

Term Project Report Submission

On

**"HEAVY METAL CONTAMINATION IN PSIEC LEATHER COMPLEX, JALANDHAR,
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CE60234 Hazardous Waste Management

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1. INTRODUCTION

1.1 Circular Economy in the Dairy Industry: A Comprehensive Case Study:

The dairy industry plays a vital role in global food systems, providing essential nutrition and livelihoods for millions of people worldwide. However, traditional dairy production and processing methods often lead to significant environmental degradation and resource depletion. In response to these challenges, there has been a growing interest in adopting circular economy principles within the dairy sector to promote sustainability and resilience.

Circular economy principles advocate for the redesign of systems to minimize waste, maximize resource efficiency, and promote the regeneration of natural systems. In the context of the dairy industry, this entails rethinking traditional linear models of production and consumption and transitioning towards more sustainable and circular practices.

In this section, we delve into the various strategies adopted by dairy farmers to integrate circularity into their operations. This includes the adoption of sustainable farming practices such as regenerative agriculture, organic farming, and agroforestry. Additionally, effective waste management strategies, such as composting and biogas production from animal waste, contribute to closing the nutrient loop and reducing environmental impact.

Dairy processing plants are integral components of the dairy supply chain, where significant opportunities exist to enhance circularity. This section explores how dairy processors can optimize production processes to minimize waste generation, improve energy efficiency, and promote the reuse and recycling of by-products.

Efficient supply chain management is critical for the successful implementation of circular economy principles in the dairy industry. This section examines the importance of traceability and transparency in supply chains, the role of collaboration and partnerships among stakeholders, and the potential for optimizing logistics to reduce emissions and improve efficiency.



While the adoption of circular economy principles offers significant benefits for the dairy industry, it also presents several challenges. This section discusses regulatory hurdles, technological advancements, and the role of consumer awareness and demand in driving the transition toward circularity.

1.2 Understanding Circular Economy :

Understanding Circular Economy in detail involves grasping the principles, strategies, and implications of this economic model aimed at minimizing waste, maximizing resource efficiency, and fostering sustainability. Here's a detailed explanation:

1. Principles of Circular Economy:

- **Design out Waste and Pollution:** In a circular economy, products are designed to be reused, repaired, or recycled at the end of their lifecycle, minimizing waste and pollution. This principle emphasizes the importance of eco-design, material selection, and product durability.
- **Keep Products and Materials in Use:** Instead of the traditional "take-make-dispose" linear model, a circular economy seeks to prolong the lifespan of products and materials through strategies like remanufacturing, refurbishment, and sharing platforms (e.g., renting or leasing).

- Regenerate Natural Systems: Circular economy practices aim to restore and regenerate natural ecosystems by minimizing resource extraction, promoting renewable energy, and adopting regenerative agriculture techniques.

2. Strategies for Circular Economy Implementation:

- Closed-Loop Systems: Companies implement closed-loop systems where materials are recycled back into the production process, reducing the need for virgin resources. This includes practices like material recovery, recycling, and cascading utilization.
- Product-as-a-Service (PaaS): Instead of selling products outright, businesses offer them as services, incentivizing durability, repairability, and reuse. Examples include leasing models for electronics or furniture.
- Resource Recovery: Circular economy strategies focus on recovering valuable resources from waste streams through techniques such as composting, anaerobic digestion, and extraction of secondary materials from end-of-life products.
- Sharing Economy: Sharing platforms facilitate the sharing, renting, or lending of products among multiple users, maximizing their utilization and reducing the overall demand for new goods.



3. Implications for Businesses and Industries:

- **Innovation and Collaboration:** Embracing circular economy principles requires innovation in product design, manufacturing processes, and business models. Collaboration across value chains is essential to optimize resource flows and minimize waste.
- **New Revenue Streams:** Circular economy practices can create new revenue streams for businesses through services like repair, refurbishment, and recycling. Companies that adopt circular business models may find opportunities for differentiation and market leadership.
- **Risk Mitigation:** Transitioning to a circular economy can help businesses mitigate risks associated with resource scarcity, regulatory changes, and environmental degradation. By reducing reliance on finite resources and minimizing environmental impact, companies can enhance their long-term resilience.

4. Policy and Regulatory Support:

- **Extended Producer Responsibility (EPR):** EPR policies hold producers accountable for the end-of-life management of their products, incentivizing them to design for recyclability and resource efficiency.
- **Circular Economy Legislation:** Governments are increasingly implementing legislation and regulations to promote circular economy practices, such as recycling targets, waste diversion mandates, and incentives for eco-design.
- **Public Procurement:** Public sector procurement policies can drive demand for circular products and services by prioritizing sustainable and resource-efficient options.

5. Societal and Environmental Benefits:

- **Resource Conservation:** Circular economy practices reduce resource extraction and consumption by maximizing the value and utility of existing materials and products.
- **Waste Reduction:** By minimizing waste generation and promoting reuse and recycling, circular economy approaches contribute to reducing landfill waste and pollution.
- **Climate Mitigation:** Circular economy strategies, such as energy efficiency, renewable energy adoption, and carbon sequestration, can help mitigate greenhouse gas emissions and combat climate change.

6. Challenges and Barriers:

- **Technological Limitations:** Some circular economy practices may require advanced technologies or infrastructure, posing challenges for widespread adoption, particularly in developing countries.
- **Economic Incentives:** Economic incentives and market mechanisms may need to be aligned with circular economy principles to encourage businesses and consumers to prioritize sustainability over short-term profitability.

- Behavioral Change: Shifting consumer behavior and cultural norms to embrace concepts like sharing, repair, and reuse may require education, awareness campaigns, and social marketing efforts.

In summary, understanding the circular economy involves recognizing its principles, implementing strategies to minimize waste and maximize resource efficiency, and navigating the economic, regulatory, and societal factors that influence its adoption and impact. By embracing circularity, businesses, industries, and societies can move towards a more sustainable and resilient future.

1.2 Circular Business Models in Dairy Industries :

Circular business models in dairy farming and processing involve innovative approaches to maximize resource efficiency, minimize waste, and promote sustainability throughout the dairy value chain. Here's a detailed explanation of some key circular business models in this sector:

Closed-Loop Systems:

- In dairy farming, closed-loop systems aim to minimize waste and resource inputs by reusing or recycling materials within the farm. For example, manure from cows can be converted into nutrient-rich compost through anaerobic digestion or vermicomposting processes. This compost can then be used to fertilize crops, closing the nutrient cycle on the farm.
- Similarly, waste heat generated from dairy processing operations can be captured and reused for heating purposes, reducing the need for external energy sources and enhancing overall energy efficiency.

Circular Supply Chains:

- Circular supply chains in dairy farming involve collaborating with other industries or stakeholders to optimize resource flows and minimize waste. For instance, dairy farms can establish partnerships with local breweries or distilleries to recycle spent grains as animal feed, reducing both waste disposal costs and the environmental impact of feed production.
- Additionally, dairy processors can source milk from nearby farms practicing regenerative agriculture or agroforestry, promoting biodiversity and soil health while reducing transportation emissions.

Product-as-a-Service (PaaS):

- In the dairy industry, the PaaS model involves offering dairy products and services rather than selling them outright. For example, instead of purchasing individual dairy products, consumers can subscribe to a dairy delivery service that provides milk, cheese, yogurt, and other dairy items on a regular basis.
- This model incentivizes dairy producers to focus on product durability, quality, and reusability, as they are responsible for maintaining and repairing products throughout their lifecycle. It also encourages consumers to return packaging for refilling or recycling, reducing packaging waste.

Resource Recovery and Valorization:

- Dairy processing facilities can implement resource recovery and valorization strategies to extract value from waste streams. For example, whey, a byproduct of cheese production, can be processed into high-protein ingredients for use in sports nutrition products, baked goods, or animal feed.
- Similarly, dairy processors can extract biogas from organic waste streams through anaerobic digestion, generating renewable energy to power on-site operations or feed into the grid. This not only reduces greenhouse gas emissions but also generates additional revenue streams for the company.

Circular Packaging Solutions:

- Dairy companies can adopt circular packaging solutions to minimize the environmental impact of their products. This includes using recyclable or compostable materials for packaging, designing packaging for easy disassembly and recycling, and implementing take-back programs for used packaging.
- Some dairy brands have also explored innovative packaging alternatives such as edible packaging made from milk protein or biodegradable packaging derived from agricultural residues, further reducing reliance on fossil-based plastics.

Collaborative Consumption and Sharing Platforms:

- Collaborative consumption platforms enable dairy farmers to share equipment, machinery, or resources with neighboring farms, maximizing asset utilization and reducing capital investment. For example, farmers can collectively invest in shared milking parlors or manure management systems, reducing costs and environmental impact.

- Similarly, dairy processing facilities can collaborate with other food producers to share distribution networks or cold storage facilities, optimizing transportation routes and reducing food waste throughout the supply chain.

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Websites and Online Resources:

Ellen MacArthur Foundation - <https://www.ellenmacarthurfoundation.org/>

World Economic Forum - <https://www.weforum.org/>

European Circular Economy Stakeholder Platform - <https://circulareconomy.europa.eu/platform/en>