

Sustainable, Innovative and Successful Model Dairying: A Way to Empower Rural People

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Dairying has been an integral part of rural livelihoods for centuries, serving as a source of nutrition, income, and social cohesion. In India, where agriculture dominates the rural landscape, dairying plays a significant role in the socio-economic fabric of communities across the nation. However, the journey of dairying in India has been marked by both triumphs and challenges. The roots of dairying in India can be traced back to ancient times, where cow rearing was not only prevalent but also revered as sacred. The Rigveda, one of the oldest scriptures, extols the virtues of the cow and the importance of dairy products. Over time, dairying became intertwined with agrarian practices, providing rural communities with milk, ghee, and other dairy products essential for sustenance. During the colonial era, dairying underwent significant changes with the introduction of modern breeding practices and the establishment of dairy cooperatives. The formation of the Amul cooperative in 1946 marked a watershed moment, revolutionizing the dairy industry by empowering farmers and ensuring fair returns for their produce.

Today, India stands as the world's largest milk producer, with over 230.6 million tons of milk in the year 2022-23 (Basic Animal Husbandry Statistics, MoFAHD, DAHD, GoI). The dairy sector contributes significantly to the rural economy, providing livelihoods to millions of small and marginal farmers. However, despite its impressive growth, the sector faces several challenges that hinder its sustainability and potential for rural upliftment. One of the primary constraints facing the dairy sector is the prevalence of small-scale and unorganized dairy farming practices (Gamit *et al.*, 2021). Fragmented landholdings, lack of access to modern technology, and inadequate infrastructure hinder productivity and quality standards. Additionally, issues such as low milk yields per

animal, poor animal healthcare, and post-harvest losses further exacerbate the challenges faced by dairy farmers. Fluctuating prices of milk and input costs, coupled with market volatility, pose significant risks to farmer incomes (Rajeshwaran and Naik. 2016). Inadequate access to credit, limited extension services, and the absence of value addition opportunities also impede the sector's growth potential.

Recognizing the importance of the dairy sector in rural development, the Government of India has implemented various initiatives to support dairy farmers and promote sustainable practices. The National Dairy Plan, launched in 2012, aims to increase milk production by enhancing breed improvement, promoting fodder development, and strengthening dairy cooperatives. schemes such as the Rastriya Gokul Mission, the Dairy Entrepreneurship Development Scheme, and the National Programme for Bovine Breeding and Dairy Development focus on genetic improvement, capacity building, and infrastructure development in the dairy sector.

To address the constraints hindering sustainable dairying and rural upliftment, a multi-pronged approach is necessary: Promoting Cooperative Dairy Farming: Encouraging the formation and strengthening of dairy cooperatives can empower farmers by providing access to markets, technology, and collective bargaining power. Enhancing Extension Services: Investing in extension services and training programs can improve farmers' knowledge and adoption of best practices in dairy farming, including breed management, nutrition, and healthcare. Infrastructure Development: Developing robust infrastructure, including cold chains, storage facilities, and transportation networks, can minimize post-harvest losses and ensure the quality and safety of dairy products. Value Addition and Market Linkages: Facilitating value addition

activities such as milk processing, dairy product manufacturing, and marketing can create additional income opportunities for farmers and enhance the competitiveness of the dairy sector. Integrated Livelihood Development: Integrating dairy farming with allied activities such as agriculture, horticulture, and poultry can diversify rural livelihoods and enhance overall resilience to economic shocks.

Innovations in dairy processing and distribution

A number of processing and distribution innovations have been made in the dairy business recently with the goal of enhancing product quality, sustainability, and efficiency. The following are a few noteworthy innovations: high-pressure processing (HPP): With the use of this technology, dairy products are put under intense pressure to increase shelf life while retaining flavours and nutrients. HPP is especially well-liked for items like cheese, yoghurt, and milk. Proteins and fats in milk can be separated using ultrafiltration and membrane technology, which enables the creation of specialty dairy products with unique nutritional profiles. Processes for removing lactose and concentrating milk also use ultrafiltration. Cold pasteurisation: In order to destroy dangerous bacteria, milk is heated using traditional pasteurisation techniques. The taste and nutritional value of the milk are preserved through cold pasteurisation, also referred to as cold plasma or pulsed light processing, which produces comparable effects without the need for high temperatures. Automation and robotics: Dairy processing facilities are increasingly using automation technologies, such as automated packaging lines and robotic milking systems. These technologies guarantee consistency in product quality, increase productivity, and lower labour costs. Blockchain technology and traceability: People are becoming more curious about the provenance and calibre of the goods they buy. Blockchain technology makes it possible to track dairy products all the way through the supply chain, resulting in accountability and transparency. Alternatives made of plants: Although not directly related to the traditional dairy sector, the popularity of plant-based milk and dairy substitutes has encouraged advancements in the methods used to process goods. Different processing techniques are frequently needed for these

substitutes than for conventional dairy products. Packaging innovations: The dairy industry is seeing a rise in the use of sustainable packaging options like recyclable and biodegradable materials. Modified atmosphere packaging (MAP), one of the innovations in packaging technology, also contributes to extending the shelf life of dairy products and decreasing food waste. Cold chain management: When it comes to ensuring the safety and quality of dairy products during distribution and transit, maintaining the cold chain is essential. Dairy products are delivered to consumers in the best possible condition thanks to advancements in refrigeration technology, temperature monitoring systems, and logistics optimisation software.

Successful dairy models across the globe

California-based Straus Family Creamery is well-known for its dedication to sustainability. They lessen their carbon footprint by using renewable energy sources, such as solar energy. Additionally, they emphasise pasture-based farming, which improves soil health and lessens dependency on outside inputs. Cleopatra Dairy: Located in Egypt, Cleopatra Dairy is a noteworthy illustration of a dairy project that is sustainable in a developing nation. They put into practice a number of sustainable measures, including effective water management, manure composting for fertilisation, and the use of biogas digesters to produce renewable energy from cow dung. La Ferme des Peupliers (France): This dairy farm has adopted sustainable practices such as agroforestry, biodiversity conservation, and rotational grazing. In order to minimise transportation emissions and lessen reliance on outside inputs, they also produce their own feed. USA: Organic Valley: Focusing on sustainable dairy production, Organic Valley is a cooperative of organic farmers in the US. Animal welfare regulations, organic feed, and pasture-based farming are given top priority. Their cooperative structure encourages farmers to work together and exchange sustainable best practices. Fonterra (Zimbabwe): Fonterra, a prominent global dairy cooperative, has executed a range of sustainability endeavours, encompassing energy and water conservation programmes, strategies for mitigating carbon emissions, and conservation efforts aimed at conserving biodiversity. They also provide incentives

and education to help their farmers adopt sustainable practices. Danone's Fund for Livelihoods in Family Farming (Multiple nations): Danone's Livelihoods Fund has contributed to a number of sustainable agriculture initiatives, including dairy farming, in developing nations, though it is not solely focused on dairy projects. These initiatives prioritise supporting sustainable land use, water management, and carbon sequestration while enhancing the standard of living for smallholder farmers.

Sustainable dairying holds immense potential as a catalyst for rural upliftment in India. Innovations in dairy processing and distribution contribute to a more sustainable, efficient, and consumer-centric dairy industry. By addressing the constraints through concerted efforts from stakeholders, including

government agencies, dairy cooperatives, NGOs, and private sector partners, we can unleash the transformative power of the dairy sector. Empowering dairy farmers, promoting inclusive growth, and fostering sustainable practices will not only enhance rural livelihoods but also contribute to the overall economic development of the nation.

References

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