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Sustainable Practices of Dairying with Consumers Perceptions

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Sustainable dairying involves practices that aim to balance economic viability, environmental stewardship, technological innovation, resource efficiency, policies and social responsibility within the dairy industry. Sustainable dairying practices focus on minimizing environmental impacts such as water pollution, greenhouse gas emissions that contribute to climate change. From the beginning, milk was considered one of the greatest sources of vital nutrients out of all other food products. With rapid industrialization, the dairy industry is expanding at about 4.2 percent annually since 2000. Because of this, there is a rise in water pollution as the dairy industry, is a significant contributor. Dairy wastewater contains high concentrations of organic matter, nutrients with significant source of N and P that when land applied in excess of crop requirements can cause contamination of surface water and suspended particles, posing environmental and health risk to human and animal communities that rely on them as a source of drinking water. The dairy industry has a significant, detrimental impact on rivers and ecosystems. Dairy is responsible for 2.9 percent of total human-induced greenhouse gas emissions. In addition, dairy production in intensive farming systems pollutes air and water and contributes heavily to soil degradation and deforestation. Dairy farms are also responsible for other types of air pollution, including an estimated 19 to 24 percent of the country's total ammonia emissions. This involves efficient management of resources like water, land, and energy, as well as minimizing the use of chemical inputs.

Environmental sustainability

In animal welfare, ensuring the well-being of dairy cows is essential for sustainable dairying which involves comfortable housing, access to clean water and nutritious feed, and proper healthcare. Practices by farmers for dairy cows such as rotational grazing,

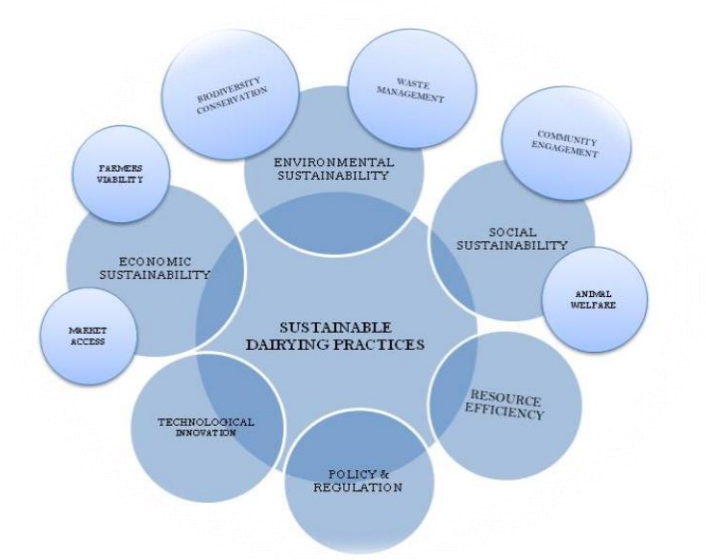
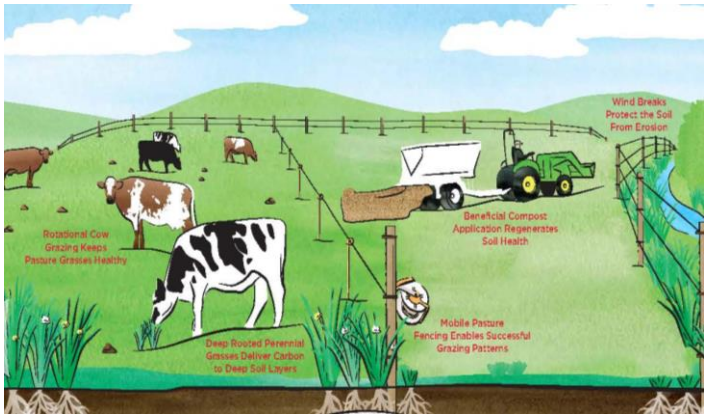


Fig. 1: Radial Vein Diagram of Sustainability Dairying Practices

providing ample space for movement, and minimizing stress during handling and transportation contribute to better animal welfare. Proper handling and management of animal waste, including manure, is crucial for environmental sustainability. Techniques such as composting, anaerobic digestion, and nutrient management planning help reduce nutrient runoff and contamination of water bodies.



Social Sustainability

Social sustainability in dairying refers to practices and initiatives within the dairy industry that prioritize the well-being of people involved in dairy production and the communities surrounding dairy farms. It encompasses aspects such as labor rights,

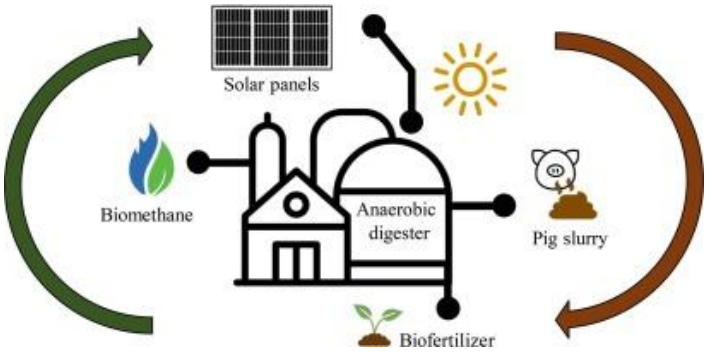
community engagement, and equitable access to resources and opportunities. Ensuring fair wages, safe working conditions, and access to healthcare and education for dairy farm workers is essential for social sustainability. This includes compliance with labor laws and regulations, as well as providing training and development opportunities for employees. Practices such as providing comfortable housing, access to clean water and nutritious feed, and proper healthcare contribute to positive social outcomes for both animals and farm workers. Dairy products are an important source of nutrition for many communities, contributing to food security and public health. Promoting access to affordable and nutritious dairy products, as well as addressing food insecurity and malnutrition, supports social sustainability goals.

Economic Sustainability

Sustainable dairying practices should be economically viable for farmers in the long term. This may involve diversifying income streams, improving operational efficiency, and accessing markets that reward sustainability, such as organic or fair-trade markets. Sustainable dairying is a dynamic process that requires ongoing monitoring, evaluation, and adaptation.

Farmers and industry stakeholders should continuously seek opportunities for improvement, whether through adopting new technologies, implementing best management practices, or participating in training and education programs such as Keeping healthy soil is key for both dairy farmers and a sustainable future for the planet, Regenerative agriculture practices include planting cover crops to protect and replenish the soil, Anaerobic digester also referred to as methane digesters, take organic materials, like the manure from dairy cows, food waste or biosolids (like sewage sludge) and break down the materials using bacteria in a sealed environment (called a reactor) with no oxygen. From here, this energy can be reused in the form of electricity, heat or natural gas, while the solids exiting the digester can be used as a natural fertilizer or animal bedding

Solar panels have begun to pop up on dairy farms by utilizing the energy from his own solar farm, reduction in greenhouse gas emissions (GHGs), which benefits humans, wildlife and ecosystems alike. Solar farms also reduce water consumption and improve nearby air quality.



Protecting the rights and well-being of farm workers is essential for social sustainability. This includes providing fair wages, safe working conditions, and access to training and development opportunities.

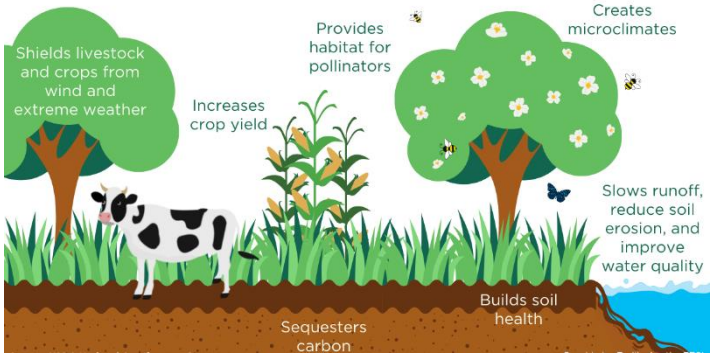
Supportive policies and regulations play a critical role in promoting sustainability within the dairy industry. Governments and regulatory bodies can incentivize sustainable practices through subsidies, tax incentives, and environmental regulations that encourage conservation and responsible management of resources.

Technological Innovation

Study of consumer perception showed the personal characteristics affect consumer attitudes and intentions towards dairy products obtained through using three innovative and sustainable production practices: agroforestry, prolonged maternal feeding and alternative protein sources.

- Agroforestry- Agroforestry systems create diverse and resilient ecosystems by combining multiple plant species, including trees, crops, and livestock,

within the same landscape. This diversity provides habitat for beneficial insects, birds, and microorganisms, contributing to ecosystem health and resilience. Trees in agroforestry systems help improve soil health by enhancing soil structure, increasing organic matter content, and promoting nutrient cycling. Tree roots penetrate deep into the soil, improving soil aeration and water infiltration, while also stabilizing soil against erosion. Trees in agroforestry systems store carbon in their biomass and in the soil, helping to offset greenhouse gas emissions and mitigate climate change impacts. By harnessing the multiple benefits of agroforestry, farmers can build more resilient and environmentally friendly farming systems for the future. Farmers can derive revenue from timber, fruits, nuts, medicinal plants, and other non-timber forest products, reducing reliance on single crops or commodities.



- Maternal feeding- Prolonged maternal feeding, also known as extended breastfeeding or extended lactation, is an innovative and sustainable production practice in animal agriculture, particularly in dairy farming. This practice involves allowing dairy cows to nurse their calves for a longer period than is traditionally practiced in conventional systems. They receive a continuous supply of high-quality milk from their mothers, which provides essential nutrients and promotes proper growth and development. From a consumer perspective, dairy products derived from cows raised through prolonged maternal feeding may be perceived as more ethical and sustainable, which can enhance market acceptance and consumer trust. this practice contributes to more resilient and socially responsible dairy farming systems
- Protein sources- Like plant-based protein, insect protein, cell based or microbial protein are alternative protein sources which are becoming increasingly important as global demand for protein continues to rise. Sustainable production practices for alternative protein sources involve a combination of agricultural innovation, technological advancement, and environmental stewardship to address the challenges of feeding a growing population while minimizing environmental impact and promoting animal welfare.

Conclusion

Sustainable dairy farming practices that are not perceived as addressing relevant ethical concerns or producing easily perceivable societal benefits are not likely to be accepted by consumers. Given that organic dairy products are well accepted by consumers, who are ready to pay more for them, the proposed innovations are likely to be relevant only if they become part of organic best practices.

Overall, sustainable dairying involves a holistic approach that considers the interconnectedness of environmental, social, and economic factors. By adopting practices that promote sustainability, dairy farmers can contribute to a more resilience while maintaining profitability and meeting the needs of consumers by adopting sustainable production practices of prolonged maternal feeding that showed the highest level of acceptance by consumers. The least accepted practice was alternative protein source for the feeding of dairy cows. By embracing sustainable production principles, businesses can mitigate risks, reduce costs, enhance brand reputation, and contribute to a more resilient and sustainable global economy.

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