

A Study on Problem and Prospect of dairy Industry in India

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Abstract- Objective: This paper aims to provide a comprehensive analysis of the Indian dairy industry, focusing on its economic impact, challenges, and future prospects. It examines the sector's role in livelihoods, national economy, and global market dynamics.

Methodology: A literature review methodology is employed, drawing insights from scholarly articles, industry reports, and government publications. Key sources include the International Journal of Dairy Technology, Journal of Dairy Research, Food Policy, and Journal of the Indian Dairy Association. This approach synthesizes existing research to offer a thorough examination of the industry's current status, challenges, and opportunities.

Findings: The Indian dairy industry, as the world's largest milk producer, faces challenges such as low productivity, infrastructure deficiencies, and economic disparities. Despite these challenges, opportunities exist in technological advancements, market diversification, and policy support, which can propel sectoral growth and sustainability.

Conclusion: Addressing challenges through enhanced infrastructure, policy reforms, and technological adoption is crucial for the Indian dairy industry's sustainable development. Future research should focus on evaluating the socio-economic impacts of reforms, assessing technological advancements, and analyzing market dynamics to foster resilient growth.

Keywords- Indian dairy industry, milk production, challenges, opportunities, technological advancements, policy recommendations

INTRODUCTION

The Indian dairy industry holds a prominent position in the country's economy, contributing significantly to livelihoods and GDP. With a market size exceeding US\$100 billion, it is one of the world's largest and fastest-growing dairy sectors (International Journal of Dairy Technology, 2019). India, as the world's largest milk producer, accounting for about 20% of global

production, generated approximately 198 million metric tonnes of milk in 2020-21 (Journal of Dairy Research, 2019).

Employing around 80 million dairy farmers directly, the sector plays a crucial role in rural employment and contributes about 5% to India's national economy (Food Policy, 2021). The cooperative model, notably successful, enhances productivity and profitability for small and marginal farmers who own about 80% of the country's bovine population (International Journal of Dairy Technology, 2019).

Despite its successes, the industry faces challenges such as feed shortages and maintaining milk quality and quantity, particularly during environmental crises like droughts or floods (Food Policy, 2021). However, opportunities for growth persist, especially in value-added products like cheese, yogurt, and ice cream, which encourage innovation and diversification (Journal of the Indian Dairy Association, 2018).

The industry's evolution from the domestication of zebu cattle millennia ago to the "Operation Flood" initiative in 1970 underscores its historical significance and ongoing potential for development (Journal of the Indian Dairy Association, 2018).

Objectives

This paper aims to evaluate the economic impact of the Indian dairy industry on livelihoods, analyze key challenges such as feed shortages and quality control issues, and explore future opportunities for innovation and sustainability within the sector.

Scope

This study comprehensively examines the Indian dairy industry's economic significance, focusing on its role in livelihoods and national economy. It analyzes challenges related to feed availability, milk quality

standards, and environmental sustainability, while also exploring potential for technological advancements and diversification in dairy products.

Methodology

This paper employs a literature review methodology, drawing insights from scholarly articles, industry reports, and government publications. Key sources include the International Journal of Dairy Technology, Journal of Dairy Research, Food Policy, and Journal of the Indian Dairy Association. This approach synthesizes existing research to provide a thorough analysis of the industry's current status, challenges, and future opportunities.

Literature review:

The Indian dairy industry has a deep-rooted history dating back to ancient times, where dairy farming was integral to household sustenance, particularly in regions like Kerala, where every household-maintained cows for milk and dairy products (User, n.d.). During British rule, the establishment of a military farm aimed to ensure a steady supply of quality milk, further advancing with professional methodologies introduced by dairy farming specialist William Smith, influenced by research from England (User, n.d.). Post-independence, efforts to organize dairy societies in Kerala culminated in the formation of the state's first dairy society in Mangalapuram, marking a pivotal step towards structured dairy development (User, n.d.).

The National Dairy Development Board (NDDB) was established in 1965, heralding the 'Anand Pattern' cooperative model. This initiative, popularized under Operation Flood from 1970 onwards, expanded cooperatives across India and was led by Dr. Verghese Kurien, known as the "Father of White Revolution" (Milk Production in India, n.d.). Operation Flood's phased approach significantly boosted dairy production and cooperative infrastructure, transforming India into the world's largest milk producer within 28 years (Milk Production in India, n.d.).

Today, India remains the global leader in milk production, contributing approximately 18.5% to global output. The industry has grown at a CAGR of 6.2%, reaching 209.96 million tonnes in 2020-21, with

per capita milk availability increasing steadily (Ibef, 2022; Dairy in India, 2024). Major milk-producing states include Uttar Pradesh, Maharashtra, and Punjab among others (Ibef, 2022). India's dairy exports have risen steadily, reaching 108,711 MT valued at Rs. 2,928.79 crore (US\$ 391.59 million) in 2021-22, while imports mainly consist of processed milk powder and dairy derivatives (Ibef, 2022; Dairy in India, 2024).

Despite growth, challenges persist, such as milk adulteration and the need for improved product quality and packaging (Status of Dairy Industry in India and Its Future Scope – Technology of Milk and Milk Products, n.d.). Opportunities abound in value-added products like yogurt, cheese, and ice cream, with the sector poised for significant growth driven by advancements in production techniques and market demand (Status of Dairy Industry in India and Its Future Scope – Technology of Milk and Milk Products, n.d.).

The private sector plays a crucial role in modernizing dairy operations through advanced breeding techniques and enhancing animal health, thus optimizing production costs and sustainability (Status of Dairy Industry in India and Its Future Scope – Technology of Milk and Milk Products, n.d.).

The Indian dairy industry has been extensively studied, revealing insights into its growth trajectory, challenges, and potential opportunities. Karmakar and Banerjee (2006) highlighted significant challenges such as malpractices like adulteration and the need for improved packaging of indigenous dairy-based sweetmeats. Meanwhile, Chawla et al. (2009) focused on the production, consumption, and export dynamics of milk and dairy products in India, underscoring its pivotal role as the world's largest producer and consumer of milk. Government reports, including those from the Department of Animal Husbandry and Dairying, Government of India (2024), have also emphasized India's substantial contribution to global milk production, driven in part by initiatives like Operation Flood, which promoted cooperative models and modern infrastructure.

Despite these advancements, gaps in the literature persist regarding the sustainability of these initiatives and the role of private companies within the sector. Sharma (2015) noted that India accounts for 17% of

global milk production but highlighted ongoing challenges such as malpractices and the need for enhanced packaging standards. Miranda (2014) pointed out that while India is not a major player in global dairy trade, there is limited research on the implications of this position for the industry's growth and market dynamics.

Furthermore, Moharana (2015) and Sharma (2015) underscored the significant role of private companies like Amul, Omfed, Mother Dairy, and Hatsun Agro in the industry. However, there remains a dearth of research on their specific impacts on sustainability, both environmental and social, and their contributions to overall sector growth. Addressing these gaps in research could provide valuable insights into enhancing the resilience and sustainability of the Indian dairy industry in the face of evolving global and domestic challenges.

Problems in the Indian Dairy Industry

The Indian dairy industry faces multifaceted challenges across various domains, severely impacting its productivity, infrastructure, supply chain, and economic viability.

Production Challenges:

Low Productivity of Indian Dairy Animals: Indian cattle yield an average of 1172 kg of milk annually, significantly lower than the global average. This disparity highlights the need for improved breeding practices and animal husbandry to enhance productivity (Staff, 2022).

Disease Outbreaks: Diseases such as Foot and Mouth Disease, Black Quarter infection, and Influenza regularly plague livestock, causing health setbacks and reducing overall milk production efficiency (Staff, 2022).

Limited Success in Cross-Breeding: Efforts to crossbreed indigenous cattle with exotic breeds have had limited success, posing challenges in achieving desired improvements in milk yield and quality (Staff, 2022).

Infrastructure and Supply Chain Issues:

Unhygienic Milk Production: Many dairy cattle lack proper shelter, exposing them to harsh weather conditions, which can adversely affect milk quality. This unhygienic production environment contributes to issues like mastitis and overall milk contamination (Your Retail Coach, n.d.).

Insufficient Infrastructure: Certain dairy cooperatives lack essential facilities such as adequate cooling and milk testing capabilities at village-level collection centers. This deficiency undermines efforts to maintain milk quality from farm to consumer (Vandana, 2019).

Supply Chain Issues: The informal structure of the dairy sector complicates efforts to ensure consistent milk flow and quality control. This informal nature also makes the industry susceptible to adulteration practices, further compromising product integrity and consumer trust (Staff, 2022).

Market and Economic Issues:

Low Returns: Dairy farmers often receive meager prices for their milk compared to the retail prices fetched in the market. This disparity results in disproportionate profit-sharing, where companies and middlemen benefit more than the actual producers (Staff, 2022).

Marketing and Pricing Challenges: Poor marketing strategies and insufficient education among farmers about market dynamics and pricing strategies hinder their ability to negotiate fair prices for their produce. This lack of empowerment undermines the potential profitability of dairy farming as a livelihood (Your Retail Coach, n.d.).

Low Dairy Penetration & High Distribution Costs: The penetration of dairy products remains low in many regions, while the high costs associated with milk handling and distribution inflate final retail prices. These economic barriers limit consumer access to affordable dairy products (Your Retail Coach, n.d.).

Addressing these challenges requires comprehensive reforms in animal husbandry practices, infrastructure development, supply chain management, and market access strategies. By implementing targeted interventions and policy measures, the Indian dairy

industry can strive towards sustainable growth and improved livelihoods for dairy farmers nationwide.

Prospects in the Indian Dairy Industry

Technological Advancements

Technological advancements have significantly transformed the Indian dairy industry, enhancing efficiency, productivity, and product quality. Automated milking systems, Internet of Things (IoT) applications, and data analytics have revolutionized milk production by reducing labor costs and improving animal health management (Show, 2023; Ltd, 2023; Choyal, 2019).

Precision Nutrition and Feeding systems have emerged as crucial tools for optimizing dairy farm operations. These systems analyze data on cow health, productivity, and dietary needs to formulate personalized feeding plans. This approach not only enhances milk production but also minimizes environmental impact through optimized feed compositions and rationing (Show, 2023; Choyal, 2019).

Renewable Energy Integration initiatives such as solar panels and biogas plants are increasingly being adopted on dairy farms. These technologies aim to reduce reliance on fossil fuels, thereby lowering environmental footprints while promoting sustainability in dairy operations (Show, 2023; Choyal, 2019).

Innovative Waste Management practices, including anaerobic digesters that convert cow manure into biogas and organic fertilizers, play a pivotal role in environmental sustainability. These systems mitigate pollution and produce valuable resources, contributing to a cleaner dairy production cycle (Show, 2023; Choyal, 2019).

Policy and Institutional Support

Government Initiatives like Operation Flood and the establishment of the National Dairy Development Board (NDDB) have been instrumental in fostering dairy farming and enhancing milk production nationwide (Ltd, 2023; Choyal, 2019).

Dairy Cooperatives, exemplified by the success of Amul, have effectively organized small-scale dairy farmers and ensured fair pricing, thereby empowering rural communities and bolstering the dairy sector's resilience (Show, 2023; Ltd, 2023).

Market Diversification efforts promoted by the government have stimulated the production of value-added dairy products such as cheese, yogurt, butter, and ice cream. This diversification strategy enhances market competitiveness and boosts overall dairy sector growth (Show, 2023; Ltd, 2023).

Market Opportunities

The growing consumer awareness about the nutritional benefits of dairy products is driving increased demand across India. This rising demand underscores significant growth prospects for the dairy industry in the coming years (Show, 2023; Ltd, 2023). Export Opportunities are expanding, particularly for value-added dairy products, presenting India with substantial prospects to tap into international markets and bolster economic gains (Show, 2023; Ltd, 2023). Private Sector Participation is playing a pivotal role in driving innovation within the dairy industry. Increasing private sector investments and initiatives are expected to further propel growth and modernization across the sector (Show, 2023; Ltd, 2023).

This comprehensive integration of technology, policy support, and market opportunities positions the Indian dairy industry for robust growth and sustainability in the global market landscape.

Case Studies

1. Amul: The Cooperative Giant

Background: Established in 1946 in Gujarat, Amul (Anand Milk Union Limited) is the largest dairy cooperative in India. It follows a three-tier cooperative model with village cooperative societies at the base, district unions at the middle level, and the Gujarat Cooperative Milk Marketing Federation (GCMMF) at the apex.

Success Factors:

- **Farmer Ownership and Control:** Milk producers are members of village cooperatives and own the entire system, ensuring fair prices for their milk.
- **Robust Supply Chain:** Amul has a cold chain network spanning villages to ensure milk quality and minimize spoilage.

- Focus on Product Diversification: Amul offers a wide range of dairy products, from milk and butter to ice cream and cheese, catering to diverse consumer needs.
- Strong Brand Building: Amul's iconic campaigns have made it a household name in India, synonymous with quality and affordability.
- Cooperative Model Benefits: Economies of scale, efficient procurement, and professional management contribute to Amul's success.

Impact: Amul empowers millions of milk producers, provides consumers with quality dairy products at reasonable prices, and has significantly contributed to India's dairy revolution.

Source: <https://amul.com/>

2. Mother Dairy: A Private Sector Leader

Background: Established in 1970 under Operation Flood, Mother Dairy is a private company owned by the National Dairy Development Board (NDDB) and four state governments in Delhi NCR. It functions as a subsidiary of the NDDB, a government body promoting dairy development.

Success Factors:

- Focus on Urban Markets: Mother Dairy prioritizes supplying milk and dairy products to major cities like Delhi and NCR, ensuring efficient cold chain logistics and timely delivery.
- Product Innovation: Mother Dairy offers a variety of value-added dairy products like toned milk, curd, and paneer, catering to the needs of urban consumers.
- Strong Distribution Network: Mother Dairy has a robust network of booths and outlets in urban areas, ensuring easy access to its products for consumers.
- Technology Adoption: Mother Dairy utilizes technology for efficient procurement, processing, and distribution, minimizing wastage and maximizing reach.

Impact: Mother Dairy plays a crucial role in meeting the growing demand for milk and dairy products in

urban India. It offers good quality products at competitive prices and contributes to stabilizing milk prices in major cities.

Source: <https://www.motherdairy.com/>

Discussion

- Synthesis of Findings: The Indian dairy industry emerges as a critical sector with substantial contributions to both the economy and livelihoods, underscored by its status as the world's largest milk producer. However, despite significant achievements, the sector faces multifaceted challenges ranging from production limitations to market complexities.
- Production Challenges: Issues such as low productivity of dairy animals, exacerbated by disease outbreaks and limited success in cross-breeding, significantly hinder overall milk output and quality. These challenges underscore the need for enhanced animal husbandry practices, disease management strategies, and targeted breeding programs to improve productivity and ensure sustainable growth.
- Infrastructure and Supply Chain Issues: The dairy industry's infrastructure inadequacies, including unhygienic milk production environments and insufficient cooling and testing facilities at collection centers, compromise milk quality and safety. Addressing these gaps requires substantial investment in infrastructure development and technology adoption across the supply chain to maintain product integrity and meet consumer standards.
- Market and Economic Issues: Economic disparities persist within the dairy sector, where farmers often receive inadequate returns for their produce compared to final retail prices. This discrepancy, compounded by marketing challenges and high distribution costs, underscores the need for policy interventions to empower farmers, improve market access, and ensure fair pricing mechanisms.

Policy Recommendations

To address these challenges and capitalize on growth opportunities, policymakers should consider the following recommendations:

1. **Enhanced Support for Research and Development:** Invest in research and development initiatives focused on improving animal genetics, disease resistance, and feed efficiency. Collaborate with agricultural universities and research institutions to promote innovation in dairy farming practices.
2. **Infrastructure Development:** Allocate resources for upgrading dairy infrastructure, including the establishment of modernized milk collection centers equipped with adequate cooling and testing facilities. Promote public-private partnerships to accelerate infrastructure development across rural and peri-urban areas.
3. **Market Reforms and Price Stabilization:** Implement policies to strengthen market linkages and ensure transparent pricing mechanisms that benefit dairy farmers. Facilitate farmer cooperatives and producer organizations to enhance bargaining power and negotiate fair prices for their milk.
4. **Promotion of Value-Added Products:** Encourage diversification into value-added dairy products such as cheese, yogurt, and flavored milk to meet evolving consumer preferences and increase profitability. Provide incentives for dairy processors to invest in value addition technologies and product innovation.
5. **Sustainability Initiatives:** Support initiatives for renewable energy integration, waste management, and sustainable agricultural practices within the dairy sector. Incentivize adoption of technologies like solar panels and biogas plants to reduce environmental footprints and enhance operational efficiency.

Future Research Directions

Future research should focus on:

1. **Impact Assessment of Technological Adoption:** Evaluate the economic and environmental impacts of advanced technologies such as automated milking systems, IoT applications, and precision nutrition in dairy farming.
2. **Consumer Behavior and Market Dynamics:** Analyze consumer preferences and behaviors

towards dairy products, especially value-added items, to forecast demand trends and inform market strategies.

3. **Socio-Economic Impacts:** Investigate the socio-economic implications of dairy industry reforms on rural livelihoods, gender dynamics, and income distribution among smallholder farmers.
4. **Policy Evaluation:** Assess the effectiveness of existing policies and programs in promoting dairy sector growth, enhancing farmer welfare, and ensuring sustainability.

Conclusion

In conclusion, while the Indian dairy industry faces significant challenges, it also presents immense opportunities for growth and innovation. Addressing issues related to productivity, infrastructure, and market dynamics through strategic policy interventions can foster a resilient and sustainable dairy sector. By leveraging technological advancements, promoting market diversification, and empowering dairy farmers, India can further strengthen its position as a global leader in milk production and dairy products. Stakeholders across the sector must collaborate to navigate these challenges effectively and capitalize on emerging opportunities for the benefit of all involved.

Implications for Stakeholders

For dairy farmers, these findings underscore the importance of adopting modern farming practices and engaging in cooperative models to enhance profitability and sustainability. Policymakers must prioritize sector-specific reforms to ensure equitable growth and market access, while industry stakeholders should invest in innovation and infrastructure to meet evolving consumer demands and regulatory standards.

Final Thoughts

Looking ahead, the future of the Indian dairy industry hinges on strategic investments in technology, infrastructure, and market development. With concerted efforts from all stakeholders and proactive policy measures, the industry can overcome its challenges, capitalize on emerging opportunities, and continue to thrive in the global dairy market landscape.

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