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KODECET
Knowledge Development for Circular Economy Transition

GOOD PRACTICES FOR CIRCULAR ECONOMY IN THE EUROPEAN UNION

D3.5 EU manual of CE best practices

November 2024

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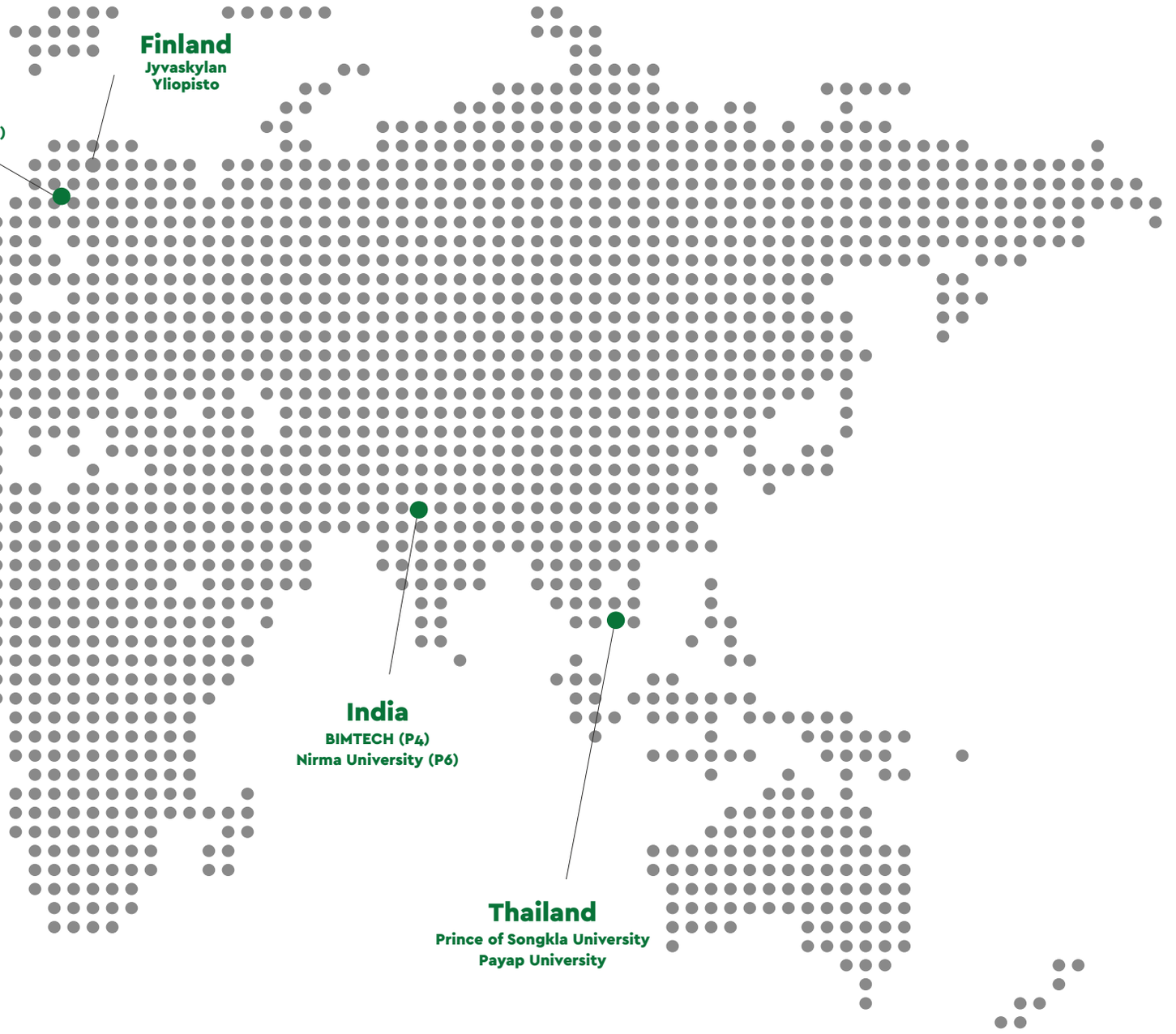

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Good practices for Sustainable Circular Economy in the European Union

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Summary

Title of organisation	Field of Industry	Country	Institution
Bio Azul (P2Green project)	Fertilisers	Spain, Malaga	JYU
Betolar	Construction materials	Finland, Kannonkoski	JYU
Palpa	Packaging	Finland, Helsinki	JYU
FairPhone	Consumer Electronics (smartphone)	The Netherlands, Amsterdam	JYU
IKEA	Furniture	The Netherlands, Delft	JYU
Philips	Health Technology	The Netherlands, Amsterdam	FHJ
Voestalpine	Steel	Austria, Linz	FHJ
Lenzing AG	Textile	Austria, Lenzing	FHJ
Infineon Technologies	Technology and electronics	German, Neubiberg	FHJ
Vattenfall	Energy	Sweden, Solna	FHJ

COMPANIES LOCATIO

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LITHUANIA
BELARUS
POLAND
UKRAINE
MOLDOVA
ROMANIA
BULGARIA
GREECE
TURKEY
KAZAKHSTAN
MONGOLIA
UZBEKISTAN
TURKMENISTAN
CHINA
NORTH KOREA
SOUTH KOREA
JAPAN
SYRIA
IRAQ
IRAN
AFGHANISTAN
KASHMIR
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GOOD PRACTICES FOR CIRCULAR ECONOMY IN THE EUROPEAN UNION

D3.5 EU manual for Case Development

November 2024

Content

KODECET

Knowledge Development for Circular Economy Transition

KODECET
Good Practice Manual

This manual is designed to offer a variety of best practice examples with a focus on the Sustainable Circular Economy (CE). This short guide has been designed to help you navigate the content of the manual efficiently and make the most of the information provided. Here's a quick overview of how this manual is structured.

This manual serves as a resource for understanding and applying Sustainable Circular Economy principles and indicators in higher education such as students, educators and researchers. It is also ideal for practitioners seeking to deepen their understanding of sustainable CE or to implement sustainable CE principles and indicators in their operations. Through practical insights and examples, they can gain valuable knowledge on sustainable CE strategies, business models, and collaborative approaches.

The manual show cases examples of companies and projects that demonstrate relevant practices, innovative processes, and their environmental and social impacts within the Circular Economy in the European Union region. All information has been sourced from the organizations' public reports and websites.

Structure of the manual

The content of the manual is organised into chapters according to the case examples for easy reading and referencing. The manual starts with giving a brief definition of what we mean with good practice in Circular Economy, followed by an introduction of the framework and detailing the key components or indicators used for analysing the case examples sustainable CE practices.
The chosen good practices are presented according to the framework each case as its individual chapter. All the chapters start with basic information about the organisation and an executive summary followed by the organisations Core Circular Economy Strategies. Each case is then reviewed based on the indicators outlined in the framework. At the end of each case is a short summary of the key points.

The work is a joint effort of the project partners in University of Jyväskylä, Finland FH Joanneum, Austria and Birla institute of Management Technology, India. To have a common line for all partners, some criteria related to Sustainable Circular Economy were researched in advance and have been used in the collecting the examples and their analysis.

Introduction

The global shift towards sustainable development has placed the circular economy (CE) at the forefront of business strategies across industries. As resource depletion, climate change, and waste management challenges intensify, companies are increasingly adopting circular economy principles to minimize environmental impact while maintaining economic growth. This document aims to evaluate various case companies that are leading the transition to circular practices by integrating circular economy strategies into their operations.

Each company case study will be evaluated showing their core circular economy strategies and by using a comprehensive framework that highlights key circular economy indicators. These indicators encompass core areas such as environmental impact, economic viability, social well-being, and innovation in design and business models. By assessing these aspects, the document provides an in-depth understanding of how each company's strategies contribute to a sustainable, circular economic model. In the manual, the indicators may vary according to company. Not all indicators are applicable to each case, as the industries and business models vary. Therefore, we have assessed each company carefully according to the framework and have selected the ones that are representative of a wide range of indicators in the framework.

Good practice companies

The identification of good practice companies in the circular economy (CE) is based on a structured approach that aligns with established methodologies for evaluating sustainability performance. These companies were selected for their exemplary implementation of circular economy principles, making them leaders in transforming traditional business models into sustainable, circular systems. The selection process was informed by both qualitative and quantitative criteria, ensuring that only companies with significant contributions to circular economy practices were included.

A primary resource used in identifying best practices is the European Circular Economy Stakeholder Platform (ECESP), which provides a repository of circular economy case studies across various industries. The platform's Good Practices section, available at circulareconomy.europa.eu, highlights companies that have successfully integrated circular economy principles in areas such as resource efficiency, waste minimization, product lifecycle extension, and innovative business models. This database was crucial in identifying companies that meet the stringent criteria for inclusion in this evaluation.

Framework Model for Identifying Circular Economy Good Practices

Our analytical framework for identifying and evaluating circular economy best practices draws extensively from the "Indicators for a Circular Economy" report, developed under the SUMMA project. This foundational document incorporates methodologies established by the European Union. The framework's structure integrates key insights from comprehensive reports published by the Joint Research Centre (JRC) and the European Environment Agency (EEA), ensuring alignment with established European environmental policy guidelines. This evidence-based approach builds upon well-documented research and policy frameworks, combining theoretical rigor with practical applications in circular economy assessment and implementation strategies. This seminal work, which outlines an inventory of indicators derived from EU scoreboards, monitoring frameworks, and literature reviews, serves as a cornerstone for our approach. It underscores the necessity of employing a nuanced set of indicators for a holistic assessment of circular economy practices across various dimensions, including environmental impact and resource efficiency. By integrating these insights, our framework adopts a comprehensive view, ensuring practical applicability and alignment with global sustainability objectives. This document's guidance on the classification and application of indicators across different levels has been crucial in refining our methodology, enhancing its theoretical robustness and practical utility in promoting sustainable economic practices.

This framework aims to offer a comprehensive toolkit for identifying, evaluating, and promoting circular economy practices that exemplify multi-dimensional sustainability. By integrating environmental, economic, and social aspects, this model provides a more holistic lens for understanding and advancing the circular transition.

Key Components

1. Environmental Impact

Key Considerations: This component emphasizes the environmental advantages of adopting circular economy practices, which are pivotal in transitioning towards sustainability. It highlights the importance of reducing resource consumption, minimizing waste generation, and mitigating pollution and greenhouse gas emissions. In addition to these fundamental considerations, the effects on the environment are also analysed.

Example Indicators:

- **Water use reduction:** Measures the decrease in water consumption achieved compared to a linear process.
- **CO2 emissions:** Quantifies carbon footprint reduction throughout the product lifecycle.
- **% recycled content:** Percentage of recycled or reused materials incorporated into a product.

2. Economic Viability

Key Considerations: Circular economy models must be economically sustainable to drive long-term adoption. This component assesses profitability, job creation, and new market opportunities.

Example Indicators:

- **Return on Investment (ROI):** Calculates the financial gains achieved from a circular initiative.
- **New revenue streams:** Identifies additional income channels created through circular business models.

3. Social Well-being

Key Considerations: Examines how circular practices impact communities, employees, and society. Focuses on equitable opportunities, fair working conditions, and quality of life improvements.

Example Indicators:

- **Local employment:** Tracks job creation and its benefits within the community where the initiative is implemented.
- **Fair wages:** Ensures that workers involved in circular processes receive just compensation.
- **Consumer satisfaction:** Measures positive perceptions of sustainable products and services.

4. Design for Circularity

Key Considerations: Emphasizes product design that facilitates reuse, repair, refurbishment, and ultimately recycling.

Example Indicators:

- **Product lifespan:** Evaluates how long a product remains functional and avoids ending up in landfill.
- **% recyclable/compostable materials:** Percentage of materials easily recovered and reintegrated into production

5. Material Innovation

Key Considerations: Advances the use of renewable, low-impact, and safe materials in product development.

Example Indicators:

- **% renewable materials:** Percentage of materials sourced responsibly and not contributing to resource depletion.
- **Hazardous substance reduction:** Measures the decrease in the use of harmful substances or complete elimination.

6. Business Model Innovation

Key Considerations: Supports models that prioritize access over ownership, extend product life, and create closed-loop systems for material recovery.

Example Indicators:

- **Subscription models:** Evaluates effectiveness of models designed for continuous use and maintenance over outright ownership.
- **Take-back programs:** Measures the volume of products reclaimed at their end-of-use.

7. Stakeholder Engagement and Collaboration

Key Considerations: Success in the circular economy hinges on cooperation. This component assesses alliances across sectors and active consumer participation.

Example Indicators:

- **Cross-sector collaborations:** Describes impactful partnerships between businesses, governments, and NGOs
- **Consumer education programs:** Evaluates initiatives to change consumption behaviour and promote circular principles.

8. Policy & Regulatory Support

Key Considerations: Examines the impact of policies that accelerate circularity, like incentives and regulations geared towards waste reduction and resource efficiency.

Example Indicators:

- **Extended Producer Responsibility (EPR):** Identifies EPR laws which hold manufacturers accountable for product end-of-life.
- **Waste disposal taxes:** Addresses any disincentives for landfill use that encourage circularity.

9. Policy & Regulatory Support

Key Considerations: Highlights the power of emerging technologies in optimizing resource use, developing new materials, and driving process efficiencies.

Example Indicators:

- **IoT sensors:** Evaluates the use of sensors for tracking material flows and managing assets responsibly.

10. Impact Measurement and Reporting

Key Considerations: Stresses the importance of data and standardized metrics to track circularity progress and justify investments.

Example Indicators:

- **Circular performance indicators:** Quantifies waste reduction, resource efficiency, longevity, etc.

Bio Azul (P2green)

Name of the Company	Bio Azul (P2Green)
Country	Spain (13 EU countries)
City	Málaga
Website	https://www.bioazul.com/

Executive Summary

Bio Azul's P2GreeN project epitomizes a forward-thinking approach to creating a sustainable and circular economy, with a focus on nutrient recovery and reuse within the agricultural sector. Launched on December 1, 2022, this four-year Horizon Europe initiative aims to facilitate the transition from conventional, linear nutrient systems to more circular models by recovering nitrogen (N) and phosphorus (P) from human sanitary waste and converting them into bio-based fertilizers. The project seeks to combat nutrient pollution, reduce reliance on mineral fertilizers, and promote sustainable agricultural practices from urban to rural areas.

A key facet of the P2GreeN project is its holistic methodology, adhering to the principles of Reduce, Reuse, and Recover. This strategy is demonstrated through its pilot projects in diverse European regions, including the Baltic Sea region, the Hamburg-Hannover metropolitan area, and La Axarquía in Southern Spain. These regions serve as testing grounds for adapting and validating the nutrient recovery technology to various environmental and infrastructural contexts. The project also aims to establish and refine governance solutions that can be scaled and replicated across Europe.

The expected impacts of P2GreeN are both environmental and economic. Environmentally, the project aims to reduce nitrogen and phosphorus discharge into ecosystems, thereby mitigating pollution and enhancing resource efficiency. Economically, it opens new markets for bio-based fertilizers, potentially fostering economic growth and creating new revenue streams.
Furthermore, Bio Azul ensures robust stakeholder engagement by partnering with 32 European entities, including universities, research institutes, and industry players. This collaborative approach enhances knowledge sharing and fosters innovation, driving the project's objectives forward. Overall, Bio Azul's P2GreeN initiative stands as a model for sustainable nutrient management, demonstrating the potential of circular economy practices to revolutionize agricultural and waste management systems in Europe.

Introduction

Bio Azul is a pioneering engineering and technology consulting firm dedicated to developing eco-innovative and sustainable solutions, particularly in the realm of water resource management. The P2GreeN project, undertaken by Bio Azul, is a testament to the company's commitment to fostering a circular economy by closing the nutrient cycles of nitrogen (N) and phosphorus (P). This project is part of the Horizon Europe initiative and seeks to transform human sanitary waste into valuable bio-based fertilizers, thereby promoting sustainable agricultural practices and reducing environmental pollution.

Launched on December 1, 2022, the P2GreeN project spans four years and involves a comprehensive strategy to recover and reuse nutrients, essential for advancing the transition from linear resource systems to circular material flows within the agri-food supply chain. By focusing on the recovery of N and P, the project aims not only to mitigate pollution but also to support sustainable food systems from farm to fork, ultimately decreasing dependence on mineral fertilizers.
A distinctive feature of the P2GreeN project is its holistic approach, which adheres to the principles of Reduce, Reuse, and Recover (3R). This approach is operationalized through pilot projects in diverse European regions, each with unique environmental and infrastructural contexts. The three primary pilot regions include the Baltic Sea region in Northern Europe, the Hamburg-Hannover metropolitan area in Central Europe, and La

Axarquía in Southern Spain. These regions serve as demonstration sites for the nutrient recovery technologies, providing valuable insights that can be replicated and scaled across Europe. The successful implementation of the P2GreeN project hinges on robust stakeholder engagement, involving 32 European partners such as universities, research institutes, local governments, and industry players. This collaborative framework is designed to enhance knowledge sharing, drive innovation, and ensure the development of effective governance solutions that facilitate the adoption of circular economy practices across Europe.

By focusing on the integration of circular economy principles, the P2GreeN project by Bio Azul aims to set a precedent for future initiatives, demonstrating how innovative nutrient recovery solutions can contribute to the sustainability and resilience of agricultural systems, while also fostering economic growth and creating new revenue streams through the development of bio-based fertilizers.

Core Circular Economy Strategies

Nutrient Recovery and Reuse

P2GreeN employs advanced technologies like struvite precipitation and the Stuttgart Process to recover nitrogen and phosphorus from wastewater. These recovered nutrients are transformed into bio-based fertilizers tailored for agricultural use, ensuring a closed-loop system.

Pilot Demonstrations Across Europe

The project tests its methods in three pilot regions with diverse environmental contexts:

- Baltic Sea Region: Focuses on nutrient recovery in water-stressed areas.
- Hamburg-Hannover: Develops fertilizers from both urine and faeces, enhancing nutrient reuse.
- La Axarquía (Southern Spain): Tailors solutions for semi-arid climates and nutrient-depleted soils.

Pollution Mitigation

By recovering nutrients, P2GreeN prevents eutrophication, a major issue caused by excess nitrogen and phosphorus in water bodies, thereby protecting aquatic ecosystems.

Sustainable Fertilizer Production

Bio-based fertilizers produced locally reduce reliance on energy-intensive mineral fertilizers, stabilizing costs for farmers and minimizing environmental impact.

Stakeholder Collaboration

With 32 partners—including universities, local governments, and industries—the project fosters innovation and knowledge sharing, ensuring effective implementation and scalability.

Policy Alignment

P2GreeN works within EU regulatory frameworks like the Urban Wastewater Treatment Directive, ensuring compliance while advocating for broader adoption of circular models.

Framework's Indicators

Environmental Impact

- Nutrient Recovery Rates: Advanced technologies recover up to 75% of phosphorus and significant amounts of nitrogen from wastewater, ensuring efficient resource use.
- Pollution Reduction: By addressing nutrient discharge, the project mitigates eutrophication, preventing hypoxic conditions in aquatic ecosystems.
- Reduced Resource Dependency: Recycled fertilizers decrease the need for mined phosphorus and synthetic nitrogen, conserving natural resources.
-

Economic Viability

- Cost Savings for Farmers: Bio-based fertilizers offer a cheaper alternative to increasingly expensive mineral fertilizers, reducing input costs.
- New Revenue Streams: Farmers benefit from higher market demand for sustainably grown produce, which commands price premiums.
- Transportation Savings: Local fertilizer production minimizes logistics costs and associated emissions.

Social Well-being

- Job Creation: Pilot projects stimulate local economies, creating employment opportunities in fertilizer production, logistics, and research.
- Improved Food Security: Sustainable nutrient management supports higher crop yields and healthier soil.
- Stakeholder Engagement: Collaboration with farmers, researchers, and policymakers enhances social equity and community involvement.

Design for Circularity

- Product Longevity: Bio-based fertilizers release nutrients gradually, improving plant uptake and reducing wastage.
- Material Reuse: Recycled materials from wastewater are transformed into high-value agricultural inputs, closing nutrient loops effectively.

Material Innovation

- Advanced Recovery Technologies: Struvite precipitation captures both phosphorus and nitrogen, while the Stuttgart Process enhances recovery efficiency for phosphorus.
- Biodegradable Fertilizers: Nutrients recovered are formulated into eco-friendly fertilizers that minimize environmental residue.

Policy & Regulatory Support

- EU Directives Compliance: The project aligns with regulations like the Urban Wastewater Treatment Directive and Fertilising Products Regulation, ensuring widespread applicability.
- Advocacy for Circular Governance: P2GreeN promotes frameworks that integrate waste and agricultural systems for long-term sustainability.

Technology & Innovation

- Scalable Solutions: Technologies like the KREPRO process and bioreactors demonstrate adaptability across diverse regions, ensuring replicability in other contexts.
- Integrated Systems: Combining urban and rural waste streams creates an efficient circular flow of nutrients.

Impact Measurement and Reporting

- Recovery Metrics: The project tracks quantities of nitrogen and phosphorus recovered, demonstrating environmental and economic benefits.
- Performance Indicators: Carbon emissions reductions, water quality improvements, and cost savings are monitored, providing data for policy recommendations.

Conclusion

The P2GreeN project by Bio Azul has identified several best practices that align with circular economy principles and advance sustainable agricultural practices through innovative nutrient management. Central to these practices is the recovery and reuse of essential nutrients, such as nitrogen (N) and phosphorus (P), from human sanitary waste, which effectively closes the nutrient cycle and transforms waste into valuable bio-based fertilizers. The project employs advanced recovery technologies like struvite precipitation and the Stuttgart process, enhancing resource efficiency while minimizing environmental impact. Additionally, the holistic 3R approach —Reduce, Reuse, Recover— underpins the project's strategy, supported by robust stakeholder collaboration among 32 diverse partners, fostering knowledge sharing and innovative governance. The emphasis on education and consumer awareness about the benefits of bio-based fertilizers further drives sustainable practices. Economically, local production of fertilizers reduces costs and stabilizes prices, supporting regional economies. Alignment with key EU directives on sustainability ensures regulatory compliance and market acceptance. Collectively, these best practices demonstrate effective nutrient management strategies, paving the way for transformative changes in agricultural systems across Europe and underscoring the potential of circular economy models to enhance environmental resilience and economic sustainability.

Betolar

Name of the Company	Betolar
Country	Finland
City	Kannonkoski
Website	https://www.betolar.com/

Executive Summary

Betolar, a Finnish materials technology company, pioneers' circular economy practices in construction and mining. It focuses on reducing CO_2 emissions, minimizing virgin resource use, and transforming industrial side streams into building materials. Its Geoprime solution, AI-driven research, and collaborative strategies set new sustainability standards.

- Overview of Betolar's innovations in the circular economy within construction and mining.
- Highlights of key achievements: CO_2 reduction, side stream utilization, and partnerships.

Introduction

As global industries face resource depletion and climate challenges, Betolar introduces a paradigm shift in material use, transforming industrial waste into valuable resources for construction. By leveraging circular economy principles, it is setting benchmarks for sustainability through reduced resource consumption and emissions.

Key points:

- Importance of circular economy in addressing resource depletion and environmental challenges.
- Betolar's role in transforming waste into resources.

Core Circular Economy Strategies

This chapter highlights Betolar's multifaceted approach to implementing circular economy principles, focusing on four key areas: industrial side stream utilization, carbon footprint reduction, AI-driven innovation, and collaboration.

Utilization of Industrial Side Streams

At the heart of Betolar's circular economy strategy is the innovative use of industrial side streams. The company has developed Geoprime, a proprietary solution that incorporates up to 95% side stream materials in the production of sustainable construction products. By repurposing industrial by-products such as fly ash and slag, Betolar not only reduces waste headed for landfills but also conserves virgin natural resources. This approach aligns with the core principles of a circular economy, where waste is viewed as a valuable resource, thus minimizing the need for new raw materials.

Carbon Footprint Reduction

Betolar is committed to significantly reducing the carbon emissions associated with construction materials. Through the optimization of existing production processes and the use of alternative low-carbon materials, Betolar's Geoprime solution enables the production of construction products with up to 80% lower greenhouse gas emissions compared to traditional cement-based materials. This reduction is crucial in an industry where cement production is a major contributor

to global CO_2 emissions. By offering low-carbon alternatives, Betolar addresses a pressing environmental challenge and leads the way in sustainable construction practices.

AI-Driven Innovation

A key component of Betolar's strategy is the integration of artificial intelligence (AI) into its research and development (R&D) processes. Betolar's AI platform analyses data from over 250 industrial side streams, optimizing the properties of materials like concrete and geopolymers for strength, viscosity, and durability. This AI-driven approach accelerates the identification and development of new sustainable materials, making the process more efficient and data-driven. By leveraging AI, Betolar is able to innovate faster and more effectively, setting new standards for sustainable construction materials while maximizing resource efficiency.

Collaboration and Partnerships

Betolar recognizes that collaboration is essential to driving widespread adoption of circular economy principles. The company actively engages in strategic partnerships across the construction and mining sectors, working with key industry players to develop and implement innovative solutions. For example, Betolar collaborated with Consolis Parma to create the world's lowest-emission hollow-core slabs. These partnerships not only enhance Betolar's ability to scale its solutions but also foster the sharing of best practices, enabling a broader transition towards circular economy models across the industry.

Framework's Indicators

Environmental Impact

Betolar's use of industrial side streams, particularly through its Geoprime solution, directly aligns with the environmental goals of reducing resource consumption and minimizing waste. Geoprime uses up to 95% side stream-based materials, significantly cutting down on virgin material use and waste generation. This aligns with the framework's environmental indicators, such as:

- Water use reduction: Although not directly addressed, Betolar's focus on alternative materials may indirectly reduce water consumption in material processing.
- CO2 emissions: Betolar's solutions reduce raw material-level greenhouse gas emissions by up to 80%, which directly corresponds to the framework's emphasis on reducing carbon footprints.
- % recycled content: The extensive use of industrial by-products in Betolar's materials speaks to the framework's call for increased recycled content.

Economic Viability

Betolar demonstrates strong economic sustainability through its business innovations and partnerships. The use of AI to optimize material formulations and the development of low-emission building products highlight its economic feasibility. This is in line with the framework's indicators for economic viability, including:

- Return on investment (ROI): Betolar's ability to create value from waste streams and reduce material costs suggests potential for significant ROI.
- New revenue streams: The creation of sustainable construction materials from industrial waste opens new markets for eco-friendly products.

Social Well-being

Betolar promotes collaborations across sectors, ensuring knowledge-sharing and community engagement. Its efforts in local employment and sustainable resource management contribute to societal benefits. This aligns with the social well-being aspect of the framework:

- Local employment: Betolar's focus on utilizing local resources supports job creation and local economies, fulfilling the framework's emphasis on job creation within CE practices.
- Consumer satisfaction: While not directly measured, the creation of environmentally friendly building materials likely enhances consumer perception and satisfaction.

Design for Circularity

Betolar's focus on modular design and the long lifespan of its construction materials underscores its commitment to CE. Its use of 95% side stream materials and the development of products like

the world's lowest-emission hollow-core slabs are clear examples of circular design. This directly aligns with the framework's indicators:

- Product lifespan: Betolar's products are designed for durability and efficiency, fulfilling the framework's goal of extended product life cycles.
- % recyclable/compostable materials: The company's use of side streams in its materials ensures high recyclability, a core aspect of circularity.

Material Innovation

Betolar's research into AI-driven material optimization ensures efficient use of side streams, which are often considered waste. The company's innovations with low-carbon binders and geopolymer materials demonstrate a commitment to material innovation, aligning with the framework's indicators:

- % renewable materials: While Betolar focuses on recycled rather than renewable materials, it still contributes to resource conservation by reducing reliance on virgin materials.
- Hazardous substance reduction: Betolar's materials aim to reduce the use of cement, a significant contributor to environmental harm, thus aligning with the framework's goals of hazardous substance reduction.

Business Model Innovation

Betolar's innovations in product design and lean supply chain management offer new ways of minimizing resource use and waste, which aligns with the framework's call for business model innovation:

- Subscription models: Betolar doesn't explicitly follow a subscription model, but its emphasis on take-back programs and the reuse of materials corresponds to the framework's goals for circular business models.

Stakeholder Engagement and Collaboration

Betolar's collaborative efforts with industry partners, such as Consolis Parma, highlight its commitment to engaging stakeholders. This partnership is in line with the framework's indicator for cross-sector collaborations:

- Cross-sector collaborations: Betolar's partnerships within the construction industry exemplify the framework's call for collaboration in driving circular economy practices.
- Consumer education programs: Although not explicitly mentioned, Betolar's work in promoting low-carbon building materials indirectly educates consumers and industry professionals about sustainable alternatives.

Policy & Regulatory Support

While not deeply discussed in the Betolar document, the company's commitment to reducing emissions and transforming industrial side streams into valuable resources aligns with broader regulatory goals related to resource efficiency and waste reduction. This matches the framework's emphasis on Extended Producer Responsibility (EPR) and waste disposal taxes that encourage circularity.

Technology & Innovation

Betolar's use of AI-driven platforms to optimize its production processes showcases the integration of advanced technology, as promoted in the framework. This innovation improves resource efficiency and aligns with:

- IoT sensors: While Betolar doesn't explicitly mention IoT use, its AI platform plays a similar role by managing resource flows and optimizing material compositions.

Impact Measurement and Reporting

Betolar's commitment to quantifying its environmental impact, especially in terms of CO2 reductions and waste reduction, aligns well with the framework's emphasis on standardized metrics. This aligns with the indicators for measuring circular performance in terms of resource efficiency and waste reduction.

Palpa

Name of the Company	Suomen palautuspakkaus Oy (Palpa)
Country	Finland
City	Helsinki
Website	https://www.palpa.fi/

Executive Summary

Palpa is a Finnish non -profit company owned by franchising groups and breweries. Finland established its bottle return system in the 1950s, and in the 1990s, Palpa was founded to build on this legacy. Today, 30 countries on average have implemented beverage packaging return systems, positioning Palpa as a pioneer in the circular economy with its focus on recycling and reusing beverage packaging materials by implementing a return deposit system.

Managing and developing the recycling systems of beverage packaging is in the core operations of Palpa. The returning of the packaging is based on a deposit system which is a successful concept in encouraging consumers to return the bottles and cans. The main purpose of the company is administrational; to manage and develop the return and recycling system with a strategy to outsource the services needed in recycling operations. Papa's operations are monitored by the Regional State Administrative Agency.

Introduction

Beverage packaging and other packaging materials are a severe environmental problem. Plastic waste especially is causing tremendous harm to animals and ecosystems globally. The operating model Palpa administers, keeps beverage packaging materials in reuse extending the life cycle of the materials, reducing waste, energy consumption and consumption of natural resources. For example, reusing the aluminium in beverage cans saves 95% of the energy compared to making a can from virgin materials. Palpa's packaging return program operates through a deposit-based system. The deposit system as a mode of operation is very effective as the return percentage of the aluminium cans, glass bottles and plastic bottles and containers in Finland was 97% in 2023.

The company is owned by the beverage manufactures and the import companies. Their role is the financing of the operations. The system is based on and made possible through wide and close cooperation with different actors through the society starting from designing the beverages packaging to the reuse of the different materials. The materials are reused in new beverage packaging or made into different products such as clothing from Polyethylene terephthalate (PET) – plastic packaging.

Key points:

- Palpa's Operating Model and Goals: Palpa manages the recycling and reuse of beverage packaging as a non-profit company. The company's operating model is based on a deposit system, which enables a high return rate.
- Broad Cooperation: The system's success relies on extensive cooperation with various stakeholders across society, from the design of packaging to the reuse of materials.
- Environmental benefits: Recycling of the beverage packaging reduces waste in landfills and nature. Reuse of the materials significantly saves resources such as energy and natural resources.

Core Circular Economy Strategies

Outsourcing and managing the operations
Outsourcing of the recycling operations allows Palpa to manage the innovations and stakeholder collaborations of the beverage package recycling and material reuse. The costs of the system are covered by fees paid by beverage manufacturers and import companies. The chain of the operations includes taking back the packaging in the return points, transportation, treatment of beverage containers in processing plants, processing of the recycled materials. Palpa pays handling fees to the return points that receive packaging from consumers. Return points include shops and all businesses that sell beverages, which are required to accept returned beverage packages.

Costs from transportation of the returned packaging and the material as well as the processing of packaging materials are also covered by Palpa. The material processor then pays Palpa the current market price for the material, such as aluminium

The deposit system
The producer responsibility (waste law) obligates all actors who sell beverages to take back and pay the deposit for consumers. Joining the Palpa return scheme is beneficial for beverage manufacturers and importers as this will exempt them from the beverage packaging tax. The minimum deposit for packaging is established by law. The deposit on the packaging is tied to the current price of the materials and is monitored by the government.

A deposit gives incentive to consumers to recycle their household beverage packaging. In Finland and other Nordic countries which have implemented the system, the rates of recycling are the highest in the world. This clearly demonstrates the effectiveness of the return deposit system. Many EU countries and countries globally are in the process of introducing the system or variations of it. Alternative options in use globally for recycling beverage packaging include deposit programs managed by retail chains, voluntary sorting alongside other household waste, and sorting at waste treatment facilities.

Stakeholder collaboration
Recycling and processing of the materials requires strong collaboration between all the operators involved. The picture below illustrates the different actors and phases of packaging recycling. Other factors alongside the deposit introduced at the point of sail, also influence the success of the system. The location of the nearest return points and how well the return machines work, also influence the consumers' willingness to recycle. Habits and attitudes are pivotal in consumer behaviour as well as organisational actions. Palpa educates and co-operates with a wide range of

Figure 1 The Picture illustrates the different process and operators needed for successful recycling of beverage packaging. (Source Palpa, 2024)

actors on different levels of society widening the scale of recycling and reuse of the recycled materials. However, the role of governmental steering is not to be underestimated. The Government Decree on the return system for beverage containers is clearly defined including obligations to the manufacturers, importing companies as well as the operators of the system.

Saving resources
Palpa's aim is to reduce the amount of waste and save energy.
Recycling materials from beverage packaging, reduces the need for natural resources. For example, Using recycled aluminium in drink can production requires only 5% of the energy needed to make a can from virgin raw material. As well as manufacturing new bottles, a wide range of industries utilise the materials from PET plastic bottles and glass containers.

Framework's Indicators

Environmental Impact

The take back and deposit system Palpa has created and administrates allows high quantities of recycled materials to be reused.recycling and reuse of beverage packaging, along with repurposing materials, directly support environmental goals of reducing resource consumption and minimizing waste. The system enables almost unlimited reuse of materials, particularly when they are recycled into new packaging, reducing energy consumption by up to 95%.

- Resource savings and CO2 reduction are considerable throughout the product life cycle.

Economic Viability
Palpa is a non-profit company. The revenues are directed to developing the system further. Palpa finances the operations of the system with the fees from producers and importers, which are obligated to join the Palpa scheme or pay beverage tax. Streamlining processes and investing in technology brings benefits not only from the company's perspective but also from the ecological point of view.

- New revenue streams: The designing and using recycled glass and PET plastics offers new markets for more ecological products in different industries.

Social Well-being
Palpa promotes collaborations across a wide range of sectors. Outsourcing of the activities creates local employment in different industries such as maintenance and sorting materials. Effective waste management contributes to societal benefits, keeps the living environment clean and reduces waste in the ecosystems. This aligns with the social well-being aspect of the framework:

- Local employment: Palpa's outsourcing strategy supports job creation and local economies, fulfilling the framework's emphasis on job creation within CE practices.
- Consumer satisfaction: According to Palpa the Finns recycle their beverage because of environmental reasons and the deposit system. The deposit system is effective. 85% of the respondents in Palpa's questionnaire returns all their household beverage packaging and 55% of the households also return the beverage packaging without the deposit.

Design for Circularity
Design for circularity considers the product lifespan evaluating how long a product remains functional and avoids ending up in landfill.

The Palpa recycling system allows nearly unlimited usage of the materials, especially when the material is reused for new packaging where the energy use reduction is 95 %. This directly aligns with the framework's indicators:

- Product lifespan: The recycled material from glass bottles and aluminium cans can be reused virtually 100%
- The process can be repeated almost indefinitely.
- Nearly 100% of the recycled PET plastic bottles are recycled and the material is used for making new bottles or other food containers or used in the textile industry.

Business Model Innovation
The reclaiming of beverage packing is in alignment with the take back indicator of the sustainable Ce framework.

- Take-back programs: Palpa has nearly 4,000 return points and 2.2 billion bottles are returned yearly. The return rates of beverage packaging in Finland are close to 100 %.

Stakeholder Engagement and Collaboration
Palpa highlights the collaboration and engagement of stakeholders. Their strategy of outsourcing and innovation is dependent on many actors.

- Cross-sector collaborations: The beverage packaging system involves actors throughout the society and multiple sectors from designing the packaging to reusing the materials.
- Consumer education programs: Palpa has actively engaged consumers, and the deposit system works as a highly motivational system for recycling.

Policy & Regulatory Support
One of Palpa's key stakeholders is the Finnish government. Government decree on the beverage container return system is clearly defined, outlining obligations for manufacturers, importers, and system operators. This aligns directly with the framework for sustainable CE identifying laws which hold manufacturers accountable for product end-of-life.

- Extended Producer Responsibility (EPR): The beverage packaging system involves actors throughout the society and multiple sectors from designing the packaging to reusing the materials.

Impact Measurement and Reporting
Palpa's commitment to quantifying its environmental impact, especially in terms of waste reduction and reducing resource use aligns with the framework's indicators for measuring circular performance with recycling rates and the percentage of ability to reuse the materials for manufacturing the same product or using the recycled material in other industries.

Conclusion

Palpa demonstrates how a deposit-based recycling system can effectively integrate circular economy principles, reducing waste and conserving resources. By fostering stakeholder collaboration, leveraging regulatory frameworks, and educating consumers, Palpa achieves one of the highest beverage container return rates globally. Its innovative practices set a gold standard for sustainable packaging and circular economy strategies, offering a replicable model for other industries and regions.

FairPhone

Name of the Company	FairPhone
Country	The Netherlands
City	Amsterdam
Website	https://www.fairphone.com/

Executive Summary

Fairphone is a Dutch electronics manufacturer dedicated to sustainability and the circular economy. This report examines Fairphone's methodologies, including product repairability, material sourcing, lifecycle assessments, and industry collaboration strategies. The company's repairable and modular smartphone design, extended software support, use of recycled and ethically sourced materials, and commitment to electronic waste neutrality underscore its pioneering role in circular economy practices. Fairphone's initiatives have profound impacts on reducing environmental footprints and enhancing social conditions in the supply chain, setting new standards within the mobile phone industry.

Introduction

Fairphone, based in Amsterdam, is an innovative electronics company that stands out in the highly competitive smartphone market by placing a strong emphasis on sustainability and social responsibility. Founded in January 2013 by Bas van Abel, Tessa Wernink, and Miquel Ballester, Fairphone originated from an awareness campaign about conflict minerals in electronic devices, an issue that sparked significant public interest and support. Since then, the company has evolved into a viable business that produces smartphones with minimal ethical and environmental impact, aligning its business operations with its core mission of advocating for a fairer technology sector.

Fairphone's approach to sustainability is multifaceted, encompassing responsible material sourcing, innovative product design, and a commitment to long-term software support. A key aspect of Fairphone's philosophy is the promotion of a circular economy model, which aims to keep resources in use for as long as possible through practices like repairability, reuse, and recycling. By adopting modular designs, Fairphone allows consumers to easily replace parts and extend the lifespan of their devices, thereby reducing electronic waste significantly.

The company's dedication to using ethically sourced materials is evident in its efforts to integrate conflict-free and Fairtrade-certified minerals into its supply chain. For example, the gold, silver, and other metals used in Fairphone devices are sourced from suppliers that adhere to strict ethical standards, ensuring fair labor practices and minimal environmental harm.

Fairphone also actively engages with its community and industry stakeholders to drive systemic change. Through collaborations with organizations like the Fair Cobalt Alliance and participation in initiatives that promote fair labor practices in mining, Fairphone not only improves its supply chain but also sets new benchmarks for the industry.

This report delves into the various practices that underpin Fairphone's circular economy strategy, exploring how the company's innovative approaches to product design, material sourcing, and

stakeholder engagement contribute to a more sustainable and responsible electronics industry. By examining Fairphone's comprehensive strategy and its impact, we can gain insights into the practical implementation of circular economy principles within the consumer electronics sector.

Core Circular Economy Strategies

Modular Product Design

Fairphone's smartphones are built for easy repair and upgradeability, allowing consumers to replace components like the battery, camera, and display with minimal effort. The Fairphone 5 exemplifies this approach, achieving a perfect 10/10 repairability score from iFixit. This modular design includes 10 replaceable parts, such as SIM card slots and the motherboard, which are independently available for purchase.

Impact: By enabling repairs and upgrades, Fairphone reduces electronic waste and extends the usable lifespan of its devices. This design stands in stark contrast to the industry norm of planned obsolescence.

Extended Software Support

Fairphone's long-term software strategy ensures devices remain secure and functional for years. The Fairphone 5 will receive at least five major Android updates and security support for a minimum of eight years, with plans to extend this to ten years. Similarly, the Fairphone 2, released in 2015, received software updates up to 2021, showcasing the company's commitment to usability and longevity.

Impact: Extended software support reduces the need for hardware replacements, directly addressing the industry's rapid obsolescence problem and reducing associated environmental costs.

Ethical Material Sourcing

Fairphone integrates conflict-free and Fairtrade-certified materials into its supply chain. By sourcing gold, tungsten, tin, and tantalum responsibly, the company minimizes environmental harm and supports fair labor practices in mining communities.

Collaborations: Partnerships with initiatives like the Fair Cobalt Alliance improve social and environmental conditions in cobalt mining, while Fairtrade gold integration ensures equitable sourcing.

Recycled Materials

Fairphone devices incorporate over 70% fair or recycled materials, including aluminum, tin, rare earth elements, plastics, and more. For instance, the Fairphone 4's back cover is made entirely from post-consumer recycled plastic.

Impact: By prioritizing recycled content, Fairphone reduces the extraction of virgin materials and its environmental footprint.

E-Waste Neutrality

For every device sold, Fairphone collects an equivalent amount of e-waste for recycling, ensuring a net-zero contribution to global electronic waste. This is achieved through robust take-back programs that encourage consumers to return old devices for proper disposal.

Impact: E-waste neutrality ensures valuable materials are recovered and reintegrated into production cycles, reducing landfill waste.

Stakeholder Collaboration

Fairphone actively engages with stakeholders to promote systemic industry change. Collaborations with organizations like Closing the Loop ensure responsible e-waste management, while partnerships with telecom providers like KPN assess and improve product circularity.

Impact: Collaborative efforts amplify Fairphone's impact, driving broader adoption of sustainable practices across the industry.

Framework's Indicators

Environmental Impact

- Water Use Reduction: Sourcing recycled materials reduces water consumption compared to virgin material processing. Suppliers are encouraged to adopt water-saving measures, aligning with Fairphone's sustainability goals.
- CO2 Emissions Reduction: Modular designs and extended software support reduce emissions associated with frequent device replacements. Manufacturing with renewable energy further minimizes the company's carbon footprint.
- % Recycled Content: Over 70% of materials used in Fairphone devices are recycled or ethically sourced, including post-consumer plastics and metals.

Economic Viability

- ROI: Repairability and modular upgrades reduce costs for consumers and the company by extending product lifespans.
- New Revenue Streams: Modular components and extended software updates create additional value propositions for eco-conscious customers.

Social Well-being

- Local Employment: Partnerships with the Fair Cobalt Alliance support safer and more equitable working conditions in mining regions.
- Fair Wages: Fairphone ensures equitable pay for workers throughout its supply chain, particularly in regions involved in material extraction.
- Consumer Satisfaction: Repairable and long-lasting smartphones address consumer demand for sustainable electronics.

Design for Circularity

- Product Lifespan: Modular construction and software longevity extend device usability, significantly reducing waste.
- % Recyclable Materials: Devices are designed for easy disassembly, ensuring efficient recycling and material recovery.

Material Innovation

- % Renewable Materials: Fairphone integrates responsibly sourced and recycled materials, including Fairtrade-certified gold and post-consumer plastics.
- Hazardous Substance Reduction: Fairphone eliminates toxic materials, such as lead and mercury, from its devices.

Business Model Innovation

- Take-back Programs: Recycling initiatives ensure old devices are responsibly managed, contributing to the circular economy.
- Subscription Models: While not implemented, modular upgrades and extended software support align with sustainable ownership models.
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Stakeholder Engagement and Collaboration

- Cross-Sector Collaborations: Fairphone partners with NGOs, telecom providers, and recycling initiatives to enhance sustainability practices across the industry.
- Consumer Education Programs: Fairphone actively educates users on repairability and the environmental benefits of its products.

Policy & Regulatory Support

- Extended Producer Responsibility (EPR): Compliance with e-waste regulations ensures devices are responsibly recycled.
- Waste Disposal Taxes: Minimizing waste through modular designs aligns with policies discouraging landfill use.

Technology & Innovation

- IoT Sensors: While not a direct feature, Fairphone promotes community-driven open-source software development to enhance device functionality and sustainability.

Impact Measurement and Reporting

- Circular Performance Indicators: Annual reports provide detailed metrics on emissions, material recovery, and e-waste neutrality, showcasing progress toward sustainability goals.

Conclusion

Fairphone's approach to the circular economy exemplifies how a company can integrate sustainability into every aspect of its operations. Through repairability, responsible material sourcing, extended product lifespans, and active collaboration, Fairphone not only reduces its environmental footprint but also sets new standards within the mobile phone industry. Their efforts demonstrate a viable path towards a more sustainable and circular electronics market.

By examining Fairphone's strategies and practices, we can gain valuable insights into the practical implementation of circular economy principles in the electronics industry and the significant positive impact such initiatives can have on both the environment and society.

IKEA

Name of the Company	IKEA
Country	The Netherlands
City	Delft
Website	https://www.ikea.com/

Executive Summary

IKEA, the global furniture giant, endeavours to revolutionize its operations through circular economy principles, aiming to become a fully circular business by 2030. Their strategy incorporates designing products for longevity and recyclability, increasing the use of renewable and recycled materials, and adopting innovative business models like product leasing and take-back programs. Stakeholder engagement and consumer education play pivotal roles in fostering a sustainable culture. Progress has been marked by substantial reductions in CO2 emissions and waste generation, coupled with economic benefits from new revenue streams. However, challenges including material availability, effective waste management, and maintaining high-quality standards underline the need for continuous innovation and collaboration. IKEA's efforts demonstrate a comprehensive approach to sustainability, promising significant environmental, economic, and social benefits.

Introduction

In response to increasing global concerns over resource depletion, climate change, and waste management, IKEA has committed to a transformative circular economy strategy aimed at becoming fully circular by 2030. This approach seeks to address significant environmental challenges while fostering sustainable economic growth. Key objectives of IKEA's circular economy initiative include designing products that are long-lasting, easily repairable, and recyclable, thereby extending their lifecycle and reducing waste. The company aims to utilize only renewable and recycled materials in its products, minimizing reliance on virgin resources and promoting material efficiency.

By adopting innovative business models, such as take-back programs, resale of refurbished items, and furniture leasing, IKEA creates new revenue streams while enhancing customer engagement and encouraging responsible consumption. Stakeholder engagement, including collaborations with customers, suppliers, and industry experts, plays a crucial role in fostering a culture of sustainability and circularity. The overall impact of these circular economy practices on IKEA's operations is profound, leading to significant reductions in CO2 emissions and advancements in resource efficiency.

Furthermore, these initiatives not only contribute to IKEA's sustainability goals but also serve as a blueprint for integrating circular principles within the broader retail and manufacturing sectors. This commitment positions IKEA as a leader in the transition towards sustainable practices, highlighting the importance of circularity in modern business strategies. By addressing environmental, economic, and social dimensions, IKEA's circular economy strategy exemplifies a holistic approach to sustainability.

Core Circular Economy Strategies

Circular Product Design

IKEA prioritizes designs that support longevity, repairability, and recyclability:

- Design for Easy Disassembly and Repair: Products such as the MÖRBYLÅNGA [1] table and wedge dowel click-technique furniture enable easy repairs and refurbishment.
- Modular Design: Items like modular sofas and desks allow customization, adaptation, and reconfiguration to meet evolving consumer needs.
- Standardized Parts: Consistent use of parts simplifies repairs and supports remanufacturing, extending product life cycles.

Use of Renewable and Recycled Materials

- Renewable Resources: Over 60% of IKEA's products are made from renewable materials like wood and cotton.
- Recycled Content: More than 10% of the product range includes recycled materials, with innovative processes enabling fibreboard recycling.
- Bio-Based Innovations: Products like the SMEVIKEN and SUTTERVIKEN[2] lines showcase the use of recycled fibreboard, reducing the need for virgin materials.

Circular Business Models

- Take-Back Programs: IKEA's Buy Back & Resell service allows customers to return gently used furniture for store credit, fostering reuse and waste reduction.
- Resale of Refurbished Items: The As-Is section offers inspected, lightly used, or discontinued products at reduced prices, extending their usability.
- Furniture Leasing: Pilot programs in markets such as Sweden and the Netherlands enable customers to lease furniture, keeping products in circulation for longer.

Stakeholder Engagement and Consumer Education

- Collaborations with organizations like the Ellen MacArthur Foundation[3] enable the development of circularity frameworks.
- Educational campaigns and events raise consumer awareness about reusing, sharing, and repairing items.

Framework's Indicators

Environmental Impact

- CO2 Emissions Reduction: IKEA achieved a 22% reduction in its climate footprint compared to its 2016 baseline through renewable electricity, energy-efficient lighting, and optimized production volumes.
- Water Use Reduction: Innovations in material recycling reduce water consumption associated with virgin resource extraction.
- % Recycled Content: Products increasingly feature recycled materials, exemplified by fibreboard innovations enabling over 50% recycled wood usage.

Economic Viability

- Return on Investment (ROI): Circular business models such as leasing, and resale generate new revenue streams while reducing costs associated with raw material procurement.
- Market Demand for Sustainable Products: Consumers increasingly favour products with lower environmental impacts, creating opportunities for IKEA to cater to eco-conscious markets.

Social Well-being

- Job Creation: Repair and refurbishment services provide employment opportunities in local communities.
- Fair Practices: IKEA ensures ethical labour practices across its supply chain.
- Consumer Engagement: Initiatives like the As-Is Online service encourage participation in circular practices, fostering a culture of sustainability.

Design for Circularity

- Product Lifespan: Modular and repairable designs extend product life cycles, reducing waste.
- % Recyclable Materials: Products are designed for disassembly, ensuring effective recycling.

Material Innovation

- Advanced Recycling Processes: Fibreboard recycling technologies allow high-quality material recovery, showcasing IKEA's leadership in material innovation.
- Bio-Based Adhesives: The introduction of corn starch-based glue reduces emissions from fossil-based alternatives.

Business Model Innovation

- Subscription-Based Leasing: Furniture leasing pilots promote reuse and adaptability, reducing environmental footprints.
- Take-back Programs: Services like Buy Back & Resell ensure products are reused or recycled responsibly.

Stakeholder Engagement and Collaboration

- Partnerships with industry experts and NGOs drive innovation and knowledge sharing.
- Consumer education programs promote sustainable practices, empowering individuals to contribute to circular goals.

Policy & Regulatory Support

- Compliance with Sustainability Standards: IKEA aligns its operations with global regulations and sustainability standards, advocating for policy frameworks supporting circularity.

Impact Measurement and Reporting

- Performance Metrics: IKEA tracks progress on emissions reductions, resource efficiency, and circular product adoption, ensuring transparency and accountability.

Conclusion

IKEA exemplifies how circular economy principles can be integrated into a global business model, achieving significant environmental, economic, and social impacts. By focusing on product design, renewable materials, and innovative business models, the company demonstrates the potential of sustainability-driven strategies to reshape industries. Through stakeholder collaboration, consumer education, and robust impact measurement, IKEA is setting a benchmark for circular practices, driving the transition toward a sustainable future.

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[1] The MÖRBYLÅNGA table, manufactured by IKEA, features an oak veneer top with plank detailing and dovetail joints. From a circular economy perspective, the table represents a sustainable design choice by utilizing resource-efficient particleboard combined with veneer technology, which maximizes the benefits of wood while minimizing raw material usage (An Earthy and Sustainability-Focused Dining Room.

[2] The SMEVIKEN and SUTTERVIKEN lines represent IKEA's distinct approaches to traditional storage design. Both lines utilize sustainable materials, incorporating frames made of chipboard, fiber board, or solid wood with honeycomb filling for lightweight yet sturdy construction. As part of IKEA's circular initiative, these lines exemplify the company's commitment to sustainability, being manufactured from recycled fibreboard that gives new life to waste and broken furniture. Both collections are designed for adaptability and longevity, featuring standardized parts that enable easy maintenance and repair throughout their lifecycle.

[3] The Ellen MacArthur Foundation, established in 2010, is a charity organization committed to accelerating the transition to a circular economy. The Foundation works with businesses, academia, policymakers, and institutions to promote an economic system that eliminates waste and pollution, circulates products and materials at their highest value, and regenerates nature. Through their global network and evidence-based research, they focus on key areas including plastics, food, fashion, and climate change to demonstrate how circular economy principles can address major environmental challenges. (https://www.weforum.org/organizations/ellen-macarthur-foundation/)

Philips

Name of the Company	Philips
Country	Netherlands
City	Amsterdam
Website	https://www.philips.com/

Executive Summary

Philips, a leading health technology company, champions circular economy principles through product lifecycle management, leasing models, and equipment refurbishing. By prioritizing resource efficiency, sustainable design, and stakeholder collaboration, Philips showcases how healthcare innovation can align with sustainability goals.

Introduction

Philips operates globally, focusing on health technology solutions such as imaging systems, personal health devices, and medical equipment. Recognizing the environmental challenges of electronic waste and resource consumption, Philips adopts circular economy principles to ensure product longevity, recyclability, and resource efficiency.

Core Circular Economy Strategies

Product-as-a-Service Models

Philips provides healthcare equipment on a leasing basis, ensuring continuous upgrading, maintenance, and eventual refurbishment or recycling.

Refurbishing Programs

Used medical devices are refurbished to like-new standards, extending their lifecycle and reducing waste.

Take-back and Recycling Initiatives

Philips collects end-of-life equipment for responsible recycling, preventing valuable materials from ending up in landfills.

Eco-design

Products are designed for easy disassembly and recycling, reducing material waste during production and at end-of-life.

Energy-efficient Products

Philips integrates energy-saving technologies into its devices, reducing energy consumption during use.

Framework's Indicators

Environmental Impact

- Water Use Reduction: Advanced manufacturing techniques optimize water usage during the production of medical and consumer devices, reducing strain on water resources.
- CO2 Emissions Reduction: Energy-efficient devices and production processes lower carbon emissions across the product lifecycle. The company also incorporates renewable energy in its operations.

- % Recycled Content: Philips integrates recycled plastics and metals into its products, reducing reliance on virgin materials.

Economic Viability
- ROI: Refurbishing and leasing equipment ensure cost efficiency and prolonged asset utilization, leading to improved ROI.
- New Revenue Streams: Offering refurbished equipment and leasing models appeals to budget-conscious and sustainability-focused healthcare providers.

Social Well-being
- Local Employment: Refurbishment centres create jobs, contributing to local economies.
- Fair Wages: Philips ensures fair labour practices throughout its global supply chains.
- Consumer Satisfaction: Sustainable healthcare solutions meet growing demands for eco-friendly medical equipment.

Design for Circularity
- Product Lifespan: Leasing models and refurbishment extend the lifecycle of medical devices, reducing electronic waste.
- % Recyclable/Compostable Materials: Devices are designed for easy disassembly, ensuring high recyclability.

Material Innovation
- % Renewable Materials: Philips incorporates bioplastics and other renewable materials in its consumer products.
- Hazardous Substance Reduction: The company eliminates harmful substances such as mercury in imaging systems.

Business Model Innovation
- Subscription Models: Philips' leasing model ensures products are maintained, upgraded, and refurbished, reducing waste.
- Take-back Programs: End-of-life products are collected for responsible recycling or refurbishment.

Stakeholder Engagement and Collaboration
- Cross-Sector Collaborations: Partnerships with hospitals, NGOs, and recycling initiatives drive circular healthcare solutions.
- Consumer Education Programs: Philips actively educates customers on the benefits of refurbished equipment and sustainable healthcare practices.

Policy & Regulatory Support
- Extended Producer Responsibility (EPR): Philips complies with regulations mandating take-back and recycling of medical equipment.
- Waste Disposal Taxes: Minimizing waste aligns Philips with policies penalizing landfill use.

Technology & Innovation
- IoT Sensors: IoT-enabled healthcare devices enhance energy efficiency and support predictive maintenance, extending product life.

Impact Measurement and Reporting
- Circular Performance Indicators: Philips' annual reports include detailed metrics on recycled content, energy savings, and emissions reductions.

Conclusion

Philips redefines sustainable healthcare innovation by integrating circular economy practices into its operations. By focusing on leasing, refurbishment, and eco-design, Philips demonstrates the feasibility of aligning healthcare technology with sustainability goals.

Voestalpine

Name of the Company	Voestalpine
Country	Austria
City	Linz
Website	https://www.voestalpine.com/

Executive Summary

Voestalpine, a global steel and technology group based in Austria, integrates circular economy principles to address environmental challenges in steel production. By recycling by-products, incorporating renewable energy, and fostering innovation, the company minimizes its ecological footprint while maintaining economic competitiveness. Voestalpine's leadership in circular economy practices highlights its commitment to a sustainable future.

Introduction

As a global leader in high-quality steel production, Voestalpine operates in over 50 countries with approximately 50,000 employees. Steel production is traditionally resource-intensive, contributing significantly to global emissions. Voestalpine has embraced circular economy principles to address these challenges, implementing innovative strategies for recycling, energy efficiency, and stakeholder collaboration. Its initiatives set benchmarks for sustainability in the steel industry.

Core Circular Economy Strategies

Recycling Industrial By-products

Voestalpine reuses steel mill by-products such as slag and dust. Slag is repurposed in cement production and road construction, while dust is processed to recover valuable zinc, reducing waste and conserving raw materials.

Scrap Metal Recycling

The company integrates over 27% recycled scrap metal into its steelmaking processes. This reduces the demand for virgin iron ore and lowers the energy intensity of production.

Hydrogen-based Steelmaking

Through the H2FUTURE project, Voestalpine pioneers the hydrogen-based steel production, replacing coal to significantly reduce carbon emissions.

Energy Recovery and Efficiency

Waste heat from production processes is captured and repurposed to power operations, enhancing energy efficiency and reducing emissions.

Digital Optimization

Advanced monitoring systems and IoT sensors optimize resource usage and ensure efficient material flows, further reducing waste.

Stakeholder Engagement

Voestalpine collaborates with policymakers, energy providers, and research institutions to advance circular practices, particularly in transitioning to green steel.

Framework's Indicators

Environmental Impact
- Water Use Reduction: Water recycling systems minimize consumption in cooling processes.
- O2 Emissions: Hydrogen-based production reduces emissions, contributing to global climate targets.
- % Recycled Content: Recycling over 27% scrap metal reduces reliance on virgin materials.

Economic Viability
- Return on Investment (ROI): Recycling and energy recovery lower costs, enhancing profitability.
- New Revenue Streams: Green steel attracts environmentally conscious buyers.

Social Well-being
- Local Employment: Recycling and green steel projects create jobs in innovative sectors.
- Fair Wages: The company ensures equitable pay across its operations.

Design for Circularity
- Product Lifespan: Steel products are designed for durability in industries such as construction.
- % Recyclable Materials: Nearly all Voestalpine steel products are recyclable.

Material Innovation
- % Renewable Materials: Exploring hydrogen technology reduces dependency on non-renewable inputs.
- Hazardous Substance Reduction: Phasing out coal minimizes environmental harm.

Business Model Innovation
- Take-back Programs: Collecting end-of-life steel ensures it re-enters production cycles.

Policy & Regulatory Support
- Extended Producer Responsibility (EPR): Aligning with EU regulations ensures lifecycle accountability.

Conclusion

Voestalpine's comprehensive approach to circular economy practices demonstrates its leadership in sustainable steelmaking. By integrating recycling, renewable energy, and stakeholder collaboration, the company sets a global standard for sustainability in resource-intensive industries.

Lenzing AG

Name of the Company	Lenzing AG
Country	Austria
City	Lenzing
Website	https://www.lenzing.com/

Executive Summary

Lenzing AG, a global leader in sustainable fibre production, embodies circular economy principles in the textile and nonwoven industries. Utilizing renewable raw materials, closed-loop manufacturing, and innovative recycling technologies, the company is a sustainability pioneer in one of the most resource-intensive sectors. Lenzing combines its environmental efforts with strong stakeholder collaboration and transparent impact reporting, setting a benchmark for sustainable practices in the global fashion and textile markets.

Introduction

The textile and fashion industries are among the largest contributors to global environmental challenges, including deforestation, water scarcity, and pollution. Lenzing AG, headquartered in Austria, has been addressing these challenges for decades. Operating in over 20 countries, the company focuses on producing high-performance fibres from renewable wood sources while minimizing environmental impacts. Lenzing's commitment to the circular economy is reflected in its innovative technologies, strategic partnerships, and leadership in sustainable fibre production.

Core Circular Economy Strategies

Renewable Raw Materials

Lenzing's fibres are primarily derived from sustainably sourced wood from certified forests (e.g., FSC® and PEFC™). These forests are managed to ensure long-term ecological balance, providing a renewable alternative to fossil-based fibres like polyester.

Closed-loop Production Processes

The company has revolutionized fibre production through technologies like Lyocell, which recovers and reuses over 99% of the chemicals and water used during manufacturing. This system significantly reduces waste, water use, and emissions.

Biodegradable and Recyclable Fibres

Lenzing's fibres, including TENCEL™ and LENZING™ ECOVERO™, are fully biodegradable and compostable. These fibres degrade back into natural components without leaving harmful residues, addressing end-of-life challenges in textiles.

REFIBRA™ Technology

Lenzing's REFIBRA™ technology integrates post-consumer cotton waste with sustainably sourced wood pulp to create new fibres. This innovation promotes the recycling of textiles that would otherwise end up in landfills, reducing waste and raw material demand.

Energy Efficiency and Renewable Energy

Lenzing's facilities are equipped with energy-efficient technologies and rely increasingly on renewable energy sources. For example, the company's biorefineries extract energy from wood residues, powering its production processes while reducing dependency on fossil fuels.

Water Stewardship
Recognizing the textile industry's significant water footprint, Lenzing adopts advanced water management systems. These include water recycling and wastewater treatment to ensure minimal impact on local water resources.

Collaboration with Stakeholders
Lenzing partners with fashion brands, retailers, and NGOs to drive systemic changes in the textile supply chain. Collaborative initiatives, such as the Fashion Industry Charter for Climate Action , enable shared progress toward sustainability goals.

Transparency and Consumer Engagement
Through initiatives like fibre certification (e.g., OEKO-TEX®), Lenzing educates consumers and brands about the sustainability of its products, empowering informed choices.

Digital Traceability
Lenzing employs blockchain technology to ensure the traceability of its fibres throughout the supply chain. This innovation promotes transparency and accountability, enabling brands to verify sustainable sourcing.

Framework's Indicators

Environmental Impact
- Water Use Reduction: Advanced closed-loop systems reduce water usage by up to 50% compared to conventional viscose production, conserving freshwater resources.
- CO2 Emissions: TENCEL™ fibres generate up to 50% fewer emissions than traditional fibres, contributing to the global fight against climate change.
- % Recycled Content: The REFIBRA™ process incorporates up to 30% recycled textile waste, addressing landfill concerns and reducing reliance on virgin materials.

Economic Viability
- Return on Investment (ROI): The closed-loop Lyocell technology reduces operational costs while maintaining premium fibre quality, ensuring profitability.
- New Revenue Streams: Lenzing's eco-friendly fibres open opportunities in high-growth markets such as sustainable fashion and home textiles.

Social Well-being
- Local Employment: Forestry and fibre production create stable jobs in rural areas, contributing to regional economic development.
- Fair Wages and Working Conditions: Lenzing ensures fair labour practices across its operations and supply chains, aligning with global ethical standards.
- Consumer Satisfaction: Eco-conscious consumers increasingly favour biodegradable and sustainable textiles, boosting the brand's market appeal.

Design for Circularity
- Product Lifespan: Durable and high-quality fibres like TENCEL™ extend product usability in applications ranging from apparel to industrial fabrics.
- % Recyclable/Compostable Materials: Lenzing's fibres are designed to be recyclable or compostable, contributing to closed-loop product cycles.

Material Innovation
- % Renewable Materials: Sustainable wood sourcing ensures a renewable raw material base for all Lenzing products.
- Hazardous Substance Reduction: Closed-loop technologies minimize chemical usage and prevent harmful discharges into the environment.

Business Model Innovation
- Subscription Models: Lenzing collaborates with brands to explore leasing models for textile production and recycling.

- Take-back Programs: By working with partners, Lenzing facilitates textile take-back systems, promoting fibre reintegration into the supply chain.

Stakeholder Engagement and Collaboration
- Cross-Sector Collaborations: Partnerships with global brands like Patagonia and H&M demonstrate collective progress toward sustainability.
- Consumer Education Programs: Lenzing engages directly with consumers through certifications, marketing campaigns, and sustainability events.

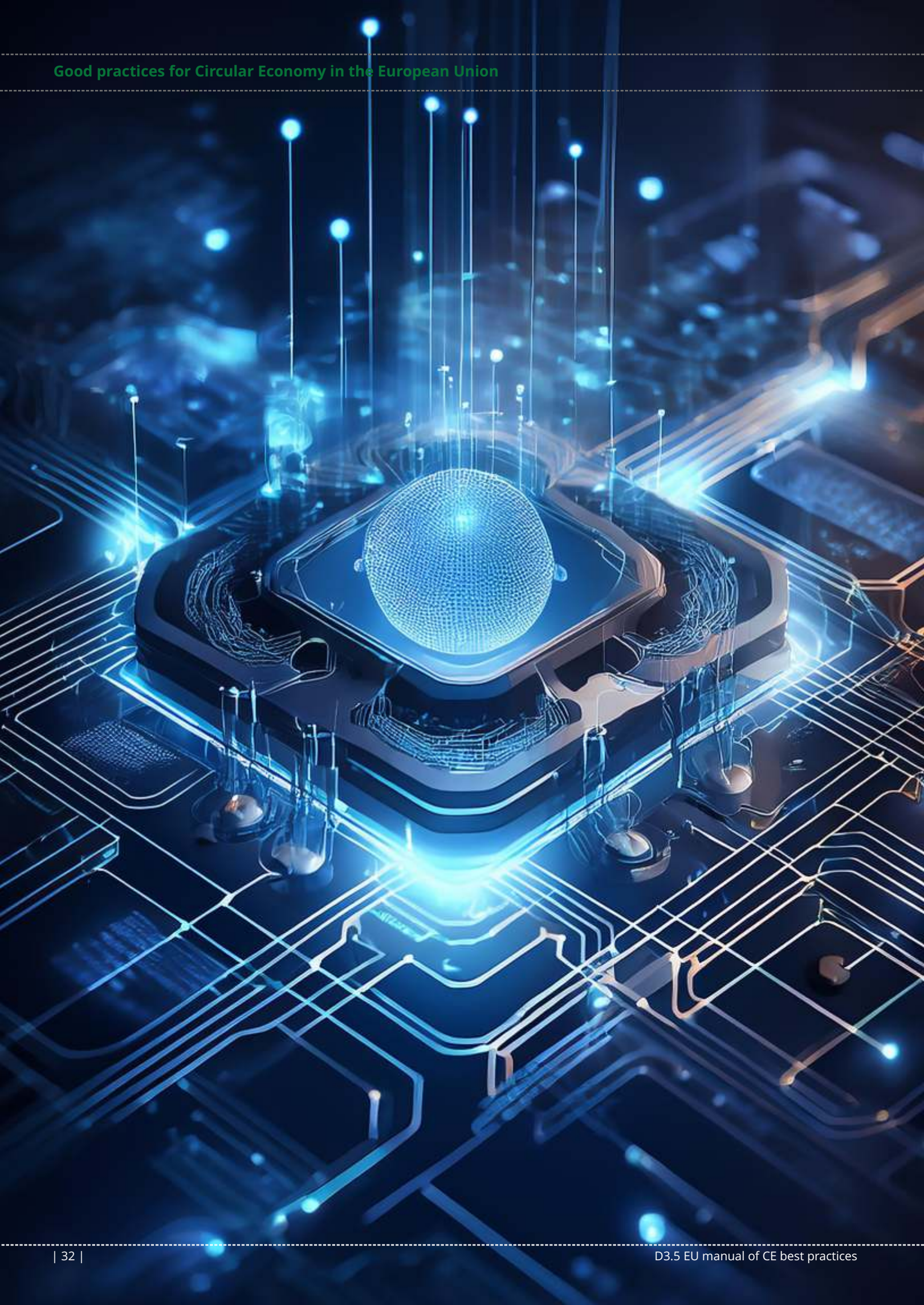
- **Policy & Regulatory Support**
- Extended Producer Responsibility (EPR): Advocates for recycling policies that make textile producers accountable for end-of-life waste.
- Waste Disposal Taxes: Lenzing's biodegradable products align with policies discouraging landfill use.

Technology & Innovation
- IoT Sensors and Blockchain: Digital innovations enhance resource efficiency and ensure transparency across the supply chain.

Impact Measurement and Reporting
- Circular Performance Indicators: Lenzing publishes annual sustainability reports with detailed metrics on water use, emissions, and fibre recycling rates.

Conclusion

Lenzing AG demonstrates how circular economy principles can be applied effectively in the textile industry. Through innovative fibre technologies, closed-loop systems, and stakeholder collaboration, the company addresses critical environmental and economic challenges while setting a new standard for sustainable textiles. Its leadership showcases how circular practices can drive systemic change, paving the way for a sustainable future in fashion and beyond.



Infineon Technologies

Name of the Company	Infineon Technologies
Country	Germany
City	Neubiberg
Website	https://www.infineon.com/

Executive Summary

Infineon Technologies, a global leader in semiconductor solutions, integrates circular economy principles into its operations. The company focuses on material recovery, energy-efficient production, design for durability, and innovation in packaging. These practices not only enhance sustainability but also drive economic viability, demonstrating Infineon's commitment to responsible technology production.

Introduction

Infineon Technologies plays a critical role in sectors such as automotive, renewable energy, and consumer electronics. As a semiconductor manufacturer, the company faces challenges of resource consumption, waste generation, and energy-intensive production processes. Infineon addresses these challenges by implementing strategies that prioritize recycling, material efficiency, and innovative product design.

Core Circular Economy Strategies

Material Recovery and Recycling

Infineon recovers precious metals like gold, silver, and copper from production waste, minimizing the need for virgin materials. This process is critical in reducing resource extraction and environmental degradation.

Energy-efficient Manufacturing

Advanced manufacturing technologies reduce energy consumption in wafer fabrication and other high-energy processes. The company also utilizes renewable energy to power some of its operations.

Closed-loop Water Systems

Infineon employs closed-loop systems to recycle water used in semiconductor manufacturing, significantly reducing water consumption and preventing contamination.

Design for Longevity

Products are engineered for extended lifespans, reducing electronic waste and increasing customer satisfaction.

Eco-friendly Packaging

Infineon has transitioned to sustainable packaging materials, reducing waste generated during product distribution.

Innovation in Circular Practices

The company integrates IoT sensors to monitor production efficiency and optimize resource use across its facilities.

Framework's Indicators

Environmental Impact
- Water Use Reduction: Infineon's closed-loop water systems recycle up to 90% of water used in semiconductor manufacturing. This significantly reduces the company's freshwater footprint while ensuring high production standards.
- CO2 Emissions Reduction: Energy-efficient production processes, combined with renewable energy sources, have allowed Infineon to cut emissions per chip produced. The adoption of smart power management technologies also reduces energy consumption in customer applications.
- % Recycled Content: Infineon's material recovery operations reclaim precious metals like gold, silver, and copper from production waste, ensuring that a substantial percentage of materials re-enter the production cycle.

Economic Viability
- Return on Investment (ROI): By recovering high-value materials and improving energy efficiency, Infineon reduces operational costs, delivering significant economic returns on sustainability investments.
- New Revenue Streams: Offering energy-efficient chips and sustainable packaging attracts eco-conscious businesses, opening new market opportunities in green technologies.

Social Well-being
- Local Employment: Recycling facilities and energy projects provide jobs, particularly in regions near production plants. Infineon prioritizes hiring and training local talent to strengthen community ties.
- Fair Wages: The company adheres to international labour standards, ensuring equitable wages across its global operations.
- Consumer Satisfaction: By delivering reliable and energy-efficient semiconductor products, Infineon supports the development of greener technologies that meet customer and societal demands.

Design for Circularity
- Product Lifespan: Infineon's semiconductors are designed to be durable and perform efficiently in long-term applications like renewable energy systems and electric vehicles.
- % Recyclable/Compostable Materials: Sustainable packaging and material recovery processes ensure that electronic components are as recyclable as possible.

Material Innovation
- % Renewable Materials: Transitioning to bioplastics and other sustainable materials for packaging minimizes the use of non-renewable resources.
- Hazardous Substance Reduction: Infineon has eliminated lead in its soldering processes and continues to innovate with non-toxic material alternatives.

Business Model Innovation
- Take-back Programs: Infineon partners with electronics recycling programs to ensure its products are responsibly managed at the end of their lifecycle.

Stakeholder Engagement and Collaboration
- Cross-Sector Collaborations: Partnerships with research institutions and electronics manufacturers drive innovation in sustainable semiconductor practices.
- Consumer Education Programs: Infineon educates customers about the energy savings and environmental benefits of its products, fostering more sustainable usage.

Policy & Regulatory Support
- Extended Producer Responsibility (EPR): Infineon complies with global e-waste regulations, ensuring proper recycling and disposal of electronic components.
- Waste Disposal Taxes: Reduced waste generation helps Infineon align with policies penalising landfill use.

Technology & Innovation

- IoT Sensors: Infineon employs IoT technology to monitor and optimize production processes, ensuring resource efficiency and minimizing waste.

Impact Measurement and Reporting

- Circular Performance Indicators: The company regularly publishes metrics on emissions reductions, resource efficiency, and recycling rates, demonstrating progress in its sustainability goals.

Conclusion

Infineon Technologies demonstrates how circular economy practices can transform high-tech industries. By integrating material recovery, energy efficiency, and innovative design, the company sets a benchmark for sustainable semiconductor manufacturing.

Vattenfall

Name of the Company	Vattenfall
Country	Sweden
City	Solna
Website	https://group.vattenfall.com/

Executive Summary

Vattenfall, a European leader in renewable energy, exemplifies circular economy practices by recycling energy infrastructure, utilizing waste heat, and innovating with recyclable materials. The company aligns its operations with global sustainability goals, setting a precedent for circular practices in the energy sector.

Introduction

Operating across Europe, Vattenfall focuses on delivering fossil-free energy while minimizing environmental impacts. The company incorporates circular economy principles into its operations, from recycling wind turbine components to leveraging waste heat for district heating.

Core Circular Economy Strategies

Recycling Wind Turbine Components

Vattenfall collaborates with partners to recycle blades and other turbine materials, reducing landfill contributions.

Waste Heat Utilization

Excess heat from energy production is repurposed for district heating systems, improving resource efficiency.

Solar Panel Recycling

Innovative methods recover valuable materials like silicon and silver from end-of-life solar panels.

Recyclable Wind Blades

Vattenfall supports the development of fully recyclable wind blades, advancing circularity in renewable energy.

Framework's Indicators

Environmental Impact

- Water Use Reduction: Innovations in solar panel recycling reduce the need for water-intensive mining.
- CO2 Emissions Reduction: Recycling wind turbines and leveraging waste heat significantly reduce emissions.
- % Recycled Content: A high percentage of materials in wind turbine components are recovered and reused.

Economic Viability

- ROI: Recycling infrastructure components and reusing materials enhance cost efficiency.
- New Revenue Streams: Vattenfall's investment in recyclable wind blades opens markets for sustainable energy infrastructure.

Social Well-being
- Local Employment: Recycling facilities and waste heat recovery systems create jobs in local communities.
- Fair Wages: The company ensures fair compensation for workers involved in circular economy projects.
- Consumer Satisfaction: Customers benefit from lower costs and improved sustainability of renewable energy solutions.

Design for Circularity
- Product Lifespan: Durable wind turbines and solar panels ensure long-term usability.
- % Recyclable/Compostable Materials: Development of recyclable wind blades and solar panels ensures end-of-life sustainability.

Material Innovation
- % Renewable Materials: Vattenfall advances the use of renewable and recyclable materials in energy infrastructure.
- Hazardous Substance Reduction: Innovations in solar panel recycling reduce the use of toxic substances like cadmium.

Business Model Innovation
- Take-back Programs: Wind turbine components are collected for recycling, creating closed-loop systems.

Stakeholder Engagement and Collaboration
- Cross-Sector Collaborations: Partnerships with turbine manufacturers and recycling firms enhance circular practices.
- Consumer Education Programs: Vattenfall educates stakeholders on the benefits of circular energy solutions.

Policy & Regulatory Support
- Extended Producer Responsibility (EPR): Recycling initiatives comply with regulations promoting producer accountability.
- Waste Disposal Taxes: Circular infrastructure projects align with policies reducing landfill dependency.

Technology & Innovation
- IoT Sensors: Sensors monitor turbine performance, optimizing maintenance and extending lifespans.

Impact Measurement and Reporting
- Circular Performance Indicators: Vattenfall reports on recycled materials, emissions reductions, and resource efficiency, ensuring transparency.

Conclusion

Vattenfall's commitment to circular economy principles in renewable energy demonstrates its leadership in sustainability. By recycling infrastructure, innovating with materials, and leveraging waste heat, the company exemplifies how energy providers can advance the transition to a circular economy.

Circular Economy Strategies: A Comprehensive Summary of European Business Practices

The transition towards circular economy practices represents a fundamental shift in how businesses approach sustainability and resource management. This comprehensive analysis examines how leading European companies have successfully implemented circular economy principles, demonstrating the feasibility and benefits of sustainable business models across diverse sectors. Through detailed examination of multiple case studies, this analysis reveals the transformative potential of circular practices in addressing environmental challenges while maintaining economic viability.

The implementation of circular economy strategies has emerged as a critical response to growing environmental concerns and resource scarcity. Companies across Europe have demonstrated remarkable innovation in developing sustainable business models that prioritize resource efficiency, waste reduction, and environmental stewardship. These organizations have moved beyond traditional linear production models to embrace circular principles that emphasize material recovery, product longevity, and stakeholder engagement. Their success stories provide valuable insights into the practical application of circular economy principles and their potential for widespread adoption across industries.

Companies like Betolar exemplify the innovative potential of circular economy practices in traditional industries. By transforming industrial waste into construction materials, Betolar has achieved remarkable reductions in CO_2 emissions, demonstrating how circular principles can revolutionize resource-intensive sectors. Their approach, incorporating artificial intelligence for material optimization and fostering cross-sector collaborations, illustrates the sophisticated integration of technology and sustainability. The company's success in utilizing up to 95% waste materials in their products while achieving an 80% reduction in emissions compared to traditional materials serves as a compelling example of circular economy's potential.

In the consumer electronics sector, Fairphone has pioneered a revolutionary approach to product design and lifecycle management. Their modular smartphone design directly addresses the growing challenge of electronic waste while promoting consumer engagement in sustainable practices. By incorporating ethical material sourcing and establishing effective take-back programs, Fairphone has created a comprehensive circular model that extends from production to end-of-life management. Their success demonstrates how circular principles can be applied to complex consumer products while maintaining commercial viability and meeting consumer expectations.

The beverage packaging industry has seen remarkable transformation through Palpa's deposit return system in Finland. Achieving near-perfect recycling rates of 97%, Palpa's model demonstrates the effectiveness of well-designed circular systems in promoting consumer participation and resource recovery. Their success in managing billions of returned containers annually while maintaining high-quality recycling standards provides valuable insights into the scalability of circular economy practices in consumer-facing industries.

IKEA's commitment to becoming fully circular by 2030 represents an ambitious transformation of a global retail business model. Their comprehensive approach encompasses product design, material selection, and innovative business models such as furniture leasing. By sourcing over 60% of materials from renewable resources and implementing take-back programs, IKEA demonstrates how large-scale retailers can systematically integrate circular principles into their operations while maintaining market leadership and consumer satisfaction.

The industrial sector has shown significant progress in circular economy adoption through companies like Voestalpine and Lenzing AG. Voestalpine's integration of hydrogen-based steelmaking and by-product recycling showcases how traditional heavy industries can reduce their environmental impact while maintaining operational efficiency. Similarly, Lenzing AG's closed-loop fibre production processes and innovative REFIBRA™ technology demonstrate the potential for circular practices in textile manufacturing, addressing both resource efficiency and waste reduction.

In the technology sector, Infineon Technologies and Philips have pioneered circular approaches that combine innovation with sustainability. Infineon's focus on material recovery and energy-efficient manufacturing processes shows how high-tech industries can minimize their environmental impact while maintaining technological advancement. Philips' transformation of their business model to include product-as-a-service offerings and comprehensive refurbishment programs demonstrates how circular principles can create new value propositions in healthcare technology.

The energy sector's adaptation to circular economy principles is exemplified by Vattenfall's innovative approaches to infrastructure recycling and waste heat utilization. Their focus on developing recyclable materials for wind turbine components and implementing district heating systems shows how circular thinking can transform energy infrastructure development and operation, contributing to both environmental sustainability and operational efficiency.

These various implementations of circular economy strategies demonstrate several common success factors: strong stakeholder engagement, innovative design thinking, and systematic approaches to resource management. The companies' achievements in reducing environmental impact while maintaining or improving economic performance provide compelling evidence for the viability of circular business models. Their experiences offer valuable lessons for organizations seeking to transition towards more sustainable operations while creating long-term value for stakeholders.

The analysis of these companies reveals that successful implementation of circular economy principles requires a holistic approach that considers environmental, economic, and social impacts. The demonstrated benefits include significant reductions in resource consumption and emissions, creation of new revenue streams, and enhanced stakeholder relationships. These outcomes suggest that circular economy strategies not only contribute to environmental sustainability but also create robust business models capable of thriving in an increasingly resource-constrained world.

As global attention to environmental challenges intensifies, these case studies provide valuable insights into practical approaches for implementing circular economy principles. The diverse strategies employed across different sectors demonstrate that circular economy practices can be successfully adapted to various business contexts, providing a framework for other organizations to follow. This analysis underscores the importance of continued innovation and collaboration in advancing circular economy principles as a fundamental approach to sustainable business development.

Authors

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After several years of experience as a Supply Chain Manager and Project Manager in an international environment, he has focused on the research field of sustainable development and circular economy. In the Erasmus+ projects CATALYST and KODECET as well as project lectures at the FH Joanneum, he combines theoretical concepts with current economic challenges to actively promote sustainable development.

Thomas Winkler did his PhD degree at the Institute of System Sciences, Innovation and Sustainability, University of Graz. After finishing his studies in Sustainable Development and Environmental System Sciences, including exchange and research stays at the University of Utrecht, University of New England in Australia and in Nepal he got a PhD scholarship at the University of Graz. Thomas Winkler, together with his supervisor Dr. Wilfried Winiwarter, was working on greenhouse gas emissions scenarios for Austria focusing on comparisons of national and international data to identify possible mitigation opportunities as well as emissions from livestock production considering the whole life cycle. From 2018 to 2022 Thomas Winkler has been part of the R&D team of the Innovation Management department at the University of Applied Sciences CAMPUS 02 where he has been responsible for several national and international research projects focusing in innovation and entrepreneurship. His research interests are in sustainable innovations, food systems, bioeconomy, sustainable lifestyle, and innovation management. Since 2022 he is involved in the ERASMUS+ project Catalyst as economic partner for Austria dealing with the development of trainings about sustainable transformation for small and medium-sized companies. Since July 2024 he complements the team of the department of International Management and Entrepreneurship as lecturer at FH Joanneum in Graz.

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About the Project

The KODECET project is a pioneering initiative transforming the landscape of education. Supported by the ERASMUS-EDU-2023-CBHE program, our consortium unites leading universities from Finland, Austria, India, and Thailand. Our mission is to implement Sustainability and Circular Economy (SACE) principles into higher education curricula across Asia and Europe.

As part of this effort, the KODECET project aims to establish four digital, knowledge-based capacity-building centres in India and Thailand, dedicated to fostering the creation and sharing of knowledge on the Sustainable Circular Economy.

- Programme: Erasmus+ Capacity Building in the field of Higher Education
- Duration: 36 Months
- Aim: The Digital Centres will focus on creation and dissemination of the knowledge and practices in fundamentals of circular economy and transition management of circular economy and sustainability solutions at different levels.
- Number of partners: 6

Project objectives:

- Conduct analysis of the status and identify specific local needs for Circular Economy (CE) education in India and Thailand.
- Build capacity among experts in sustainable Circular Economy and establish four digital centres at Payap University and Prince of Songkla University in Thailand, and Nirma University and Birla Institute of Management and Technology in India.
- Enhance knowledge capacity through the development and implementation of engaging study materials.
- Disseminate the knowledge gained through capacity-building training sessions.
- Undertake technical development of Centres of Excellence for sustainable CE in the four Higher Education Institutions (HEIs) in India and Thailand.
- Implement and operate the four Centres of Excellence for sustainable CE.
- Foster collaboration between HEIs and companies and enrich student learning experiences by creating innovative sustainable CE case studies.
- Promote innovation and university-business collaborations through Hackathons.
- Develop a collaborative network among European and Asian HEIs to exchange valuable insights on the challenges and opportunities in Asian and European economies.
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