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Livestock, Livelihoods, And Limitations: An Insight Into Dairy Sector Challenges

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Abstract

India's dairy sector stands as a cornerstone of rural livelihood and agricultural resilience, contributing over 23% to global milk production and engaging more than 80 million rural households. Beyond its economic significance, the sector plays a vital role in ensuring food and nutritional security, especially through the daily consumption of affordable dairy products. Despite remarkable growth since the mid-20th century—driven by initiatives such as Operation Flood and the rise of dairy cooperatives—the sector faces persistent structural and ecological challenges. These include low milk yields from indigenous breeds, chronic feed and fodder shortages, inadequate veterinary infrastructure, climate change-induced stress, and limited access to financial and institutional resources. Furthermore, regional disparities and gender inequities continue to undermine the inclusive potential of dairy development.

This paper presents a comprehensive analysis of the Indian dairy sector, emphasizing its socio-economic importance, identifying prevailing constraints, and exploring sustainable strategies. Particular attention is given to the role of women in dairying, the impacts of climate variability, technological innovations such as artificial insemination and digital extension platforms, and the role of cooperatives in equitable market access. The paper argues for a paradigm shift towards value-added, climate-smart, and inclusive dairy practices, supported by unified policies and robust public-private partnerships. By addressing these multifaceted challenges through an integrated approach, the Indian dairy sector can evolve into a model of sustainable rural transformation.

Introduction

Dairy farming in India is more than a livestock-based enterprise—it is a lifeline for millions of rural households, particularly small and marginal farmers. With over 23% of the global milk output, India has emerged as the world's largest milk producer (FAO, 2021), a remarkable transformation from the milk-deficient era of the 1950s. This growth has been largely attributed to policy-driven interventions such as the White Revolution, spearheaded by Operation Flood, and the expansion of dairy cooperatives that enhanced milk procurement, processing, and marketing systems.

Today, dairy farming contributes significantly to rural incomes, particularly by providing a stable cash flow in regions where agriculture remains vulnerable to climate variability. It also plays an essential role in addressing the protein and fat requirements of a growing population through culturally integrated dairy products such as milk, curd, ghee, and paneer. More than 70% of India's dairy producers operate at a small scale, often with one to three animals, and a substantial portion of dairy activities—such as milking, feeding, and animal care—are managed by women, making the sector a key contributor to both economic and social empowerment in rural India.

Despite its quantitative achievements, the sector is riddled with qualitative shortcomings. Low productivity of indigenous breeds, inadequate access to nutritious feed and quality veterinary services, poor infrastructure, and institutional fragmentation limit the efficiency and resilience of dairy systems. The growing threat of climate change, through heat stress and emerging livestock diseases, further exacerbates

these vulnerabilities, while the sector's own environmental footprint—through methane emissions and manure mismanagement—raises sustainability concerns.

Additionally, socio-economic barriers such as limited access to credit, lack of insurance coverage, and exclusion of marginalized communities and women from decision-making processes hinder the equitable growth of the sector. Regional disparities in dairy development, where states like Gujarat and Punjab outpace their eastern and northeastern counterparts, reflect the uneven distribution of institutional support, technical capacity, and market access across the country.

In light of these challenges, this paper undertakes a multi-dimensional exploration of the Indian dairy sector. It evaluates the sector's contribution to rural livelihoods, examines persistent constraints, and highlights emerging innovations and strategies that can support sustainable development. By focusing on inclusive growth, climate resilience, technological integration, and institutional reform, this study aims to propose actionable pathways that can transform dairy farming into a more productive, equitable, and environmentally responsible enterprise.

Role of Dairy Sector in Livelihoods

Employment and Income

Dairy farming provides livelihood opportunities to over 80 million rural households in India, especially those owning one to three milch animals. It serves as a reliable and regular source of cash flow, unlike seasonal crops. In rainfed and arid zones, livestock is often the primary income source, helping mitigate crop failure risks. The dairy sector contributes significantly to the rural economy by generating employment in both forward (processing, marketing) and backward (breeding, feed production) linkages (DAHD, 2022).

Gender and Social Empowerment

Women are central to the dairy ecosystem. They perform over 60% of the daily dairy operations including milking, feeding, cleaning, and animal healthcare. Women's participation in Self Help Groups (SHGs) and dairy cooperatives has led to increased decision-making power in households and communities. Programs like Mahila Dairy Cooperatives and women-centric animal husbandry schemes are helping break traditional gender roles and empowering rural women economically and socially (Chander & Thakur, 2018).

Dairy Cooperatives

Dairy cooperatives play a transformative role in ensuring equitable access to markets, veterinary services, and credit. The Amul model, replicated across many Indian states, connects farmers directly with processors, removing exploitative middlemen. Cooperatives ensure assured procurement of milk at stable prices, offer technical training, and supply inputs like mineral mixtures and veterinary drugs. Their success has encouraged states like Gujarat, Karnataka, and Maharashtra to expand cooperative coverage (Kumar et al., 2020).

Challenges Facing the Dairy Sector

Low Productivity of Indigenous Breeds

Indigenous cattle breeds such as Gir, Sahiwal, and Red Sindhi are well adapted to local climatic stress and diseases but produce less milk compared to exotic and crossbred cattle. The average yield of indigenous cows is around 2–3 litres/day versus 7–10 litres/day for crossbreds. Lack of organized breeding, poor nutrition, and insufficient record-keeping worsen the productivity problem (FAO, 2021). Although crossbreeding programs have been introduced, they often neglect the conservation of native germplasm.

Feed and Fodder Shortage

Livestock productivity is heavily dependent on the availability of nutritious and affordable feed. India faces a deficit of 23.4% in green fodder, 11.24% in dry fodder, and 28.9% in concentrates (ICAR-NIANP, 2022). Erratic monsoons, shrinking pasturelands, and competition from food crops worsen the fodder crisis. Farmers often resort to feeding crop residues that are low in protein and digestibility, resulting in poor animal health and suboptimal milk output.

Animal Health and Veterinary Services

Frequent disease outbreaks such as Foot-and-Mouth Disease (FMD), Hemorrhagic Septicemia, Brucellosis, and mastitis lead to production losses, increased veterinary costs, and farmer distress. India has just 1 veterinarian for every 5,000 animals, far below the recommended ratio of 1:500 (DAHD, 2021). Inadequate disease surveillance, limited vaccine availability, and weak extension services further hamper effective livestock healthcare delivery.

Climate Change and Environmental Stress

The dairy sector is highly vulnerable to climate variability. Heat stress lowers milk yield, impairs reproductive performance, and increases mortality. Livestock also contributes to climate change—enteric fermentation in ruminants releases methane, a potent greenhouse gas. Manure mismanagement causes soil and water contamination. Efforts to reduce emissions by altering feed formulations or promoting biogas units remain limited in scale (Gerber et al., 2013).

Inadequate Infrastructure

India lacks a robust cold chain infrastructure essential for milk storage and transportation.

Over 30% of milk in rural areas is sold in unorganized markets, often without quality control.

Only 35% of total milk production is processed in organized dairies (NITI Aayog, 2020). Inadequate chilling centres, lack of milk testing equipment, and inefficient transport logistics contribute to post-harvest losses and poor product quality.

Financial and Institutional Constraints

Credit access remains a challenge for small dairy farmers. Formal financial institutions are reluctant to lend due to high transaction costs and absence of collateral. Insurance coverage for dairy animals is still low, leaving farmers vulnerable to losses from disease or death. Furthermore, many farmers lack awareness of government schemes or face bureaucratic hurdles in accessing benefits (World Bank, 2020).

Policy and Market Barriers

While initiatives like the National Dairy Plan and Rashtriya Gokul Mission aim to modernize dairy farming, their impact is diluted by fragmented execution and poor coordination between central and state agencies. Price volatility, import of milk products, and lack of Minimum Support Price (MSP) for milk make dairy farming economically unpredictable. Regulatory complexities further hinder private sector investment in rural milk collection and processing (Kumari et al., 2022).

Regional Disparities and Social Dynamics

Dairy development is uneven across India. Gujarat, Maharashtra, and Punjab have well-developed cooperative networks and infrastructure, while eastern states like Odisha, Jharkhand, and Bihar lag due to poor logistics, lack of technical manpower, and weaker institutional support. Moreover, caste and class dynamics often determine who accesses cooperative benefits or government schemes. Marginalized communities, especially SCs and STs, are underrepresented in organized dairying setups (Rangnekar, 2014).

Technological Interventions and Innovations

Artificial Insemination and Genomic Selection

Artificial insemination (AI) programs have helped improve breed quality, especially in crossbred cattle. However, AI coverage in India is only about 30% of breedable animals. New tools like genomic selection and embryo transfer are being tested to accelerate genetic gains and produce disease-resistant, high-yielding animals. Institutions like ICAR-NBAGR are working on digitized breed records and e-registries to maintain lineage purity and performance data (ICAR-NBAGR, 2022).

Digital Platforms

The integration of digital technology in livestock farming is transforming farmer outreach.

Platforms like **e-Pashuhaat** allow online purchase of semen, embryos, and disease-free animals. The **National Digital Livestock Mission (NDLM)** provides farmers with real-time alerts, weather data, vaccination schedules, and market price updates. These innovations bridge the information gap and increase transparency in input-output transactions (NDDB, 2023).

Strategies for Sustainable Development

To ensure the long-term viability of the dairy sector, a multidimensional strategy is needed:

- **Breed Improvement:** Strengthen genetic selection programs for indigenous and crossbred cattle through AI, sex-sorted semen, and genomic tools.
- **Feed Security:** Promote cultivation of high-yielding fodder crops, hydroponic green fodder systems, and silage units for year-round feed availability.
- **Disease Control:** Implement universal vaccination campaigns, mobile veterinary clinics, and livestock health cards for disease monitoring.
- **Women-Centric Models:** Support women-led dairy cooperatives and SHGs through financial literacy, entrepreneurship training, and targeted subsidies.
- **Green Practices:** Promote manure management, biogas units, and low-emission feed additives to mitigate environmental impacts.

- **Public-Private Partnerships (PPP):** Encourage private investment in dairy infrastructure, R&D, extension services, and value-added processing through flexible policy frameworks.

Conclusion

India's dairy sector plays a crucial role in supporting rural livelihoods, ensuring nutritional security, and diversifying agriculture. From the milk shortages of the 1950s to becoming the top global producer, the sector's growth has been remarkable. Yet, behind this progress lie persistent challenges such as low productivity, feed shortages, limited veterinary care, and climate stress, which hamper its overall potential. Structural issues like poor infrastructure, fragmented markets, and lack of access to finance continue to affect smallholders, especially women and marginalized communities who form the backbone of rural dairying. Regional disparities further widen the development gap, with states like Gujarat and Punjab advancing rapidly, while others lag due to weaker institutions and limited support.

Climate change adds another layer of complexity, impacting both animal health and feed availability, while the sector itself contributes to emissions. Though technological tools like AI, digital platforms, and genomic techniques offer promise, their reach remains limited among rural populations.

Addressing these issues requires a holistic and inclusive strategy—improving indigenous breeds, ensuring year-round feed availability, strengthening veterinary outreach, promoting green technologies, and empowering women-led cooperatives. A unified national policy with strong public-private partnerships can help bridge systemic gaps and make the sector more resilient and sustainable.

For India's dairy sector to thrive, it must shift from a volume-centric approach to one that emphasizes quality, equity, and environmental sustainability. With the right mix of technology, policy, and community engagement, it can become a model for inclusive and climate-smart rural development.

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