

International Journal of Agriculture Extension and Social Development

Volume 8; SP-Issue 4; April 2025; Page No. 53-60

Received: 10-02-2025
Accepted: 16-03-2025

Indexed Journal
Peer Reviewed Journal

Sustainable milk marketing channels through agribusiness innovations: Insights from buffalo farmers in Haryana, India

Gururaj Makarabbi, Navneet Saxena and Aiswarya S

ICAR-Central Institute for Research on Buffaloes, Hisar, Haryana, India

DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i4Sa.1829>

Corresponding Author: Gururaj Makarabbi

Abstract

In India, the dairy industry has undergone significant transformations, shifting from a deficit to a surplus in milk production, driven by technological advancements. Haryana, a progressive dairy state, ranks eighth in total milk production. The state witnessed a substantial increase in milk production from 34.19 lakh tonnes in 1990-91 to 116.29 lakh tonnes in 2022-23, with a growth rate of 21.19 percent. Approximately 75-80 percent of the milk in Haryana is sourced from buffaloes, followed by cows. The state boasts the highest per capita availability of milk (1,098 grams/day) after Punjab (1,283 grams/day), compared to the national average of 459 grams during 2022-23. Despite this high per capita milk consumption, about 65-70 percent of the marketed surplus milk is made available to non-producers. In this context, the present study was undertaken to analyze the available marketing channels for disposing of surplus milk among buffalo farmers in the state. Both secondary and primary data were utilized. Secondary data revealed that between 1990-91 and 2022-23, the number of registered dairy cooperative societies grew at a rate of 24.57 percent, with membership enrolment increasing by 17.13 percent. Similarly, milk procurement through dairy cooperative societies rose significantly from 341.50 lakh liters in 1990-91 to 1,673.24 lakh liters in 2022-23. However, the proportion of milk procured through organized channels remained low due to the dominance of unorganized milk marketing systems in the state. Primary data on production, consumption, marketed surplus, and marketing channels were collected from 120 buffalo farmers in Hisar and Karnal districts using a multi-stage random sampling technique. The results indicated that 68.33 percent of respondents preferred unorganized milk marketing channels, citing reasons such as doorstep milk collection and advance payment for purchasing inputs. Furthermore, the binomial logit model revealed that the age and educational status of respondents positively influenced their choice of milk marketing channels in the study area. The findings suggest that despite the success of dairy cooperatives in India, many milk producers remain dependent on unorganized milk marketing channels. This study concludes that milk marketing channels in Haryana must be strengthened through agribusiness innovations such as the integration of organized marketing systems, technological interventions, and capacity-building initiatives.

Keywords: Agribusiness, innovations, milk marketing, Haryana, buffalo farmers, India

Introduction

In India, the dairy industry has undergone significant transformations, transitioning from deficit to surplus milk production, driven by technological advancements. Dairying provides livelihoods for millions through milk production and associated activities. India produces 230.8 million tonnes of milk, accounting for about 25% of global milk production (DAHD, 2023). Buffalo milk constitutes approximately 45% of the total milk production, the highest share among bovine species. India is endowed with rich biodiversity in buffalo germplasm, comprising 20 recognized breeds and several non-descript types. According to the Breed Survey (2020), about 54.6% of buffaloes are of descript type, while the remaining 45.4% are non-descript. Among descript buffaloes, the Murrah type dominates with 42.80%, followed by Mehsana (4.00%), Surti (2.20%), Jaffrabadi (1.90%), Bhadawari (1.80%), Banni (0.70%), Pandharpuri (0.50%), Marathwadi (0.20%), and Nili-Ravi (0.20%). Murrah is regarded as one of the best buffalo breeds in the world, often referred to as the "black gold" of India due to its high milk yield, superior fat

content, and efficient feed conversion, even with low-quality roughages. The breeding tract of the Murrah buffalo falls in Haryana, which has 5.01 million Murrah buffaloes, including 2.40 million purebreds and 2.60 million graded breeds (Kumar *et al.*, 2019) ^[10].

In Haryana, the livestock sector contributes 30% to the agricultural Gross Domestic Product (GDP), with milk accounting for 60-65% of the livestock GDP (Anonymous, 2019). The state ranks 8th in milk production in India, producing 116.29 lakh tonnes annually, of which approximately 80% comes from buffaloes, highlighting the dependence of the dairy industry on buffaloes. Haryana also has the highest per capita milk availability (1,283 grams/day) after Punjab (1,098 grams/day), compared to the national average of 459 grams/day during 2022-23 (Department of Animal Husbandry, GoI). Despite this high per capita milk consumption, 65-70% of the marketed surplus is made available to non-producers through various marketing channels.

The efficient marketing of surplus milk is critical for improving the performance of the dairy sector in Haryana.

In India, milk is marketed through two primary channels: unorganized/traditional and organized systems. Despite the success of dairy cooperatives in the country, about 60% of surplus milk is still handled and procured by unorganized channels, while the remaining 40% is handled by cooperatives (20%) and private dairies (20%) (DAHDF, 2018). Even in Haryana, milk marketing is predominantly dominated by unorganized channels. This dominance reflects the limited impact of cooperative dairy development in curbing the traditional marketing system's hold (Kumar *et al.*, 2011) [9]. Consequently, milk producers often remain reliant on traditional milk marketing channels due to the shortcomings of cooperative and public-sector initiatives. In this context, the present study was undertaken to analyze milk production, consumption, marketed surplus, and the marketing channels used to dispose of surplus milk, alongside exploring agribusiness innovation strategies to strengthen and encourage milk marketing systems in the state.

Research methodology

Sampling plan

A total of 120 buffalo farmers from Karnal and Hisar districts of Haryana were selected using multi-stage random sampling techniques. Karnal and Hisar, located in the eastern and western parts of the state respectively, have the highest buffalo population (Livestock Census, 2019) [4]. Two blocks from each district were selected, and two villages were randomly chosen from each block. In the final stage, fifteen buffalo farmers from each village were personally interviewed using a pre-tested structured interview schedule. The respondents were categorized into three groups based on the number of milch Murrah buffaloes they owned: Group I (1-2 milch Murrah buffaloes), Group II (3-4 milch Murrah buffaloes), and Group III (5 or more milch Murrah buffaloes). Approximately 46.67% of buffalo farmers were in Group I, while 33.33% and 20% were classified under Group II and Group III, respectively.

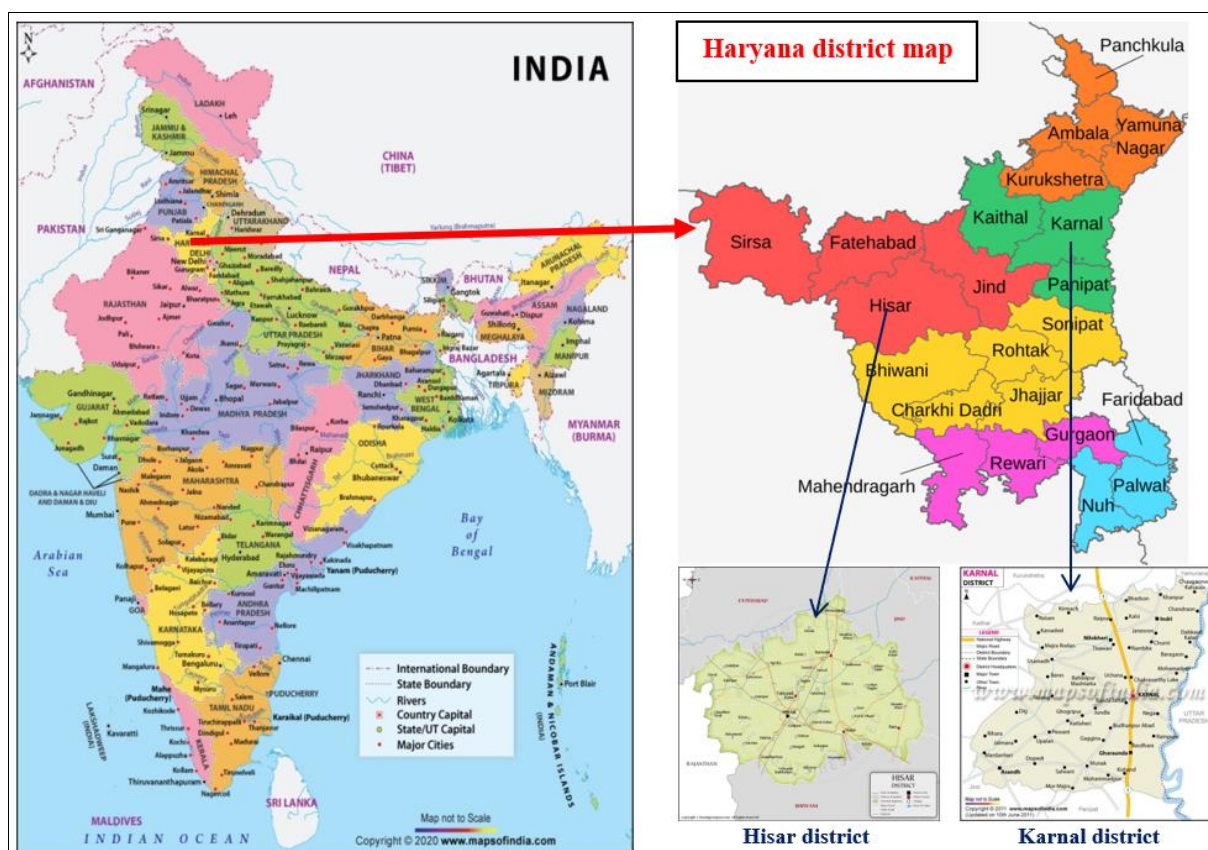


Fig 1: Depicts selection of the study area

Analytical technique

The Compound Annual Growth Rate (CAGR), binary logistic regression and Garret Ranking Technique (GRT) were applied.

Compound Annual Growth Rate (CAGR)

The Compound Annual Growth Rate (CAGR) was used to calculate the growth rate of milk production, milch animal population, number of artificial inseminations, veterinary institutions, buffalo population, buffalo contribution to milk production, number of artificial inseminations performed in buffaloes, milk procurement through dairy cooperative

societies, number of dairy cooperative societies, and the chilling capacity of dairy cooperative societies during the period 1990-91 to 2022-23.

The formula used to calculate the Compound Annual Growth Rate is as follows: $Y_t = Y_0(1 + r)^t$ (1)

Where,

Y_t = Buffalo population/milk production at time 't'

Y_0 = Buffalo population/milk production at initial time

r = Compound growth rate

t = Time period

The equation (1) is estimated after transforming it to

logarithmic form as follows -

$$\ln Y_t = \ln Y_0 + t \ln(1+r)$$

$\ln$ = Natural logarithm

$$\ln Y_0 = \beta_1 \text{ and } \ln(1+r) = \beta_2$$

Modified equation-

$$\ln Y_t = \beta_1 + \beta_2 t \quad (2)$$

Here, β_1 and β_2 are estimated by Ordinary Least Square (OLS) method and CAGR (r) is computed using the relationship

$$r = \{\text{antilog}(\ln b) - 1\} \times 100$$

Here, CAGR is calculated in the percentage term.

Binomial logistic regression

A binomial logistic regression was used to recognize the discrete choice nature of the dependent variable (Karli *et al* 2006; Priscilla *et al* 2016) [7, 12]. The model postulates that P_i , the probability that i^{th} buffalo farmer choice of the milk marketing channel is a function of an index variable Z_i , summarizing a set of explanatory variables. Z_i is equal to the logarithm of the odds ratio, i.e., the ratio of probability that buffalo farmers likely to choose the organised milk marketing channels to the probability that they choose the un-organised milk marketing channels. Z_i is expressed as a linear function of explanatory variables X_i . Mathematically, the logistic regression model is expressed as:

$$P_i = F(Z_i) = F(X_i) = \frac{1}{1 + e^{-Z_i}}$$

$$Z_i = \ln \left\{ \frac{P_i}{1 - P_i} \right\} = \alpha + \sum_{k=1}^M \beta_k X_{ki}$$

Where,

P_i = Probability that i^{th} buffalo farmer chose the organised milk marketing channel

$i = 1, 2, \dots, N$ = Number of buffalo farmers

$k = 1, 2, \dots, M$ = Number of explanatory variables

α = constant

β = unknown parameter

The parameters used in the regression model were estimated using the maximum likelihood method. The index variable Z_i indicating whether buffalo farmer chose the organised or unorganised milk marketing channel is linear combination of a set of explanatory variables and the functional form for the same is given below:

$$Z_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_6 X_{6i}$$

Garret Ranking Technique (GRT)

It helps in ranking the most important reasons of buffalo farmers in preference for the milk marketing channel. The formula used for percent position calculation in GRT is given below.

$$\text{Percent position} = \frac{[100 (R_{ij} - 0.50)]}{N_j}$$

Where,

R_{ij} = Rank allotted for i^{th} reason/factor by the j^{th} individual

N_j = Number of reasons/factors ranked by the j^{th} individual

Using Garret chart percent position was converted into scores (Garret and Woodworth, 1969) [1]. For each reason, the sum score was calculated and later divided by number of respondents to arrive at mean scores. The final rank was given based on mean scores. The reason with highest mean score value ranked first and the lowest mean score reason ranked last.

Results and Discussion

Growth trends in milch animal population, milk production, artificial inseminations and veterinary institutions in Haryana

The compound annual growth rate of milk production, total milch animals (including indigenous cows, crossbred cows, and buffaloes), and artificial inseminations performed in Haryana during 1990-91 to 2022-23 is presented in Table 1. Overall, milk production achieved a growth rate of 21.19% during the study period. An inter-period analysis revealed that the highest growth in milk production was recorded during 2015-16 to 2022-23. Similarly, the milch animal population grew at a rate of 1.68% during the same period. The population estimates were based on livestock census data from 1992, 1997, 2003, 2007, 2012, and 2019. Milch animals included indigenous cows, crossbred and exotic cows, and buffaloes. However, inter-period analysis indicated a significant decline in the milch animal population during 2015-16 to 2022-23 (between the 19th and 20th livestock censuses). Despite this decline, milk production achieved its highest growth rate in the same period. This could be attributed to increased bovine productivity, as dairy farmers prefer to retain elite animals while selling low-yielding ones. Higher milk productivity is also linked to technological interventions, particularly artificial insemination using elite germplasm. The total growth rate of artificial inseminations (AIs) performed in bovine species was 41.38%. The period 2000-01 to 2005-06 recorded the highest growth rate of AIs at 155.76%. This improvement can be largely credited to the expansion of veterinary infrastructure in the state. During the same period, veterinary institutions such as Government Veterinary Hospitals (GVHs) and Government Veterinary Dispensaries (GVDs) grew at rates of 14.59% and 20.39%, respectively.

Table 1: Growth trends in milch animals, milk production, artificial inseminations and veterinary institutions in Haryana during 1990-91 to 2022-23, (In percent)

Census	Milk production (Lakh tonnes)	Milch animals (In millions)	Total Ais (In millions)	Veterinary institutions (In number)	
				GVH	GVD
1990-91 to 1995-96	18.63	6.98	-9.97	10.30	26.51
1995-96 to 2000-01	19.55	14.09	-14.46	6.04	-0.70
2000-01 to 2005-06	9.26	-1.98	155.76	16.23	17.12
2005-06 to 2010-11	18.29	5.43	56.89	39.97	81.08
2010-11 to 2015-16	33.73	-	46.62	0.11	0.28
2015-16 to 2022-23	38.75	-18.97	19.81	10.50	0.06
Overall	21.19	1.68	41.38	14.59	20.39

Note: For milch animal estimation, census (1992, 1997, 2003, 2007, 2012 & 2019) data was used

Growth trends in number of dairy cooperative societies, membership and their milk procurement in Haryana

The growth trends in the number of dairy cooperative societies, membership, and milk procurement in Haryana during 1990-91 to 2022-23 are presented in Table 2. Dairy cooperative societies grew at an annual rate of 24.57%, while membership enrollment increased by 17.13% annually. Inter-period analysis revealed that the highest growth rates in the establishment of dairy cooperative societies and membership enrollment were achieved during

2000-01 to 2005-06. The number of dairy cooperatives and their membership directly influenced milk procurement in the study area. The highest growth rate in milk procurement through dairy cooperative societies was observed during 1995-96 to 2000-01. Overall, milk procurement through dairy cooperatives grew at a rate of 33.30%. Despite these advancements, the share of dairy cooperatives in the total milk production remains low due to the dominance of unorganized milk marketing channels in the state.

Table 2: Growth trends in number of dairy cooperative societies, membership and their milk procurement in Haryana during 1990-91 to 2022-23, (In percent)

Year	Milk procurement (Lakh litres)	Dairy Cooperative Societies (DCS)	Members of societies (In thousands)
1990-91 to 1995-96	27.12	11.16	2.37
1995-96 to 2000-01	132.50	13.28	0.00
2000-01 to 2005-06	45.48	49.31	43.93
2005-06 to 2010-11	27.73	33.27	16.47
2010-11 to 2015-16	-12.46	10.55	12.12
2015-16 to 2022-23	1.91	21.38	25.66
Overall	33.30	24.57	17.13

Milk production, consumption and marketed surplus among selected buffalo farmers

The average production, consumption, and marketed surplus of milk among buffalo farmers are presented in Table 3. On average, households produced 22.75 kg of milk per day. Of this, approximately 23.84% was consumed at the producer level, primarily as raw milk or processed into milk products such as curd, ghee, and paneer. The remaining 76.16%

constituted the marketed surplus, which was sold to non-producers through various milk marketing channels. Inter-group analysis revealed that Group III had the highest marketed surplus (82.66%), followed by Group II (72.79%) and Group I (58.01%). This trend can be attributed to the larger herd size of buffaloes maintained by Group III farmers compared to their counterparts.

Table 3: Production, consumption and marketed surplus of milk among Murrah buffalo farmers

S. No.	Particulars	Group-I	Group-II	Group-III	Overall
1	Milk production per household (In kg)	10.61 (100.00)	18.46 (100.00)	39.17 (100.00)	22.75 (100.00)
2	Milk consumption per household (In kg)	4.45 (41.99)	5.02 (27.21)	6.79 (17.34)	5.42 (23.84)
3	Marketed surplus of the milk (In kg)	6.15 (58.01%)	13.44 (72.79%)	32.38 (82.66%)	17.32 (76.16%)

Note: Figure in parenthesis shows percent to total milk production

Different milk marketing channels

Milk is a highly perishable commodity, requiring surplus milk to be disposed of as quickly as possible. There are two primary milk marketing channels: organized and

unorganized. In the present study, 68.33% of buffalo farmers preferred unorganized milk marketing channels, while 31.67% opted for organized channels to sell their surplus milk.

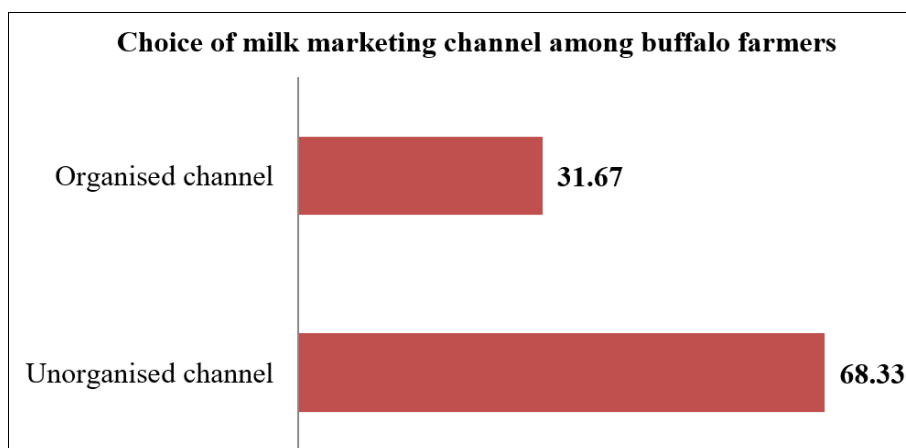


Fig 2: Shows choice of milk marketing channels among buffalo farmers

Reasons to choose different milk marketing channels

Organized marketing channels

The reasons for choosing organized milk marketing channels are presented in Table 5. The most significant reason, ranked first by buffalo farmers based on the highest Garret score, was the availability of a regular and assured market for disposing of surplus milk. Farmers emphasized that a secure and guaranteed market is essential for ensuring regular and sustainable income from milk production in the study area. Regular and timely payments ranked as the second most important reason, as these payments enable farmers to purchase necessary inputs for uninterrupted dairy activities. Government and private dairy cooperatives, as well as Farmer Producer Organizations (FPOs), were noted for providing consistent payments. Proximity to the dairy cooperative society emerged as the third most important reason, suggesting that farmers are more likely to participate in organized milk marketing channels when these facilities are located near their residences. Other notable reasons included dairy societies being run by known individuals, support in obtaining dairy farm loans, provision of veterinary services, supply of inputs at comparatively lower prices, transparency in quality checks, minimal price variations in milk, and a lack of alternative market options. These factors collectively underline the preferences of buffalo farmers for organized milk marketing channels in the study area.

Table 4: Reasons for opting organized milk marketing channels by buffalo farmers

Parameters	Mean score	Rank
Regular and assured market	72.00	1
Regular and timely payment	70.95	2
Society is near to my home	61.34	3
Society is run by my relative/friend/localite	55.39	4
Assistance in availing dairy farm loan	53.97	5
Provides veterinary services	49.92	6
Provides inputs at comparatively low price	45.32	7
Transparency in quality checks	38.13	8
Less variation in milk price	27.63	9
No other market options	19.21	10

Un-organized marketing channels

The important reasons for choosing unorganized milk marketing channels among Murrah and Nili-Ravi buffalo

farmers are presented in Table 6. Both categories of dairy farmers ranked doorstep milk collection as the primary reason for opting for unorganized milk marketing channels. This preference can be attributed to the fact that dairy farmers are often busy with agriculture and allied activities throughout the year. The second most important reason was the availability of advance payments for the purchase of farm inputs, which motivates farmers to sell surplus milk to unorganized channels in the study area. Regular and timely payments were ranked third by Nili-Ravi buffalo farmers and fourth by Murrah buffalo farmers as important reasons for choosing unorganized channels. Conversely, regular and assured markets were ranked third by Murrah buffalo farmers and fourth by Nili-Ravi buffalo farmers. Other factors, such as transparency in quality checks, less variation in milk prices, the familiarity and trustworthiness of vendors/processors, provision of inputs at lower prices, lack of strict quality checks, and no alternative market options, were ranked fifth through tenth in importance by both Murrah and Nili-Ravi buffalo farmers. These reasons collectively reflect the preferences of buffalo farmers for unorganized milk marketing channels in the study area.

Table 5: Reasons for opting un-organized milk marketing channels by buffalo farmers

Parameters	Mean score	Rank
Door step milk collection	70.12	1
Provide advance to purchase inputs	67.99	2
Regular and assured market	65.24	3
Regular and timely payment	63.30	4
Transparency in quality checks	50.73	5
Less variation in milk price	48.67	6
Vendor/processor is well known and trustworthy person	44.28	7
Provide input at comparatively low price	37.66	8
No strict quality checks	29.32	9
No other market options	18.17	10

Socio-economic determinants influence choice of milk marketing channels

The results of socio-economic determinants influencing buffalo farmers' choice of milk marketing channels are presented in Table 6. The findings indicate that parameters such as the age of the respondent, educational level of the farmer, land holdings, number of Murrah buffalo holdings, and marketed surplus of milk had a positive influence on

Murrah buffalo farmers' preference for selling surplus milk through organized milk marketing channels. On the other hand, variables such as family size showed a negative relationship with the preference for organized milk marketing channels in the study area. Age and educational

level of the buffalo farmers were found to be statistically significant. This implies that Murrah buffalo farmers in older age groups with higher education levels are more likely to prefer organized milk marketing channels for disposing of their surplus milk.

Table 6: Socio-economic determinants of buffalo farmers in choice of milk marketing channels

Parameters	Estimated coefficient	Standard error	P-value
Constant	-6.309	1.834	0.001
Age of the Murrah buffalo farmer (X_1)	0.101	0.028	0.000**
Educational level of the respondents (X_2)	0.485	0.159	0.002**
Family size of Murrah farmer (X_3)	-0.263	0.154	0.088
Number of Murrah buffalo holdings (X_4)	0.131	0.100	0.192
Land holding size (X_5)	0.214	0.139	0.125
Marketed surplus of milk (X_6)	0.011	0.020	0.589

Note: * * indicates significant at 5% level.

Agribusiness Innovation Strategies to Strengthen Milk Marketing Channels in the State

Strengthening milk marketing channels in the state requires a comprehensive set of innovative strategies to address existing challenges and enhance efficiency. The following approaches are proposed:

- **Encouraging Participation in Organized Milk Marketing Channels:** Incentives for farmers are essential to encourage their participation in organized milk marketing systems such as cooperative societies and private-sector milk unions. Financial support, quality-based bonuses, and additional payments based on milk fat content or volume will motivate farmers to prefer formalized channels over unorganized ones. This shift is expected to improve price realization and promote the sustainability of cooperative societies.
- **Offering Doorstep Veterinary Services:** Farmers benefit significantly from the availability of high-quality inputs such as feed, fodder, and veterinary medicines at milk collection centers. Mobile veterinary units, equipped with modern tools and staffed by skilled professionals, ensure prompt animal healthcare, improving productivity and reducing economic losses.
- **Establishing Input Supply at Milk Collection Centers:** Farmers benefit significantly from access to high-quality inputs such as cattle feed, fodder seeds, mineral mixtures, and veterinary medicines at milk collection centers. This initiative reduces logistical challenges, enhances productivity, and ensures timely availability of essential resources.
- **Integrating Digitization into Milk Marketing Operations:** Modernizing milk marketing channels through digitization improves transparency and operational efficiency. Measures such as introducing mobile apps for price updates, milk collection schedules, and digital payment systems foster trust and streamline processes. Blockchain technology can further ensure quality control by tracing milk along the supply chain.
- **Promoting Public-Private Partnerships for Feed Material Supply:** Collaborative efforts between the public and private sectors ensure the steady supply of affordable and quality feed materials. Partnerships with private companies specializing in feed production can result in cost-effective solutions for dairy farmers,

ensuring consistent availability.

- **Implementing Capacity Building Programs in convergence mode:** Capacity-building programs in convergence mode aim to enhance the knowledge, skills, and practices of dairy farmers by integrating resources and expertise from various stakeholders such as government agencies, Krishi Vigyan Kendras (KVKs), NGOs, private organizations, and educational institutions. These programs focus on practical training in animal husbandry, feeding practices, value addition, and quality control, with a special emphasis on empowering women and smallholder farmers. Customized training modules, exposure visits to model dairy farms, and the use of digital tools like mobile apps and video demonstrations make the programs more accessible and impactful. Additionally, these initiatives strengthen Farmer Producer Organizations (FPOs) and promote compliance with quality standards, enabling farmers to access premium markets and achieve sustainable growth in dairy farming.
- **Strengthening Regulatory Frameworks to Prevent Adulteration:** Establishing robust regulatory mechanisms ensures the quality and safety of milk marketed through formal channels. Regulatory bodies equipped with advanced monitoring systems will detect and penalize adulteration and unethical practices, safeguarding consumer trust and farmer livelihoods.
- **Improving Organizational and Credit Linkages:** Enhanced coordination between farmers, cooperatives, and financial institutions facilitates access to low-interest loans and subsidies. Financial support for acquiring improved livestock breeds, constructing modern dairy sheds, and adopting advanced technologies contributes to increased productivity.
- **Developing Cold Chain Infrastructure:** Investments in cold storage facilities, insulated transport vehicles, and milk chilling units at collection centers reduce spoilage and maintain product quality. Expanding milk collection centers in remote areas enables greater participation of small-scale farmers.
- **Encouraging Production of Value-Added Dairy Products:** Processing milk into value-added products such as cheese, yogurt, and paneer creates additional revenue streams. Farmers and cooperatives benefit from skill development programs focusing on production

techniques, branding, and marketing strategies tailored to consumer preferences.

- **Supporting Women's Role in Dairy Farming:** Programs tailored to empower women in dairy farming are vital. Training initiatives, access to credit, and recognition of women's contributions foster their active involvement and improve household income.
- **Establishing Dairy Hubs:** Centralized hubs equipped with resources such as feed banks, healthcare services, and advisory centers address multiple farmer needs in one location. These hubs serve as innovation and knowledge-sharing platforms for the dairy sector.
- **Adopting Community-Based Milk Marketing Models:** Encouraging community-led milk marketing systems enhances farmers' collective bargaining power and reduces dependence on intermediaries. This approach fosters a sense of ownership and mutual cooperation among farmers.
- **Integrating Renewable Energy Solutions:** Eco-friendly technologies such as biogas plants and solar-powered milk chillers reduce operational costs and promote sustainable dairy practices. Renewable energy solutions contribute to long-term environmental and economic benefits.
- **Establishing Market Intelligence Systems:** Access to real-time data on milk prices, demand trends, and consumer preferences allows farmers to make informed decisions about production and marketing. Market intelligence systems also support cooperatives in optimizing their operations.
- **Introducing Livestock Insurance Schemes:** Affordable insurance schemes protect farmers from financial losses caused by diseases, accidents, or natural disasters. Coverage for livestock ensures stability and minimizes risks associated with dairy farming.

These strategies collectively aim to enhance the efficiency, inclusivity, and sustainability of milk marketing channels, ensuring long-term benefits for both farmers and consumers.

Conclusion

This study highlights several critical policy implications for promoting sustainable agribusiness innovation in milk marketing channels for buffalo farmers in Haryana. Strengthening organized milk marketing channels requires policymakers to prioritize the expansion of dairy cooperatives and Farmer Producer Organizations (FPOs) in rural areas, ensuring greater accessibility for farmers. Financial incentives such as subsidies or low-interest loans for the establishment of dairy processing units could further encourage farmers to participate in formal milk marketing systems. Given farmers' preference for doorstep milk collection, improving infrastructure and logistics within these channels is essential. Establishing collection centers closer to farms and offering regular pick-up services would address logistical challenges, making organized milk marketing more appealing. Enhancing cold storage and chilling facilities would also improve the quality and shelf life of milk, making formal markets a more attractive option for farmers. Recognizing the importance of financial stability, policies should provide revolving funds or credit facilities linked to dairy cooperatives. Offering regular

payments and advances for farm inputs ensures a steady cash flow, allowing farmers to invest in their dairy operations. Furthermore, implementing education and training programs that focus on the benefits of organized marketing channels and improving management practices would play a pivotal role. Given the correlation between education and the preference for organized markets, such initiatives could drive higher adoption rates of formal milk marketing systems. Strengthening the regulatory framework is crucial to ensuring quality assurance, standardized pricing, and transparency in milk markets. This would build trust among farmers, encouraging more participation in organized milk marketing channels. Additionally, integrating support services such as veterinary care, farm loans, and the provision of farm inputs within dairy cooperatives or FPOs would improve the productivity and profitability of buffalo farmers. Adopting these strategies will enable policymakers to foster agribusiness innovations that enhance the sustainability of milk marketing channels, ultimately benefiting both buffalo farmers and the dairy industry in Haryana.

Acknowledgement

All the authors thank Director, ICAR-Central Institute for Research on Buffaloes, Hisar for support and financial help to conduct research.

References

1. Garrett EH, Woodworth RS. Statistics in Psychology and Education. Bombay: Vakils, Feffer and Simons Pvt. Ltd.; c1969.
2. Government of Haryana. Statistical Abstract of Haryana: 1990-91 to 2022-23. Department of Economic and Statistical Affairs, Government of Haryana; c1991-2023.
3. Government of Haryana. Integrated Sample Survey Report (ISSR) 2022-23. Department of Animal Husbandry and Dairying, Government of Haryana; c2023.
4. Government of India (GoI). 15th to 20th Livestock Census. Department of Animal Husbandry and Dairying, Ministry of Agriculture; c1992-2019.
5. Government of India (GoI). Estimated Livestock Population breed wise. Department of Animal Husbandry and Dairying, Ministry of Agriculture; c2019.
6. Government of India (GoI). Basic Animal Husbandry Statistics 2024. Ministry of fisheries, animal husbandry and Dairying; c2024. Available from: <http://www.dahd.nic.in> [cited 2025 Apr 24].
7. Karli B, Bilgi A, Gill Y. Factors affecting farmers decision to enter agricultural cooperatives using Random Utility Model in the South Eastern Anatolian Region of Turkey. J Agric Rural Dev Trop Subtrop. 2006;107(2):115-127.
8. Kumar A, Parappurathu S. Economics of dairy farming and marketing: micro-level perspectives from three major milk producing states of India. Indian J Anim Sci. 2014;84(2):204-209.
9. Kumar A, Staal SJ, Singh DK. Smallholder dairy farmers' access to modern milk marketing supply chain in India. Agric Econ Res Rev. 2011;24:243-253.

10. Kumar M, Dahiya SP, Ratwan P, Kumar S, Chitra A. Status, constraints and future prospects of Murrah buffaloes in India. *Indian J Anim Sci.* 2019;89(12):1291-1302.
11. National Dairy Development Board (NDDB). *nddb.coop*. [cited 2025 Apr 24]. Available from: <https://www.nddb.coop/information/stats/milkprodstate>.
12. Priscilla L, Chauhan AK, Lalrinsangpuii, Nagrale BG. Determinants of participation of dairy farmers in dairy cooperative societies in Manipur. *Indian J Econ Dev.* 2016;12(2):377-379.