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Role of the Government in Promoting Dairy Sector: Evidence from Indian States

Yashobanta Parida[1], Pankaj Parmar[2], and Harekrishna Misra[3]

[1] Assistant Professor, Department of Economics, Flame University,
[2]Assistant Professor, Dairy Technology Department, Parul Institute of Technology, Parul University, Vadodara, Gujarat, India.
[3]Professor, Institute of Rural Management Anand, Gujarat, India. Corresponding author: Dairy Technology Department, Parul Institute of Technology
Correspondence should be addressed to Yashobanta Parida; yashobanta.parida@flame.edu.in

ABSTRACT: India is the world's largest milk producer, accounting for 22% of the world's milk supply in 2017. Five Indian states produced over 50% milk in 2016. The Indian dairy sector also played a major role in raising the socio-economic status of the rural landless, besides small and medium farm households. Besides, this sector helps reduce rural poverty by providing employment opportunities for rural workers, particularly women. Several factors have contributed to India's rising milk production, including the role of co-operatives. The present study examines the dairy industry's output and employment performance. Data show that the dairy industry contributes around two percent of the total manufacturing industry output while generating around one percent of the entire manufacturing industry employment jobs. The studies further examine the performance of private, public, and cooperative dairy firms. Data confirm that the Indian co-operative sector contributes about 30% of total revenue, with Indian private companies and government companies/subsidiary companies contributing 23.5% and 11%, respectively. In contrast, foreign firms contribute around 8.6%. Additionally, the study examines the government's role in India's milk production while controlling for natural disaster factors. The results show that state government expenditure for dairy development and implementation of dairy-related policies enhanced milk production and per capita availability in the Indian states.

KEYWORDS: Dairy industry; fixed effect estimate; Government policy; India; Milk production

I. INTRODUCTION

The livestock segment constitutes an important segment of the Indian economy, which, in 2017-2018, contributed 4.9% of G.D.P. and 28.4% of agricultural and allied G.D.P. in 2017-18. The livestock sector helps ease inequality and poverty in the country's rural areas and creates jobs for Indian farmers. Dairy is an important sub-sector in India's rural economy within the livestock sector. The livelihood of the country's nearly 8.47 million people is dairying, 71% women. Dairy farming is a guaranteed 365 days employment provider compared to agriculture which provides only 90-120 days employment per year .According to the . milk accounts for 67% of livestock share [1], [2].

The data indicate a 32% rise in milk production over the combined paddy and wheat yield. The monthly average revenue from the farm household was 2604, of which 69% was generated from milk sales between July 2012 and June 2013. This sector is expected to help double farmers' incomes by 2021-22. In addition to its value to the Indian economy, India is the world's leading milk producer contributing 22% of global milk production in 2017 Food and Agriculture Organization, Milk production and per-capita availability in India were 55.6 million tonnes and 178 g/day in 1991, which grew to 187.7 million tonnes and 394 g/day in 2018. The milk production CAGR was 4.4% in 2018. It was expected to increase to 254.55 MMT by 2021-22 and 300 MMT by 2023-24 . In rural areas, 48% of the overall milk supply is either producer-level self-consumed or marketed to non-producers. The remaining 52% of milk is available to urban consumers. Of the 52%, around 40% is managed by the organized sector (20% by dairy co-operatives and 19% by private dairies), with the remaining 60% regulated by the unorganized sector. Antecedents like higher per capita income, higher urbanization, population growth, and changing food habits are responsible for increasing India's milk production and demand. Elements like improved village dairy co-operative networks and government initiatives, such as Rashtriya Gokul Mission (R.G.M.), National Dairy Plan (N.D.P.) (Phase-I), and Intensive Dairy Development Programme (I.D.D.P.), serve to push up milk production in India [3].

The Indian dairy industry faces numerous challenges despite being a world leader in milk production. These challenges hinder milk production growth, milk producers' exposure to the organized market, milk processing, milk-related value-added commodity production, and, finally, consumer access to quality milk and milk products. The Indian dairy industry's major challenges include low productivity, imbalanced feed, technological adaptation, and lack of village supply chain facilities, among other things. Hence, we assess the Indian dairy industry's success in milk production and the value of the Indian

economy's milk market. We also examine employment trends and the output of the organized dairy industry.
Finally, we discuss the role of government policies relevant to improving milk production in the Indian states. Section 2 analyses previous studies related to the performance of dairy co-operatives in India. Section 3 analyses the significance of the dairy sector in the Indian economy. Section 4 examines the performance of the organized dairy sector in India. Section 5 examines the government's role in enhancing milk production. Empirical findings are discussed in Section 5.

II. REVIEW OF LITERATURE

Santarossa et al. in their study illustrated that few studies exist related to the performance of the dairy sector globally. Among the most notable contributions to dairying's economic sustainability comes from They argue that economic weights are not for genetic improvements because of the system's nonlinearity prompted by diminishing marginal product of inputs and the limited capacity of resources. Maynard, Wolf and Gearhardt argued that milk pricing could be leveraged through hedging, options, and futures markets to provide a safety net. However, several studies have evaluated the performance of the dairy sector in India. Parida, Ghule and Dudharejiya examined the competitiveness of the Indian dairy industry and factor enhancing the dairy export. The study indicates that dairy products lack export competitiveness and free trade and that the world per capita has a favorable effect on dairy exports. Ohlan confirms that dairy exports are elastic in world market size and exchange rate. He also indicates that eliminating quantitative constraints has improved Indian dairy exports. Rakotoarisoa and Gulati (2006) investigate the effect of global dairy sector policy reforms on dairy industry competitiveness and India's dairy production. They show the competitiveness of milk products, mainly skim milk powder (S.M.P.), improved from the 1990s [4] ,[5].
Rajarajan, Saravanakumar and Singh evaluated the trade competitiveness of Indian dairy products. They demonstrate that India imports primary dairy products from developed nations and that India's dairy exports increased marginally during the post-liberalizations phase. They also affirm India's competitive advantage after liberalization regarding exporting S.M.P., W.M.P., and ghee. Kumar explores the effect on Indian livestock export competitiveness. He concludes that India is not competitive in exporting dairy products. Instead, India is well placed to export meat products. Jha explores the effect of import liberalizations on the dairy sector in India's coastal and land-locked states using the economic surplus approach. The study indicates that low price imports of milk have negatively impacted dairy-related employment [6] , [7].
Apart from competitiveness, Kannan and Birthal explored the relationship between trade liberalization and India's dairy industry's performance with the Annual Survey of Industry data. They found that capital and labor productivity, net value-added, and gross output are negatively related to economic reforms (proxy by protection level), except for employment in the Indian dairy industry. Singh, Coelli and Fleming evaluated dairy co-operatives and private firms' performance using plant-level panel data in India. In doing so, they have demonstrated that dairy co-operatives are more cost-effective than private plants. Besides, the cost-effectiveness of dairy co-operative plants does not increase after liberalizations. Ohlan applied the data envelopment analysis and Tornqvist index to measure efficiency and the Indian dairy industry's total factor productivity. He found that the productivity of the dairy sector had improved dramatically by 72%, although 38% of the study's inefficiency was detected [8] [9].
Gautam, Dalal and Pathak demonstrate that access to concentrated feed contributes to an increase in India's milk production, while technology access has a limited impact. They also affirm that animals' genetic development enhances milk production while insufficient veterinary services and lack of consumer access make it challenging to improve milk production in India. Atkins addresses the issues and impacts of Operation Flood (O.P.) dairy production in India and discusses the polarized among the farmers. Kumar, Parappurathu ad Joshi (2013) investigated the structural shift of milk production in India. They found changes in milk productivity due to changes in the cattle population's composition from traditional to crossbred buffaloes and cows. In addition, they affirm that other factors such as market access and the availability of veterinary facilities alongside sufficient dairy infrastructure further improve milk production and milk yield [10], [11].
Rajendran and Mohanty examine the opportunities and challenges faced by India's dairy co-operatives. Their study confirms that the unorganized sector handles 80% of the milk, while the remaining 20% is managed by the organized industry provided by the rural dairy farmer. They also demonstrate that milk co-operatives play a crucial role in reducing rural poverty through milk production and adequate marketing facilities. Also, they argued that insufficiency of infrastructural facilities, inadequate transportation, and lack of transport facilities constitute major constraints affecting milk production and the price of milk received by the farmers. Misra et al. (2020) examined the impact of the Dairy Vigyan Kendra (D.V.K.) training on increasing income and milk production in rural Gujarat. They confirm that training intervention by D.V.K. has significantly increased milk production as well as income received for milk sales. The study also confirms that 93% of farmers are satisfied with D.V.K. training which has helped increase herd size [12] [13].

III. DISCUSSION

Overview of Milk Production and Contribution of the Indian Economy India is the world's leading milk producer, contributing 22% to global milk supply, followed by the U.S. (12%), Pakistan (5.5%), China (4.3%), Brazil (4.2), Germany (4.1%), and so on. In 2016, these six countries contributed about 52% to global milk production (Table 1). Fifteen countries now contribute 71% of the overall global milk supply. Between 1961 and 2017, India's milk production grew about nine-fold, reflecting a compound annual growth rate of around four percent per year. Multiple factors, including Operation Flood, the existence of organized milk co-operatives, improved transportation, superior distribution networks,

and a higher cattle population, are responsible for enhancing milk production. Another component is equally accountable for expanding the demand for milk and milk products in India (Table 1), thereby increasing production.

Table 1: Global Milk Production of Top Fifteen Producing Countries.

Country	1961 (Million Tonnes)	Share (%)	2001 (Million Tonnes)	Share (%)	2017 (Million Tonnes)	Share (%)	CAGR (%)
India	20.4	5.9	83.6	14.2	176.3	21.9	3.9
USA	57	16.6	75	12.7	97.8	12.1	1.0
Pakistan	6.0	1.7	26.3	4.5	44.3	5.5	3.6
China	1.8	0.5	14.5	2.5	34.9	4.3	5.4
Brazil	5.3	1.5	21.4	3.6	33.7	4.2	3.4
Germany	25.3	7.3	28.2	4.8	32.7	4.1	0.5
Russia	0.0	0.0	32.9	5.6	31.2	3.9	-0.3
New Zealand	5.2	1.5	13.1	2.2	21.4	2.7	2.6
Turkey	6.5	1.9	9.5	1.6	20.7	2.6	2.1
UK	12	3.5	14.7	2.5	15.3	1.9	0.4
Netherlands	7.0	2.0	11	1.9	14.5	1.8	1.3
Poland	12.8	3.7	11.9	2.0	13.7	1.7	0.1
Italy	10.6	3.1	12.3	2.1	12.0	1.5	0.2
Mexico	2.5	0.7	9.7	1.6	12.0	1.5	2.8
Ukraine	0.0	0.0	13.4	2.3	10.5	1.3	-1.5
Top 15 countries	172.4	50.1	377.6	64	570.9	70.9	2.2
Rest of the World	171.8	49.9	212.5	36	234.3	29.1	0.6
Total	344	100	590	100	805	100	1.5

India's milk production witnessed growth from 20 million tonnes in 1961 to 176 million tonnes in 2017. In the same period, India's contribution to global milk production significantly increased by 6% to 22%, with an annual growth rate of 4%. In the context of state-wise milk production, Uttar Pradesh contributed 17% of all India's milk production, followed by Rajasthan (13%), Madhya Pradesh (8%), Gujarat (7.7%), Andhra Pradesh (7.4%), Punjab (6.8%), Maharashtra (6%) and Uttarakhand (1%), which figured the lowest of India's 19 states. A few states like Uttar Pradesh, Rajasthan, MP, Gujarat, A.P., and Punjab perform better than other states in India. These six states contributed around 59% to milk production nationally in 2016-17 (Table 2). India's 19 states contributed about 97% of the country's milk. The per capita milk availability (Gram/Day) of nine states, namely Punjab, Haryana, Rajasthan, Gujarat, A.P., H.P., MP, Uttarakhand, and J&K, are above the national per capita milk availability while the remaining states and U.T.s figure are below the national average.

Table 2: State-Wise Milk Production

States	2001-02		2016-17		GARG
	Milk (Thousand Tonnes)	Share (%)	Milk (Thousand Tonnes)	Share (%)	
Uttar Pradesh	14648	17.36	27770	16.79	4.4
Rajasthan	7758	9.19	20850	12.61	6.8
Madhya Pradesh	5283	6.26	13445	8.13	6.4
Gujarat	5862	6.95	12784	7.73	5.3
Andhra Pradesh	5814	6.89	12178	7.36	5.1
Punjab	7932	9.40	11282	6.82	2.4
Maharashtra	6094	7.22	10402	6.29	3.6
Haryana	4978	5.90	8975	5.43	4.0
Bihar	2664	3.16	8711	5.27	8.2
Tamil Nadu	4988	5.91	7556	4.57	2.8

Karnataka	4797	5.68	6562	3.97	2.1
West Bengal	3515	4.16	5183	3.13	2.6
Telangana	NA	0.00	4681	2.83	NA
Kerala	2718	3.22	2520	1.52	-0.5
Jammu and Kashmir	1360	1.61	2376	1.44	3.8
Odisha	929	1.10	2003	1.21	5.3
Jharkhand	940	1.11	1894	1.14	4.8
Uttarakhand	1066	1.26	1692	1.02	3.1
Top 19 states	81346	96.38	160864	97.26	
Rest of the states and Union Territories	3059	3.63	4539	2.73	

Livestock is an important segment of the Indian economy within the agriculture and allied sector. In 2015-16, livestock accounted for 4.5% of G.D.P., while ten states contributed as a percentage of G.S.D.P. compared to the nation. The livestock sector contributed 9.5% of G.S.D.P. in Andhra Pradesh, followed by Rajasthan (9.2%), Punjab (8.4%), and Goa (0.4%), which contributed the least (see Figure 1). Within the livestock sector, the share of milk and milk products represents 67% of total livestock production, followed by meat (21%), dung (5.5%), eggs (3.2%), silkworm cocoons and honey (0.8%), and wool & hair (0.1%), which had the lowest share among all livestock products in 2016. This sector stimulates poverty reduction and food security for millions of rural farm households. The sector also generates employment opportunities for the landless and the marginal and small farmers, particularly women. Crop production generates rural jobs for 90 to 120 days; dairying provides alternate employment opportunities for the rest of the year. In 2016, milk grabbed the highest share, i.e., 67 % of the total livestock products. Milk and its products contribute over 32% of paddy's and wheat's combined output. Figure 1 discloses the livestock percentage GSDP.

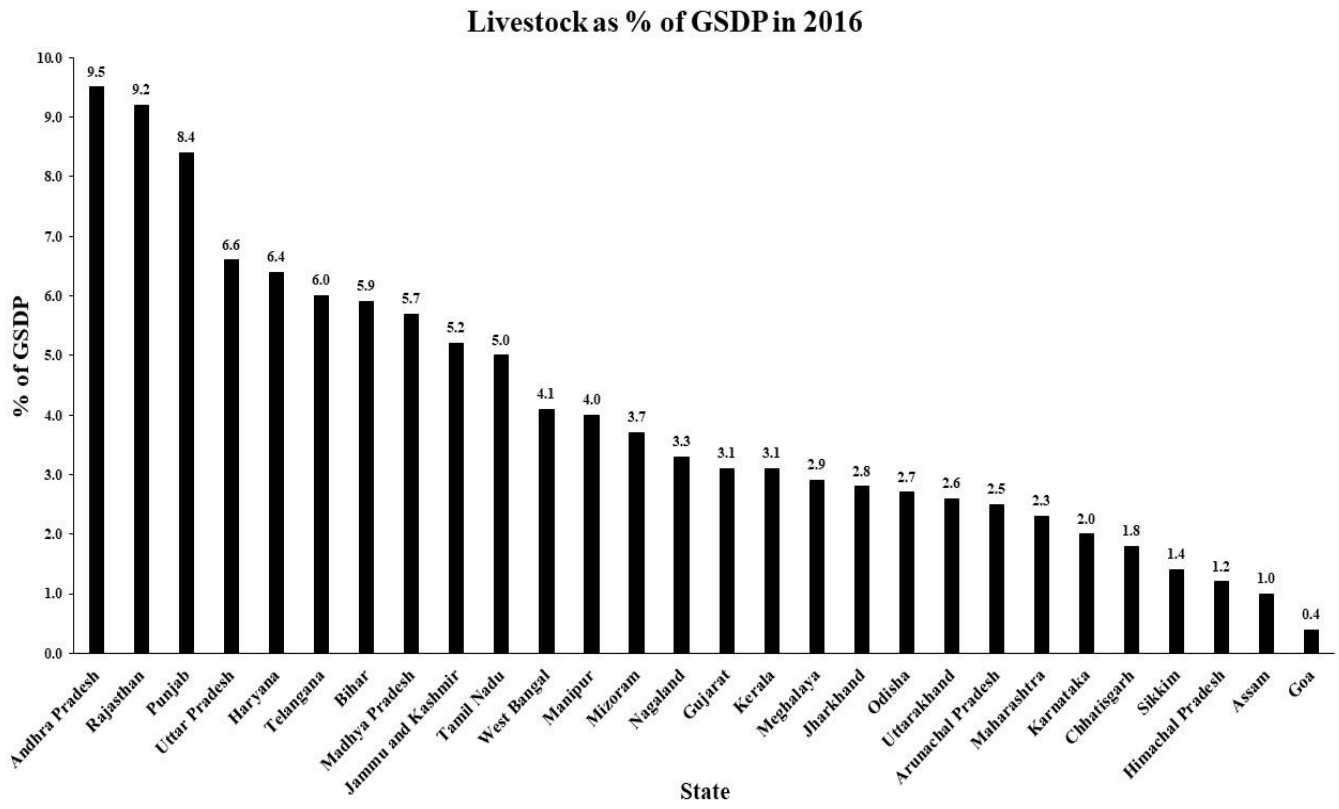

Figure 1: Livestock as % GSDP In 2016

Output and Employment of the Dairy Manufacturing Industries in India The dairy industry has become one of India's most prominent sectors in the past decade. This industry not only collects milk from farmers it also manufactures value-added dairy products while generating employment. This sector contributes to decreasing rural poverty and growing farmers' incomes by supplying around 60% milk from small dairy farmers. The number of milk processing plants rose from 258 in 1980 to 1,943 in 2015; the industry's production as a proportion of total

industry output also increased from 1.1 percent in 1980 to 2 percent in 1998. From 1998, the dairy sector's production steadily plummeted to 1.3% in 2008. Following 2008, the dairy industry's production rose to two percent in 2015.

The dairy industry has helped create jobs for the skilled and semi-skilled workforce. Employment rose from 36,947 to 1,63,815 personnel in the same period. In 1980, it had accounted for 0.5% of the total industry employment, reaching approximately one percent in 2015.figure 2 discloses the output and employment of the dairy manufacturing industry.

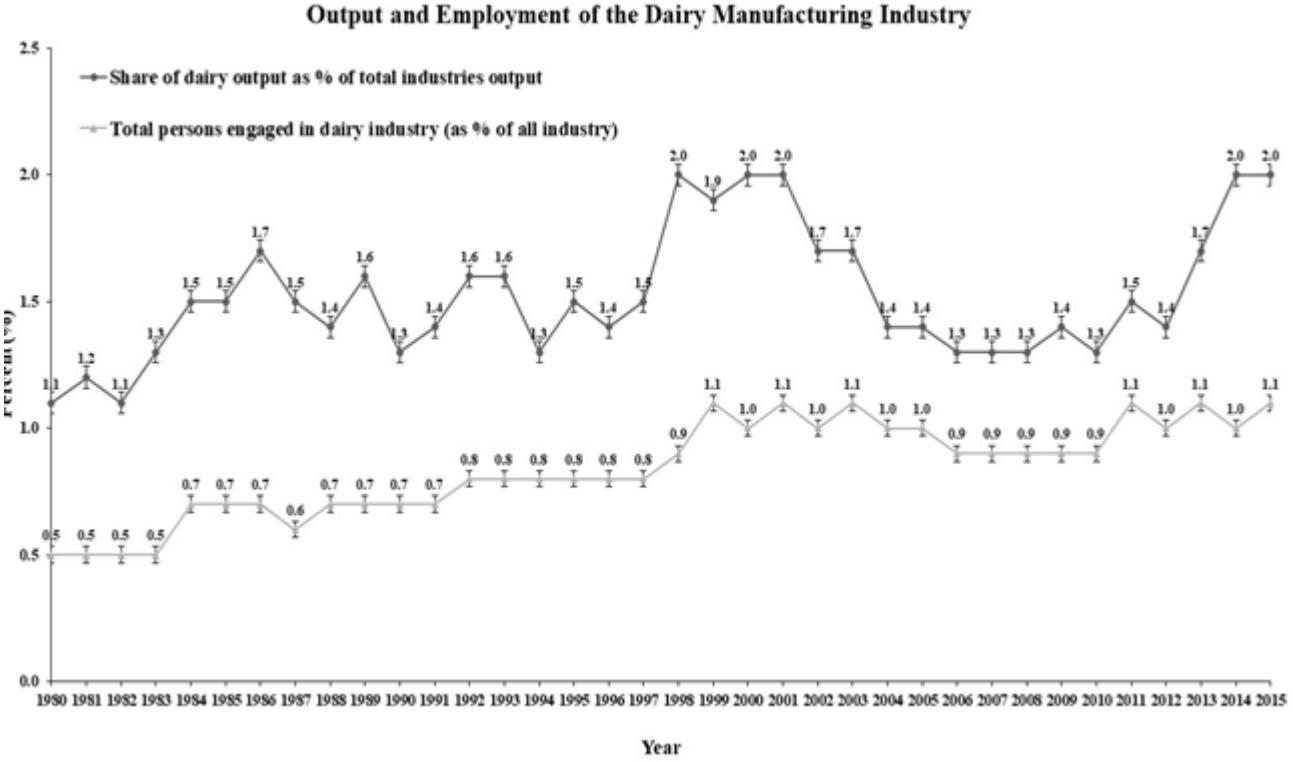

Figure 2: Output and Employment of the Dairy Manufacturing Industry

Table 3 shows the state-wise performance of the dairy industry. In 2001, Punjab contributed the highest output represented as a percentage of the total output (5.5%), followed by UP (3.6%), Kerala (3.1%), Bihar (2.9%), A.P. (2.5 %), and so on. Assam and Chhattisgarh contributed 0.1% each, the lowest among the states. Maharashtra contributed the highest in terms of nominal output, followed by Gujarat, UP, Punjab, and A.P. Assam contributed the lowest dairy output among all the states [14], [15].

Table 3: State-Wise Performance of the Dairy Industry in India

States	2001		2015	
	Total Output in the dairy industry (lakh)	Share (as % of all industry Output)	Total Output in the dairy industry (lakh)	Share (as % of all industry Output)
Gujarat	255338	1.7	3013110	2.6
Maharashtra	421193	2.3	1930028	1.7
Tamil Nadu	132391	1.4	1621499	2.3
Uttar Pradesh	238870	3.6	1498639	3.5
Karnataka	113072	2.1	1084031	2.5
Andhra Pradesh	162991	2.5	1012957	2.4
Haryana	42375	0.9	766604	1.9
Rajasthan	64081	2.1	649525	2.7
Punjab	207591	5.5	565677	3.0
Madhya Pradesh	34750	0.9	348483	1.8
Kerala	73325	3.1	336533	2.7
Bihar	19706	2.9	230983	4.8
Orissa	7344	0.5	118943	0.9
West Bengal	39032	0.9	104144	0.4
Uttarakhand	4757	0.9	49407	0.2
Jharkhand	6403	0.3	39766	0.3
Himachal Pradesh	NA	0.0	22987	0.2

Jammu & Kashmir	1514	1.0	20049	0.8
Goa	NA	0.0	16452	0.3
Chhattisgarh	1679	0.1	16367	0.2
Assam	468	0.1	8166	0.1
Tripura	494	1.7	1966	1.5

Similarly, in 2015, Gujarat contributed the highest dairy output, followed by Maharashtra, TN, UP, Karnataka, and A.P., while Tripura contributed the lowest in all the states. As regards the percentage of dairy production as overall industrial output, Bihar contributed the highest (4.8%), followed by UP (3.5%), Punjab (3%), Rajasthan (2.7%), Kerala (2.7%), and Gujarat (2.6%); Assam (0.1%) figured the lowest among all states. The Indian dairy sector is engaged in the manufacture of value-added milk products and provides job opportunities for rural workers across India. Table 4 shows the state-wise employment trend of the dairy manufacturing industry between 2001 and 2015. In 2015, UP provided the highest employment, followed by T.N., Maharashtra, Karnataka, Gujarat, etc. Tripura registered the lowest employment rate among all the states.

Table 4: State-Wise Employment of Dairy Manufacturing Industry

States	2001		2015	
	Total Persons Engaged in the dairy industry	Share (as % of Total industry employment)	Total Persons Engaged in the dairy industry	Share (as % of Total industry employment)
Uttar Pradesh	7217	1.41	941293	1.30
Tamil Nadu	8379	0.76	31082	1.34
Maharashtra	17813	1.53	24334	1.23
Gujarat	9453	1.33	20736	1.33
Karnataka	1232	0.25	12805	1.27
Andhra Pradesh	9416	1.05	11089	1.34
Punjab	7576	2.17	9348	1.53
Rajasthan	3395	1.46	6479	1.27
Haryana	2113	0.74	6087	0.85
Madhya Pradesh	2426	1.16	5835	1.63
Kerala	2994	0.98	4069	1.20
Bihar	1528	2.44	3088	2.58
West Bengal	1840	0.34	2930	0.46
Orissa	619	0.54	1996	0.77
Uttarakhand	335	0.82	852	0.22
Himachal Pradesh	NA	0.00	700	0.37
Chhattisgarh	193	0.21	660	0.38
Jharkhand	250	0.16	635	0.35
Jammu & Kashmir	127	0.52	559	0.81
Assam	99	0.09	405	0.19
Goa	NA	0.00	352	0.49
Tripura	85	0.82	120	0.45

Performance of the Organized Dairy Manufacturing Companies The study analyses the performance of private, public, and cooperative dairy firms over the period 2013-2016. The sales turnover data for registered dairy companies in India was obtained from Prowess, Centre for Monitoring Indian Economy (C.M.I.E.). There were 142 dairy firms, the data available at C.M.I.E. typically, unorganized operations that manufacture milk in hygienic

conditions dominate the Indian dairy industry. Milk procurement of India's organized dairy industry is projected to rise annually at ~14.8% between 2018 and 2023; it is expected to reach Rs. 2,458.7 billion by 2023. Therefore, it is time to critically analyse the efficiency of organized milk companies in India, something we have attempted in this study and presented in Table 5. The latter shows the performance of the top 10 organized manufacturing dairy firms in India. In 2013, Gujarat Co-operative Milk Marketing Federation Limited (G.C.M.M.F.) contributed around 30% of the overall sales, followed by Mother Dairy (10%), GlaxoSmithKline Consumer Healthcare Ltd (8.6%), Kwality Ltd (7.6%), and Hatsun Agro Products Ltd (4.2%) among others [16].

Table 5: Performance of Dairy Corporate Sector Firms

Company Name	2013-14		2014-15		2015-16		2016-17		CAGR
	Sales in Crore	Share (%)	Sales in Crore	Share (%)	Sales in Crore	Share (%)	Sales in Crore	Share (%)	
Gujarat Co-op. Milk Mktg. Fedn. Ltd. (Co-operative)	18143.0	30.3	20733.0	30.0	22972.0	32.2	27043.4	38.0	14.2
Mother Dairy Fruit & Vegetables Pvt. Ltd. (Central Govt Commercial Enterprises)	6364.8	10.6	6916.3	10.0	7167.1	10.0	7891.8	11.1	7.4
Kwality Ltd. (PI)	4578.1	7.6	5269.2	7.6	5658.3	7.9	6131.3	8.6	10.2
GlaxoSmithKline Consumer Healthcare Ltd.(F)	5144.7	8.6	4531.2	6.6	4573.4	6.4	4426.0	6.2	-4.9
Hatsun Agro Products Ltd. (PI)	2497.3	4.2	2937.8	4.2	3450.3	4.8	4207.2	5.9	19.0
Tirumala Milk Products Pvt. Ltd. (PI)	1581.1	2.6	1817.1	2.6	1861.9	2.6	1946.2	2.7	7.2
Heritage Foods Ltd. (PI)	1723.2	2.9	2074.0	3.0	2383.2	3.3	1872.2	2.6	2.8
Parag Milk Foods Ltd. (PI)	1074.5	1.8	1425.7	2.1	1623.0	2.3	1701.1	2.4	16.5
Sterling Agro Inds. Ltd. (PI)	1822.6	3.0	1700.5	2.5	1171.3	1.6	1549.3	2.2	-5.3
Dodla Dairy Ltd. (PI)	842.3	1.4	1018.4	1.5	1182.4	1.7	1410.0	2.0	18.7
Top ten firms	43771.6	73.0	48423.3	70.0	52042.8	73.0	58178.4	81.8	9.9
Total (142 Firms)	59963.2	100.0	69154.7	100.0	71328.1	100.0	71142.1	100.0	5.9

The top 10 firms contributed around 73% of sales over total dairy sales, while the rest of the firms contributed only 27%. Of the 73% sales, co-operative firms contributed around 30%, the highest among organized dairy firms. The second-largest share was garnered by private sector companies that contributed about 23.5% of the sales. The table also indicates that Mother Dairy, a wholly-owned subsidiary of N.D.D.B., contributed around 11%, while foreign corporate firms contributed around 8.6%. Similarly, in 2016, the top 10 organized dairy firms contributed 82% of sales, while the rest of the firms contributed 18%. The co-operative sector firms registered the highest sales and contributed around 38%. Similarly, the Indian private sector dairy firms' sales share rose from 23% to 26% over 2013-2016. In comparison, the Mother Dairy sales' share rose moderately from 10.6% to 11.1%,

while the sales' share of foreign firms declined from nine percent to six percent in the corresponding period. In other words, the data show that the cooperative sector played a significant role in developing the dairy industry in India.
The study examined the export performance of individual, international, and co-operative companies for three years, between 2014 and 2016, in addition to the sales' performance of organized dairy companies. Table 6 displays the export pattern of the leading organized dairy company in India. The export share of the top eight dairy firms increased from 64% in 2014 to 92% in 2016. The export share of private companies also went up from 35% to 47% while, simultaneously, the export share of co-operative companies rose from 12% to 21%. The sales' share of foreign firms increased from 14% to 20%, while the sales' share of Mother Dairy rose from three percent to four percent in the corresponding period. The data show that approximately half of India's dairy exports could be attributed to the Indian private sector firms (47%), followed by the co-operatives (21%), foreign firms (20%), and the rest to Mother Dairy (4.4%), with the lowest export share among the organized dairy firms in 2016 [17], [18].

Table 6: Export Performance of the Registered Dairy Firm

Company Name	Main product	Ownership group	2014-15		2015-16		2016-17	
			Value in Crore	Share (%)	Value in Crore	Share (%)	Value in Crore	Share (%)
Kwality Ltd.	Skimmed milk powder	Private (Indian)	530.2	27.4	730.5	40.1	409.0	32.2
Gujarat Co-Op. Milk Mktg. Fedn. Ltd.	Dairy products	Co-operative Sector	234.5	12.1	225.0	12.3	268.7	21.1
GlaxoSmithKline Consumer Healthcare Ltd.	Malted milk foods	Glaxo (F) Group	275.0	14.2	281.6	15.4	259.1	20.4
Parag Milk Foods Ltd.	Dairy products	Private (Indian)	46.7	2.4	31.8	1.7	56.8	4.5
Mother Dairy Fruit & Vegetables Pvt. Ltd.	Milk	Central Govt. - Commercial Enterprises	51.3	2.7	56.3	3.1	55.4	4.4
Gits Food Products, Pvt. Ltd.	Ghee	Private (Indian)	43.5	2.2	41.2	2.3	42.8	3.4
Vadilal Industries Ltd.	Icecreams & kulfi	Vadilal Group (Indian)	44.5	2.3	36.2	2.0	41.7	3.3
Heritage Foods Ltd.	Milk	Private (Indian)	4.5	0.2	14.6	0.8	40.0	3.1
Top 8 firms			1230.2	63.6	1417.2	77.7	1173.5	92.3
Rest of firm			704.2	36.4	405.8	22.3	97.7	7.7
Total			1934.3	100.0	1823.0	100.0	1271.2	100.0

Table 7 depicts the value of dairy imports and the share of the top 10 dairy firms in India from 2014-15 to 2016-17. Kwality Ltd imported half the dairy products, followed by GlaxoSmithKline, Parag Milk Foods Ltd, and Mother Dairy Fruit. Overall, during the period, imports of the top eight companies increased from 63.6% in 2015-16 to 92.3% in 2016-17. Furthermore, Indian private sector companies had imported more dairy products compared to foreign companies and government-owned firms. Kwality Ltd both imported and exported more dairy products compared to other companies. One foreign firm, GlaxoSmithKline Consumer Healthcare Ltd, has been competing with Indian dairy companies [19], [20].

Table 7: Import Performance of the Registered Dairy Firm

Company Name	Main product	Ownership group	2015-16		2016-17	
			Value in Crore	share	Value in Crore	share
Kwality Ltd.	Skimmed milk powder	Private (Indian)	707.7	59.5	401.9	45.8
GlaxoSmithKline Consumer Healthcare Ltd.	Malted milk foods	Glaxo (F) Group	193.7	16.3	243.2	27.7

Schreiber Dynamix Dairies Pvt. Ltd.	Dairy products	Private (Indian)	122.0	10.3	74.4	8.5
Hatsun Agro Products Ltd.	Milk	Private (Indian)	27.4	2.3	45.0	5.1
Parag Milk Foods Ltd.	Dairy products	Private (Indian)	30.3	2.5	37.7	4.3
Mother Dairy Fruit & Vegetables Pvt. Ltd.	Milk	Central Govt. - Commercial Enterprises	6.3	0.5	14.6	1.7
Vadilal Industries Ltd.	Icecreams & kulfi	Vadilal Group	9.7	0.8	13.0	1.5
Sterling Agro Inds. Ltd.	Dairy products	Private (Indian)	45.6	3.8	12.1	1.4
Creamline Dairy Products Ltd.	Milk	Godrej Group	0.4	0.0	10.4	1.2
Metro Dairy Ltd.	Milk	Private (Indian)	6.4	0.5	6.1	0.7
	Top 10 company		1149.5	96.7	858.3	97.8
	Rest of company		39.7	3.3	19.4	2.2
	Total company		1189.2	100.0	877.6	100.0

Role of Government and Milk Production in India This section addresses the government's role in the expenditure for dairy growth and various policies related to dairy products regarding increasing the per capita supply of milk and milk production in India. We are looking at the state-wise milk production and per capita availability of milk of India's major 18 states over 1994-2016 (Per capita availability of milk data for 18 states are available from 2004 to 2016). These data have been taken from the various annual reports of the Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture and Farmers Welfare, GoI. The state-wise grazing land data have been taken from land-use statistics, Directorate Of Economics & Statistics, Ministry Of Agriculture and Farmers Welfare, .. Flood-related information was culled from the Central Water Commission (C.W.C.) report, GoI. Information related to droughts was taken from the farmers' portal, the Department of Agriculture & Cooperation and Farmers Welfare, GoI. We estimated the fixed-effects models using equation (1) to examine the role of government on milk production in Indian states. The equation is as follows;

$$\ln(\text{Milk Production})_{st} = \beta_1 + \beta_2 DD_{st} + \beta_3 RGM_{st} + \beta_4 NDP_{st} + \beta_5 IDDP_{st} + \beta_6 \acute{X}_{st} + \delta_s + \gamma_t + \epsilon_{st} \quad (1)$$

Where $\text{Milk Production}_{st}$ denotes the natural logarithm of milk production in states' in year 't', DD_{st} represents the natural logarithm of government expenditure for dairy development over total government expenditure, R.G.M. is the Rashtriya Gokul Mission dummy (if the year 2014 onwards is equal to 1, otherwise zero), N.D.P. is the National Dairy Plan (Phase-I) dummy (if the year 2012 onwards equal to 1, otherwise zero), I.D.D.P. is the Intensive Dairy Development Programme) dummy (if the year 2005 onwards equal to 1, otherwise zero), $\acute{X}_{st}$ represents other control variables such as drought, floods, and state-wise grazing land, and δ_s denotes the time-invariant unobserved state-specific factors that correlate with explanatory and outcome variables. For example, the milk production of states depends on cultural, religious, and consumption factors that are correlated with explanatory and outcome variables; γ_t denotes the states' time-variant factors and is also correlated with explanatory and outcome variables in our models. For example, central government schemes for dairy development have impacted all states to enhance their milk production. We estimated equation using the fixed-effect mode; the estimates are presented in C1 of Table the coefficients of government expenditure dairy development are positive and significant, showing a one percent increase in expenditure for dairy development that leads to increased milk production by 0.114%. The results show that the government plays a crucial role in raising milk production by investing in dairy development. In addition, the implementation of the Rashtriya Gokul Mission (R.G.M.) has had a positive effect on milk production. The R.G.M.'s goal is to safeguard indigenous bovine species. Indigenous milk contains high fat and SNF content [21]–[23].

Table 8: Milk Production and the Role of the Government

Variables	ln (Milk production)	ln (Per capita availability milk) $
	C1	C2
Lag of ln (Dairy development/ Total government expenditure)	0.114*** (0.033)	0.070** (0.034)
Rashtriya Gokul Mission (RGM) dummy (if year 2014 onwards equal to 1, otherwise zero)	0.121*** (0.041)	0.131*** (0.030)
National Dairy Plan (NDP) (Phase-I) dummy (if year 2012 onwards equal to 1, otherwise zero)	0.173*** (0.031)	0.110*** (0.022)
Intensive Dairy Development Programme (IDDP) dummy (if year 2005 onwards equal to 1, otherwise zero)	0.319*** (0.053)	0.113*** (0.027)
Lag of ln (State grazing land/All India grazing land)	0.249 (0.433)	-6.567*** (1.574)
Drought dummy (State experienced drought year equal to I, otherwise zero)	0.001 (0.020)	0.005 (0.012)
Food dummy (State experienced flood year equal to 1, otherwise zero)	0.018 (0.015)	0.006 (0.013)
No of observations	378	234
No of states	18	18
State fixed effect	yes	yes
Year fixed effect	yes	yes

IV. CONCLUSION

The implementation of the National Dairy Plan (N.D.P.) (Phase-I) and Intensive Dairy Development Programme (I.D.D.P.) schemes has also enhanced milk production. The core goal of the N.D.P. (Phase-1) and I.D.D.P. is to increase milk production, increase the productivity of milk animals, and establish a dairy system to increase the availability of milk. The other control variables, such as drought and flood, wield a positive impact on milk production. During crises, households try to invest in dairy for alternative livelihoods. For robustness check, we analyzed the role of the government in introducing different schemes related to investment related to dairy production to increase the per capita supply of milk. The results are shown in C2 of Table 5. The estimates produce the same results and are consistent with the findings of the C1. The dairy industry has a vital role to play in the rural economy, helping build employment for rural landless and marginal farmworkers and the national economy. This sector also helps reduce rural poverty and inequity while providing nutritional support to millions of rural households. Around 70 million rural households depend on this sector for their livelihoods (. Enhanced reliance of this sector, a robust dairy cooperative network, and government assistance are compositely responsible for increasing milk production across the Indian states. These factors also help render India's status as the world's largest milk producer. Based on the significant contribution of the Indian economy, we analyzed the government's (a proxy of expenditure on dairy development and implementation of various schemes related to dairy) role in improving the per capita availability of milk and milk production. The findings show that government spending on dairy growth and the implementation of various milk schemes have raised milk production in Indian states. The data show that India produced 176.3 million tonnes of milk in 2017, accounting for 22% of global milk production, followed by the U.S. (12%), Pakistan (5.5%), and China (4.3%). As far as the states are concerned, Uttar Pradesh produced 17% milk, followed by Rajasthan (12.6%), Madhya Pradesh (8%), Gujarat (7.7%), and Andhra Pradesh (7.3%). That apart, these six states contributed around 59% to milk production, nationally, in 2016-17. Per capita milk availability (gram/day) in nine states – Punjab, Haryana, Rajasthan, Gujarat, A.P., H.P., MP, Uttarakhand, and J&K – are above the national per capita milk availability; the remaining states are below the national per capita. We also studied the dairy industry's output in India relevant to production and employment. The data show that the proportion of dairy output over total industry output increased from 1.1% to two percent between 1980 and 2015. The dairy industry's employment increased from 0.5% to 1.1% over the corresponding period. In 2001-2015, dairy industry output and employment followed the same trend, except in a few states. We assessed performance in terms of sales' turnover and the export and import of organized dairy manufacturing firms, including private, public, and cooperative dairy firms. In 2016-17, Gujarat Co-operative Milk Marketing Federation Limited (G.C.M.M.F.) registered the highest sales and contributed around 38%, followed by Indian private sector dairy firms (26%), Mother Dairy (11.1%), and foreign firms (6%). Data show that around half the dairy exports were attributed to India's private sector (47%), followed by co-operatives (21%), foreign firms (20%), and the rest to Mother Dairy (4.4%), which had the lowest export share among the organized dairy firms. Our findings show that government investments in milk production in India are not sufficient for raising milk production. More investments are required for increasing milk production

and employment prospects in this sector. This includes building dairy infrastructure for increasing milk processing and procurement and formalizing milk through co-operatives. The creation of more dairy plants to manufacture value-added milk products is an added imperative. Besides, the government has identified potential districts or villages for decentralizing milk production in India.

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