

Growth and Structural Dynamics of Dairy Industry in India: Trends, Challenges and Opportunities

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Abstract: India is the largest producer of milk globally, contributing about 23% to world production. The dairy sector is vital for rural employment, nutrition security and agricultural GDP. This paper examines the growth trajectory and structural dynamics of the Indian dairy industry from 2014 to 2022. The sector's unique three-tier cooperative structure, pioneered through Operation Flood, continues to coexist with a growing private sector and dominant unorganized market channels. Despite achieving per capita milk availability of 444 grams per day in 2021-22, significantly above the world average of 394 grams, the industry faces persistent challenges including fodder deficits, low animal productivity, infrastructure gaps, and quality concerns. This paper identifies critical opportunities in value-added products, technological adoption, export potential, and policy interventions that could sustain the sector's growth momentum. The findings suggest that India's dairy industry, contributing approximately 5% to national GDP and employing over 80 million farmers, requires strategic interventions in feed security, processing infrastructure, and market access to maintain its competitive position in the global dairy economy. The paper suggests strengthening FPOs, cold chain and women's participation for sustainable growth.

Keywords: Dairy Industry, Milk Production, Cooperatives, Value Chain, White Revolution, structural dynamics, value-added products

1. INTRODUCTION

1.1 Background and Significance

The dairy industry occupies a central position in India's agricultural economy and rural livelihood structure. As the world's largest milk producer since 1998, India accounts for approximately 25% of global milk production, making the sector strategically important for food security, nutritional enhancement, and rural employment. The industry's significance extends beyond mere production statistics—it represents a unique development model that has lifted millions of smallholder farmers out of poverty while ensuring steady milk supply to India's growing urban population. Dairy farming in India differs fundamentally from industrialized dairy systems in Western countries. The Indian model is characterized by smallholder production, with over 80 million rural households owning 2-5 animals each, integrating livestock with crop agriculture in mixed farming systems. This decentralized production structure, combined with the cooperative marketing framework established through Operation Flood, has created a resilient and inclusive dairy economy that provides daily cash flow to farmers, particularly during lean agricultural seasons.

The year 2022 marked a critical juncture in India's dairy sector evolution. With milk production reaching 230.58 million tonnes and per capita availability achieving 459 grams per day, the sector demonstrated continued growth momentum despite pandemic-related disruptions and input cost pressures. However, underlying structural challenges—including persistent fodder deficits, low genetic potential of indigenous breeds, inadequate cold chain infrastructure, and increasing competition from private processors—threatened to constrain future growth.

1.2 Historical Context: The White Revolution

The transformation of India's dairy sector is inextricably linked to the White Revolution, initiated through Operation Flood in 1970 under the leadership of Dr. Verghese Kurien and the National Dairy Development Board (NDDB). This ambitious program, inspired by the successful Anand cooperative model in Gujarat, aimed to replicate the farmer-owned cooperative structure across India's diverse agro-climatic zones.

Operation Flood unfolded in three phases:

Operation Flood I (1970-1980): This initial phase established the foundational infrastructure by connecting 18 major milksheds to four metropolitan cities (Delhi, Mumbai, Kolkata, and Chennai) through a national milk grid. The

program was uniquely financed through the sale of donated milk powder and butter oil from the European Union, creating a self-sustaining funding mechanism.

Operation Flood II (1981-1985): The second phase expanded the milk grid to 136 milk sheds, dramatically increasing the number of village-level dairy cooperative societies. Milk production rose from 31.6 million tonnes to 44.1 million tonnes during this period, demonstrating the scalability of the cooperative model.

Operation Flood III (1985-1996): The consolidation phase strengthened cooperative infrastructure, added processing capacity, and expanded veterinary services. By 1996, India had surpassed the United States to become the world's largest milk producer, a position it has maintained continuously since.

The cooperative model's three-tier structure—village dairy cooperative societies (VDCS), district milk producers' unions, and state cooperative milk marketing federations—ensured farmer ownership, fair pricing based on fat content, and elimination of exploitative middlemen. Farmers received 75-80% of the consumer price through cooperatives, compared to 30-40% in traditional trader-dominated markets.

1.3 Objectives and Scope

This paper aims to provide a comprehensive analysis of India's dairy industry with the following objectives:

1. To examine the growth trends in milk production, productivity, and per capita availability from 2015 to 2022
2. To analyze the structural dynamics of the dairy sector, including the roles of cooperatives, private players, and unorganized market channels
3. To identify key challenges constraining sector growth, including input costs, infrastructure gaps, and productivity issues
4. To explore emerging opportunities in value-added products, technology adoption, and export markets
5. To propose policy recommendations for sustainable dairy sector development

2. GROWTH TRENDS IN INDIA'S DAIRY SECTOR (2015-2022)

2.1 Milk Production Growth

India's milk production has demonstrated remarkable consistency and resilience over the past decade. From 146.30 million tonnes in 2014-15, production increased to 221.07 million tonnes in 2021-22 and further to 230.58 million tonnes in 2022-23, representing a cumulative growth of 57.6% over eight years. The compound annual growth rate (CAGR) during this period averaged approximately 6%, significantly exceeding the global average of 2%.

Table 1: India's Milk Production Trends (2014-15 to 2022-23)

Year	Milk Production(Million Tonnes)	Growth Rate(%)
2014-15	146.30	-
2015-16	155.50	6.15
2016-17	165.40	6.49
2017-18	176.50	6.71
2018-19	187.70	6.34
2019-20	198.44	5.70
2020-21	209.96	5.81
2021-22	221.07	5.52
2022-23	230.58	3.83

Source: Department of Animal Husbandry and Dairying, Basic Animal Husbandry Statistics

The growth pattern reveals several important characteristics:

Steady Acceleration (2015-2018): The period from 2015-16 to 2017-18 witnessed accelerating growth rates, peaking at 6.71% in 2017-18. This acceleration reflected favorable monsoon conditions, improved veterinary services, and expanding cooperative procurement networks.

Resilience during COVID-19 (2019-2021): Despite pandemic-related disruptions in 2020-21, the dairy sector maintained growth momentum at 5.81%, demonstrating the essential nature of dairy products and the resilience of decentralized production systems. Moderation in 2022-23: The growth rate moderated to 3.83% in 2022-23, reflecting emerging constraints including fodder shortages, rising feed costs, and climate-related stress on animal productivity.

2.2 Per Capita Milk Availability

Per capita milk availability (PCA) serves as a critical indicator of nutritional security and dairy sector performance. India's PCA increased from 351 grams per day in 2016-17 to 444 grams per day in 2021-22, and further to 459 grams

per day in 2022-23. This represents a 48% increase over the decade from 2014-15, when PCA stood at 319 grams per day. The 2022-23 PCA of 459 grams per day significantly exceeds:

The world average Per capita milk availability of milk is 329 grams per day (2023 estimate) - The WHO-recommended minimum of 280 grams per day. The Indian Council of Medical Research (ICMR) recommendation of Per capita milk availability of milk is 280 grams per day for adults.

However, significant inter-state variations persist. In 2022-23, Punjab led with 1,283 grams per day, followed by Rajasthan (1,138 g/day), Haryana (1,098 g/day), and Andhra Pradesh (799 g/day). In contrast, several north eastern states and union territories recorded PCA below 100 grams per day, highlighting regional disparities in production and distribution.

Table 2: State-wise Per Capita Milk Availability (2022-23)

State	PCA(Grams/day)	State	PCA(Grams/day)
Punjab	1283	Karnatka	523
Rajasthan	1138	Uttarakhand	442
Haryana	1098	Uttar Pradesh	426
Andhra Pradesh	799	Telangana	423
Gujrat	670	Tamil Nadu	369
Madhya Pradesh	644	All India	459

Source: Basic Animal Husbandry Statistics 2022-23

2.3 State-wise Production Patterns

Five states—Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat, and Andhra Pradesh—accounted for over 53% of India's total milk production in 2022-23. Uttar Pradesh alone contributed 15.72% (36.25 million tonnes), followed by Rajasthan (14.44%, 33.30 million tonnes), Madhya Pradesh (8.73%, 20.13 million tonnes), Gujarat (7.49%, 17.27 million tonnes), and Andhra Pradesh (6.70%, 15.45 million tonnes).

The geographic distribution of milk production reflects:

Traditional dairy belts: Punjab, Haryana, Rajasthan, and Gujarat maintain high productivity due to established cooperative networks and favorable agro-climatic conditions

Emerging producers: Madhya Pradesh, Uttar Pradesh, and Andhra Pradesh have shown rapid growth through expanded cattle populations and improved breeding programs

Regional disparities: Eastern and north eastern states continue to lag in production despite significant potential, constrained by infrastructure gaps and limited cooperative penetration

2.4 Economic Contribution

The livestock sector, with dairy as its largest component, made substantial contributions to India's economy in 2022-23:

GDP Contribution: The livestock sector contributed ₹13.55 lakh crore at current prices, representing 30.23% of agricultural GVA and 5.50% of national GVA

Employment: Dairy directly employs over 80 million farmers, with women comprising approximately 70% of the workforce in animal care and management

Rural Income: For smallholder dairy farmers, milk sales provide 25-30% of household income, serving as a critical risk mitigation mechanism against crop failures and price volatility

The dairy sector's economic significance extends beyond direct contributions. It supports ancillary industries including feed manufacturing, veterinary pharmaceuticals, cold chain logistics, and food processing, creating multiplier effects throughout rural economies.

3. STRUCTURAL DYNAMICS OF INDIA'S DAIRY INDUSTRY

3.1 Market Structure: The Tripartite Model

India's dairy industry exhibits a unique tripartite market structure that distinguishes it from dairy sectors in other countries. This structure reflects the coexistence of traditional farming practices, cooperative principles, and modern corporate approaches.

Unorganized Sector (50-60%): The unorganized sector comprises traditional vendors, local milkmen, and direct farmer-to-consumer sales. This segment dominates rural markets and peri-urban areas, characterized by:

- Informal procurement and distribution networks

- Limited quality testing and cold chain infrastructure
- Price determination through local supply-demand dynamics
- Significant role in providing market access to remote producers

Cooperative Sector (30-35%): The cooperative sector, anchored by NDDB and state federations, represents the organized procurement and processing channel.

Key features include:

- Farmer-owned and democratically controlled organizations
- Transparent fat-based pricing mechanisms
- Investment in processing infrastructure and brand building
- Social objectives balanced with commercial viability

As of 2022, the cooperative network comprised:

- 22 milk federations at the state level
- 241 district cooperative unions
- Approximately 31,908 village dairy cooperative societies
- 1.72 crore (17.2 million) member farmers
- Coverage of 2.35 lakh (235,000) villages

Private Sector (15-20%): The private sector has grown significantly since economic liberalization in the 1990s, with major players including Hatsun Agro (Arokya), Heritage Foods, Parag Milk Foods (Gowardhan), and Mother Dairy (operated by private management in some regions).

Private companies focus on:

- Value-added products with higher margins
- Urban and premium market segments
- Technology-driven supply chain management
- Brand differentiation through quality and innovation

3.2 Cooperative Model: Strengths and Evolution

The Indian dairy cooperative model, pioneered in Anand, Gujarat, and scaled nationally through Operation Flood, remains the sector's institutional backbone. The three-tier structure operates as follows:

Village Dairy Cooperative Society (VDCS): At the grassroots level, VDCS collect milk from member farmers twice daily. Key functions include:

- Milk collection and preliminary quality testing (fat and SNF content)
- Immediate payment to farmers, often within 24 hours
- Provision of input services (feed, veterinary care, artificial insemination)
- Democratic governance through elected farmer representatives

District Milk Producers' Union: District unions aggregate milk from village societies and operate processing facilities. Responsibilities include:

- Pasteurization and packaging of liquid milk
- Manufacture of value-added products (butter, cheese, yogurt, sweets)
- Quality assurance and laboratory testing
- Coordination with state federations for marketing

State Cooperative Milk Marketing Federation: State federations (e.g., GCMMF/Amul, Karnataka Milk Federation/Nandini, Rajasthan Cooperative Dairy Federation/Saras) handle:

- Brand management and marketing
- Distribution network development
- Inter-state and export sales
- Strategic planning and investment decisions

3.3 Private Sector Growth and Competitive Dynamics

The private sector's share of organized milk procurement has grown steadily since the 1990s, driven by:

Market Liberalization: Economic reforms in 1991 opened the dairy sector to private investment, enabling companies to establish procurement networks and processing facilities.

Value-Added Product Focus: Private players have concentrated on high-margin categories including cheese, yogurt, probiotic drinks, and specialty milk, where they can differentiate through branding and innovation.

Technology Adoption: Private companies have invested in supply chain technologies including automated milk collection systems, cold chain infrastructure, and digital payment platforms, improving efficiency and quality.

Urban Market Penetration: Private brands have established strong presence in metropolitan and tier-1 cities, targeting middle-class consumers willing to pay premiums for branded, packaged products.

Competitive Tensions: The growing private sector presence has created competitive dynamics with cooperatives:

Price Competition: Private players sometimes offer higher procurement prices to attract farmers, pressuring cooperative margins

Talent Competition: Both sectors compete for skilled managers, veterinarians, and technical staff

Market Share Battles: In states like Karnataka, Tamil Nadu, and Maharashtra, private and cooperative brands compete intensely for shelf space and consumer loyalty.

3.4 Smallholder Production Structure

India's dairy sector is fundamentally a smallholder enterprise, with distinctive characteristics:

Herd Size: The average dairy farmer owns 2-5 animals, with landless and marginal farmers (owning less than 2 hectares) comprising over 70% of milk producers. This contrasts sharply with industrial dairy systems in the US and Europe, where herd sizes average 200-500 animals.

Mixed Farming Integration: Most dairy farmers integrate livestock with crop agriculture, using crop residues as fodder and animal manure as fertilizer. This symbiotic relationship reduces input costs and enhances overall farm productivity.

Risk Mitigation: Dairy provides daily or weekly cash flow, buffering farmers against seasonal crop income volatility and climate-related agricultural risks. For many households, milk income represents 25-30% of total earnings, making it a critical livelihood component.

Gender Dimensions: Women perform approximately 70% of dairy-related activities including feeding, milking, animal care, and manure management. However, men typically control marketing and income decisions, though cooperatives have increasingly promoted women's participation in governance.

4. CONCLUSION

India's dairy industry stands at a critical inflection point. Having achieved remarkable growth over the past five decades—transforming from a milk-deficient nation to the world's largest producer—the sector now faces the dual challenge of sustaining growth momentum while addressing structural constraints.

Milk production reached 230.58 million tonnes with per capita availability of 459 grams per day, surpassing global averages and nutritional recommendations. The cooperative model, complemented by growing private sector participation, has created a unique tripartite market structure that balances inclusivity with efficiency. India's dairy sector has historically demonstrated resilience and adaptability. From the cooperative innovation of Operation Flood to the technology-driven transformations underway today, the sector has continuously evolved to meet emerging challenges. With strategic policy support, investment in critical enablers, and continued farmer entrepreneurship, India's dairy industry can sustain its growth trajectory, enhance rural livelihoods, and contribute to national food and nutritional security.

The White Revolution 2.0, launched in 2024, signals government commitment to expanding cooperative coverage and enhancing farmer incomes. However, success will depend on effective implementation, adequate resource allocation, and multi-stakeholder collaboration.

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