

Circular makerspaces: training program



FOREWORD

Welcome to the training program on circular economy designed specifically for makerspaces! In a world where sustainability and resource efficiency are paramount, this program is tailored to empower makerspace enthusiasts with the knowledge and skills to thrive in the dynamic intersection of creativity and circular principles. Explore the essential concepts and working methods driving sustainable innovation and join us in reshaping the future of making through this immersive learning experience.

In the changing field of innovation, makerspaces play a crucial role in shaping the future of creative projects. As we navigate a world increasingly focused on sustainability and responsible resource management, the need for a circular mindset within makerspaces becomes ever more apparent. This circular training program is designed to empower makers with the knowledge, skills, and inspiration to infuse circular principles into their projects, fostering a community of innovators committed to both creativity and environmental responsibility. Welcome to a transformative journey, where making meets sustainability, and together, we shape a more circular and thoughtful future.

Circular Spaces Project Team

Empowering makerspace communities with a comprehensive view on circular economy principles, fostering sustainable innovation, resource efficiency, and a circular mindset

This education program was developed under the Circular Spaces project, funded by Interreg Baltic Sea Region programme 2021-2027

How to make use of this program?

Circular makerspaces training program consists of 9 Topics closely complementing each other. Topics 1-4 and 9 focus on building trainees' theoretical knowledge regarding different aspects of circular economy, while Topics 5-8 target practical application of gained insights.

1. Circular Economy and Sustainability
2. Waste as a Resource in Circular Economy
3. Circular Value Chains, Ecosystems, and People
4. Circular Business Models
5. Life Cycle Thinking and Environmental Footprint
6. Design Thinking for Circular Products
7. Reusability, Repairability, Recyclability
8. Integration of Circular Approaches into Everyday Work Life
9. Circular Economy Policies across Baltic Sea Region Countries

While the most benefits for trainees come from the exploration of all Topics, each trainer can decide individually how to structure their organization of trainings by utilizing different selected topics. Examples below suggest a few formations of such option.



Each Topic begins with methodological notes which serve as a guiding material for trainers during the preparation and the organization of training activities. These notes include a summary of each Topic, expected training outcomes, defined training benefits for different target groups, training plan and other necessary information for carrying out the training.

Action required tasks, such as discussions, workshops or case analyses, are marked with **blue text** and activity icon. It is up to the trainer to decide how these tasks will be carried out. For example, trainees can go through the theoretical materials individually and implement action required tasks in groups.



Activity icon

In addition to this document, **each Topic is accompanied with slides** which can be utilized as a supporting material for trainers when presenting training content. The slides can be freely accessed **here**.

This document can be used both as an **instruction manual for the trainer** and as **informational material for the trainees**. Training organisers are invited to add their own insights, local best practices or creative practical exercises to the material presented.

Circular Business Models

Developed by

Ventspils High Technology Park

Topic

4

This training Topic provides a comprehensive understanding of circular business models, enabling participants to apply circular principles in their professional activities or entrepreneurship ventures. It is adaptable to different educational settings and can be customized to meet specific learning objectives and time constraints.

Expected training outcomes

After completing this Topic, trainees will...

- ... circular and linear business models;
- ... types of linear business models;
- ... possibilities to transfer from linear to circular business models;
- ... where to look for information about circular economy.

Notes for target groups

Different target groups can achieve the following benefits of this training Topic.

Makers

Information and samples that can be used for transferring to circular economy.

Makerspaces

Ideas on how to inform makers about circular business models, help to use reusable materials in the prototyping phase.

Suppliers

Ideas for offering more reusable materials.

Start-ups

Suggestions on how to use reusable materials in the prototyping phase, circular business thinking in developing their product.

Small and medium-sized enterprises (SMEs)

Suggestions on how to reuse leftovers and to rethink the product cycle.

Business support organizations

Stipulation of less materials that cannot be recycled, more businesses with less pollution in the region.

Training plan

| Introduction (45 min / 1-11 slides) | Main part (2 h 30 min / 12-41 slides) | Conclusion (45 min / 42-45 slides) |
|--|--|---|
| Linear and Circular Business Models; Principles of Circular Business Models; Benefits of Circular Business Models. <i>Presentation.</i> | Circular business models; Economical models and good practices; How to transfer from linear to circular business model; Circular business model innovation challenge task. <i>Presentation, workshop.</i> | Challenges and considerations; Opportunities; Conclusion. <i>Presentation, discussion.</i> |

Total duration for the Topic 4: 4 h

Training modes

| In person | Online | Hybrid |
|--|--|--|
| In person training involves face-to-face sessions conducted in a physical location. This traditional approach allows direct interaction between trainers and participants, fostering real-time engagement, hands-on activities, and immediate clarification of doubts. It provides a social learning environment and is ideal for building interpersonal skills. | Training is conducted through digital platforms, enabling participants to access content remotely. It offers flexibility in scheduling, self-paced learning, and the convenience of accessing materials from any location with an internet connection. Interactive modules, multimedia elements, and virtual simulations enhance the online learning experience. | Hybrid trainings make it possible for participants from different geographical locations to join, including those who might not be able to travel due to distance, health concerns, or budget constraints. This inclusivity enhances the diversity of perspectives and experiences shared during the training. |

Notes for the trainer

| Required previous experience and theoretical knowledge | Ethical aspects of carrying trainings | Training tools and resources |
|--|--|--|
| Theoretical knowledge about Circular business models. Deep understanding of its principles. Practical knowledge about Circular business models. Sector-specific expertise. Previous experience in lecturing. | Inclusivity and diversity; transparency and honesty; voluntary participation; informed consent; confidentiality; trainer's competence; avoidance of discrimination and bias; feedback and continuous improvement. By adhering to these ethical principles, trainers can create a positive and inclusive learning environment that respects the rights and dignity of all participants. | <i>For trainer:</i> presentation slides (use the existing presentation or add additional information to the presentation as needed); equipment for showing the presentation; access to video conferencing platform (if people are attending online); paper and pens for activity "Circular Business Model Innovation Challenge". <i>For trainee:</i> Computer, good internet connection, headset (if attending online). |

Introduction

A **linear business model** is characterized by a straight-line approach to production and consumption, operating on a "take-produce-use-dispose" framework. In this model, resources are extracted, transformed into products, sold to consumers, and eventually discarded as waste after their useful life. The linear model has been the dominant economic model for centuries, driven by a focus on short-term consumption and efficiency. However, it often leads to significant environmental challenges, including resource depletion, waste accumulation, and pollution, because it fails to consider the finite nature of resources and the environmental impact of waste. The Linear business model has been prevalent since the Industrial Revolution (1760-1840).



Key Features of the Linear Business Model:

- ✓ **Resource Extraction:** The model begins with the extraction of natural resources from the environment. This step is foundational to the production process but often leads to the depletion of natural resources and environmental degradation.
- ✓ **Manufacturing and Production:** The extracted raw materials are transformed into products through manufacturing processes. This stage is typically energy-intensive and can contribute to pollution and waste.
- ✓ **Consumption:** Products are sold to consumers, who use them until they are no longer functional or desirable. The focus is on maximizing sales, often encouraging a culture of overconsumption.
- ✓ **Waste Generation:** Once products reach the end of their life or are no longer wanted, they are discarded. The linear model rarely incorporates mechanisms for reusing, recycling, or repurposing materials, leading to significant waste accumulation.

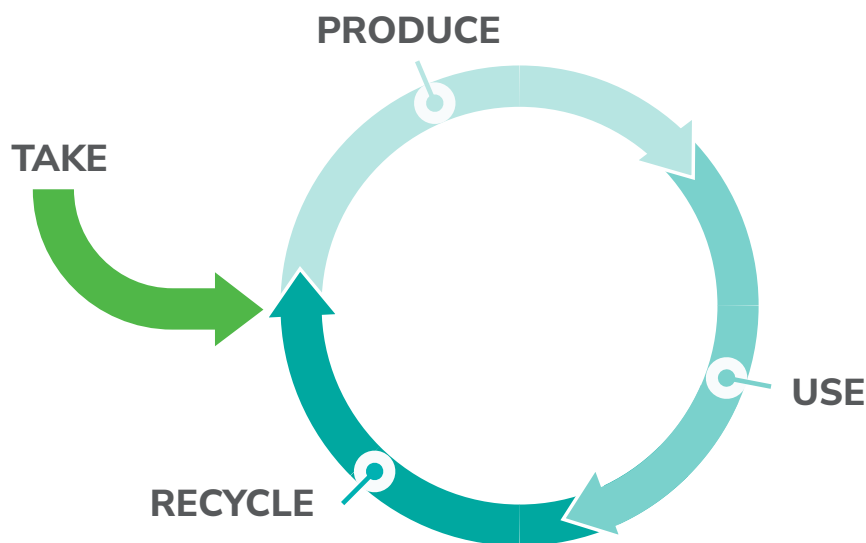
Implications of the Linear Business Model:

- ✓ **Environmental Impact:** The linear model contributes to resource depletion, pollution, and waste. It puts pressure on the environment by not efficiently using resources and not managing waste sustainably.
- ✓ **Economic Efficiency:** While the linear model can be economically efficient in the short term, it faces long-term sustainability challenges, including resource scarcity and the increasing costs of waste management.
- ✓ **Social Considerations:** The model often overlooks the social implications of unsustainable production and consumption patterns, such as health problems related to pollution and the unequal burden of waste management on certain communities.

Given its limitations and unsustainable nature, there is a growing shift away from the linear business model towards more sustainable practices. The circular economy model is one such alternative that aims to address the shortcomings of the linear model by designing out waste, keeping materials in use, and regenerating natural systems. The circular model encourages the development of products and business practices that are sustainable over their entire lifecycle, from design through to disposal or, ideally, reintegration into new products.

The transition from a linear to a circular model is seen as essential for achieving long-term sustainability, reducing environmental impact, and fostering economic resilience in the face of diminishing natural resources.

A **Circular Business Model** emphasizes sustainability by designing out waste and extending the lifecycle of resources. Unlike the traditional linear model, circular models aim to create economic value through a regenerative approach, focusing on the reuse, repair, refurbishment, and recycling of products and materials. This model is foundational to the circular economy, which seeks to maintain the value of products, materials, and resources for as long as possible, thus minimizing environmental impact and resource depletion.



Key Characteristics of Circular Business Models:

- ✓ **Design for Longevity:** Products are designed from the outset to be durable, repairable, and upgradeable, extending their usable life and reducing waste.
- ✓ **Resource Efficiency:** Materials are used more efficiently across the production and consumption process. This includes the use of renewable resources and the reduction of raw material consumption.
- ✓ **Closed-loop Systems:** Emphasis is placed on creating closed-loop systems where waste is minimized, and products or materials at the end of their life are recycled or reused for as long as possible.
- ✓ **Business Model Innovation:** Circular models often involve innovative business strategies, such as product-as-a-service (where products are leased rather than sold), take-back schemes (where companies take back products for recycling or refurbishing), and collaborative consumption (sharing or renting products).

The principles of Circular business models are grounded in the broader philosophy of the circular economy, which aims to redefine growth by focusing on positive society-wide benefits. These principles challenge the traditional linear "take-produce-use-dispose" model, advocating for a systemic shift towards sustainability that designs out waste, keeps products and materials in use, and regenerates natural systems.

Principles of the Circular business models:

- ✔ Design out waste and pollution: From the outset, products are designed to minimize waste and pollution. This involves selecting materials that are safe and recyclable, designing for easy disassembly, and employing manufacturing processes that reduce waste and emissions.
- ✔ Keep products and materials in use: Circular models prioritize extending the life cycle of products through repair, maintenance, refurbishment, and remanufacturing. This principle aims to maximize the utility of products, components, and materials, keeping them circulating in the economy for as long as possible.
- ✔ Regenerate natural systems: Beyond minimizing harm, circular business models strive to have a positive impact on natural systems. This can involve using renewable energy, supporting regenerative agricultural practices, and using materials in a way that improves the environment.
- ✔ Rethink the business model: Businesses are encouraged to innovate their business models for circularity. This could mean adopting product-as-a-service models, where the emphasis is on leasing or sharing rather than ownership, or implementing take-back schemes to ensure products are returned, reused, or recycled.
- ✔ Design for adaptability and disassembly: Products should be designed so that they can be easily adapted to different uses or disassembled for repair or recycling. This flexibility extends the useful life of products and supports the efficient recovery of materials.
- ✔ Use waste as a resource: Waste materials from one process are seen as inputs for another, creating a closed-loop system where materials are continually reused and recycled. This principle aims to eliminate the concept of waste entirely.
- ✔ Promote systems thinking: Recognizing that businesses operate within broader ecological and economic systems, circular models advocate for a system thinking approach. This means considering the impacts of business activities holistically and working collaboratively across supply chains and sectors to enable circularity.
- ✔ Foster innovation and collaboration: Transitioning to a circular economy requires innovation in technology, business models, and collaboration among stakeholders, including businesses, governments, and consumers. Sharing knowledge and resources can accelerate the adoption of circular practices.

Implementing these principles requires a shift in mindset from all stakeholders involved - from designers and manufacturers to consumers and policymakers. It involves rethinking product design, business models, and consumption patterns to create a more sustainable and resilient economy.

By adhering to these principles, circular business models not only contribute to environmental sustainability but also offer economic opportunities through cost savings, new revenue streams, and enhanced competitiveness. The transition towards circularity is seen as a crucial step in addressing global challenges such as resource depletion, climate change, and biodiversity loss.

Benefits of implementing circular business models

Environmental Benefits

Reduced Waste and Pollution: By emphasizing reuse, recycling, and the efficient use of resources, circular business models significantly reduce the amount of waste generated and the associated environmental pollution.

Conservation of Resources: These models encourage the sustainable use of resources, minimizing the extraction of raw materials and preserving natural habitats and biodiversity.

Lower Carbon Footprint: Circular practices, such as extending product lifecycles and using renewable energy sources, contribute to a reduction in greenhouse gas emissions, helping to combat climate change.

Social Benefits

Job Creation: The transition to circular business models can create new jobs in areas such as repair services, remanufacturing, and recycling, contributing to economic development.

Improved Quality of Life: Circular models promote the development of products that are more durable, repairable, and adaptable, offering consumers greater value and contributing to higher standards of living.

Innovation and Collaboration: Encouraging innovation in product design, business practices, and collaboration across industries and sectors, circular business models drive progress towards a more sustainable future.

Strategic and Operational Benefits

Enhanced Brand Image and Reputation: Companies leading in sustainability and circularity often enjoy an enhanced brand image, attracting customers, investors, and talent who prioritize environmental responsibility.

Regulatory Compliance and Incentives: Circular business practices can help companies stay ahead of regulatory requirements, benefit from government incentives for sustainability, and avoid potential fines or sanctions related to environmental compliance.

Long-term Viability: By aligning with the principles of sustainability, companies position themselves for long-term success in an economy that increasingly values resource efficiency, environmental stewardship, and social responsibility.

Circular Business Models:

Recycling model

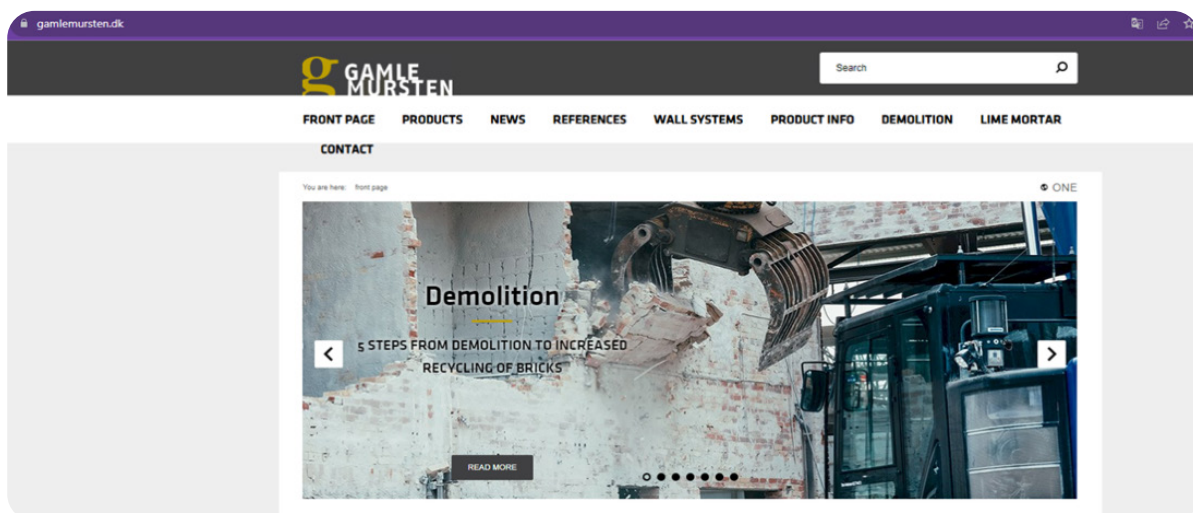
The recycling business model is centered on the collection, sorting, processing, and conversion of waste materials into usable or sellable products or raw materials. It plays a crucial role in the circular economy by ensuring that materials, otherwise considered as waste, are brought back into the economy, thus reducing the need for virgin materials and minimizing environmental impact. This model not only contributes to sustainability but also presents economic opportunities through the creation of jobs and the development of green technologies.

Key Features of the Recycling Business Model:

- ✓ **Collection and Sorting:** The initial step involves the collection of recyclable materials from various sources, including households, businesses, and construction sites. Efficient sorting is critical to separate materials by type and quality, which determines their value and recyclability.
- ✓ **Processing:** Once sorted, materials are cleaned and processed to remove impurities. The processing methods vary depending on the material, ranging from mechanical shredding and melting for plastics and metals to pulping for paper.
- ✓ **Manufacturing:** Processed materials are then transformed into new products. This can involve manufacturing entirely new items from recycled materials or producing secondary raw materials that are supplied to other industries as inputs for new products.
- ✓ **Sales and Distribution:** The final products or secondary raw materials are sold to consumers or businesses. The success of this stage depends on market demand for recycled products, which can be influenced by factors such as price, quality, and consumer awareness.

Good practice (example):

Every day, Gamle Mursten makes sure that bricks taken from demolition sites are not downcycled and crushed, but instead are upcycled and reused as a valuable building material that brings both rustic aesthetics and history to new Danish buildings. Since 2003, Gamle Mursten has been cleaning bricks for recycling, because it is against all common sense not to do so. Each recycled brick saves the environment 0.5 kg of CO₂.



Circular Business Models: Refurbishment model

The refurbishment business model focuses on extending the lifespan of products and components by restoring them to a like-new condition. This model not only reduces waste and conserves resources but also meets consumer demand for more sustainable and cost-effective products.

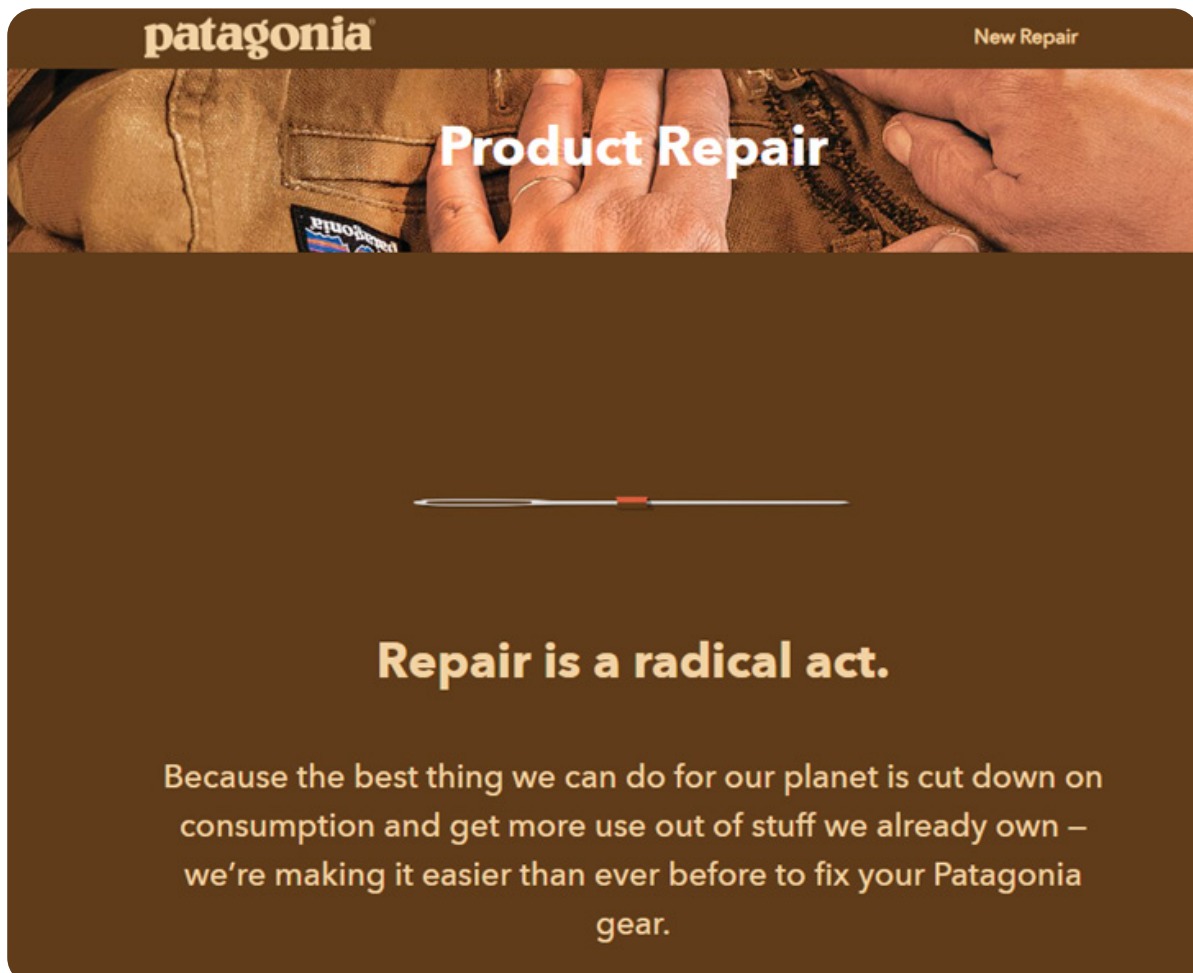
Refurbishment involves repairing, cleaning, and restoring used products to good working condition. It may include replacing worn or defective parts, cosmetic improvements, and updating software. The aim is to make the product fully functional again, although it might not necessarily meet the original factory specifications. Refurbished products are typically sold with a warranty, offering consumers a more affordable alternative to new products.

Key Features of the Refurbishment Business Model:

- ✓ Focus on extending the useful life of products.
- ✓ Less extensive than remanufacturing, often limited to surface or minor repairs.
- ✓ Products may show signs of previous use but are functional and reliable.

Good practice (example):

Patagonia is a designer of outdoor clothing and gear for silent sports: climbing, surfing, skiing and snowboarding, fly fishing, and trail running. It also offers to repair the gear.



The image is a promotional graphic for Patagonia's repair service. At the top left, the Patagonia logo is displayed in white on a dark brown background. To the right, the text 'New Repair' is written in a smaller white font. Below this, a photograph shows a pair of hands working on a piece of brown, worn outdoor gear, with the words 'Product Repair' overlaid in large white text. Underneath the photo is a horizontal line with a small red segment in the center. The main headline, 'Repair is a radical act.', is written in a bold, white, sans-serif font. Below the headline, a paragraph of white text reads: 'Because the best thing we can do for our planet is cut down on consumption and get more use out of stuff we already own – we're making it easier than ever before to fix your Patagonia gear.'

Circular Business Models: Remanufacturing model

The remanufacturing business model is a pivotal component of the circular economy, focusing on extending the lifespan of products and components by restoring them to a like-new condition. This model not only reduces waste and conserves resources but also meets consumer demand for more sustainable and cost-effective products.

Remanufacturing is a more comprehensive process that involves disassembling, cleaning, inspecting, repairing, or replacing components, and reassembling products to meet the original manufacturer's specifications or better. This process can significantly extend the product's life and often results in products that are comparable to new ones in terms of performance and warranty.

Key Features of the Remanufacturing Business Model:

- ✔ More intensive than refurbishment, involving complete disassembly and restoration.
- ✔ Products are brought up to current standards, often indistinguishable from new products.
- ✔ Supports sustainability by reducing the need for new materials and minimizing waste.

Good practice (example):

Caterpillar is the world's leading manufacturer of construction and mining equipment, off-highway diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives. The Cat Reman programs provide customers with lower-cost products, shorter downtime, and quick, dependable service options. It returns products at the end of their serviceable lives to same-as-new condition. This helps reduce your owning and operating costs by providing you with same-as-new quality at a fraction of the cost of a new part.



Caterpillar's Circular Economy

Wherever possible, we keep resources in the Caterpillar value chain through a circular flow of materials, energy and water. Our focus on developing better systems optimizes our use of resources, maximizes the total life cycle value of our products and minimizes the cost of ownership for our customers. Viewing our equipment through a total life cycle lens allows us to make sustainable progress for communities, the environment and the economy.

Caterpillar strives to provide customers with quality equipment that provides the best economic proposition for their business. Our remanufacturing (reman) and rebuild businesses provide customers not only with an immediate cost savings, but also help extend life cycles and use materials more efficiently.



1 of 2

Remanufactured Products And Rebuilt Products

The Cat Reman® programs provide customers with lower-cost products, shorter downtime and quick, dependable service options.

A leader in remanufacturing technologies and processes, Cat Reman returns products at the end of their serviceable lives to same-as-new condition. This helps reduce your owning and operating costs by providing you with same-as-new quality at a fraction of the cost of a new part. Through the remanufacturing process Caterpillar reduces waste, lowers greenhouse gas production and minimizes the need for raw materials.

Circular Business Models: Product-as-a-service (PaaS) model

The Product-as-a-Service (PaaS) business model represents a shift away from traditional ownership to a service-oriented approach. In this model, customers pay for the use of a product without owning it outright. Companies maintain ownership of the products and are responsible for their maintenance, repair, and eventual recycling or disposal, encouraging the design of more durable and sustainable products. This model is part of the broader trend towards service-based models in the circular economy, aiming to reduce waste and resource consumption while providing flexibility and sustainability for consumers.

Key Features of PaaS Model:

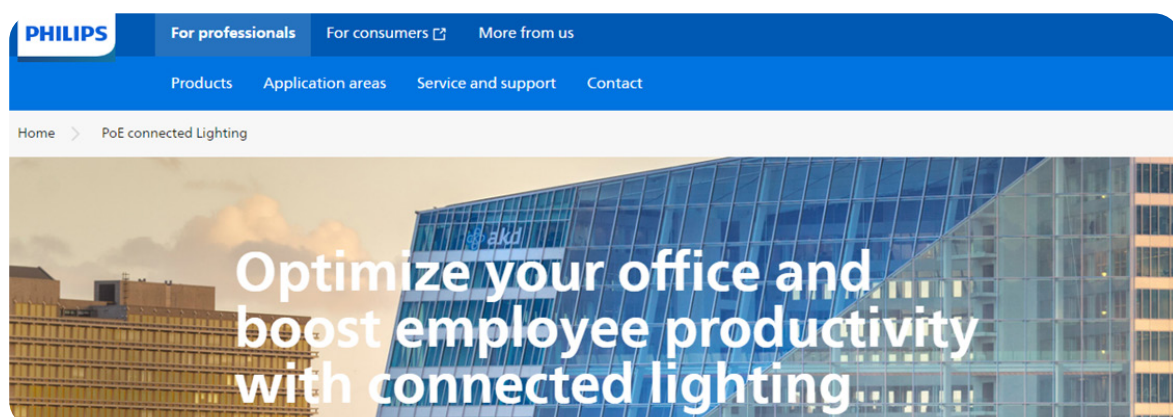
- ✓ *Access Over Ownership:* Customers access the benefits of a product through subscriptions, leasing, or pay-per-use arrangements, eliminating the need for ownership.
- ✓ *Extended Producer Responsibility:* Manufacturers or service providers retain ownership of the product, incentivizing them to create durable, repairable, and easily upgradable products.
- ✓ *Circularity and Sustainability:* By focusing on product longevity and end-of-life recovery, PaaS models contribute to the circular economy, reducing waste and encouraging the efficient use of resources.
- ✓ *Customization and Flexibility:* PaaS often allows for greater customization to meet customer needs, with flexible terms that adapt to changing consumer demands or usage patterns.

Examples of PaaS Model:

- ✓ *Technology and Electronics:* Companies offer devices (e.g., printers, computers, smartphones) as a service, including maintenance and upgrades as part of the subscription fee, allowing customers to always have access to the latest technology without the burden of ownership.
- ✓ *Transportation:* Car-sharing and bike-sharing services are examples of PaaS in the mobility sector, where users pay for access to vehicles or bikes on an as-needed basis, reducing the need for personal vehicle ownership.
- ✓ *Furniture and Appliances:* Some companies offer furniture or appliances as a service, targeting both consumers and businesses. This model is particularly appealing for temporary needs or for reducing upfront investment costs.

Good practice (example):

Philips is a diversified technology company known for its wide range of healthcare, consumer lifestyle, and lighting products. Philips' connected lighting systems is a prime example of the PaaS business model in action. This approach represents a shift from selling light fixtures as products to providing lighting as a service. Philips offers this innovative service primarily to business and municipal customers, emphasizing energy efficiency, sustainability, and smart technology.



Circular Business Models: Biological Cycles model

The Biological Cycles business model is an integral part of the circular economy, focusing on the use and management of biological resources to create value in a way that mimics natural processes. It is designed to ensure that biological materials - such as food, wood, fibers, and bioplastics - can be returned to the ecosystem after their use in economic activities, where they biodegrade and regenerate new resources. This model contrasts with technical cycles, which focus on the recycling and reuse of non-biological materials like metals and plastics.

Key Features of Biological Cycles Business Model:

- ✓ **Regenerative by Design:** This model emphasizes processes that regenerate natural systems, improving soil health, increasing biodiversity, and enhancing ecosystem services rather than depleting them.
- ✓ **Safe and Compostable Materials:** Products are made from materials that are safe for composting or anaerobic digestion, ensuring they can return to the earth without causing harm to the environment.
- ✓ **Maximizing Resource Efficiency:** It focuses on maximizing the utility of biological resources through practices like cascading use, where materials are used sequentially for different purposes, extracting the maximum value at each stage.
- ✓ **Promoting Local Production and Consumption:** Encourages local sourcing and consumption of biological materials to reduce transportation emissions and support local economies while ensuring materials are processed in a way that is compatible with local ecological conditions.

Examples of Biological Cycles Business Models:

- ✓ **Agriculture and Agroforestry:** Implementing regenerative agricultural practices that restore soil health, sequester carbon, and increase biodiversity, while producing food, fiber, and other biological materials.
- ✓ **Biodegradable Packaging:** Developing and using packaging solutions made from biological materials that can safely decompose in natural environments or through industrial composting processes.
- ✓ **Bioenergy and Biochemicals:** Producing renewable energy and chemicals from biological sources, such as biofuels from crop residues or biogas from organic waste, in ways that ensure nutrient cycling and reduce dependency on fossil fuels.

Good practice (example):

Bolt Threads is a biotechnology company that specializes in developing sustainable and innovative materials inspired by nature for use in the fashion and textiles industry. Founded in 2009 and based in Emeryville, California, Bolt Threads harnesses the power of biotechnology, materials science, and engineering to create high-performance fibers and fabrics with a lower environmental footprint compared to traditional materials.

One of their most notable innovations is Microsilk™, a protein-based material inspired by spider silk's properties, known for its strength, elasticity, and durability. Unlike natural spider silk, which is impractical to produce on a large scale, Microsilk™ is produced through a fermentation process using genetically engineered yeast, sugar, and water. This process allows Bolt Threads to manufacture silk protein in large quantities without relying on spiders, offering a sustainable and animal-friendly alternative to traditional silk. Another significant development by Bolt Threads is Mylo™, a leather-like material made from mycelium, the root structure of mushrooms. Mylo™ mimics the feel and appearance of leather but is created through a more sustainable process that significantly reduces the environmental impact associated with animal leather production and synthetic leather made from petroleum-based plastics.



ABOUT MEET B-SILK™ OUR MATERIALS OUR IMPACT CAREERS NEWS CONTACT

Bolt Technology—

MEET MICROSILK™

Spiders produce silk fibers with remarkable properties including high tensile strength, elasticity, durability, and softness.

We've developed technology to sustainably replicate this amazing process at a large scale.

Microsilk can be produced with less environmental impact than traditional textile manufacturing, with the potential to biodegrade at the end of its useful life.



Circular Business Models: Resource Recovery model

The Resource Recovery business model is a cornerstone of the circular economy, focusing on extracting valuable materials or energy from waste streams that would otherwise be discarded. This model transforms waste into resources, thus minimizing the environmental impact of waste disposal, reducing reliance on virgin materials, and promoting sustainable production and consumption cycles. It encompasses a broad range of activities, from recycling and composting to energy recovery and the extraction of useful substances from waste products.

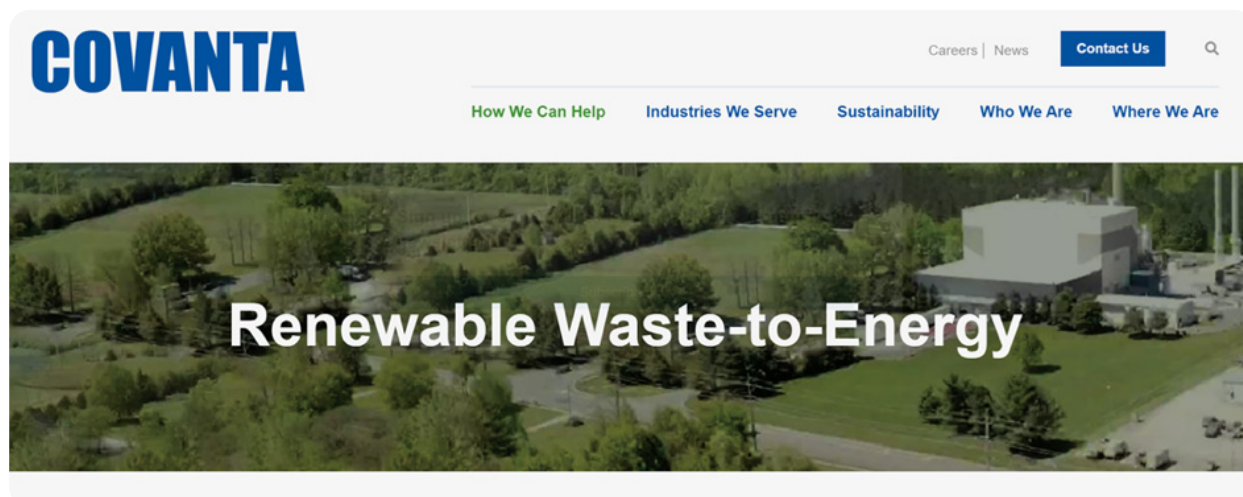
Key Features of Resource Recovery Model:

- ✓ **Material recovery:** This involves collecting and processing waste materials (such as plastics, metals, glass, and paper) to recover raw materials that can be used to manufacture new products. Material recovery reduces the demand for virgin resources and cuts down on environmental degradation associated with resource extraction.
- ✓ **Biological Recovery:** Organic waste, including food scraps and agricultural residues, is processed through composting or anaerobic digestion to produce compost or biogas. These outputs can be used to enhance soil health and provide renewable energy, respectively, contributing to a closed-loop system in the biological cycle.
- ✓ **Energy Recovery:** Non-recyclable waste materials can be converted into energy through processes like incineration with energy recovery, pyrolysis, or gasification. This allows for the generation of electricity or heat from waste, reducing fossil fuel consumption and greenhouse gas emissions.
- ✓ **Chemical Recovery:** Advanced technologies are used to extract valuable chemicals or materials from waste products. For example, certain processes can recover precious metals from electronic waste or convert plastic waste into synthetic fuels or new plastics.

Good practice (example):

Covanta Holding Corporation is a company that provides sustainable waste and energy solutions, primarily focusing on waste-to-energy (WTE) services. The company operates facilities that convert municipal solid waste into renewable energy and recover valuable metals for recycling. By doing so, Covanta plays a significant role in waste management, reducing reliance on landfills, cutting greenhouse gas emissions, and generating clean energy.

Covanta's waste-to-energy facilities use municipal solid waste as fuel, burning it at high temperatures to produce steam. This steam drives turbines to generate electricity, which is then supplied to local power grids. In addition to energy production, their process significantly reduces the volume of waste, with the ash residue often used in construction materials. Moreover, Covanta's facilities are equipped to capture and recycle metals found in the waste stream, thereby conserving resources, and reducing the need for virgin material extraction.



Circular Business Models: Industrial Symbiosis model

Industrial Symbiosis is a collaborative business model that focuses on the mutual exchange of materials, energy, water, and/or by-products among different industries or businesses to create a closed-loop system. This model is inspired by natural ecosystems, where waste from one organism serves as nutrients for another, ensuring the efficient use of resources with minimal waste. Industrial symbiosis is a key component of the circular economy, aiming to optimize resource efficiency, reduce environmental impact, and enhance economic value through collaborative networks.

Key Features of Industrial Symbiosis Model:

- ✓ *Resource Optimization:* It involves identifying and exploiting opportunities for sharing or exchanging resources between companies, such as using the waste heat from one process to power another process in a different company.
- ✓ *Waste Minimization:* By transforming waste from one industry into raw materials for another, industrial symbiosis significantly reduces the amount of waste sent to landfills and decreases environmental pollution.
- ✓ *Cost Reduction:* Companies involved in industrial symbiosis can achieve substantial cost savings through reduced raw material and waste disposal costs, as well as by sharing infrastructure and logistics.
- ✓ *Innovation and New Revenue Streams:* The model encourages innovation by identifying novel uses for waste and by-products, potentially opening up new markets and revenue streams for participating companies.
- ✓ *Collaborative Networks:* Successful industrial symbiosis relies on the creation of networks and partnerships between companies, facilitated by information sharing, trust, and coordinated management.

Good practice (example):

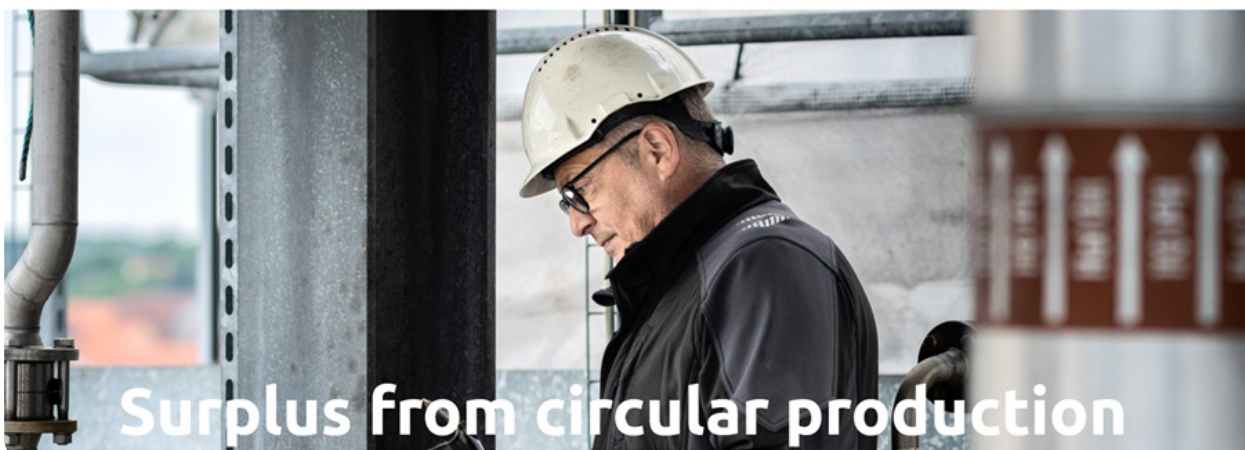
Often cited as the first and most well-known example of industrial symbiosis, the Kalundborg Symbiosis involves a network of companies, including a power station, an oil refinery, a pharmaceutical plant, and others, that exchange steam, water, and various materials to optimize resource use and reduce environmental impact.



Q English Dansk

50 years of circular production

Home page



Circular Business Models:

Design for Durability and Longevity model

The Design for Durability and Longevity business model focuses on creating products that are built to last, reducing the need for frequent replacements and thereby minimizing waste and resource consumption. This approach is a critical component of the circular economy, aiming to extend the lifecycle of products, enhance resource efficiency, and decrease the environmental impact associated with the production, use, and disposal of goods.

Key Features of Design for Durability and Longevity Model:

- ✓ *High-Quality Materials:* Utilizing durable materials that can withstand wear and tear over time, ensuring the product maintains its functionality and appearance.
- ✓ *Modular and Repairable Design:* Designing products in a way that allows for easy repair, upgrading, or replacement of components. This enhances the product's lifespan by making maintenance and updates more feasible.
- ✓ *Standardization of Components:* Employing standardized parts across product lines to facilitate repairs, replacements, and upgrades, thereby extending the products' useful life.
- ✓ *Ease of Disassembly:* Ensuring products can be easily disassembled at the end of their life for recycling or refurbishing, which is crucial for recovering valuable materials and reducing waste.

Examples of Design for Durability and Longevity models:

- ✓ *Electronics:* Companies, focusing on producing electronics that are easily repairable, upgradable, and made with high-quality components to extend their lifespan.
- ✓ *Furniture:* Designing furniture with timeless aesthetics, robust materials, and the ability to repair and refurbish, ensuring long-term use.
- ✓ *Apparel:* Creating high-quality, classic clothing items that resist wear and tear, promoting slow fashion over fast fashion trends.

Good practice (example):

Autine is a high-end tool and knife brand known for its handcrafted axes, knives, and other tools. Founded by John Neeman (also known as Janis J. Neemane) in Latvia, Autine creates tools that combine traditional craftsmanship with modern design and materials. Each piece is individually crafted by skilled artisans, emphasizing durability, functionality, and beauty.

Autine's products are highly regarded in the market for their quality and craftsmanship. They cater to a niche audience that values handmade tools for outdoor activities, bushcraft, woodworking, and culinary purposes. The brand is synonymous with excellence in material selection, including high-quality steel for blades and carefully chosen wood for handles, ensuring that each tool is not only a functional instrument but also a work of art.

AUTINE®

Technique Store Forge News

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Lifetime warranty

Materials

Technologies

Lifetime warranty

By purchasing any AUTINE made tool, you gain a tool that will serve you, and your children as well. Each instrument that comes from our forge, comes with a lifetime warranty, which covers all possible manufacturing defects.



Circular Business Models: Repurchasing of Goods model

The Repurchasing of Goods business model, often associated with buy-back or trade-in programs, is a strategy where companies buy back their products from consumers after use. This model is part of a broader approach to sustainability and circular economy practices, aiming to reduce waste and extend the lifecycle of products by refurbishing, recycling, or reselling them. It reflects a shift from the traditional linear economy towards more circular systems, where the value of products is maintained or recovered, minimizing the environmental impact of production and consumption.

Key Features of Repurchasing of Goods Model:

- ✓ **Buy-Back Programs:** Companies offer customers the option to sell back used products at the end of their life or when they wish to upgrade to a new version. The company then either refurbishes the product for resale, recycles its components, or uses the materials to manufacture new products.
- ✓ **Trade-In Offers:** Customers can trade in their old product for a discount on a new purchase. This incentivizes consumers to return products, ensuring that materials are kept within the economic cycle and reducing waste.
- ✓ **Certified Refurbishment:** Returned products undergo thorough testing, repair, and certification before being resold. This ensures that refurbished products meet quality standards and can be sold with a warranty, like new items.
- ✓ **Second-Life Sales:** Products that are no longer new but still functional can be sold in secondary markets, offering more affordable options to consumers, and extending the product's life.

Examples of Repurchasing of Goods models:

- ✓ **Electronics and Mobile Phones:** Companies like Apple and Samsung have trade-in programs where customers can return their old devices for credit towards a new purchase, promoting the recycling and refurbishment of electronic devices.
- ✓ **Automotive Industry:** Car manufacturers and dealerships often offer trade-in deals where customers can exchange their old vehicle for a discount on a new car, facilitating the resale or recycling of used vehicles.
- ✓ **Fashion and Apparel:** Some clothing brands have started programs to buy back used garments for recycling or resale, aiming to reduce textile waste and promote sustainable fashion practices.

Good practice (example):

IKEA is a Swedish multinational company known for its ready-to-assemble furniture, home accessories, and kitchen appliances. IKEA has ventured into the second-hand market. In recent years, IKEA has started to open second-hand stores and initiate pilot projects aimed at selling used and refurbished IKEA furniture. These initiatives are designed to extend the lifecycle of its products, reduce waste, and offer customers more sustainable shopping options. One notable example is the opening of its first second-hand store in Sweden in 2020, located in the ReTuna shopping mall, which is dedicated entirely to selling recycled and upcycled products.

The concept behind IKEA's second-hand stores is not only to sell pre-owned furniture but also to offer repair and refurbishment services to give products a second life. This approach aligns with IKEA's broader sustainability goals, including its ambition to become a climate-positive business by 2030. Through these efforts, IKEA aims to encourage a more circular approach to consumption, where products are reused, repaired, and recycled instead of being discarded. IKEA's move into the second-hand market reflects a growing trend among businesses to adopt circular economy practices and respond to increasing consumer demand for sustainable and eco-friendly products.



Circular Business Models: Recycling of Goods model

The Recycling of Goods business model is a foundational element of the circular economy, focusing on converting waste materials into new products or raw materials. This model reduces the need for virgin resources, minimizes environmental pollution, and lessens the volume of waste sent to landfills or incinerators.

Key Features of Recycling of Goods Model:

- ✓ **Collection and Sorting:** The initial step involves collecting recyclable materials from various sources, such as households, businesses, and industrial processes. These materials are then sorted based on type (e.g., plastics, metals, paper, glass) and quality to prepare them for recycling.
- ✓ **Processing:** Sorted materials undergo processing to clean and break them down into usable forms. This may involve mechanical shredding, melting, or chemical treatments, depending on the material type.
- ✓ **Manufacturing:** Recycled materials are used as inputs in the manufacturing of new products. The extent to which materials can be recycled into similar-quality products (closed-loop recycling) or different, lower-quality applications (open-loop recycling) varies by material type.
- ✓ **Sale and Distribution:** The final recycled products or materials are sold to manufacturers or directly to consumers. This step closes the loop by reintroducing recycled materials back into the economy.


Examples of Recycling of Goods models:

- ✓ **Paper Recycling:** Used paper is collected, processed, and remanufactured into new paper products, reducing the need for virgin wood pulp.
- ✓ **Plastic Recycling:** Plastics are sorted by type, cleaned, melted down, and remolded into new plastic products, ranging from bottles to clothing fibers.
- ✓ **Electronic Waste Recycling:** E-waste is disassembled, and valuable metals and materials are recovered and used to manufacture new electronic components or other products.

Good practice (example):

H&M is a global fashion retailer known for its fast-fashion clothing for men, women, children, and teenagers. One of the key components of H&M's sustainability strategy is its garment collecting and recycling program, which encourages consumers to contribute to a more sustainable fashion future.

H&M's garment collecting program, launched in 2013, is a global initiative that invites customers to bring any unwanted clothes and textiles, regardless of brand or condition, to H&M stores. In exchange, customers may receive a discount voucher toward their next purchase. The collected items are sorted into three categories: re-wear (clothing that can be worn again), reuse (textiles that can be turned into other products), and recycle (materials that can be transformed into textile fibers or used for other purposes such as insulation).



The only trends worth following? Recycling and repairing.

Here's a not-so-fun fact: Today, less than 1% of the materials used to make clothes get recycled each year. This means that thousands of tonnes of textiles end up in landfills. By reusing or recycling fashion, we can turn that around.

Our Garment Collecting programme is the world's biggest of its kind. It was rolled out globally in 2013.

Want to keep an old favourite? Take care.

Over 10% of a garment's total impact on the climate happens after you've left the store. Things like how often you wash your clothes or if you toss them in the rubbish instead of recycling, have an effect. So, how you take care of them really matters! Learn how you can make your clothes last longer with our Take Care concept, available in all online stores.

Circular Business Models: Equipment and Technology Sharing model

The Equipment and Technology Sharing business model, often aligned with the concepts of the sharing economy and collaborative consumption, revolves around the shared use of physical assets, equipment, and advanced technologies among multiple users or organizations. This model maximizes the utilization of resources, reduces redundancy, and minimizes the environmental impact associated with the production and consumption of goods. It is particularly relevant in today's economy, where technological advancements and connectivity have made sharing and collaboration more feasible and efficient than ever before.

Key Features of Equipment and Technology Sharing Model:

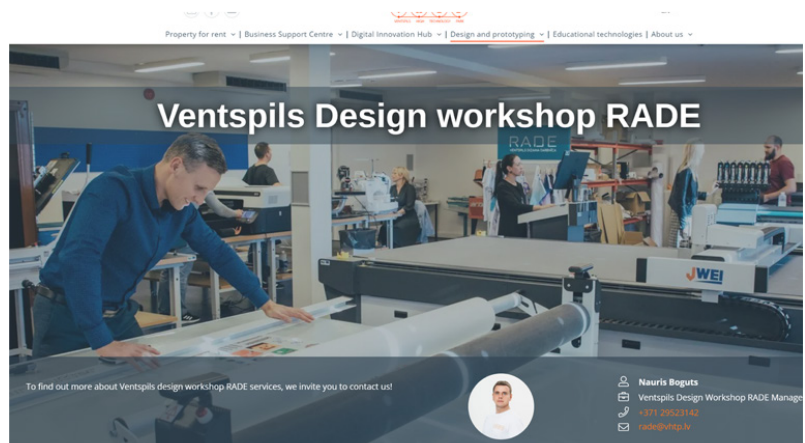
- ✓ **Access Over Ownership:** The model prioritizes access to equipment and technology over individual ownership. Users pay to access or use the equipment for a specified period, without bearing the costs and responsibilities of ownership.
- ✓ **Efficient Utilization:** By sharing resources, their utilization rate is maximized, ensuring that the embodied energy and materials in these assets are used more efficiently throughout their lifecycle.
- ✓ **Cost Reduction:** Sharing reduces the financial burden on individual users or businesses, as costs are distributed among multiple users. It enables access to high-quality or advanced technology that might be otherwise unaffordable.
- ✓ **Flexibility and Scalability:** Users can access a wide range of equipment and technologies as needed, allowing for flexibility and scalability without significant capital investment.

Examples of Equipment and Technology Sharing models:

- ✓ **Co-working Spaces:** Provide shared access to office equipment, internet technology, and meeting spaces for freelancers, entrepreneurs, and remote workers.
- ✓ **Makerspaces and Fab Labs:** Offer community access to manufacturing equipment, tools, and technology for prototyping and creative projects, including 3D printers, laser cutters, and CNC machines.
- ✓ **Agricultural Equipment Sharing:** Farmers and agricultural cooperatives share expensive machinery and equipment, such as tractors and harvesters, reducing individual investment costs and improving efficiency.
- ✓ **Technology Platforms:** Online platforms facilitate the sharing of specialized software, computing resources, and data analytics tools among businesses, enabling them to leverage advanced technologies on a subscription or pay-per-use basis.

Good practice (example):

Ventspils design workshop "RADE" is a production unit room where both individual users and entrepreneurs can create a variety of products. The workshop has various production units meant to transfer any design to either clothing, plastic, metal or wood, acrylic, various composite materials, and other accessory types, print photos, make stickers, and create packaging for any product created here. RADE offers individuals and businesses to share the equipment of the workshop, reducing the need to purchase the equipment.



How to Transfer from Linear to Circular Business Model

- 1 Assess current practices**

Begin by evaluating your current business model, focusing on how resources are used, and waste is generated. Identify areas where changes can lead to more sustainable practices.
- 2 Set clear goals and objectives**

Define specific, measurable objectives for the transition. These could include reducing waste, increasing the recyclability of products, or implementing a take-back program for used products.
- 3 Rethink product design**

Design products for longevity, repairability, and recyclability. Consider using modular designs that allow for easy repair or upgrading of parts instead of replacing whole products.
- 4 Implement resource-efficient processes**

Optimize manufacturing processes to minimize waste and resource use. This might involve adopting new technologies or rethinking production techniques to be more efficient.
- 5 Develop new business models**

Consider models like Product-as-a-Service (PaaS), where you offer services rather than selling products, or leasing models where products are returned for refurbishment and reuse.
- 6 Establish closed-loop supply chains**

Create or join networks for recovering and reusing materials. This could involve setting up systems for returning used products or collaborating with other companies to utilize each other's waste products.
- 7 Engage with suppliers**

Work with suppliers who are also committed to circular principles. Ensure that the materials you use are sustainably sourced and can be recycled or composted at the end of their life.
- 8 Educate and engage customers**

Inform your customers about the benefits of a circular model. Encourage them to participate in take-back schemes, recycling programs, or other initiatives that support the circular economy.
- 9 Leverage technology for efficiency**

Use technology to track resource flows, manage reverse logistics for returned products, and optimize the lifecycle of your products.
- 10 Monitor, evaluate and adapt**

Continuously monitor the impact of your changes. Collect data on resource use, waste reduction, and customer feedback to evaluate your progress and make necessary adjustments.
- 11 Promote a Circular culture internally**

Foster a culture of sustainability within your organization. Educate employees about the importance of circular practices and encourage innovation in this area.
- 12 Collaborate and build partnerships**

Engage in partnerships with other companies, governmental bodies, and NGOs to expand the reach and effectiveness of your circular initiatives.

Task – Circular Business Model Innovation Challenge



The aim of this activity is to encourage participants to think critically and creatively about sustainability, as well as to help them understand the practical applications of circular economy principles in business. This task fosters collaboration and problem-solving skills, as participants work together to envision innovative business models that can lead to a more sustainable future.

Materials Needed:

- ✓ Paper and pens for sketching ideas.
- ✓ A set of briefs describing traditional business scenarios across various industries.
- ✓ Access to online collaboration tools if participants are remote (e.g., Miro, Google Docs).

Task process:

- 1 Divide participants into small teams of 3-4 people. For remote participants, use the breakout rooms in the videoconferencing equipment.
- 2 Assign each team a brief describing a traditional business scenario. These scenarios should vary by industry (e.g., fashion, electronics, food) to allow for diverse solutions.
- 3 Teams use the circular business model principles to rethink the assigned scenario. Their challenge is to redesign the business model to make it circular, focusing on aspects such as sustainability, reducing waste, and creating a closed-loop system. Encourage teams to consider how they can extend product life, reuse materials, and create value from waste products.
- 4 Each team presents their circular business model solution to the group, explaining how it addresses the principles of the circular economy.
- 5 After each presentation, allow time for questions and constructive feedback from the other participants and facilitators.
- 6 Conclude the activity by summarizing the key takeaways and highlighting the innovative ideas generated during the challenge.

Discuss how these circular business model innovations can be applied in real-world contexts to drive sustainability and economic value.

Topic Summary

Challenges and Considerations

- ✓ **Upfront Investment and Cost:** Transitioning to a circular model often requires significant initial investment in new technologies, systems, and processes. The cost of designing products for durability, reparability, and recyclability, as well as establishing take-back schemes and reverse logistics can be substantial.
- ✓ **Consumer Acceptance and Behavior:** Changing consumer habits from a traditional take-produce-use-dispose mindset to one that embraces sharing, leasing, or buying refurbished products is challenging. There is also the need to build trust in the quality and performance of refurbished or remanufactured products.
- ✓ **Supply Chain Complexity:** Developing a circular supply chain involves coordination with multiple stakeholders, including suppliers, manufacturers, and waste management companies. It requires transparency and collaboration across the value chain to ensure the return, refurbishment, and recycling of products.
- ✓ **Regulatory and Policy Barriers:** Existing regulations may not support circular practices, or there may be a lack of incentives for businesses to invest in circular models. In some regions, the regulatory environment may lag behind innovation, hindering the adoption of circular practices.
- ✓ **Technical Challenges:** The complexity of modern products, with their mix of materials and components, can make disassembly, repair, and recycling difficult and costly. Developing the necessary technologies and processes for efficient recycling or remanufacturing poses significant technical challenges.
- ✓ **Market Demand for Recycled Materials:** Fluctuations in the market demand and prices for recycled materials can affect the economic viability of recycling operations. Ensuring consistent quality and supply of recycled materials is essential for building and maintaining demand.
- ✓ **Design Considerations:** Designing for circularity requires a shift in design philosophy, prioritizing durability, reparability, and the use of recyclable materials. This can sometimes conflict with other design considerations such as cost, performance, and aesthetics.
- ✓ **Intellectual Property and Data Security:** For business models based on product-as-a-service or equipment sharing, protecting intellectual property and ensuring data security for shared products can be a concern, particularly for technology and electronics companies.
- ✓ **Logistics and Infrastructure:** Setting up the logistics for collecting, sorting, and processing returned products for refurbishment or recycling requires a well-developed infrastructure. This includes challenges related to transportation, storage, and handling of used products and materials.
- ✓ **Cultural and Organizational Change:** Adopting a circular business model often requires a cultural shift within organizations. It necessitates a move away from traditional linear thinking towards a systems-thinking approach, which can be difficult to achieve and may require significant changes in corporate culture, employee mindset, and organizational structure.

Opportunities of implementing circular business models

- ✓ ***Innovation in Product Design and Development:*** Circular business models encourage the innovation of products designed for longevity, reparability, and recyclability. This shift opens up new avenues for businesses to explore sustainable materials, modular designs, and innovative functions that make products more adaptable to changing consumer needs and technological advancements.
- ✓ ***Creation of New Business Models and Revenue Streams:*** Adopting circular principles enables companies to explore new business models such as Product-as-a-Service (PaaS), where products are leased rather than sold, or take-back schemes where products are returned for refurbishment and resale. These models not only extend product lifecycles but also create continuous revenue streams from the same product multiple times.
- ✓ ***Cost Reduction and Efficiency Gains:*** By maximizing the use of resources and minimizing waste, circular business models can lead to significant cost savings. Efficient resource use, reduced material costs, and energy savings are direct benefits that enhance business efficiency and profitability.
- ✓ ***Competitive Advantage:*** Businesses that successfully implement circular models can differentiate themselves in the marketplace, appealing to a growing segment of environmentally conscious consumers. This can enhance brand loyalty, improve customer satisfaction, and attract new customers, giving companies a competitive edge.
- ✓ ***Access to New Markets and Customer Segments:*** Circular business models, particularly through the offering of sustainable products and services, can open up new markets and attract customers who are willing to invest in products that contribute to a more sustainable world.
- ✓ ***Regulatory Compliance and Leadership:*** With governments worldwide imposing stricter regulations on waste and recycling, adopting circular business models can help companies stay ahead of regulatory requirements, avoid penalties, and position themselves as industry leaders in sustainability.
- ✓ ***Enhanced Supply Chain Sustainability:*** Circular models promote the development of more sustainable supply chains by encouraging the use of recycled materials, reducing dependency on virgin raw materials, and minimizing the environmental impact of logistics and transportation.
- ✓ ***Social and Environmental Impact:*** Circular business practices contribute positively to the environment by reducing waste and emissions. They also offer social benefits by creating jobs in recycling, refurbishment, and remanufacturing sectors and by providing affordable access to quality products through second-hand markets and product-as-a-service models.
- ✓ ***Attracting Investment:*** Sustainability has become a key factor for investors. Circular business models, with their focus on long-term viability and environmental responsibility, are increasingly attractive to investors looking for sustainable investment opportunities.
- ✓ ***Building Resilience:*** By reducing dependence on finite resources and mitigating the risks associated with raw material price volatility and supply chain disruptions, circular models build business resilience against economic and environmental shocks.

Additional references, literature

Books:

- ✓ “A New Dynamic: Effective Business in a Circular Economy” by Amory Lovins and Michael Braungart (This book is a collection of essays and case studies that explore the application of circular economy principles across various sectors. It offers insights into how businesses can transition from linear to circular models, emphasizing system thinking, innovation, and sustainability. The book serves as an inspiration and practical guide for businesses looking to embark on a circular transformation).
- ✓ “Business Models in the Circular Economy” by Roberta De Angelis (This book dives into the operationalization of circular economy concepts into practical business models. It addresses the strategic, operational, and organizational challenges businesses face in transitioning towards more sustainable, circular practices).

Guides and toolkits:

- ✓ “Circular Economy Business Toolkit” by the Circular Economy Club (This toolkit is designed to help businesses of all sizes understand and implement circular economy principles into their operations. It offers a step-by-step approach to transitioning towards more sustainable, circular business models).
- ✓ “The Circular Business Model Canvas” by Circulab (The Circulab Circular Business Model Canvas is an adaptation of the traditional Business Model Canvas, specifically tailored for designing and implementing circular business models. This tool helps businesses identify and create value from circular opportunities).

Academic journals and reports:

- ✓ “Towards a Circular Economy: Business Rationale for an Accelerated Transition” by Ellen MacArthur (This article outlines the economic and business case for transitioning towards circular business models, providing a foundational understanding of the benefits and rationale behind the circular economy).
- ✓ “Designing Circular Business Models” by Jonker, J., O’Riordan, L., & Faber, N., published in Journal of Cleaner Production (This paper discusses the principles of designing inherently circular business models, offering insights into how companies can rethink and redesign their operations for circularity).
- ✓ “Business Models for the Circular Economy: Opportunities and Challenges for Policy” by Geissdoerfer, Martin, Paulo Savaget, Nancy M.P. Bocken, Erik Jan Hultink, published in Research Policy (This article explores the intersection of circular business models and policy, examining how government actions can support or hinder the adoption of circular business practices).

Government Publications:

- ✓ “A Framework for Enabling Circular Business Models in Europe” by European Environment Agency (the publication delves into the circular economy and its significance in Europe).
- ✓ “Circular Economy Action Plan” by European Commission (the document outlines strategies and initiatives to promote a more sustainable and circular economy within the European Union).

Online courses:

- ✓ Coursera: “Business Models For Sustainability” by Copenhagen Business School (the course delves into sustainable business model theory, sustainable business model innovation, and tools and strategies).
- ✓ Coursera: “Business Sustainability in the Circular Economy” by University of London (the course delves into sustainability, circular economy, recycling, and reverse logistics).
- Futurelearn: “Tackling Climate Change: Sustainable Business Models for a Circular Economy” by University of Glasgow (the course helps to discover how circular economies and business models enable sustainability and help respond to the climate emergency).