector quotas. Projects are considered based on their individual merits. Anyone can submit their request for financing to the EIB for infrastructure and innovation projects, and for SME financing, to EIB and EIF partner institutions in each country. To benefit from EFSI resources deployed through the EIB, your projects need to undergo the standard EIB due diligence process.

EU level financial instruments

InnovFin

Outline of the programme

InnovFin stands for ‘EU Finance for Innovators’. This is a joint initiative launched by the European Investment Bank and the Commission. The instrument aims to facilitate and accelerate access to finance for innovative businesses and other innovative entities in Europe by providing financing for research and innovation. Financing can be provided in a variety of forms (e.g. equity, loans, guarantees) and can either provided directly or via a financial intermediary.

Offered support to SMEs

InnovFin can provide financing starting at €25.000,- for investments in research and innovation (R&I) to companies and other entities of all sizes and age. InnovFin is available across all eligible sectors in EU member states and associated countries.

How to apply for InnovFin funding

The eligibility criteria should be checked with the individual financial intermediaries as these products are made available through financial intermediaries. The intermediary’s due diligence process will determine the time elapsing between first contact and signature of a financing contract.

EU level financial instruments

More information on the EU level financial instruments

Horizon2020

- General information
- Find calls for proposals
- Find information on SME-exclusive instrument

COSME

- General information
- Find a local financial institution

LIFE

- General information
- Find calls for proposals

ESIF

- General information
- General information on ERDF
- Find national ERDF projects

ESFI

- General information
- Find national EFSI projects
- EFSI Application information
- EIF financial intermediaries

InnovFin

- General information
- Information on InnovFin Equity
- Information on InnovFin SME Guarantee

EU level non-financial instruments

Introduction

The objective of this module is to introduce a selection of the non-financial instruments which the European Commission offers to SMEs to help them adopt circular strategies and practices. This information can form the basis for SME support organizations to start helping their members to make use of these instruments. First the different types of programs are shortly explained. These programs are then elaborated on to show the direct instruments that can be used by an SME.

The EU has five major programmes which offer non-financial instruments to help SMEs adopt circular strategies and practices

Since adopting the Circular Economy Package, the Commission has implemented various programs to help businesses adopt circular economy strategies and practices. Including five major programmes which offer non-financial instruments to help SMEs.

These five majors EU level programmes are:

- *Product Environmental Footprint (PEF):* PEF is a multi-criteria measure of the environmental performance of a good or service throughout its life cycle.
- *Organisational Environmental Footprint (OEF):* OEF is a multi-criteria measure of the environmental performance of a goods/services-providing organisation from a lifecycle perspective.
- *EU Eco-Management and Audit Scheme (EMAS):* The EU Eco-Management and Audit Scheme (EMAS) is a premium environmental management instrument developed by the European Commission.
- *EU Ecolabel:* The EU Ecolabel is a third party certified Type I ISO 14024 aimed to promote products and services that have a reduced environmental impact.
- *Environmental Technology Verification programme (ETV):* The ETV programme allows new environmental technologies that do not fall under existing labels or certification to obtain a statement verifying claims regarding their performance.

In addition to abovementioned instruments there is one major EU level programme to help SME support organisations with the implementation of circular economy amongst SMEs.

- *European Resource Efficiency Knowledge Centre (EREK):* EREK is a platform to enable and reinforce businesses and especially SMEs to take action for Resource Efficiency in Europe and beyond.

EU level non-financial instruments

PEF

Outline of the programme

PEF stands for: Product Environmental Footprint. The programme offers a set of common voluntary methodologies to facilitate the calculation of the environmental footprint of products / to perform Life Cycle Analyses (LCAs). It enables to assess, display and benchmark the environmental performance of products. Such analyses can help companies to support the claim that their product is more sustainable in comparison to the products of competitors and to test impacts of the circular business models, validate their assumptions and get feedback for improvement.

Between 2013-2017, PEF pilot projects were initiated with the aim of developing such a harmonized environmental foot printing methodology for products. The approach was tested together with more than 280 volunteering companies and organisations. Based on the results of the testing, the European Commission will propose how to use the PEF in future policies (e.g. labelling).

Offered support to SMEs

SMEs benefit from the results of the PEF pilots by:

1. A guide on how to calculate a PEF
2. Product category-specific methodological requirements
3. Best-practice example PEFs from different sectors
4. Principles for communicating product environmental performance
5. Improved data availability via Life Cycle Inventory (LCI) datasets

As a consequence, SMEs are able to measure, manage (e.g. reduce emissions) and communicate their PEF. In addition, the EC initiated the development of open-source software tools for SMEs to calculate the PEF. The tools will be shaped around 4 pilot cases : beer, leather, olive oil and T-shirts. Currently there are already three e-learnings available on PEF in English, German and French which can help companies understand the Environmental Footprint and the type of information they will find in PEF.

Benefits for SMEs

Life Cycle Assessments are useful tools to compare products and to demonstrate environmental sustainability. The advantage for SMEs is that standardized methodologies from the PEF can be used, which facilitates uptake and reduces costs of a life cycle assessment in comparison to a tailor made LCA.

EU level non-financial instruments

OEF

Outline of the programme

OEF (Organisational Environmental Footprint) is a multi-criteria measure of the environmental performance of a goods/services-providing organization from a lifecycle perspective. Opposed to the PEF, it enables to assess, display and benchmark the environmental performance of organisations rather as products. The outcomes of such analyses may help companies to measure and manage/improve their environmental performance (e.g. reduce water consumption).

Between 2013-2017, OEF pilot projects were initiated with the aim of developing such a harmonized environmental foot printing methodology for products. The approach was tested together with more than 280 volunteering companies and organisations. Based on the results of the testing, the European Commission will propose how to use the OEF in future policies (e.g. labelling).

Offered support to SMEs

SMEs benefit from the results of the OEF pilots by:

1. A guide on how to calculate a OEF
2. Sector-specific methodological requirements
3. Best-practice example OEFs from different sectors
4. Principles for communicating organisational environmental performance
5. Improved data availability via Life Cycle Inventory (LCI) datasets

In addition, the EC initiated the development of open-source software tools for SMEs to calculate the OEF.

Benefits for SMEs

Using the OEF can help SMEs to stand out with regard to their environmental performance and business model. The development of open-source software will result in lower costs of implementation for SMEs in comparison to other tools and professional-services to assess the footprint of an organisation.

EU level non-financial instruments

EMAS

Outline of the programme

The EU Eco-Management and Audit Scheme (EMAS) is a premium environmental management instrument developed by the Commission for companies to evaluate, report, and improve their environmental performance. Companies can obtain the EMAS label if they comply with EMAS criteria on energy efficiency, material efficiency, emissions etc.. Companies need to follow 10 steps to get certified by EMAS (see: figure 9).

Offered support to SMEs

With EMAS, SMEs can reduce their environmental impacts, strengthen legal compliance and employee involvement, and save resources and money. EMAS provides enhanced

1. Credibility, transparency and reputation
2. Environmental risks and opportunities management
3. Environmental and financial performance
4. Employee empowerment and motivation

EMAS registered organisations can use their environmental statements and the official EMAS logo to show stakeholder (e.g. customers) their commitment to environmental performance. SMEs benefit from lower fees, lower verification and lower publication requirements. Technical and financial support for SMEs is also provided. SMEs can become EMAS registered by using the so-called EMAS Easy method.

EMAS is the most credible and robust environmental management tool on the market and goes beyond the requirements of ISO 14001, the international standard for Environmental Management Systems.

The ISO 14001 standard has been an integral part of EMAS since 2001, and in this way it has allowed many ISO-certified organisations to step up to EMAS through an uncomplicated process.

Some of the main features that distinguish EMAS from ISO 14001 are:

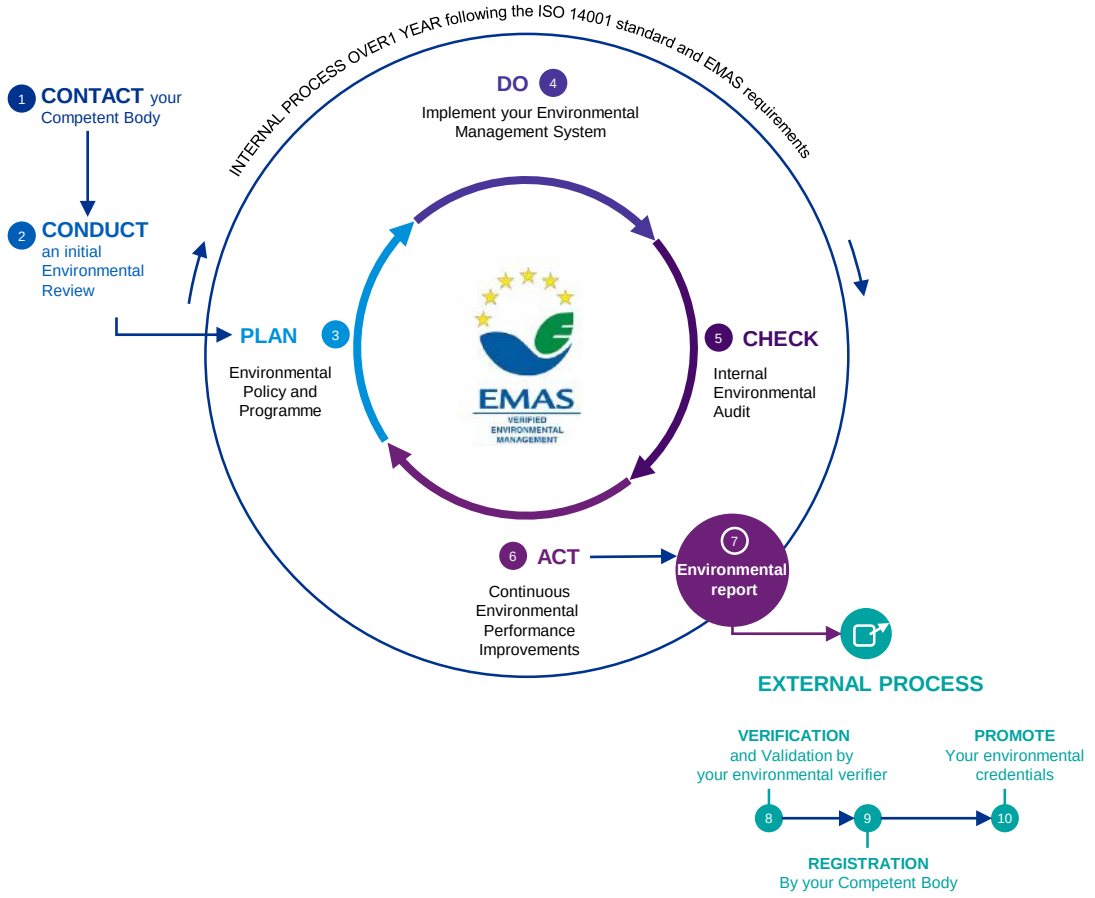
- Boost external communication strategy by annually publishing an environmental report (called ‘environmental statement’). This report documents the organization’s environmental activities and performance and needs to be validated externally.
- EMAS helps to find innovative and creative ways to involve employees.
- EMAS helps to facilitate and communicates commitment to continuous improvement of the organization’s environmental performance.

How to apply for EMAS

Every Member State has designated a Competent Body who is responsible for managing the EMAS scheme in their country. This body can also provide SMEs with useful information on the steps to implement EMAS and the administrative procedures and fees involved. Some EU member states offer financial support to reduce the costs hurdle for SMEs. For an overview of the application process please refer to figure 9.

EU level non-financial instruments

Figure 9: How to apply for EMAS



EU level non-financial instruments

EU Ecolabel

Outline of the programme

The EU Ecolabel is aimed to promote products and services that have a reduced environmental impact. It helps European consumers distinguish more environmentally friendly products from others. Recognised across Europe, the EU Ecolabel is a label of environmental excellence that is awarded to products and services meeting high environmental standards throughout their life-cycle. There are currently 29 different product groups: from rinse-off cosmetics to cleaning products, from home and garden to clothing and paper products, and from household appliances to tourist services. While EMAS is focused on environmental performance of companies, Ecolabel is focused on specific products or services.

Offered support to SMEs/benefits for SMEs

SMEs can take full advantage of the EU Ecolabel through advertising and communication. On the B2C level, SMEs can benefit from the trend towards a higher demand for environmentally friendly products. On the B2B level, SMEs with an ecolabel can also respond to public procurers increasing pressure to source environmentally friendly products (in accordance with ISO 14024). The EU Ecolabel is also a pro-active way to adhere to upcoming EU regulations since the EU Ecolabel requirements are regularly ahead of laws and regulations. Via the label organisations also gain access to webinars and workshops on how to improve performance and/or adhere to upcoming requirements.

Special discounts for SMEs, micro-enterprises and applicants from developing economies facilitate compliance.

See the example of A&B Laboratorios for the story of a SME which has received an EU Ecolabel and the benefits it provides.

How to apply for the EU ecolabel

There are seven steps for the application:

1. Contact your national competent body, which is available to provide technical support throughout the application process.
2. Register your product and/or service on the online EU Ecolabel Catalogue (ECAT).
3. Test and show compliance of your product/service with the Ecolabel criteria.
4. Submit application and pay fees.
5. Get assessment by the Competent Body.
6. Get application approval and license awarded.
7. Communicate about your EU Ecolabel products and services.

EU level non-financial instruments

ETV

Outline of the programme

ETV is short for Environmental Technology Verification. It is a verification procedure designed for new environmental technologies that are too innovative to verify claims on their performance against existing labels or certification schemes. The ETV programme is an independent assessment that reviews the claims put forward by the producer and verifies these to understand the technology's value and potential. If accepted, a Statement of Verification is issued that can be used to inform stakeholders such as investors.

Currently, the programme is in its pilot phase and is limited to specific technological areas – Water; Materials, Waste & Resources; and Energy Technologies. The pilot is coordinated by a Steering Group that includes the European Commission and seven Member States.

Offered support to SMEs

SMEs benefit from the results of the ETV pilot by:

1. Quick scan procedure to assess whether the technology is suitable for the ETV
2. Guide on the steps within the procedure
3. Examples of verification assessment criteria
4. Stakeholder forums that provide updates and allows for feedback on the ETV

Benefits for SMEs

SMEs benefit from independent proof of verifiable performance parameters. These can be used as a guarantee for investors. Additionally, the assessment allows for a validation of technological features. Through the ETV, added value can be demonstrated – another benefit to investors. Finally, the programme is not a fail/pass system, but a dynamic process, allowing for interaction between the SME and the verification body.

EU level non-financial instruments

EREK

Outline of the programme

The European Resource Efficiency Knowledge Centre (EREK) is is a pan-European network of highly-motivated business support organisations who want to stay tuned, gain knowledge, share their expertise and promote Resource Efficiency in their region and sectors.

With effort and individual knowledge of the member organisations, European businesses can access essential information, tools and learning material and get into personal contact with technical experts on their local level. EREK is available to its member organisations through its comprehensive online platform as well as live events in various European regions.

What does the EREK network offer?

1. Access to international knowledge, technical expertise and practice
2. Latest information on Resource Efficiency, good-practice examples of European businesses and a selection of best available technologies
3. Regular updates on EREK-related developments and news from the EREK community
4. Support and advice while promoting Resource Efficiency in your sector and region
5. Tools and instruments for an assessment of businesses' individual saving potentials
6. Quick overview of relevant support programmes available on European, national and regional levels
7. Member access to the EREK online platform including webinars and special information, and extended learning and training materials to refresh your knowledge on the topic
8. Multimedia and virtual training opportunities to learn from Resource Efficiency experts
9. Specialist events and activities on Resource Efficiency trends and developments, and updates on professional events within the European Resource Efficiency community

4 steps in getting involved

1. Send a message at www.resourceefficient.eu/en/contact-us containing your name, your email address, the name of your organisation, and a short paragraph on the interest of your organisation in resource efficiency and the circular economy. The EREK team will reach out to you and will follow an exchange of basic information (e.g. your organisation's logo and details)
2. You will be asked to sign the Network Charter as symbol and basis for your organisation's commitment to EREK's goals and activities
3. In dialogue with the EREK team you will discuss your organisation's possibilities for a direct involvement in the Network activities according to your individual fields of interest. This might also include learning areas.
4. Get started by using and contributing to the EREK Self-Assessment Tool, promoting EREK Network and EREK activities among fellow organisations in your area and perhaps a first update on news and events in your region and sector.

EU level non-financial instruments

More information on the EU level non-financial instruments

PEF

- General information on PEF
- Information on PEF pilots
- EU Environmental Footprint Wiki

OEF

- General information on OEF
- Information on OEF pilots
- EU Environmental Footprint Wiki

EMAS

- General information on EMAS
- Information on ten steps to get certified by EMAS
- Information on EMAS for SMEs

EU Ecolabel

- General information on EU Ecolabel
- Information on how to apply for EU Ecolabel

ETV

- General information on ETV
- Guidelines for applying to the ETV programme
- Information on events and stakeholder forums

EREK

- General information on EREK
- Information on four steps to become member of the EREK community

This section consists of five modules which provide a deep dive into specific sector which face specific challenges in the context of the circular economy, because of their value-chains, environmental footprint and/or dependency on material from outside Europe.

Module 9:
Construction & demolition

Module 10:
Plastics

Module 11:
Critical raw materials

Module 12:
Food waste

Module 13:
Biomass & bio-based products

Construction & demolition

Introduction

The objective of this module is (1) to explain why the construction & demolition sector is crucial in the transition towards a circular economy, (2) to provide suggestions for possible circular practices for SMEs in the construction & demolition sector and (3) to refer to EU instruments which can help SMEs in the construction & demolition sector to adopt circular economy strategies and practices.

The construction & demolition sector is the sector which uses the most material resources and is biggest source of waste in EU

The construction sector plays an important role in the European economy. It generates almost 10% of the EU's GDP and provides 20 million jobs, mainly in SMEs. Construction is also a major consumer of intermediate products (raw materials, chemicals, electrical and electronic equipment, etc.) and related services. The sector consumes large (enormous) quantities of raw materials and energy and largely determines the energy consumption in the build environment due to the long lifetime of buildings. In the Roadmap to a Resource Efficient Europe it was estimated that better construction and use of buildings could help making significant resource savings:

- it could influence 42% of our total final energy consumption;
- about 35% of our total GHG emissions;
- 50% of the total amount of extracted materials;
- and in specific regions it could save up to 30% of water[1].

The sector is also responsible for 35% of the total waste flow in the EU. A large part of this construction waste is recycled. However, this is often done low-grade. This largely concerns rubble that is processed into granules used for road foundations.

The circular economy provides huge opportunities for SMEs in the construction & demolition sector

Adopting circular economy strategies and practices provides huge opportunities for SMEs in the building and construction sector. There is a large potential for SMEs in the construction sector to save costs by increasing their resource efficiency (e.g. increase energy efficiency, reduce the amount of excess purchased building materials). In addition there are significant opportunities to increase revenues because although the contractor's role in the supply chain is not changed by circular construction. It is expected that there will be more emphasis on maintenance and renovation (mostly done by smaller construction companies) instead of on the construction new buildings (mostly done by larger construction companies).

For demolition companies there will be large opportunities in 'dismantling' buildings rather than demolishing them. This provides demolition companies with the opportunity to harvest/sell high-grade building materials and deliver extra added value.

Construction & demolition

These opportunities will be driven by an increasing demand for energy efficient and circular buildings which is partially enforced by EU, national and/or regional requirements. The European Commission has set the standard that by 2020:

- all newly constructed buildings need to be energy neutral;
- and a minimum of 70% (by weight) of non-hazardous construction and demolition waste must be prepared for re-use or recycled.

In addition more and more governmental agencies and larger companies are demanding circular buildings in an effort to use their procurement function to stimulate the transition towards a more circular economy.

Another argument for SMEs in the construction & demolition sector to adopt circular economy strategies and practices is that it will reduce their exposure to the risk of rising and more volatile prices for building materials due to increasing material scarcity (see: figure 2).

An example of a highly circular building

The business park of Alliander, an energy grid company, was transformed from seemingly outdated real estate to an example of circular construction and the first large energy positive building in the Netherlands. By connecting several buildings under an innovative roof construction which functions like a greenhouse: the old existing buildings could be reused, more space was added and a highly energy efficient structure was created.

It was Alliander's specific wish to use as much as possible reused parts and materials and to facilitate reuse at the end of the use-period. By using a materials passport, a document which lists which materials have been applied, Alliander has gained insight in which materials are reused and can be reused. Making the building a materials depot.

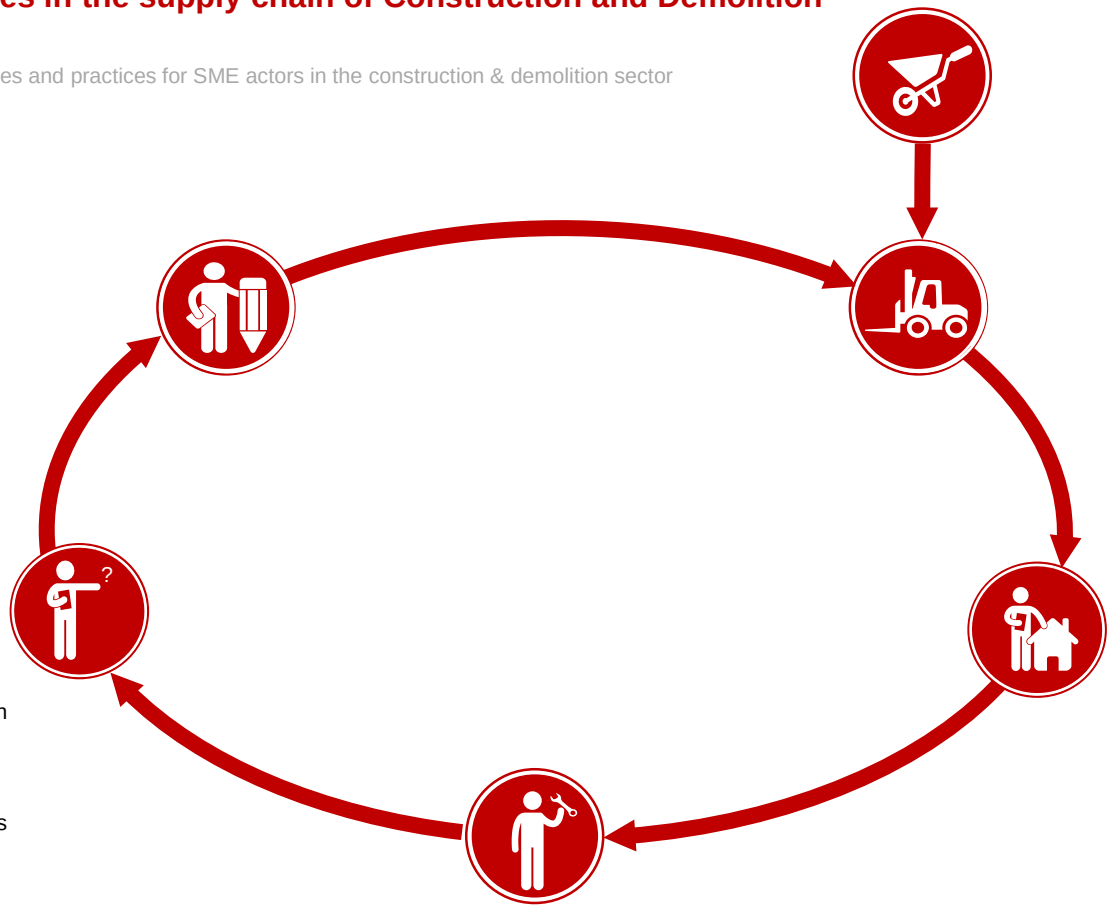
Up to 93% of all materials are part of a circular model and the building is seen as a resources depot. In total, 80% of the materials are reclaimed and it is the first renovation to obtain a BREEAM-NL outstanding certificate.

Source: KPMG (2016), link

Construction & demolition

Possible circular activities in the supply chain of Construction and Demolition

Figure 10, Overview of circular strategies and practices for SME actors in the construction & demolition sector



Building materials
- Use biobased materials
- Use reusable materials
- Use materials with a low environmental footprint

Construction
- Tender on performance standards
- Focus on reuse and sustainable building methods and materials
- Minimize and manage leftovers and waste from construction

Use / maintenance
- Use a maintenance or circular business model
- Minimise energy and consumption and produce renewable energy.
- Consider smart water solutions to overcome local water issues

Reconstruction & Demolition
- Consider renovation instead of demolition
- Recover and reuse materials. For example with the use of a material bank

Building request
- Consider renovation instead of greenfield development
- Take circular options into account when deciding on location and function. For example :Urban Farmers, industrial Symbiosis
- Consider fostering the circular functions in one building and the locations

Design
- Use building materials with a low environmental footprint
- Use reusable building materials
- Use reused materials. For example: jeans
- Create a materials passport
- Design for disassembly

Construction & demolition

An example of tendering on performance standards

The road to realize a highly circular and energy efficient business park for Alliander (see example on p.69) started with an innovative European procurement process which encouraged collaboration between all the parties involved.

This process was based on having an open dialogue with all interested consortia on how they thought to be able realize a highly sustainable building within a set Total Cost of Ownership (TCO) framework.

Eventually three consortia remained in the tender, with which Alliander conducted an intensive and truly open dialogue about the award phase. In these conversations, the boundaries between the disciplines within the consortia faded and innovations appeared.

The tender was rewarded to the overall most competitive bid. The design exceeded the organization's expectations and the cost estimate was well within that determined by the TCO framework. The result is a unique, energy-efficient building that is mainly constructed using recycled materials.

Source: KPMG (2017), link, Copper8 (2017), link

An example of choosing for circular business models in real estate

By choosing for circular business models for components, parts and/or aspects of the building and/or the interior companies can facilitate the reuse of these parts and/or the materials in the parts by the supplier.

For example, Desso a Dutch carpet manufacturer offers a Take Back ^{tm} programme through which carpet tiles can be leased for a five or seven years period after which Desso recollects the tiles to be recycled in a closed loop process.

To be able to offer this model Desso collaborates with a financial services company which specializes in corporate lease constructions. They claim that costs, taking into account the Net Present Value, in the lease construction are lower in comparison to purchasing the tiles.

Source: Desso (2017), link

Construction & demolition

An example of using buildings as material banks

Buildings can be seen as large stockpiles of stacked materials.

By drafting a materials passport companies can gain insight into the materials used to create a building, and into their quantities. Additionally, such passports can contains information on the quality of materials, their locations, and their monetary and circular value.

With the help of such a materials passport it becomes easier to reuse the materials from buildings after their use period.

Madaster is a company which offers a platform to companies to draft and maintain detailed materials passports for their real estate.

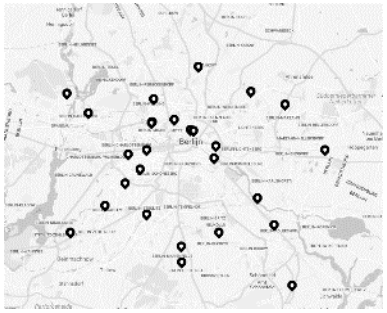
Source: Madaster (2017), link

An example of taking circular principles into account when choosing a location

Considering circle economy principles when choosing a location for business activities may help to significantly reduce the environmental footprint of activities and/or facilitate the exchange of material/energy streams with partners.

An example of the consequences of which opting for a different location may have is provided by vertical urban farming. The current agricultural practices and the food production chain at large have a large impact on the environment through the: required land use, water consumption, nutrient pollution, the use of pesticides and transport distances. By redesigning this chain and growing food within cities in closed systems supported by advanced technology these environmental impacts can significantly be reduced.

For example InFarm uses such methods to grow food at various locations in Berlin in a fully biological and pesticide free way, on a small amount of land and with a requiring a minimum amount of water.



Source: InFarm (2017), link

Construction & demolition

An example of designing buildings for disassembly

Another example of a highly circular building is Circl. This is a pavilion in the hart of the Amsterdam business district, which hosts: a bar, restaurant and multiple meeting rooms. Part of why Circl can be considered circular is that in the design of Circl the future disassembly has been taken into account.

Therefore the architect and the construction company worked together to avoid using wet bond to connect any materials.

In addition the construction company has drafted disassembly instructions for the components which are used in the building. These were added to the buildings materials passport and will further facilitate the future disassembly of Circl.

Source: KPMG (2016), link

An example of focussing on sustainable building methods and materials

Specific early stage design decisions can help to realize more sustainable buildings at relatively low costs. The choice for certain building materials or practices can have a significant environmental impact (e.g. steel requires a significant amount of energy consumption to be produced) and may significantly limit the options for reuse / recycling in the future (e.g. made to measure natural stone kitchen tops are hard to reuse or recycle).

An example of sustainable choice which reduces the environmental footprint of a building and increases the reusability is to opt for a wooden support structure instead of a reinforced concrete structure. Since reinforced concrete requires a large amount of energy, water and materials. Whereas wood is a renewable resource and can easily be disassembled and reused.

The Spanish non-profit organisation ITeC offers a database with technical, environmental and economic information regarding a large amount of construction elements and materials which can guide such decisions.

Construction & demolition

The European Commission offers various financial and non-financial instruments to help SMEs in the construction & demolition sector to become circular

Next to the generic financial and non-financial instruments which haven introduced on modules 7 and 8, the Commission also offers specific instruments to help SMEs in the construction & demolition sector to adopt circular economy strategies and practices:

- The NANDO database: the NANDO database identifies Notified Bodies (NB) and Technical Assessment Bodies (TAB) responsible for construction products. These bodies are assessing products and/or the manufacturing processes for relevant harmonised European standards (HEN).

- Level(s): Level(s) is a voluntary reporting framework to improve the sustainability of buildings, for:
  - clients (e.g.: developers and investors);
  - design teams (e.g.: architects, engineers, quantity surveyors);
  - construction management (e.g.: construction manager, lead contractor);
  - facilities managers;
  - asset managers;
  - and buildings occupants (households or organisations).

Level(s) provides a common EU approach to assess environmental performance in the built environment. Within the Level(s) framework, each indicator is designed to link the individual building's impact with the priorities for sustainability at the European level. This helps organisations to focus on a manageable number of essential indicators at building level that contribute to achieving EU and national policy goals.

Level(s) is currently being tested. During the test period the Commission will offer support to participants on how to use the tooling.

Construction & demolition

References to other resources

Publications

- European Commission (2011), Roadmap to a Resource Efficient Europe (RERM)
- ING Bank (2017), Circular construction: Opportunities for demolishers and wholesalers
- Circle Economy (2015), Circular Construction: The foundation under a renewed sector

Tools

- NANDO database
- Level(s)
- European Circular Construction Alliance
- Madaster
- The Green Construction Board

Plastics

Introduction

In this section the plastics sector and possibilities for plastic in a circular economy will be further explored. The European plastics industry plays a vital role in the European economy, with 1.45 million employees and a turnover of €350 billion. In Europe over 40% of plastics are used in packaging and a large amount in construction and the automotive industry. Other large shares include furniture, household appliances and electronic goods and agricultural uses.

From a circular economy perspective there are three main issues related to plastic use

When considering the use of plastics from a circular economy perspective there are three main interrelated issues:

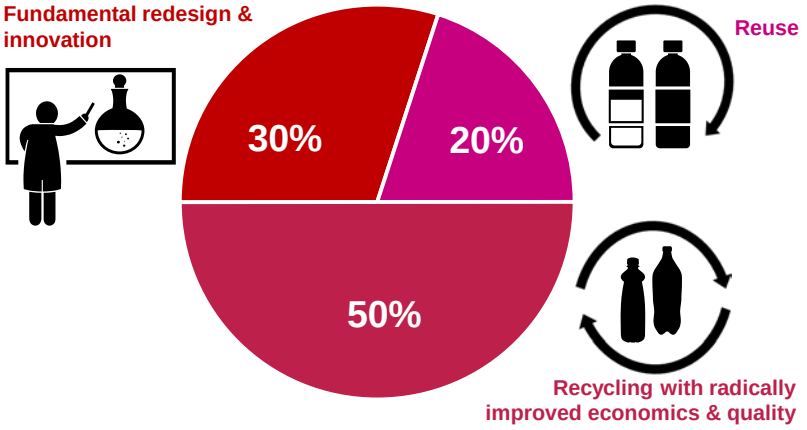
1. **Plastics are often based on virgin fossil feedstock;**
2. **plastics are often not recycled;**
3. **and a significant amount of plastics ends up in the environment where it degrades very slowly and has a large impact on the functioning of ecosystems.**

Plastics are often used because of their low costs, ease of manufacture, versatility, and water blocking properties and are used in an enormous and an expanding range of products. Plastics are generally very durable and degrade very slowly. This however also means that they are resistant to most natural processes of degradation, which is the reason why it is important to keep the material in the technological cycle and recycle it (see: figure 3). For this reason it is also important to limit the leakage into the environment. The Commission wants to address these three interrelated issues: high dependence on virgin fossil feedstock, low rate of recycling and reuse of plastics, and significant leakage of plastics into the environment.

To address these issues multiple strategies and actions from various stakeholders are required

Resolving these issues requires multiple strategies (recycling, reuse, redesigning) and actions from various stakeholders. This can also create opportunities, in particular improved supply security, economic benefits and reduced pressure on the environment.

Figure 11, Three transition strategies to accelerate the shift to a circular plastics economy share of plastic packaging market by weight. (adapted from: Ellen MacArthur Foundation, 2016)



Other challenges regarding the use of plastics

Micro plastics

Micro plastics, form a large problem as a result of plastic production. Micro plastics are plastics smaller than 5 mm in diameter and are widespread in the marine environment. They come both directly from a variety of sources including cosmetics, clothing and industrial processes and indirectly as a result of disintegration of larger pieces. Micro plastics are of environmental concern because they are ingested by a range of organisms as they are extremely small. These plastics can cause harm directly but also pile up inside the animals. Recent scientific investigations in Europe have also revealed the presence of micro plastic residues also in fresh water systems, including drinking water and wastewater treatment.

Bio plastics

In recent years, there has been an increasing trend towards replacing conventional fossil based plastics with bioplastics, plastics that are derived partly or fully from either biomass or that are biodegradable.

The bioplastics industry positions itself as helping to speed the reduction in fossil fuel use and solving the ever-growing plastic pollution and marine litter issues. However, bioplastics might actually also create new problems. Due to their often complex design, bioplastics create difficulties in collection and recycling processes. Therefore, as with conventional plastics, they are likely to end up in landfills or incinerators or risk polluting the marine environment. The assumption that the plastics are biodegradable can also increase littering, contaminate recycling streams and increase management costs of bio-waste.

Plastics

There is a wide variety of plastics

Plastics is a generic term which covers a wide variety of synthetic or semi-synthetic organic compounds that are malleable and so can be molded into solid objects. Different types of plastics have different properties which therefore require different strategies to keep in a circular loop.

Figure 12, overview of the seven most commonly used plastics

Symbol	Polymer type	Examples of applications	Environmental qualities
	PET polyethylene terephthalate	Soft drink and water bottles, salad trays	Recycled into fleece coats, carpets, surfboards
	HDPE high density polyethylene	Milk bottles, shampoo bottles, toys, houseware	Recycled into plastic lumber products
	PVC polyvinyl chloride	Window frames, floor coverings, pipes, cable insulation	The by products from manufacturing are known to cause cancer, recycled into handrails, house siding
	LDPE low density polyethylene	Carrier bags, bin liners, packaging films	Recycled in small amount into bags
	PP polypropylene	Microwave-proof containers, automotive parts, food packaging	Difficult to collect for recycling; Recycled into car battery cases
	PS Polystyrene	Yoghurt pots, insulating packaging and building materials, plastic cutlery, protective packaging for consumer goods	No longer made with CFCs but by-product from manufacturing degrade air quality
	Other	PUR, Hub caps (ABS); optical fibres (PBT); eyeglasses lenses; (PC) touchscreens (PMMA); cable coating in telecommunications (PTFE);other applications in aerospace, medical implants, surgical devices, membranes, valves and seals, protective coatings etc.	Layered aspects make this difficult to recycle, recycled into benches, marine pilings

Plastics

Numbers behind plastics use and recycling

Figure 13, overview of figures regarding plastics consumption and recycling (source: Plastics Europe (2015); Plastics Europe (2016), link)

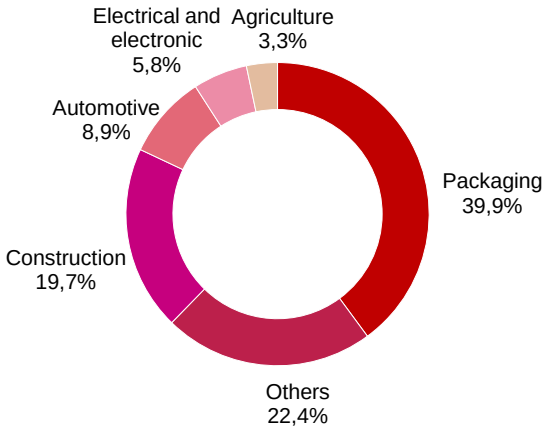
Growth of plastics consumption

Plastics consumption has increased by

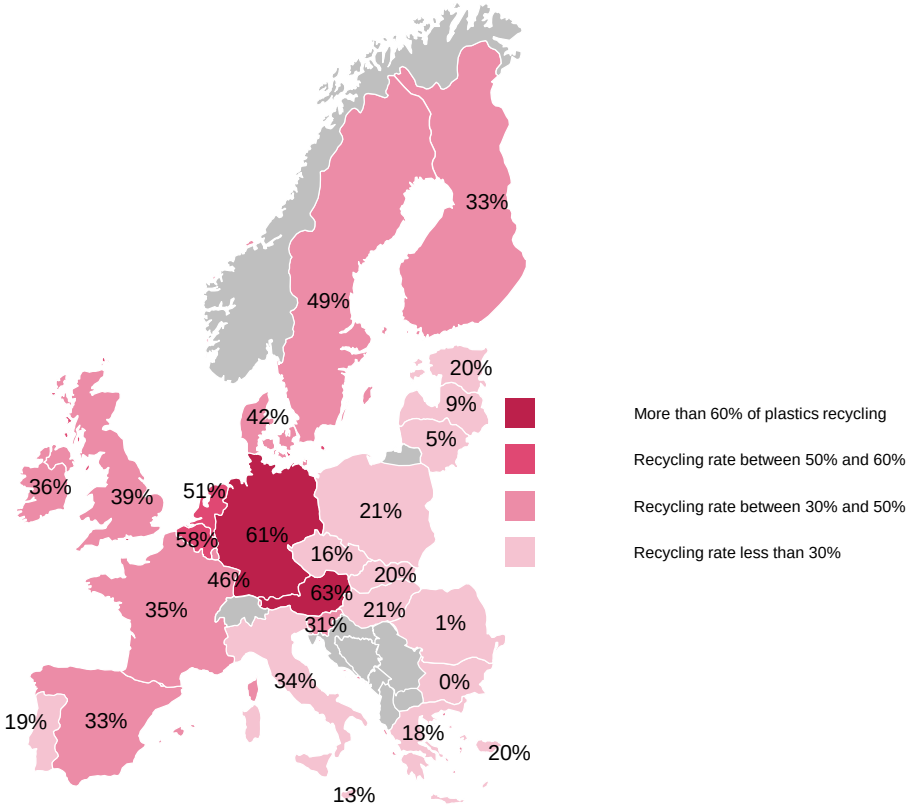
2000%

between 1964 and 2014

Share of plastics consumption per sector



Plastics recycling rates



Plastics

New European strategy for plastics in a circular economy

In January of 2018 the Commission published its strategy for plastics in circular economy. This strategy present commitments for action at EU level and calls on: national and regional authorities, cities, citizens, corporates and SMEs to be part of the transition to a circular plastics economy. The central vision which is outlined is that by 2030 all plastics packaging placed on the EU-market is either reusable or can be recycled in a cost-effective manner.

To support a transition towards achieving this vision the Commission has announced various actions, including:

- the implementation of new rules on waste management (e.g.: recycling requirements for vehicles, batteries and electronics, restrictions on landfilling, recycling requirements for plastic packaging);
- the development of quality standards for sorted plastic waste and recycled plastics;
- a pledging campaign to invite actors to come forward with substantive pledges by June 2018;
- and legislation on: single-use plastics, port reception facilities (to reduce discharges of waste by ships), oxo-plastics (degradable plastics which fragment into microplastics) and intentionally adding of microplastics.

More legislation is expected to follow if actions from the forementioned actors are expected to fall short to realize the vision of a circular plastics economy.

Plastics

Possible circular activities in the supply chain of plastics for SMEs

Figure 14, Overview of circular strategies and practices for SME actors in the plastics supply chain

Feedstock
- Make biobased plastics

Production
- Use recycled plastics
- Reduce the amount of plastics in products
- Use types of plastics that can be recycled
- Use recycled plastics in products.

Use & Reuse
- Refuse single use plastics
- Use products with less packaging
- Innovate towards creative, new delivery models based on reusable packaging
- Scale up reusable packaging in a business-to-business setting for both large rigid packaging and pallet wrap
- Consider alternatives to plastic products

Collection
- Ensure plastic collection possibilities
- Create incentives to hand in plastics

Energy recovery/ Incineration
- Make sure that plastic waste is not landfilled but used for energy production at end-of-life.

Mechanical Recycling or Chemical Recycling

Design
- Design for Long-life
- Do not design for single use
- Ensure products with different plastics can be taken apart for recycling
- Take end of life into account when designing
- Use alternatives to microbeads (See: micro plastics)

Plastics

An example of reducing the plastics for packaging

By rethinking the reason for plastic packaging Eosta has created and alternative for stickers and packaging on vegetables in supermarkets. They have created a laser for providing information on biologically produced food.

A high definition laser removes part of the pigment from the outer layer of the peel of the fruit or vegetable leaving a permanent mark. As this mark is clearly visible it is no longer necessary to pack the products in harmful plastic foil. The method is completely safe and no additional substances are used. Furthermore, the method is so superficial that it has no effect on taste, quality or shelf life. The energy needed for a marking is less than 1% of the energy needed for a sticker.

Through Natural Branding Eosta is saving large amounts of plastic. Just for one product line for one reatiler, they are saving over 750,000 packaging units.

Source: Eosta link

An example of biodegradable plastics

Peeze has created coffee capsules that are a sustainable solution to the wasteful standard coffee capsules. The new capsules and sealing foil are made of polylactic acid, PLA, a biobased and compostable material. The packaging complies with the European standard for compostable packaging EN-13432. This allows the cups to carry the Vegetable logo and to be disposed of at the GFT waste.

Source: Peeze link

Plastics

References to other resources

Publications

- The New Plastics Economy: Rethinking the Future of Plastics
- The New Plastics Economy: Catalyzing Action
- Plastics in a Circular Economy: Opportunities and Challanges
- Strategy on Plastics in Circular Economy
- PlasticsEurope's Views on a Strategy on Plastics
- Inspirational examples of products (the Netherlands based)
- European Bioplastics
- Neste – Redefining the future of plastics

Tools

- ResCoM, which stands for Resource Conservative Manufacturing

Events

- European Commission events Regarding Plastic

Critical raw materials

Introduction

The objective of this module is: (1) to share the list of defined critical raw materials, (2) explain why these materials are deemed critical and (3) provide suggestions for possible circular practices for SMEs to secure their access to critical raw materials.

The Commission has defined a list of 27 critical raw materials which are becoming more scarce and are increasingly more important to the global economy

Within the EU and across the globe the unhindered access to certain raw materials is becoming a growing concern due to the increasing scarcity of these materials and the increasing importance of these materials to the global economy. This increasing scarcity is specific importance to the European economy since the European continent is generally relatively poor in terms of the availability of non-renewable natural resources.

The European Commission has defined a list of 27 materials which:

- are of significant economic importance for key sectors in the European economy (e.g.: consumer electronics, environmental technologies, automotive, aerospace, defense, health and steel);
- have a high-supply risk due to the dependence of imports and a high-level of concentration of these Critical Raw Materials (CRMs) in particular countries;
- and there is a lack of (viable) substitutes, due to the very unique and reliable properties which these materials have.

Defining this list should increase the awareness of actors of the need to secure supply of these materials by:

- negotiating long-term contracts with their suppliers;
- increasing their resource efficiency – hence reducing their exposure to supply risks;
- and/or investing in circular economy strategies and practices as natural hedge to increasing prices and price volatility (‘tomorrow’s resources at today’s prices’)(see: figure 2).

Whereas it also meant to help the Commission’s efforts to:

- stimulate the production of CRMs by enhancing new mining and recycling activities in the EU;
- foster efficient use and recycling of critical raw materials;
- and negotiate trade agreements/challenge trade distortion measures to guarantee the supply of critical raw materials.

Critical raw materials

The list of 27 critical raw materials

Figure 15, table overview of 27 defined ciritical raw materials

Material	Most common uses for the material
Antimony	Antimony is used as a flame retardant in materials, paints, ceramic enamels, glass and pottery. Antimony alloys are also used in batteries, low friction metals, type metal and cable sheathing, among other products.
Baryte	Baryte is important in the manufacture of paper and rubber. It is also used in radiology for x-rays of the digestive system. When crushed, it is added to mud to form barium mud, which is poured into oil wells during drilling.
Berylium	Beryllium is used as an alloying agent in producing beryllium copper, which is extensively used for springs, electrical contacts, spot-welding electrodes, and non-sparking tools. It is applied as a structural material for high-speed aircraft, missiles, spacecraft, and communication satellites.
Borate	Borates in the EU are mainly used for intermediate uses such as in the manufacture of glass and for the synthesis of new substances. It is also used in and coatings, industrial fluids and/or metallurgical applications.
Cobalt	Cobalt is also used to make alloys for jet engines and gas turbines, magnetic steels and some types of stainless steels. Cobalt-60, a radioactive isotope of cobalt, is an important source of gamma rays and is used to treat some forms of cancer and as a medical tracer.
Coking Coal	Coking coal, also known as metallurgical coal, is used exclusively as an essential ingredient for steel production. Used to produce coke, which is almost pure carbon.
Fluorspar	Industrially, fluorite is used for smelting, and in the production of certain glasses and enamels. The purest grades of fluorite are a source of fluoride for hydrofluoric acid manufacture, which is the intermediate source of most fluorine-containing fine chemicals.
Gallium	Gallium easily forms alloys with most metals and has been used to create low melting alloys. Gallium has been used to produce solid-state items like transistors and light emitting diodes. Gallium arsenide can produce laser light directly from electricity.
Germanium	Germanium is mainly used in the semiconductor industry. Germanium is also used to create alloys and as a phosphor in fluorescent lamps.
Hafnium	Hafnium is used for nuclear reactor control rods because of its ability to absorb neutrons and its good mechanical and corrosion resistance qualities.
Helium	Helium is used as a coolant liquid in cryogenics, as an inert gas atmosphere for welding metals, in the manufacturing of semiconductors and optical fibre cables, in rocket propulsion to pressurize fuel tanks, as a lifting gas, and in high-pressure breathing operations.

Critical raw materials

Material	Most common uses for the material
Indium	Indium is used in Solar, lighting, nuclear. It is also used to make other electrical components such as rectifiers, thermistors and photoconductors. Indium is also used to make low melting alloys.
Magnesium	Magnesium hydroxide (milk of magnesia), sulfate (Epsom salts), chloride and citrate are all used in medicine. Organic magnesium compounds are important for the chemical industry.
Natural Graphite	Natural amorphous and fine flake graphite are used in brake parts for heavier (nonautomotive) vehicles, and became important as a substitute for asbestos.
Natural Rubber	Natural rubber is the only biotic raw material among the 27 critical raw materials. There are few readily available substitutes, especially in the automotive sector. Europe imports mostly from Indonesia and Malaysia, which score low in the World Governance Index, so are seen as less reliable.
Niobium	Niobium is used with iron and other elements in stainless steel alloys and also in alloys with a variety of nonferrous metals, such as zirconium, Niobium alloys are strong and are often used in pipeline construction. The metal is used in superalloys for jet engines and heat resistant equipment.
Phosphate Rock	The most important use of phosphate rock is in the production of phosphate fertilizers for agriculture. Some used to make calciumphosphate nutritional supplements for animals. Pure phosphorus is used to make chemicals for use in industry.
Phospherous	The largest use of phosphorus is in fertilisers.
Scandium	The addition of scandium to aluminium limits the grain growth in the heat zone of welded aluminium components. Scandium is used in lamps, lasers and aerospace
Silicon Metal	Silicon metal is used by the chemical industry in the production of silicone compounds and by aluminum manufacturers to improve the useful properties of aluminum, as well as in the manufacture of silicon wafers used in photovoltaic solar cells and electronic semiconductors.
Tantalum	Tantalum is used in the electronics industry for capacitors and high power resistors. It is also used to make alloys to increase strength, ductility and corrosion resistance. The metal is used in dental and surgical instruments and implants because it does not cause an immune response.
Tungsten	Tungsten is used in filaments in incandescent light bulbs, it is also used in electric contacts and arc-welding electrodes. Tungsten is used in alloys, such as steel which adds strength

Critical raw materials

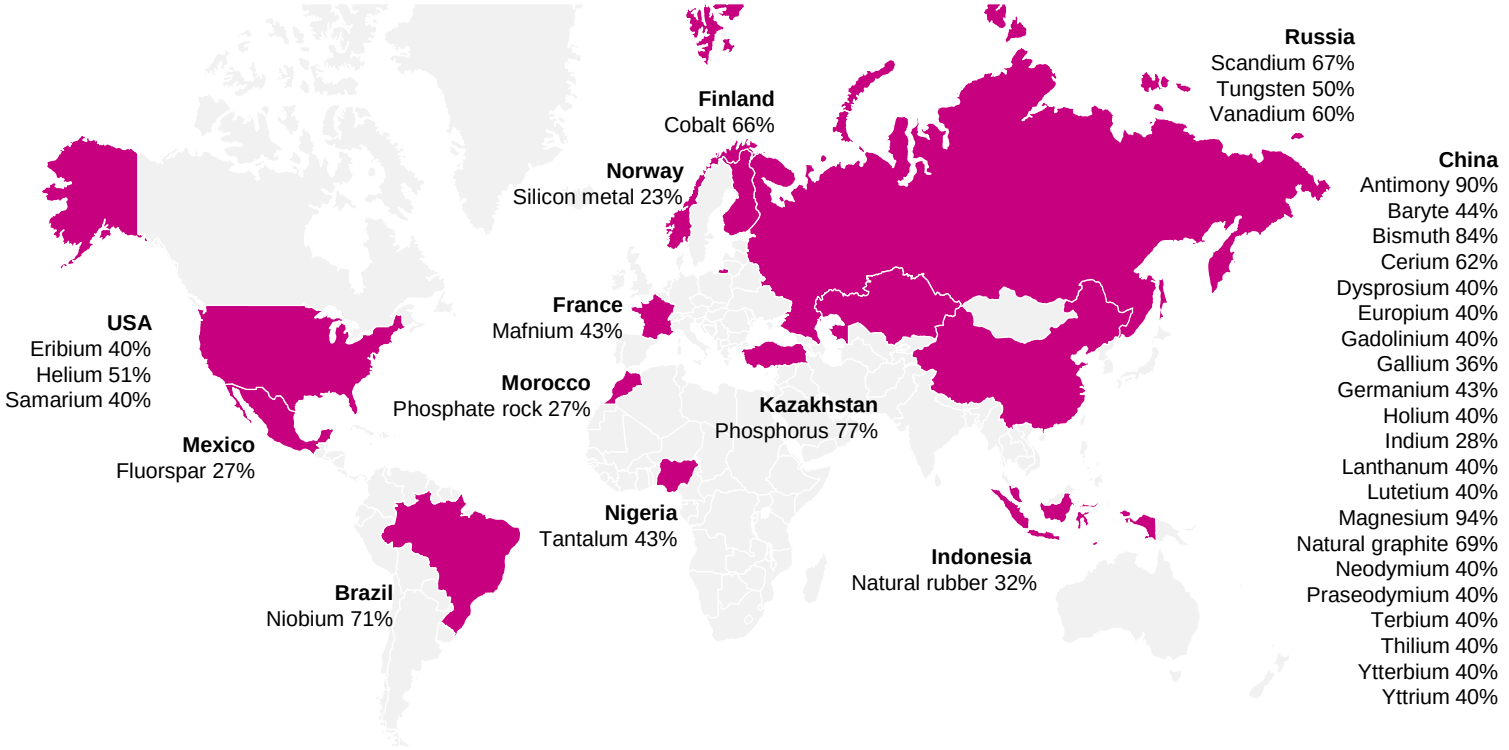
Material	Most common uses for the material
Vanadium	Titanium-aluminium-vanadium alloy is used in jet engines and for high-speed aircraft. . Vanadium-gallium tape is used in superconducting magnets. Vanadium pentoxide is used in ceramics and as a catalyst for sulfuric acid production.
Platinum group metals	The six platinum-group metals are ruthenium, rhodium, palladium, osmium, iridium, and platinum. They have similar physical and chemical properties and tend to occur together in the same mineral deposits. Platinum metals are mainly used in autocatalysts, jewelry, electronics, dental and for chemical reagents
Heavy rare earth metals	Rare earth elements are a group of seventeen chemical elements that occur together in the periodic table (Scandium, Yttrium, Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samarium). Rare earth metals and alloys that contain them are used in computer memory, DVDs, rechargeable batteries, cell phones, catalytic converters, magnets, fluorescent lighting. HREEs are less abundant than the LREE and are thus of higher value. Some HREE are listed as critical as the use of these elements is outgrowing the supply.
Light rare earth metals	Light rare earth elements (lanthanum, cerium, praseodymium , neodymium, promethium, samarium, europium, and gadolinium) are used in laser, magnets, phosphors, luminous paints, catalysts, metallurgy, superconductors, sensors, flat panel displays, medical tracers, microphones and speakers, rechargeable batteries.

Critical raw materials

Europe is a relatively non-renewable natural resource scarce continent

That Europe is a relatively non-renewable natural resource scarce continent and therefore there is high supply risk due to dependence of imports from a selected set of countries outside of the EU becomes clear when the countries accounting for the largest share of the EU's supply of critical raw materials are plotted on a map.

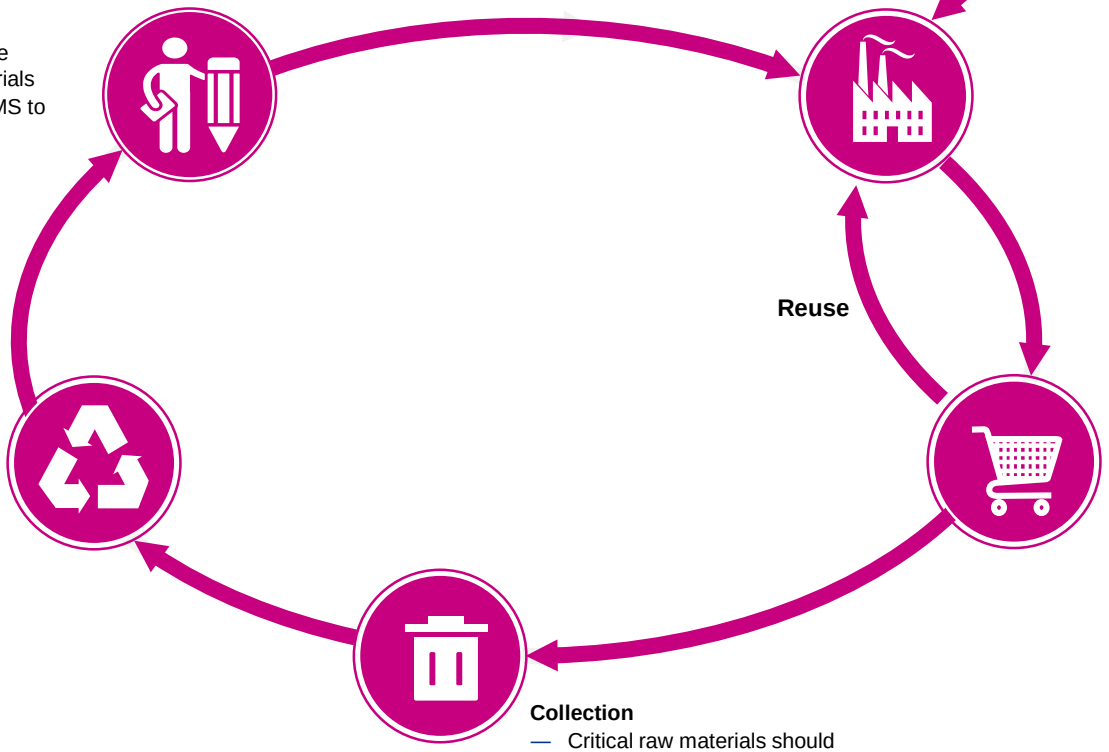
Figure 16, Countries accounting for the largest share of supply of critical raw materials for the European Union (Adapated from: European Commission (2017), link)



Critical raw materials

Possible circular strategies and practices in the supply chain of Critical Raw materials

Figure 17, Overview of circular strategies and practices for SME actors that make use of Critical Raw Materials



Mining/ Growing
- Minimizing environmental impact
- Parties can require suppliers to reduce their environmental impact

Production
- Metal alloys should be made that are recyclable/ separable
- Use recycled materials
- Use leasing system to retain value of CRMs
- Buy back products at End of Life to retain materials in product

Use
- Track materials that have CRMs in them
- Make consumer aware of importance of recycling CRMs

Collection
- Critical raw materials should be collected separately

Recycling
- Make sure that products with critical raw materials are optimally recycled
- Connect recycled material producers to product manufacturers.

Design
- Design products that can easily be disassembled to regain raw materials
- Design products that contain CRMS to have a long lifetime

Critical raw materials

Support offered by the Commission to support SMEs which use critical raw materials

The Commission acknowledges that reliable and unhindered access to critical raw materials is of growing concern to the European economy due to the depleting stocks of these materials. To support SMEs which use these materials and to secure their supply of these materials the Commission offers the following support:

- partnerships with Universities and start-ups through the EIT community Raw Materials;
- and funding for research and innovation on sustainable critical raw materials use through Horizon 2020 (see: module 7).

Example of production to minimise critical raw materials

The UNSW School of Photovoltaic and Renewable Energy Engineering, have achieved the world's highest efficiency rating for a full-sized thin-film solar cell using a competing thin-film technology, known as CZTS. Unlike its thin-film competitors, CZTS cells are made from abundant materials: copper, zinc, tin and sulphur. And CZTS has none of the toxicity problems of its two thin-film rivals, known as CdTe (cadmium-telluride) and CIGS (copper-indium-gallium-selenide). CZTS is cheaper and easier to commercialise given already available manufacturing methods.

Source: Science Daily (2016), link

Critical raw materials

References to other resources

Publications

- European Commission (2017), list of Critical raw materials
- European Commission (2017), methodology on Critical raw materials

Videos

- TED Talk - The Dawn of the age of critical materials

Communities

- CRM Alliance
- Phosphorous platform

Tools

- EU CRM Knowledge database

Food waste

Introduction

The objective of this module is to explain issues and possibilities in the food and agriculture sector regarding circular economy. It is closely linked to the next chapter on bio-based and biological materials but food waste is even more associated with quick lifetimes and perishable products.

Capitalising the losses of food is a large financial opportunity for SMEs

Around 88 million tonnes of food are wasted annually in the EU or 173 kg per capita per year, with associated costs estimated at €143 billion. In Europe a significant amount of food is wasted, from initial agricultural production to the consumers garbage. This is a concern because it is both a financial loss and a waste of resources.

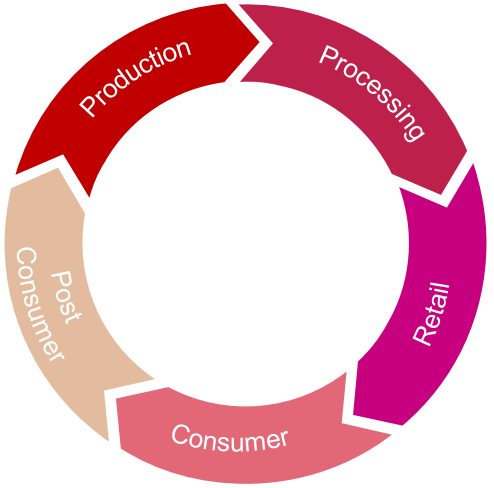
The production, distribution and storage of food use requires natural resources and generates environmental impacts. Discarding food that is still edible increases these impacts, and causes financial loss for consumers as well as the economy. The production and disposal of food waste leads to the emission of 170 million tonnes of CO2 and consumes 261 tonnes of taw materials.

Moreover the fact that there is still a large amount of malnutrition in the world makes it an important ethical social issue.

From production to the consumer food can be saved from becoming waste.

Food waste occurs all along the value chain: during production and distribution, in shops, restaurants, catering facilities, and at home.

Figure 18: The different phases of the food chain



Source: European Commission (2017), link

Food Waste

What SMEs can do to tackle food waste

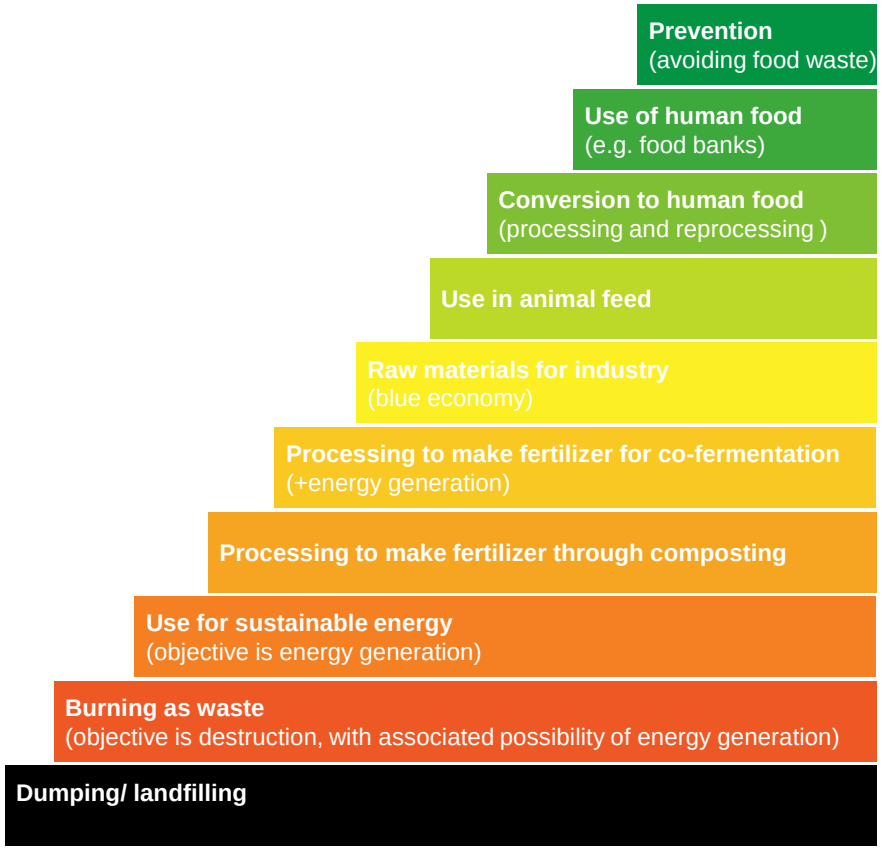
Figure 19: Overview of circular strategies and practices for SME actors related to food waste

Business Sectors	Food Waste Generation	Mitigation Actions	Business Benefits
— Agriculture — Agrichemicals	— Mortality of animals — Crops not fully harvested — Product damage during harvest	— Prefer bio-based fertilizers — Adjust production to demand — Use technology to decrease nutrient need in production	— Better quality bio-based fertilizer
— Cannery — Packaging — Processing (fish, meat, dairy products) — Sugar Industry	— Process loses (peeling, slicing, washing, etc) — Product damage during storage	— Use of packaging methods that extend the lifetime of the food	— New opportunities of processing food waste
— Transportation — Stores — Restaurants — Catering	— Date expiry in depot — Surplus stock — Product damage during storage — Products sorted due to cosmetic requirements	— Track and optimise temperature of transport — Allow more sizes and shapes in stores — Optimize food amount in restaurants and caterers	— Longer period of service — New business opportunities on delivering processed food waste — Reputation benefits
	— Waste during storage — Surplus cooked/plate scrap — Food preparation waste	— Raise awareness on procurement and due dates	
— Fertiliser Producers — Bio-based energy producers		— Collect food waste separately from other waste — Take action based on steps of hierarchy of food waste in figure 20.	— Post consumer business opportunities

Food Waste

Hierarchy of food waste from most preferred to least preferred

Figure 20: Hierarchy of food waste (Adapted from: Moerman, 1985)



Understanding of the use by and Best before dates can help in decreasing food waste.

One of the issues related to household food waste are the 'use by' and 'best before stamps', by sharing information about the meaning of these stamps companies can have an impact on the amount of food wasted by households.

'Use by' date on packaged food tell us until when we can eat the product. After this date, it may not be safe. The 'use by' date is usually found on perishable foods such as chilled meat, dairy, and pre-made meals. To avoid wasting food these should be purchased when, and in the amount, necessary.

'Best before' dates are more flexible. After this date, foods such as dried beans, lentils, and pasta, can be consumed safely, although their quality may have decreased (for example, changes in flavour, colour, texture). Trusting our senses should be sufficient for foods with these labels.

Food waste

Example of reducing production losses

Inglorious food's massive global campaign that was launched by Intermarché to sell (30% cheaper) the non-calibrated and imperfect fruits and vegetables which they dubbed "the inglorious fruits and vegetables". It aimed to rehabilitate and glorify them, with print, billboards, TV, radio, PR, and Intermarché's catalogues and social media platforms.

The campaign was a success as customers got the same quality products cheaper, growers earned money from produce that they would usually have to dispose and Intermarché increased its business as they could sell a completely new line of products

Source: marcelww (2017), link

Example of logistical improvements and food redistribution

In grocery stores, products approaching their "Best before" date are sold at a discounted price in order to minimise the amount of food waste. Food loss in S Group's grocery trade was approximately 33,000 tonnes in 2012. The loss proportionate to the sales volume, or loss by weight, was 1.96%. Throw-away loss proportionate to S Group's grocery retail decreased by 5.3 per cent from the previous year. Some of the regional co-operatives have been working together with charities to donate bread, canned foods and other non-perishable food products in particular.

The new guideline from the Finnish Food Safety Agency Evira clarifies the policies of donating foodstuffs and associated responsibilities and also makes it easier to donate products with "Use by" dates. The bio-waste which is still left after the donations is either composted or treated in a biogas plant or bio ethanol plant.

Source: European Commission (2017), link

Food waste

Example of information and education on food waste

In 2011 the UK food retail company Sainsbury's organised a food recipes competition ('love your leftovers') for dishes from leftover ingredients. After receiving thousands of entries, 10 winning recipes where chosen which received a Sainsbury's voucher.

The competition created a large amount of attention for the issue of food waste and helped to inform consumers on how they can reduce their food waste.

Source: European Commission (2017), link

Example of measuring and monitoring food waste

Winnow has developed a system, designed for commercial kitchens to track and monitor food waste. The system can then feed data and reports back to decision makers so that they adjust behaviour to minimise waste.

Winnow was founded in 2013 and today has over 1,000 sites installed or contracted. To date, on average across all sites, Winnow has been able to reduce food waste by 65% within the first 12 months, have an average ROI of 5%, and is able to link the introduction of their system to average savings in food costs of 3-8%.

Major clients include Compass Group, Elior and AccorHotels.

Source: European Commission (2017), link

Food waste

Example of technology to produce food near urban centers

The Floating Farm, aims to be an innovation lab to research and develop the optimal process of food production, energy and water handling and waste-treatment, and to close the distance between consumers and farmers. The technologies and methods employed in the Floating Farm include urine capture and manure collection robots; milking robots; indoor farming of high-nutrient grass with LED technology; wastewater capture, recycling and reuse; and solar panels and renewable energy generation.

Source: Floating Farm (2016), link

Example of measuring and monitoring food waste

Many businesses are turning to automated systems such as ValuWaste (designed and implemented by Oregon-based LeanPath) to track and manage food waste in commercial kitchens. It uses scales, cameras and touch screens to record items as they are being discarded. Such systems allow business to see where in the production chain waste occurs and make relevant changes.

Source: LeanPath (2016), link

Food waste

Example of information and education on food waste

InStock is a restaurant that creates a menu made from 80 to 100% food waste. These products are mainly from Albert Heijn in Amsterdam. Restaurant staff pick up the food on an electric bus - food waste such as fruit, vegetables, potatoes and bread that can not be sold but are still edible. In addition, products with damaged packaging, etc. are picked up from the Albert Heijn distribution centre. Additional food that is surplus or has a short shelf life are sourced from suppliers.

Source: InStock (2018), link

Example of information and education on food waste

The Dutch company Kromkommer saves 'ugly' vegetables that are destined for the bin, such as crooked cucumbers or 'two-legged' carrots. These vegetables are then made into soup which is sold in a variety of stores.

Source: Kromkommer (2018), link

Food waste

The European Commission offers various financial and non-financial instruments to help SMEs in the Food sector to become circular

Next to the generic financial and non-financial instruments which have been introduced in modules 7 and 8, the Commission also offers specific support to SMEs to prevent and reduce food waste. The Commission offers:

- a selection of good practices;
- and a resource library with information on the topic.

Food waste

References to other resources

Publications

- Combating Food Waste
- EUFIC Food today, Safe food storage at home
- Food waste in the EU

Videos

- Food waste in EU

Tools

- What can I do in my daily life to limit food waste?
- Best Before and Use By information

Events

- Saving Food

Biomass- biobased products

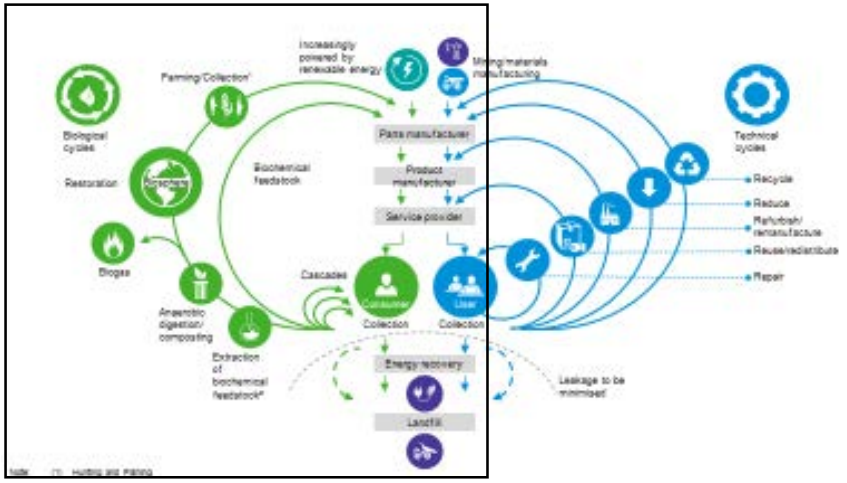
Introduction

The objective of this module is to explain the role of biomass and biobased products in a circular economy. This module builds on the overview figure presented in module 1 and partially relates to the module on food waste.

Biobased materials should be able to re-enter the biosphere and be recycled

Within the concept of circular economy commonly a distinction is made between biological and technological materials (see: figure 3). This is because in contrast to technological materials, biological materials are generally renewable by nature. Since as long as biological materials have not been combined with technological materials (e.g. combining cotton with polyester), technically enhanced (e.g. bioplastics which can not be decomposed) and/or disposed in an unfit ecosystem, the ecosystem should be able to decompose and regenerate these materials (e.g. leaving woodchips in a dry area). For biological materials the focus therefore first lies on using these materials in such a way that these can safely re-enter the biosphere and secondly on recycling / cascading materials.

Figure 21, Visual overview of the circular economy (source: adapted from Ellen MacArthur Foundation (2015))

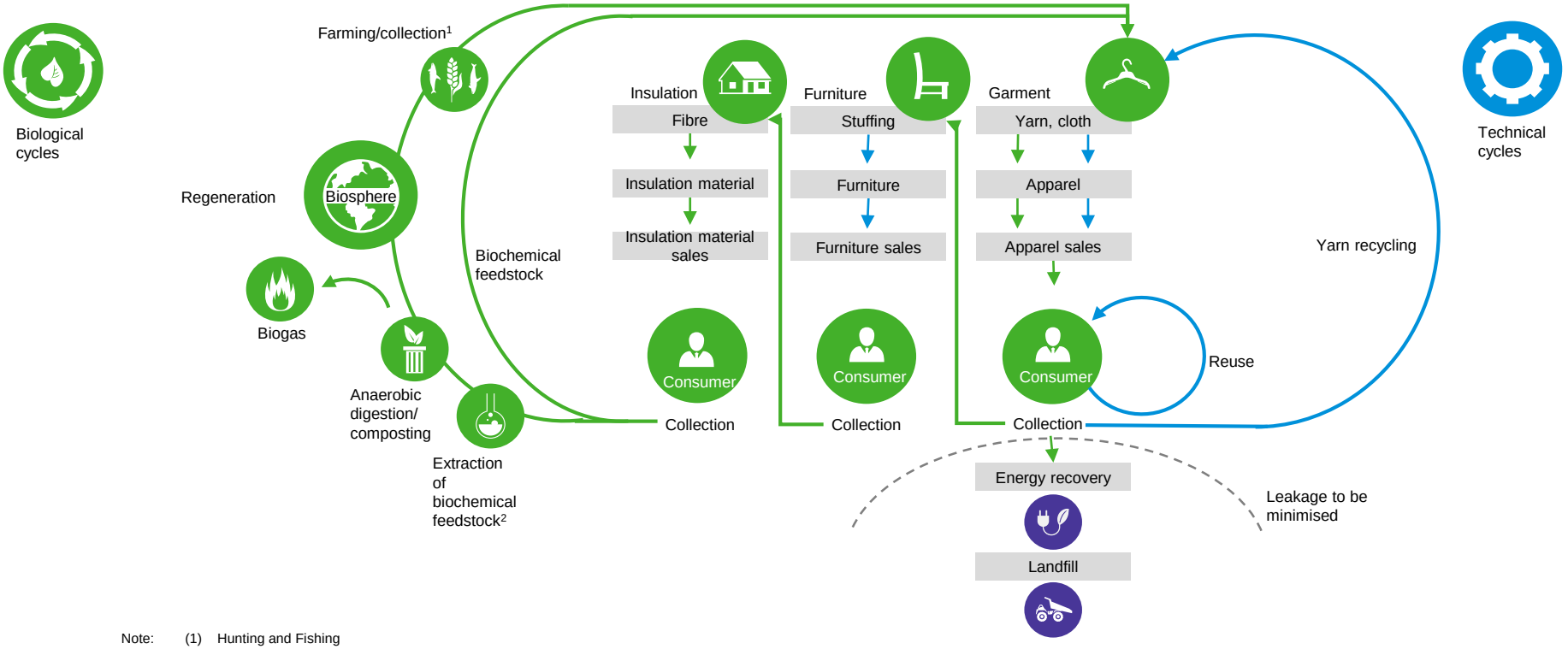


The model depicted above provides a schematic overview of the circular economy. Within this overview a distinction is made between biological and technological materials, because for these materials the transition towards a circular economy required a different approach since these are generally renewable by nature.

Cascade biological materials to preserve the value of materials

Cascading is the term commonly used to refer to the recycling of biological materials. Cascading biological materials helps to keep them in circulation for longer. Which reduces the overall demand for harvesting/extraction of virgin biological materials, and in turn reduces the stress on the global ecosystem. Cascading can be explained through the example of reusing cotton fibres (see: figure 22).

Figure 22: schematic explanation of cascading(adapted from: Ellen MacArthur Foundation (2012))



Note: (1) Hunting and Fishing
(2) Can take both post-harvest and post-consumer waste as an input

Biobased materials can be alternatives to fossil based products and energy

Biobased materials can be used in a wide range of products (e.g. construction, furniture, paper, packaging, food, textile, chemicals) and for energy uses (e.g. biofuels). Biobased materials hence provide alternatives for fossil-based products (e.g. plastics) and energy (e.g. natural gas). Replacing fossil-based products and energy generally contributes to a circular economy since the stocks of fossil fuels are finite whereas biobased materials are renewable. Bio-based materials can also present advantages linked to their renewability, biodegradability or compostability. In addition, biobased materials can results in a reduction of GHG emissions.

On the contrary, using biological resources requires attention to the environmental impact over the entire lifecycle as well as sustainable sourcing since the production of biobased materials requires land and is typically associated with adverse environmental effects. A study financed by the European Commission from 2012 on the environmental impacts of a large set of biobased materials found that the impacts of biobased materials in comparison to fossil-based materials varies significantly but that on average biobased materials save a significant amount of non-renewable energy and GHG emissions. However on average these do result in more eutrophication, acidification and ozone depletion (Weiss et al., 2012). This study and most other studies on the impacts of biobased materials and biofuels do not take into account the impact from land use or the impact on ecosystems. Biomass production requires land. Either new land needs to be made ready for agriculture, causing a change in land use, or the land needed to grow biomass needs to compete with the land required for food production. This impact is less important in the case of so called second generation biomaterials and –fuels which utilize co-products, agricultural residues and waste rather than commodity crops.

Life cycle analysis studies or societal impact analyses can help to gain insight into the overall impact of certain choices between biobased and fossil based materials and sources of energy.

Biomass- biobased products

Summarized explanation of biological side of the circular economy

1. Cascading

See paragraph: '*Cascade biological materials to preserve the value of materials'* and/or figure 22.

2. Extraction of biochemical feedstock

After the use period biological materials can be used as input for biochemical processes to extract biochemical materials and/or to create biochemical products. See the example of the Port of Rotterdam.

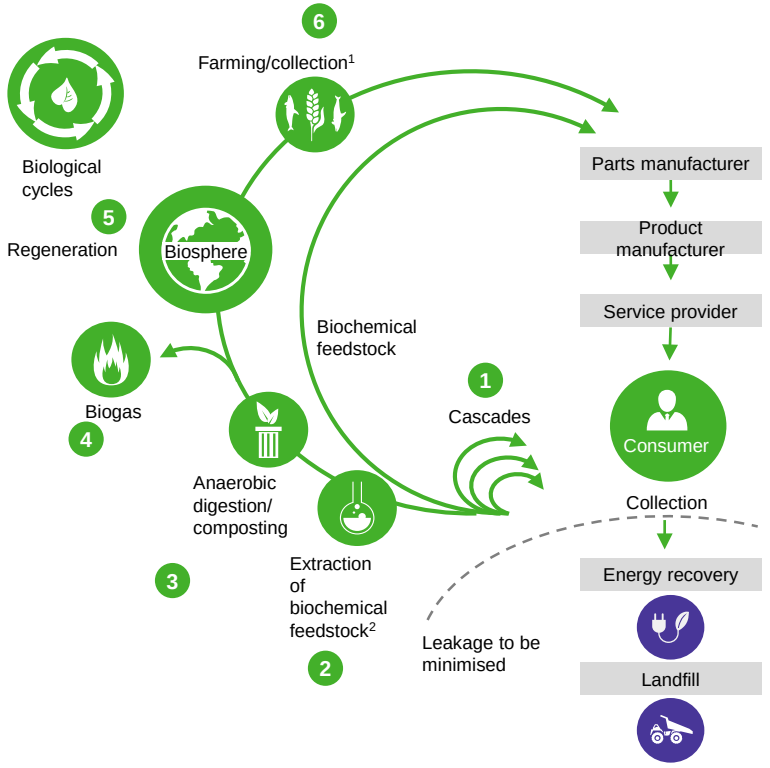
3. Anaerobic digestion/composting

Anaerobic digestion is a process in which naturally occurring microorganisms break down organic materials resulting in biogas and/or solid residual. Composting is another biological process in which organisms break down organic materials into compost.

4. Biogas

One of the products of anaerobic digestion and composting is biogas. Biogas is a mixture of different gasses which are produced when organic matter is decomposed in the absence of oxygen. Biogas is primarily methane CH_4 (natural gas). See the example of PitPoint.

Figure 23: schematic overview of the biological side of the circular economy (adapted from: Ellen MacArthur Foundation (2012))



Note: (1) Hunting and Fishing
(2) Can take both post-harvest and post-consumer waste as an input

Biomass- biobased products

5. Regeneration

The circular economy creates value through defined, separate, technical and biological material flows. In this way, the nutrients embodied in biological materials can be returned to the food and farming systems to regenerate the soil at the end of a cascade. See the example of Puma.

6. Farming/collection

Farming, collection, hunting and fishing are the main activities through which we extract renewable biological materials/nutrients from the biological cycle. For these activities it is important to keep the amount of extraction within the limits that the ecosystem can naturally replenish these materials without compromising the functioning the ecosystem in both the long and short run. See the example on dairy farming.

An example of Waste-to-chemicals

The Port of Rotterdam is the largest harbour in Europe. The harbour houses a wide variety: offshore, containers, liquid bulk, dry bulk, energy industry, bio based industry, LNG and chemical companies. Most of these industries have a significant environmental impact and/or dependent of scarce raw materials. Therefore the port invests in innovative and more sustainable business activities, including a waste-to-chemicals plant. In this waste-to-chemicals plant waste streams van be reprocessed into bio methanol which is normally won as a by-product of oil drilling and refining.

Source: KPMG (2017); Port of Rotterdam (2017), link

Biomass- biobased products

An example of biogas

PitPoint is a company that both produces bio-CNG and sells clean fuels such as CNG, LNG, hydrogen fuel and infrastructure for electric charging. The company's mission statement is to realize clean transport in 2030 by making clean fuel available at competitive prices. These fuel types are cleaner than traditional fuels. This requires continuous innovation. One of the innovations in which PitPoint is involved is the production of bio-CNG by collecting, scrubbing and compressing methane from landfills. The resulting bio-CNG can be used to replace gasoline, diesel fuel or propane/LPG.

Source: PitPoint (2017), link

An example of regeneration

In 2013 Puma introduced the InCycle collection: a collection of shoes, clothes and apparel that are either recyclable or biodegradable. In order to be able to produce a biodegradable product – in their design Puma had to reassess each chemical treatment stage (e.g., dyes and finishes) of all components to ensure that the chemicals degrade
and do not persist in the soil.

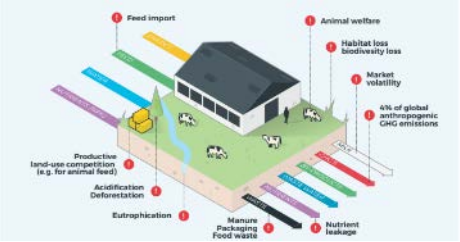
Source: Ellen MacArthur Foundation (2012), link

Biomass- biobased products

Minimizing the environmental impact of farming in a circular economy – a case study on dairy farms

The global dairy sector is forecasted to experience steady growth and create a positive impact on farmers livelihoods and human nutrition. However, it also faces major challenges to achieve a truly circular dairy sector that is regenerative and closes nutrient, water, carbon and waste cycles while promoting biodiversity, optimising land use and safeguarding farmer income. Examples of these challenges are to combine a highly efficient production with the following factors in a sustainable way:

- large scale cross border feed imports;
- animal welfare;
- preservation of biodiversity;
- GHG emissions;
- eutrophication;
- acidification;
- deforestation;
- and productive land-use competition (e.g. for animal feed).



Source: Circle Economy (2016), link

An example of biobased materials

Ooho! is a new kind of packaging made from seaweed that proposes an alternative to plastic bottles. Our spherical water container is easy and cheap to make, strong, hygienic, biodegradable, and is edible. The consumption of non-renewable resources for single use bottles and the amount of waste generated is profoundly unsustainable. The aim of Ooho is to provide the convenience of plastic bottles while limiting the environmental impact.

Source: Skipping Rocks Lab (2018), link

Biomass- biobased products

An example of biobased materials

Ananas Anam has developed an innovative, natural and sustainable non-woven textile called Piñatex™ made from pineapple leaves which are a byproduct of the agricultural industry. Piñatex has evolved from seven years of R&D to create a natural textile from waste plant fibres.

Source: Ananas Anam (2018), link

Biomass- biobased products

References to other resources

Publications

- Circle Economy (2016), The circular dairy sector
- Weiss et al. (2012), Review of the environmental impact of biobased materials

Videos

- Puma (2013), Introducing the PUMA InCycle Collection

Tools

- EU Environmental Footprint Wiki

The three modules in this section provide on several core elements of support programs for SMEs on the subject of circular economy and provide examples from the programme established in the Netherlands by CSR Netherlands.

Module 14:
Establishing and facilitating communities of practice

Module 15:
Facilitating cross sector knowledge exchange and collaboration

Module 16:
Case study – Experiences of CSR Netherlands

Establishing and facilitating a community of practice

Introduction

The objective of this module is to provide guidance on how to establish and set-up communities of practice on circular economy with and between member companies. Experience learns that activation of member companies is a successful part of (SME) support programs.

Communities of practice help SMEs to learn by doing and empowers them to successfully implement the right strategies and measures

Following guidelines, step-by-step processes and/or copying best practices are no guarantee for successfully adopting circular economy strategies and practices. This often requires practical knowledge from multiple disciplines and possibly sectors. A community of practice is a format which can help to gather such practical knowledge. It is a community of people which interacts with each other for their pursuit of a common goal (e.g. finding a way to be able to source a specific material based on circular principles). We find that such communities are often a vital part of successful support (SME) support programs since they help companies to learn by doing and empower companies to successfully implement the right strategies and measures.

Communities of practice generally exist out of a group of 10 to 15 professionals/entrepreneurs which together try to gather knowledge on a new subject with the goal to explore potential new business opportunities or to resolve business issues over the course of a series of meetings. Around the concept of circular economy such communities can be focussed on how to adopt the concept in general or on a specific circular economy topic like how to deal with upcycling of waste streams.

A Community of practice can exist of companies in the same sector of topic. This often makes it easier to share lessons learnt. However, and a bit more advanced communities of practice may also profit from having participants from various sectors, markets, disciplines, backgrounds or positions in a particular value chain– since this may provide new insights to the parties that participate. For example having product designers engage with waste management companies may provide new insights to designers on how to design products that can be disassembled (the example of the toasters of Agency of Design originated from a visit of a designer to recycling plant). Such cross-sector communities of practice are often a breeding ground for cross-sector partnerships between the participants.

Advantages of communities of practice

- They facilitate knowledge gathering and sharing by and amongst members
- They are a breeding ground for new insights, ideas and concepts in a particular value chain.
- They empower members

Guidance on how to establish and facilitate a successful community of practice

Although communities of practice (CoP's) can take various forms CSR Netherlands has good experiences with a community of practice that is set up around 4-5 sessions focused on business cases form the companies who join a community. Most of the time are co-funded. The programme pays for 50-75% of the costs, the rest is funded by attendees, who pay a fee to join.

Establishing and facilitating a community of practice

Example set-up of a community of practice

Figure 24: Example setup of a community of practice

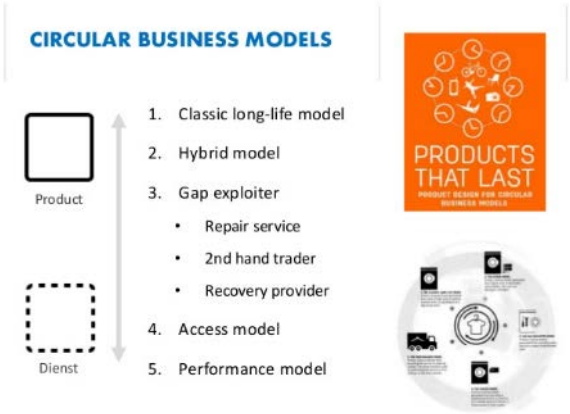
	Day 1: Rethink	Day 2: Refund	Day 3: Redesign	Day 4: Re-engineer
Goal	Find answers to the question of what circular building actually is for the case owner. What are criteria, how do we measure and ensure it?	Gather knowledge and make choices regarding the business model and financing options	Gather knowledge and make choices regarding design principles and material choices (e.g. modular, reuse, biobased etc.)	Gather knowledge and make choices regarding the building process (e.g. shaping a building coalition, contract structures)
Who	Decision makers on behalf of the case owners	All those involved in financing, so possibly also partners in the supply chain	All those involved in the design and material choices, so also partners in the supply chain	All those involved in the collaboration and contracts so also partners in the supply chain
Programme	- Introduction round - Short pitches on the theme by market parties - Group discussion for concept understanding	- Introduction round - Assignment feedback - Introduction to theme by bank - Group discussion - Work on own case - Presenting choices dilemmas and outcome	- Introduction round - Assignment feedback - Short pitches on theme by market parties - Group discussion for concept understanding - Work on own case - Presenting choices, issues and outcomes	- Introduction round - Assignment feedback - Short pitches on theme by market parties - Group discussion for concept understanding - Work on own case - Presenting choices, issues and outcomes
Outcome	Knowledge and understanding of the context and the issues regarding the building project	Knowledge and understanding of the context and the issues regarding business model and financing	Knowledge of possibilities regarding design and materials, and choices	Knowledge of possibilities and considerations regarding commissioning
Assignment	Determine a clear definition and criteria regarding the assignment	Making choices regarding ownership and financial structures	Determine preferences regarding design, material.	Considerations regarding process

Establishing and facilitating a community of practice

Example: the Circo approach, a Circular Business Design Track

Key elements of this Community of Practice:

- A 3 day workshop programme in a period of 2 months
- This programme is focused on getting participants acquainted with the circular economy, learn about circular business and design, discover chances for your own business and the first steps to the development of new products, services and business models.
- This Approach is based on the approach 'Products that Last' (Bakker, Den Hollander & Van Hinte, 2014)



Example: Community of Practice on financing a value chain

Key elements of this Community of Practice:

- A 3 day community of Practice around a case brought in by Fairphone (Fairphone as a Service, FaaS);
- Cross sectoral approach: clients / legal companies / Banks / Pension fund / consultancy / University;
- Deep dive into the possibilities and legal and financial implications of Fairphone as a service;
- Output is a white paper, a contract template and a cashflow model. Fairphone prepares her propositions to launch FaaS for her business customers in 2018.

Facilitating cross-sector knowledge exchange and collaboration

Introduction

The objective of this module is to provide guidance on how to facilitate cross-sector knowledge exchange and collaboration.

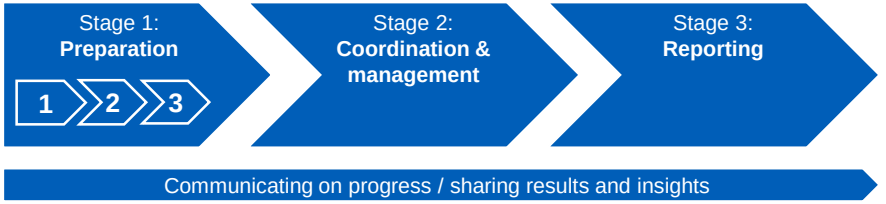
Cross-sector collaboration is often required to be able to close loops

Cross-sector collaboration is often required to implement circular strategies or practices (to close loops). For example organizations with a 'trash-to-cash' business model are logically dependent on waste providers (e.g. StoneCycling). SMEs often lack the network, contacts and time required to establish such cross-sector relations. Therefore we consider facilitating cross-sector knowledge exchange and collaboration a core element of SME support programmes.

Blueprint to facilitate cross-sector knowledge exchange and collaboration

Based on practical experience we would like to provide a 'blueprint' for systematic and successful cross-sector knowledge exchange and collaboration.

Figure 25: Blueprint for facilitating cross-sector knowledge exchange and collaboration



Preparation

The preparation stage can be subdivided in three steps: (1) select the most relevant sectors, (2) gain insight in the relevant sectors and (3) define a 'theory of change'.

The goal of the first step is to select the most relevant chain between which to exchange knowledge and establish collaboration. This requires an analysis based on the economic importance of- and interrelations between sectors, the environmental impact of sectors and the potential to preserve value within sectors. Which results in an overview of the sectors with the largest 'circular potential' from the support organisation's point of view. These results can be validated through interviews with stakeholders or member companies within these sectors.

The second step is to perform interviews with stakeholders within the sectors in order to: identify relevant actors, determine the willingness of actors to adopt circular economy strategies and practices and identify circular opportunities within the sectors.

Facilitating cross-sector knowledge exchange and collaboration

The third and final step of this stage is to define a 'theory of change' for the most relevant chains which outlines how the chain can be transitioned towards more closed loop and circular practices. Practically this means to translate the projected future state to implementation steps that contribute to the change or transition where (cross-sector) collaboration is aiming for.

Coordination & management

At the start of a cross-sectoral collaboration it is important to build a 'coalition of the willing', often SMEs with a relatively high level of ambition on the topic within and between sectors. Selecting or accommodating these participants results from the previous steps. When this group is formed the best start is to organize a 'pressure cooker' meeting. Objective of this meeting is to design the projected future circular state and vision and the best practical pilot opportunities (in terms of impact and feasibility) to go circular. In general these forms of collaborations take one to two years time to result in feasible results for SMEs.

The collaboration is best managed by an independent project manager. Besides the manager it is advised to establish coordinators. Mostly these are people from the SMEs that are involved and are knowledgeable on subtopics. These coordinators are connected to each by the identified practical circular opportunities and they meet regularly discuss their progress and the direction of the program. Furthermore they share obstacles of different kinds that need to be solved. Over the course year the full coalition meets multiple times to discuss progress, success stories and obstacles.

Knowledge sharing on circular economy challenges, ability to work on non-competitive opportunities, trust and feeding the network is key for a successful cross-sectoral collaboration, as with any complex challenge that explores new pathways.

Reporting

It is of great value to your broader SME member community to share the results and inspire others. It is advised to develop project reports, organize workshops or available online communities to share results. The objective is to share insights and lessons learnt that help others to develop collaboration in the circular economy. These report should describe the story of the collaboration that has been established. This process is described from the point of view of the participants. An open and objective case description that includes success but also failures to learn from.

Facilitating cross-sector knowledge exchange and collaboration

An example of a cross-sector knowledge exchange and collaboration project

Cross sector collaboration in 3 circular innovation programmes:

1. Programme focused on plastic and rubber in the underground infrastructure
2. Programme focused on circularity of climate installations in buildings
3. Programme focused on disposables in Health Care

Programmes lasted for about 1,5 year and over 10 cross sector innovation projects. From design, to re-use, from business model innovation (new contracts) to circular procurement innovations.

In each programme from 15-40 companies participated. Mainly SMEs but also large companies participated.

Learnings out of the project teams were systematically documented and shared with the group and by the use of an online community.

After the first year so called project histories were published to enhance collective learning.

Example of an SME support programme on circular economy

Introduction

The objective of this module is to provide an example to demonstrate how a programme can support SMEs to adopting circular economy strategies and practices. As an example we elaborate on the programme of CSR Netherlands: Netherlands Circular ('Nederland Circulair!'), which is (partially) funded by the Dutch government and stimulates and supports companies to become more circular.

CSR Netherlands provides support on three levels

CSR Netherlands provides support on three levels:

- Providing inspiration;
- Tailored support & match-making;
- and Knowledge gathering & sharing.

Providing inspiration

In order to stimulate companies to become more circular, CSR Netherlands shares knowledge on the advantages of adopting circular economy strategies and practices. These are (often) based on case studies or stories from entrepreneurs. CSR Netherlands shares these lessons amongst others through a dedicated website and in (regional) meetings with members.

Tailored support & match-making

In addition to providing inspiration, CSR Netherlands offers: (a) tailored support to organisations that have questions regarding circular economy and (b) aims to bring parties together which can jointly close loops or realize circular business cases. This support is largely channelled through/facilitated by the dedicated website of CSR Netherlands. This provides the opportunity to directly forwards questions and to have parties directly interact with one another in a facilitated environment.

Knowledge gathering & sharing

CSR Netherlands aims to gather knowledge in the field of circular economy and disseminates this knowledge amongst their members via publications and websites. This knowledge is mostly gathered through communities of practice and systems innovation projects.

Most resources of CSR Netherlands with regards to knowledge sharing are put into support offered by experts. For a lot of organizations with circular ideas it is a challenge to acquire the knowledge and network that is necessary to realize their idea or business to the next level. By starting the 'support from experts' program, CSR Netherlands is working on strengthening and accelerating the circular economy in the Netherlands, by helping organizations with their circular questions.

The support CSR Netherlands and her partners offer, is the function of sparring partner, offering organizational support and knowledge. An organization will be assigned an expert who will provide this support and receive 12 hours of funding for this.

Example of an SME support programme on circular economy

The expert can be an advisor, a scientist or someone else who has specific knowledge regarding the question.

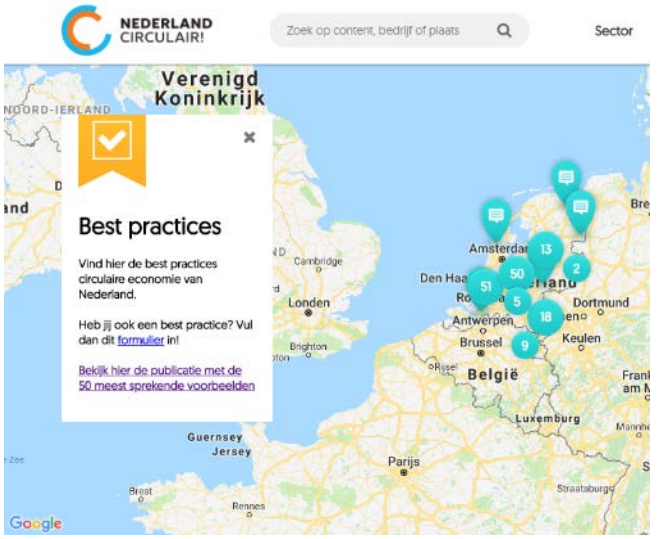
The support can include the following, depending on the question:
- Support in making your question or your initiative concrete
- Establishing contacts with other companies from the region or the supply chain that can help to solve the question.
- Connecting to scientists.
- Connecting to potential launching customers.
- Connecting to potential financial resources
- Connecting to change regulations of the government in this area.

CSR Netherlands can support a hundred companies a year in this way. Criteria to apply for this assessment are:
- The question comes from a company.
- The question concerns the circularization of one of the core components of the company.
- The question is not about developing an instrument or conducting research.
- There is no existing facility where the company can easily go with the question.
- The results on the question are relevant and scalable for a larger group.
- It is a question in which the company can be further assisted with twelve hours' support.
- The question and found solution are (afterwards) described on the online community so that others can learn from your problem.

An example of a service offered by CSR Netherlands

CSR Netherlands created an online interactive map that shows the best practices on circular economy in the Netherlands. One can simply open the interactive map to find several best practices.

Some examples off best practices:
- Remanufacturing mechanical parts
- Cities without Waste
- A solution to the plastic challenges
- G-star Raw – from pet bottle to raw denim



Source: CSR Netherlands (2018), link

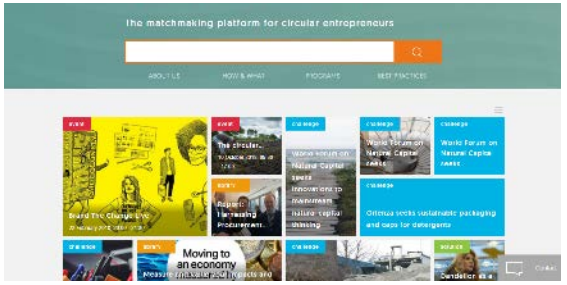
Example of an SME support programme on circular economy

An example of a service offered by CSR Netherlands

On the online community circulairondernemen.nl CSR Netherlands gives entrepreneurs, employees and interested parties in the circular economy a platform to share their projects, events and experiences. CSR Netherlands strongly believe in the strength of the community and believe that through collaboration and knowledge sharing you achieve more than on your own. The matchmaking platform for circular entrepreneurs acts as a place where questions and challenges can be placed by companies. CSR Netherlands connects challenges with those who can help to solve these challenges.

Some examples of challenges on the platform are:

- Waste from sludge looking for new purpose, by the Hoogheemraadschap Hollands Noorderkwartier
- SOFEA seeks stakeholders to improve sustainability of office supplies
- Dutch Water Boards aim to scale up production of biobased biological degradable plastic out of sewage



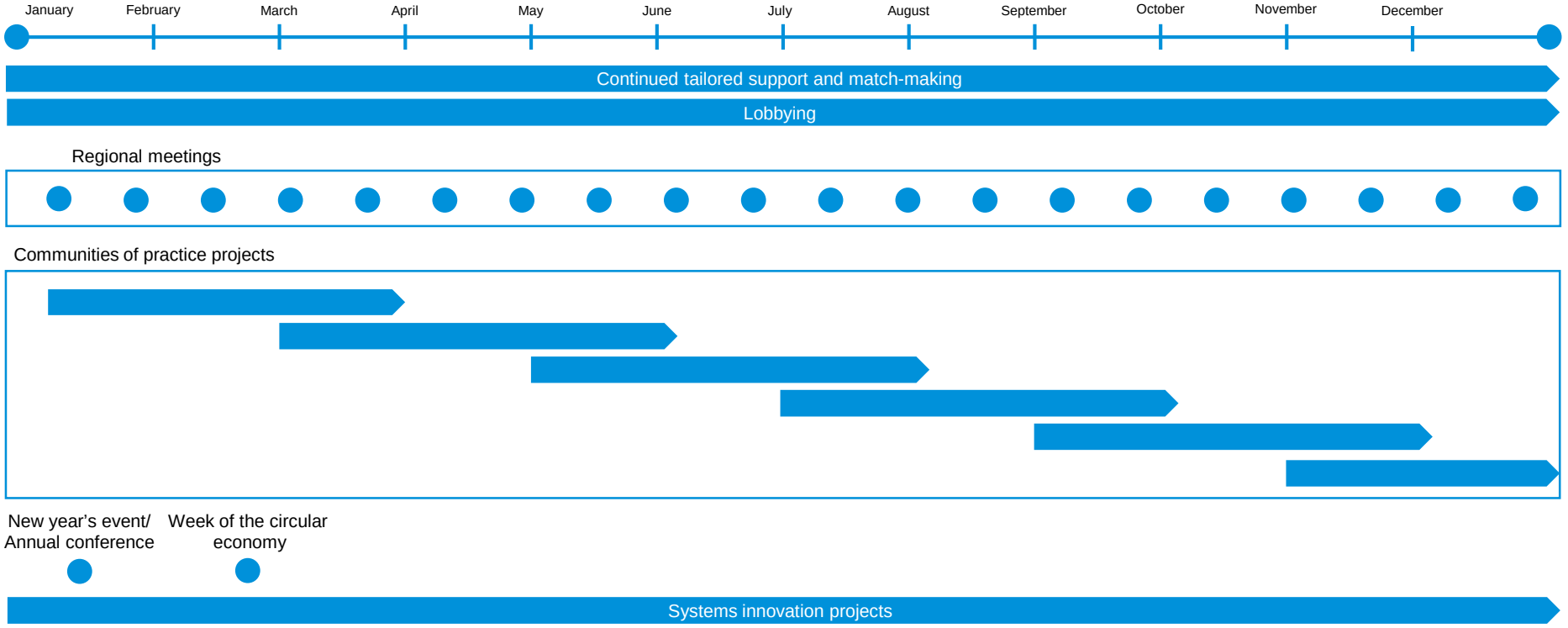
Source: CSR Netherlands (2018), link

Example of an SME support programme on circular economy

Example of an SME support programme on circular economy

To provide more insight into out of which elements the programme of CSR Netherlands exists we would like to share an overview of the various activities which are organized by CSR Netherlands over the course of a year.

Figure 26: overview of the elements of the CSR Netherlands circular economy support programme



This section consists of two modules focused on establishing, improving or expanding the programs of your SME support organization to support SMEs to adopt circular economy strategies and practices.

Module 17:
Developing action plans to establish, improve or expand your program to support SMEs

Module 18:
Implementation support

Developing action plans to establish, improve or expand your program to support SMEs

Introduction

The objective of this module is to draft an action plan on how to establish, improve or expand your SME support organization's program to help SMEs to adopt circular economy strategies and practices through a series of steps.

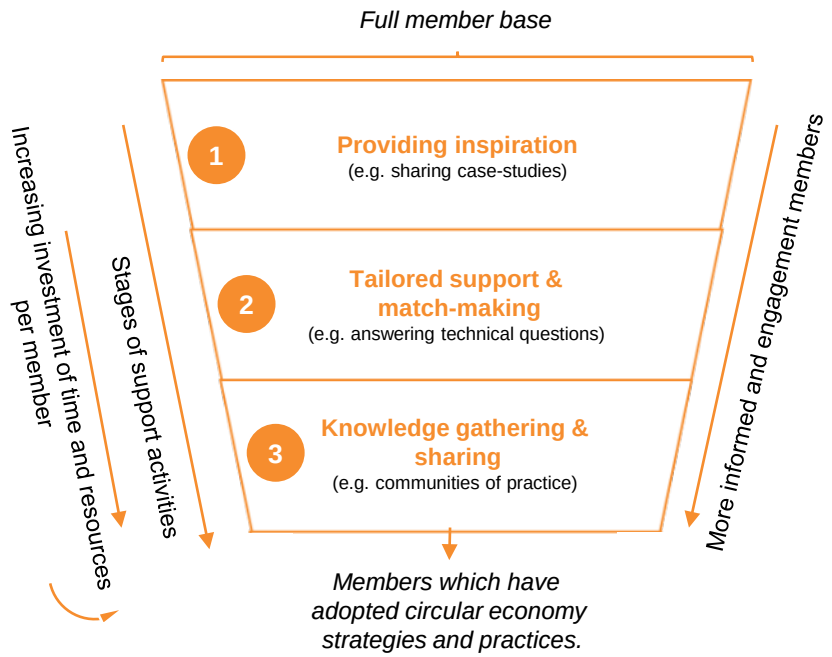
Developing an action plan in three steps

We would like to jointly come to a roadmap on how we can establish, improve or expand your SME support organization's program to help SMEs to adopt circular economy strategies and practices through a three step process.

- Step 1: Listing which support activities you would like to provide;
- Step 2: Determining which resources are required to be able to provide support;
- and Step 3: Developing a roadmap to establish, improve or expand your program.

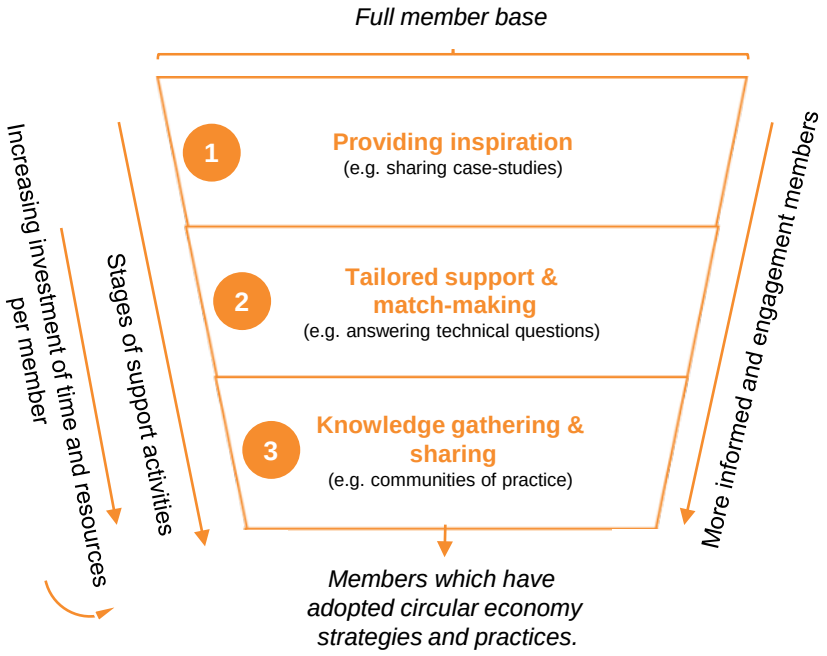
To support this process we would like to propose to use the framework presented in figure 27. This figure illustrates how members can be supported to adopt circular economy strategies and practices through a series of interlinked support services which jointly form an integrated support program. On the following pages we provide examples of services which CSR Netherlands offers within these stages.

Figure 27: generic framework for support programs of business networks



Developing action plans to establish, improve or expand your program to support SMEs

Figure 28: generic framework for support programs of business networks



Step 1: Listing which support activities you would like to provide

1

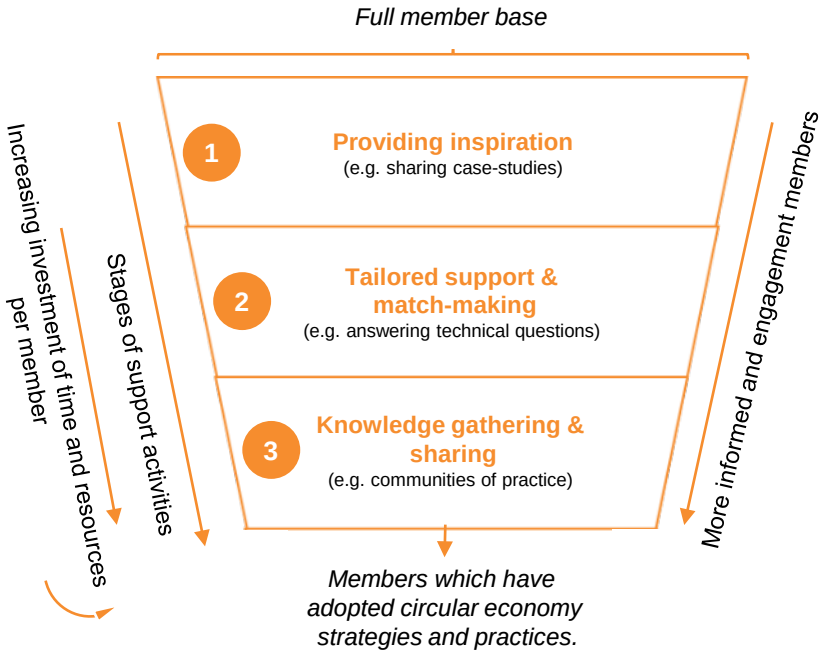
2

3

4

Developing action plans to establish, improve or expand your program to support SMEs

Figure 29: generic framework for support programs of business networks



Step 2: Determining which resources are required to be able to provide support

1

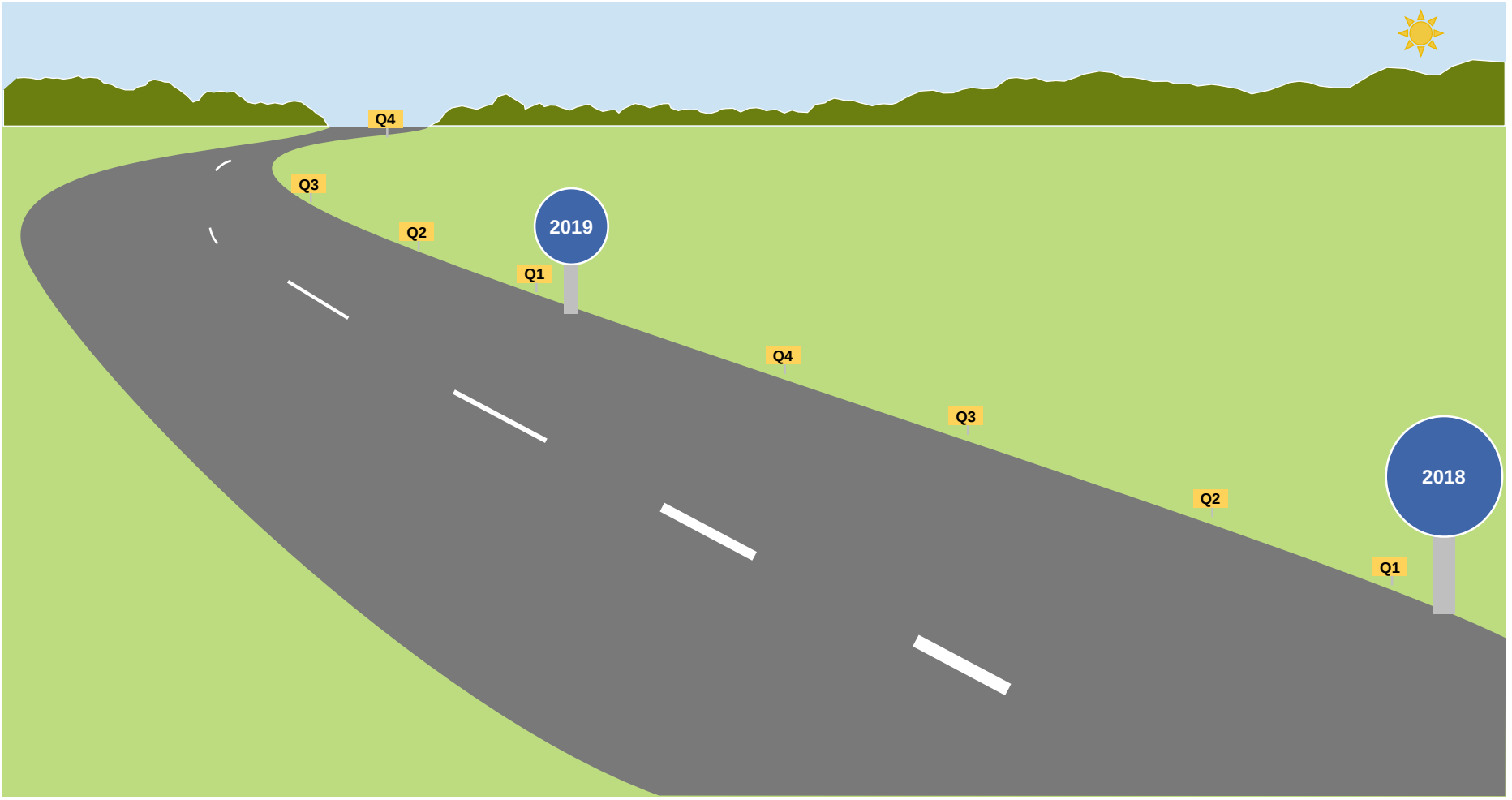
2

3

4

Developing action plans to establish, improve or expand your program to support SMEs

Step 3: Developing a roadmap to establish, improve or expand your program



Implementation support

Introduction

The objective of this module is to outline how to the Commission through KPMG, CSR Netherlands and Circle Economy will provide further support to your SME support organisation.

We will offer a tool to engage with your SME members on the topic of circular economy

As part of this project Circle Economy offers access to their tool which can help to engage with your SME members and measure the extent to which they are pursuing and implementing the circular economy. The tool consists of a set of questions formulated to help SMEs understand the systemic aspects of the circular economy. By answering these questions SMEs get educated about the circular economy and understand their current level of circular activity, challenges, and future opportunities. Whereas you get an overview of the assessment results which helps to:

- identify companies that are frontrunners or have strong potential for improvement and further engagement;
- and identify matchmaking and knowledge sharing opportunities between SMEs to encourage local business development.

Please inform us when you are interested in using this tool. In which case we will invite you a webinar, on April 4th from 14:00 to 15:00 CET, during which we will provide more information on the offered tooling.

We will be available for questions and practical advice along the way

Over the coming the experts of KPMG, CSR Netherlands and Circle Economy will be available to you for questions or when you seek advice on how to establish, expand or expand your program on circular economy.

We would like to schedule two conference calls: one in two months and another in four to five months, to discuss your progress and what we might be able to do to help you.

These training materials are exclusively prepared to support training sessions wit selected SME support organizations as part of the project “Fostering a green circular economy in Europe through capacity building, networking and exchanges of innovative solutions – Bridging the green innovations gap” and for no other purposes. KPMG Advisory N.V. (“KPMG”) does not guarantee or declare that the information in this Report is suited for the objectives of others than the addressee. This means that our Report cannot replace other investigations and/or procedures that others than the addressee may (or should) initiate with the objective to obtain adequate information about matters that are of interest to them. It is not the responsibility of KPMG to provide information to any third party that has become known or available at any time after the date of the Report. KPMG accepts no liability for the Report towards any others than the European Commission. The terms and conditions of the agreement under which this Report has been drawn up are exclusively governed by the European Commission.

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