IMPACT ASSESSMENT OF JHARKHAND STATE COOPERATIVE MILK PRODUCERS' FEDERATION ON SOCIO-ECONOMIC STATUS OF DAIRY FARMERS

THESIS SUBMITTED TO THE
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL
(DEEMED UNIVERSITY)
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

AGRICULTURAL EXTENSION EDUCATION

BY

KALYAN MANDI

M.Sc. (Agricultural Extension Education)

DIVISION OF DAIRY EXTENSION
ICAR- NATIONAL DAIRY RESEARCH INSTITUTE
(DEEMED UNIVERSITY)
KARNAL-132001 (HARYANA), INDIA

2022

Regn. No. 18-P-DX-02

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Approved by:

26/7/2022
(EXTERNAL EXAMINER)

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This is to certify that the thesis entitled, **"IMPACT ASSESSMENT OF JHARKHAND STATE COOPERATIVE MILK PRODUCERS' FEDERATION ON SOCIO-ECONOMIC STATUS OF DAIRY FARMERS"**, submitted by **Mr. KALYAN MANDI** in partial fulfillment of the requirements for award of the degree of **DOCTOR OF PHILOSOPHY** in **AGRICULTURAL EXTENSION EDUCATION** of the **ICAR-NATIONAL DAIRY RESEARCH INSTITUTE (Deemed University), Karnal (Haryana),** India, is a *bona fide* research work carried out by him under my supervision and no part of the thesis has been submitted for any other degree or diploma.

Ritu Chakravarty

(RITU CHAKRAVARTY)
MAJOR ADVISOR/GUIDE
&
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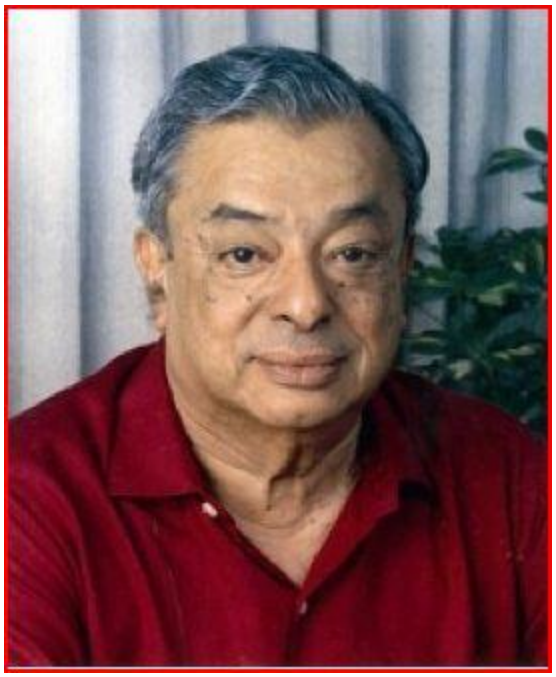
Dated: 04/02/2022

DEDICATED

TO



Dr. Verghese Kurien

(26 Nov 1921 - 9 Sep 2012)

Father of White Revolution in India

ACKNOWLEDGEMENT

Behind every success of each person there are many known and unknown helping hands and it is always a matter of pleasure to remember and thank them at the end. I have encountered so many people from all over India who have made these years exciting and fun, besides making bits and pieces of invaluable contribution, of which this work is the final outcome.

It is a matter of esteemed and profound immense pleasure to express deep sense of gratitude emanating from the innermost core of my heart to my Major Advisor cum Guide ***Dr. Ritu Chakravarty****, Senior Scientist, Dairy Extension Division, for her worthy guidance, valuable suggestions, unreserved help, constant encouragement, affection and, gentle and caring attitude throughout the period of study. Actually no words are enough to express my gratitude to my mentor for her meticulous supervision, moral support and giving me complete freedom to move on. I personally feel myself very fortunate and lucky to have got opportunity to work under her guidance.*

I would like to convey my regards and sincere thanks to my advisory committee members ***Dr. K. S. Kadian*** *(Principal Scientist & Head, Dairy Extension),* ***Dr. K. Ponnusamy*** *(Principal Scientist, Dairy Extension)* ***Dr. A. K. Dixit*** *(Principal Scientist, Dairy Economics Statistics and Management),* ***Dr. Magan Singh*** *(Senior Scientist, Agronomy),* ***Dr. A. K. Misra*** *(Head cum Principal Scientist, Livestock Production & Management) for their keen interest, valuable suggestions and critical appraisal throughout the research work.*

I also express my gratefulness to ***Dr. M. S. Chauhan*** *(Director & Vice-Chancellor, NDRI, Karnal), for providing the necessary research and academic facilities required for my study and research work. I also acknowledge ICAR as well as UGC for timely providing me scholarship.*

I would gratefully acknowledge the faculty and staff of Dairy Extension Division, NDRI, Karnal, ***Dr. K. S. Kadian****,* ***Dr. S. K. Jha****,* ***Dr. Gopal Sankhala****,* ***Dr. K. Ponnusamy****,* ***Dr. B. S. Meena****,* ***Dr. H. R. Meena****,* ***Dr. Jancy Gupta****,* ***Dr. Sanjit Maiti****,* ***Dr. Sanchita Garai****,* ***Dr. Asif Mohammad****,* ***Dr. M. C. Arunmozhi Devi*** *and* ***Dr. S. Subash*** *for their valuable suggestions and help rendered during entire period of my research work at NDRI, Karnal.*

I express my heartfelt thanks to ***Mrs. Anjana, Mr. Ravinder, Mr. Veerbhan*** *and other technical and non-technical staffs of Dairy Extension for their timely help and kind cooperation during the entire period of my research work at NDRI, Karnal.*

My profound accolade to my senior colleagues ***Abul Sir, Chandan Sir, Dasharath Sir, Mahesh Tengli Sir, Ashok Sir, Mukesh Sir, Manish Sir, Smitha Mam, Ramya Mam, Neelamadhab Sir, Vikas Sir, Pawan Sir, Sunil Sir, Manisha Mam, Shrija Mam*** *who helped me in every way when I was in need of their help. My heartfelt thanks to my*

lovely and talented juniors ***Deepak, Surjyo, Waris, Kalla Ashok, Manjunath, Amandeep, Sourabh, Sharath*** *and lot many others whom I am unable to recall by names but recognize by face.*

I am truly thankful to the classmates and friends ***Kushboo, Ditty, Elizabeth, Alagu, Gayatri, Shiv, Santhya, Ruchi Mam, Shyam Sir, Manu Sir*** *for their kind support and help whose loving company and magnanimous help throughout my stay at N.D.R.I, made it extremely joyful. The moments spend with them is captured in my heart forever.*

No task is difficult if you have well-wishers and friends like ***Dr. Narendra, Dr. Neelamani Sir, Dr. Koloi, Dr. Gopal, Dr. Tarun, Dr. Sanjay Howal, Dr. Ingle Sir, Dr. Anup, Phool, Diwakar, Shamim, and Dr. Surya*** *for boosting my morale high during the most frustrating times of Ph.D. study. You all provided such wonderful company and made my stay in NDRI a pleasant experience.*

I must not forget to owe my thanks to ***Mr. S. K. Singh (MD, JMF)*** *and also my respondents who enthusiastically interacted and shared their experiences, ideas and knowledge; I needed for this field survey. I owe my sincere thanks to my cousin brother* ***Babulal Mandi,*** *for treading miles together with me during data collection.*

*This dissertation will not be complete in any respect if I don't express my sincere and heartfelt sense of reverence to my beloved parents "****Aayo and Baba****" for giving birth to me at the first place and providing me unconditional moral support, love and blessings throughout my life. I would also like to thank my all-time source of inspiration, my younger brother* ***Dr. Milan Mandi.*** *This accomplishment would not have been possible without them.*

Last but not the least; I would bow down to the feet of the divine grace almighty "GOD" without whose blessing this small piece of work would never have seen the light of day.

Place: Karnal

Kalyan Mandi

Date: 4/02/2022 ***(Kalyan Mandi)***

ABSTRACT

The present research study was designed to assess the overall impact of Jharkhand State Cooperative Milk Producers' Federation on socio-economic status of dairy farmers. Out of, the total 14 districts, covered by JMF, the districts had been first classified into High (More than 1000), Medium (500 to 999) and Low (1 to 499) categories based on the size of member-producers available in the districts. From each category one district was purposively selected based on the highest number of member producers, BMCs and MPPs available. From each district, one BMC was randomly selected, again three MPPs under each BMCs were randomly selected, wherein 20 members and 20 non-members were randomly selected from each MPP. Therefore, a total of 360 respondents (i.e. 180=members and 180=non-members) were selected from the study area. Major findings revealed that, assured market for milk and milk products, better price realization and competitive advantage in marketplace were the major extrinsic motivational factors; whereas voluntary participation and democratic control, expectation for equal treatment among members were major intrinsic motivational factors which influenced farmers' decision to join dairy cooperative. It was evident from the study, that dairy animals reared by members showed better reproductive, productive and health performance since they adopted better dairy management practices. The impact of JMF on socio-economic status of dairy farmers using Propensity Score Matching (PSM) method revealed that farmers' participation in JMF has a positive and statistically significant influence on milk yield, net dairy income and marketable surplus while having no negative impact on household milk consumption. Cooperative pricing, on the other hand, are lower than open market prices as non-members reaped better milk price than the members. Further, SWOT analysis using Analytical Hierarchy Process (AHP) prioritized key problems and prospects of JMF at different supply chain levels (viz. procurement, processing, productivity enhancement and marketing).

सारांश

वर्तमान शोध अध्ययन को डेयरी किसानों की सामाजिक-आर्थिक स्थिति पर झारखंड राज्य सहकारी दुग्ध उत्पादक संघ के समग्र प्रभाव का आकलन करने के लिए डिज़ाइन किया गया था। जेएमएफ द्वारा कवर किए गए कुल 14 जिलों में से, जिलों को पहले उपलब्ध सदस्य-उत्पादकों के आकार के आधार पर उच्च (1000 से अधिक), मध्यम (500 से 999) और निम्न (1 से 499) श्रेणियों में वर्गीकृत किया गया था। जिलों। प्रत्येक श्रेणी से एक जिले को सदस्य उत्पादकों, बीएमसी और एमपीपी की सबसे अधिक संख्या के आधार पर जानबूझकर चुना गया था। प्रत्येक जिले से, एक बीएमसी को यादृच्छिक रूप से चुना गया था, फिर से प्रत्येक बीएमसी के तहत तीन एमपीपी को यादृच्छिक रूप से चुना गया था, जिसमें प्रत्येक एमपीपी से 20 सदस्यों और 20 गैर-सदस्यों को यादृच्छिक रूप से चुना गया था। अतः अध्ययन क्षेत्र से कुल 360 उत्तरदाताओं (अर्थात 180=सदस्य और 180=गैर-सदस्य) का चयन किया गया। प्रमुख निष्कर्षों से पता चला है कि, दूध और दूध उत्पादों के लिए सुनिश्चित बाजार, बेहतर मूल्य प्राप्ति और बाजार में प्रतिस्पर्धात्मक लाभ प्रमुख बाहरी प्रेरक कारक थे; जबकि स्वैच्छिक भागीदारी और लोकतांत्रिक नियंत्रण, सदस्यों के बीच समान व्यवहार की अपेक्षा प्रमुख आंतरिक प्रेरक कारक थे जिन्होंने किसानों के डेयरी सहकारी में शामिल होने के निर्णय को प्रभावित किया। अध्ययन से यह स्पष्ट था कि सदस्यों द्वारा पाले गए डेयरी जानवरों ने बेहतर प्रजनन, उत्पादक और स्वास्थ्य प्रदर्शन दिखाया क्योंकि उन्होंने बेहतर डेयरी प्रबंधन प्रथाओं को अपनाया था। प्रवृत्ति स्कोर मिलान (पीएसएम) पद्धति का उपयोग करते हुए डेयरी किसानों की सामाजिक-आर्थिक स्थिति पर जेएमएफ के प्रभाव से पता चला कि जेएमएफ में किसानों की भागीदारी का दूध उपज, शुद्ध डेयरी आय और विपणन योग्य अधिशेष पर सकारात्मक और सांख्यिकीय रूप से महत्वपूर्ण प्रभाव पड़ता है, जबकि इसका कोई नकारात्मक प्रभाव नहीं पड़ता है। घरेलू दूध की खपत। दूसरी ओर, सहकारी मूल्य निर्धारण खुले बाजार की कीमतों से कम है क्योंकि गैर-सदस्यों को सदस्यों की तुलना में बेहतर दूध की कीमत मिलती है। इसके अलावा, विश्लेषणात्मक पदानुक्रम प्रक्रिया (एएचपी) का उपयोग करते हुए एसडब्ल्यूओटी विश्लेषण ने विभिन्न आपूर्ति श्रृंखला स्तरों (जैसे खरीद, प्रसंस्करण, उत्पादकता वृद्धि और विपणन) पर जेएमएफ की प्रमुख समस्याओं और संभावनाओं को प्राथमिकता दी।

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LIST OF ABBREVIATIONS

BCS	:	Body Condition Score
BEP	:	Break Even Point
BMC	:	Bulk Milk Coolers
BMPCUL	:	Bangladesh Milk Producers' Cooperative Union Limited
CAGR	:	Current Annual Growth Rate
DC	:	Dairy Cooperatives
DCS	:	Dairy Cooperative Societies
FAO	:	Food and Agriculture Organization
GI	:	Gastrointestinal Tract
GIS	:	Geographic Information System
GoI	:	Government of India
JMF	:	Jharkhand State Cooperative Milk Producers' Federation
KIOSK	:	Kommunikasjon Integrert Offentlig Service Kontor
KMF	:	Karnataka Cooperative Milk Producers' Federation Limited
LLPD	:	Lakh Litres per Day
MILMA	:	Kerala Co-operative Milk Marketing Federation
MPP	:	Milk Pooling Point
NDDB	:	National Dairy Development Board
NDP	:	National Dairy Plan
OIE	:	Office International des Epizooties
SWOT	:	Strength, Weakness, Opportunity, Threat
U.S.A	:	United States of America
PSM	:	Propensity Score Matching
AHP	:	Analytical Hierarchy Process
ADO	:	Agricultural Development Officer
BDO	:	Block Development Officer
DDO	:	District Development Officer
VO	:	Veterinary Officer
KVK	:	Krishi Vigyan Kendra
SAU	:	State Agricultural University
RBQ	:	Rank Based Quotient
TNAU	:	Tamil Nadu Agricultural University

CI	:	Consistency Index
RI	:	Random Index
CR	:	Consistency Ratio
NABARD	:	National Bank for Agriculture and Rural Development
BAIF	:	Bharatiya Agro Industries Foundation
BASIX	:	Bhartiya Samruddhi Investments and Consulting Services
A.I	:	Artificial Insemination
GoI	:	Government of India
KVK	:	Krishi Vigyan Kendra
N.S	:	Natural Service
NDDB	:	National Dairy Development Board
NGOs	:	Non-Governmental Organizations
SAU	:	State Agriculture University
SHG		Self Help Group
State AH & VS Dept.	:	State Animal Husbandry and Veterinary Services Department
VLDA	:	Veterinary Livestock Development Assistant
VLW	:	Village Level Workers
VEO	:	Village Extension Officer

CHAPTER –1

Introduction

INTRODUCTION

"The greatest satisfaction and joy came from the priceless reward that comes when farmers whose lives depend on your efforts appreciate what is being done for them."

-Verghese Kurien, I Too Had a Dream

India is popularly recognized as the oyster of global dairy Industry. India has surpassed the United States as the world's greatest milk producer, accounting for 22.29 per cent of worldwide output. India's overall bovine population is estimated to be 302.79 million, with 192.49 million cattle and 109.85 million buffalo, making it a global leader in milk production (Livestock Census 2019, DAHD&F). India's milk output grew from 17 million tonnes in 1950-51 to 187.96 million tonnes in 2018-19. The country's per capita milk availability grew from 130 grams per day in 1950-51 to 394 grams per day in 2018-19, compared to the world's estimated average consumption of 294 grams per day in 2017. This suggests that the supply of milk and milk products will continue to rise in order to meet the demands of our growing population. Agriculture and related industries contribute for 17.8 per cent of India's gross value added (GVA), while livestock accounts for 4.19 per cent (Economic Survey, 2019-20). At current rates, the value of livestock output was ₹8,11,847 with the milk group contributing around ₹5,49,587 (in crores) (National Account Statistics,2017). In both rural (₹116.38) and urban (₹187.14) areas, per capita monthly expenditure on milk and milk products is rising (NSSO, 2012). Milk demand is predicted to grow at a CAGR of 5 per cent from 138 million tonnes in 2014 to 200 million tonnes in 2022, according to the National Dairy Development Board. Liquid milk is the most important component of India's dairy market. According to Dairy India (2017), liquid milk accounts for roughly 58 per cent of the entire market value (Gupta, 2017). The most essential institutional arrangement for speeding dairy development in India is cooperative development, which is commonly recognised as the most crucial institutional arrangement. Cooperative milk unions encompassed over 1,94,000 village dairy cooperative societies (DCS) with a total membership of 17.22 million milk producers during the year (2019-20) (NDDB, 2018-19).

Milk is one of the dairy industry's main products, and the majority of the milk produced in the country is produced by small and marginal farmers coupled with landless labourers. For the vast majority of India's population, milk and milk products remain a primary source of high-quality protein and essential minerals. Milk is the ideal food for humans, as created by nature. Milk is made up of 87 per cent water and 13 per cent solid matter. Due to its rich protein, fat, and mineral content, it is considered a virtually complete food. There is no single food that can completely replace milk in a diet while providing the same benefits. Milk and milk products are essential components of a healthy diet, especially for vulnerable populations such as infants, school-aged children, and the elderly. Apart from breast milk, milk is an important source of nutrients for infants and babies. Indeed, dairy consumption has lately been linked to health benefits that are direct antitheses to the diseases and complications associated with overweight and obesity.

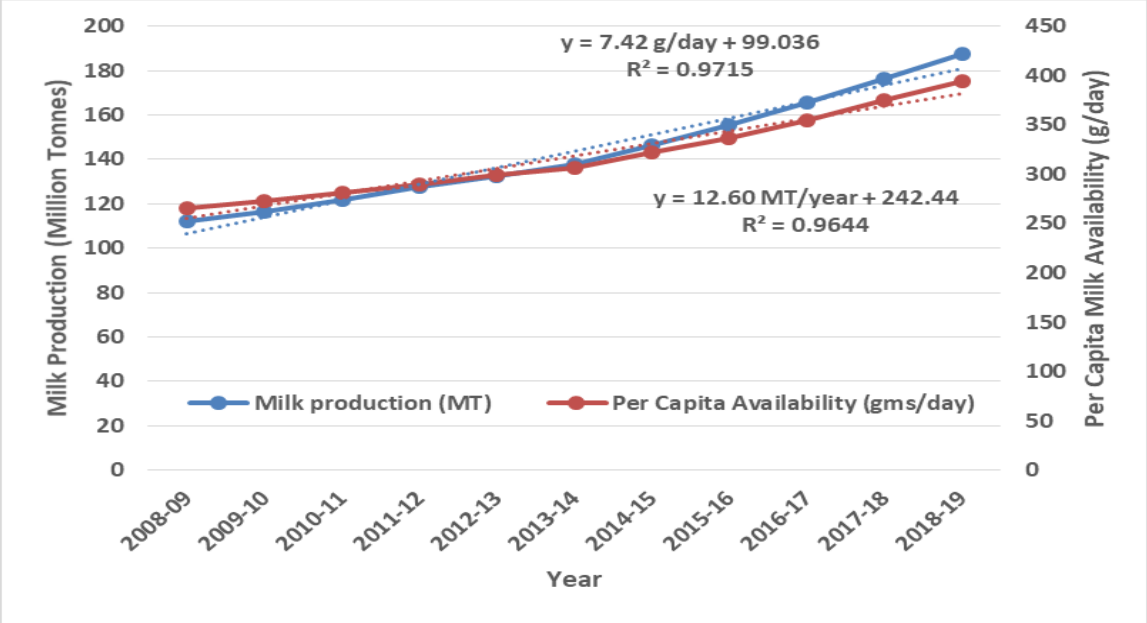


Fig 1.1 Annual Production and Per Capita Availability of Milk in India (NDDB, 2019)

Dairy farming is very important in India's rural economy. Dairy farming is more than just a business in India; it has deeper social and economic implications. Dairy farming employs around 70 million rural households, with women playing an important role in one out of every two rural homes. According to the "Situation Assessment Survey," the livestock sector contributes roughly 26 per cent of rural income to the poorest households and about 12 per cent of overall rural income.

Furthermore, animal ownership has been found to be more egalitarian than land ownership, with 85 per cent of marginal and small Indian farmers owning only 45 per cent of farm land but 75 per cent of bovines. Although dairying requires more labour than crop production, it provides a financially rewarding outlet for family labour. Dairy farming is becoming more popular as a side business for farmers due to availability of labour and a small land base. Furthermore, it not only provides a source of money for rural communities, but it also ensures the family's nutritional security by tackling concerns like malnutrition. Dairy-owning households in rural areas eat approximately three times more milk than non-dairy-owning families, according to studies (GoI, 2018). Dairy farming thus provides not only nutrition to the country's enormous population, but also opportunity for farm families, processors, and other dairy value chain partners. This also means that milk and milk products will be more readily available to our rising population.

Operation Flood and the Cooperative Dairy Sector in India

Operation Flood, which spanned from 1970 to 1996, created the groundwork for India's dairy industry to flourish. It prepared the way for new initiatives and the establishment of new conditions to help India maintain its global leadership in milk production. Microfinance and self-help groups, as well as agricultural cooperatives, such as those in the fertilizer and sugar industries, are all key rural development initiatives in India. The creation of dairy cooperatives is one strategy to boost the income and nutrition of the rural poor. "A cooperative is, in general, a business owned and democratically controlled by the people who utilize its services, with advantages derived and distributed equally on the basis of use" (Frederick, 2012). Cooperatives are defined by the Rochedale principles of voluntary and open membership, democratic member control, member economic involvement, autonomy and independence, education, training and information, cooperative cooperation and community concern (Frederick, 2012). Farmers' bargaining power has been found to be strengthened by cooperatives, which have been found to minimize transaction costs, increase information symmetry, and improve agro food safety and quality standards (Trebbin, 2014; Jia *et al.*, 2012; Moustier *et al.*, 2010; Hellin *et al.*, 2009; Markelova *et al.*, 2009; Valentinov, 2007; Holloway *et al.*, 2000). The dairy industry uses cooperative business structures all around the world. Due to the perishability of milk, the expenses of timely delivery

and processing are significant. As a result, cooperatives are seen as a successful approach to enhance producers' position against buyers and processors in an oligopolistic market system.

Since 1970, India has supported dairy cooperatives as part of Operation Flood (OF), a government-sponsored policy initiative. In the early years after independence, attempts to modernize India's dairy sector failed. Many smallholders lacked access to metropolitan markets, and most production programmes favored urban producers. Government organizations encouraged superior breeds and artificial insemination, but farmers had no motivation to raise production without guaranteed viable markets (Candler and Kumar, 1998). The prosperous Kaira District Cooperative Milk Producers Union, popularly known as Anand, rose to prominence against this backdrop. In 1946, it was created by a group of Gujarati milk producers who sought to sell their product in Bombay. With political support, the cooperative grew swiftly and became a model for dairy cooperatives across India (Verhagen, 1990).

The National Dairy Development Board (NDDB) was founded by the Government of India (GoI) in 1965 with the purpose of extending the "Anand-model" throughout India. This agency was in charge of forming cooperatives and assisting farmers with planning, farmer extension services, engineering, dairy technology, veterinary services, and nutrition. As a result, Operation Flood was conceived as a large-scale policy initiative targeted at developing a cooperative dairy selling system across the country in order to boost milk output and rural household incomes. Operation Flood must also be viewed in the perspective of a macroeconomic import substitution policy coupled by strong dairy protection measures. A price increase in the local market was prevented by changing the supply curve of dairy products to a higher level, and prices eventually fell toward international market values (Candler and Kumar, 1998).

Operation Flood was carried out in three stages and substantially scaled up from 1970 to 1996. It was developed by the Government of India (GoI) and the National Dairy Development Board (NDDB) with financial and technical aid from foreign institutions such as the European Union (EU), the World Bank, and the Food and Agriculture Organization (FAO) of the United Nations. The proceeds from the sale of dairy commodity food aid provided by the EU were utilized to fund

Operation Flood (Cunningham, 2009; Singh and Pundir, 2000; Rajendran and Mohanty, 2004). The initial phase concentrated primarily on four major cities: Mumbai, Kolkata, Delhi, and Chennai. In the subsequent phase, the geographical reach was increased to 147 large Indian cities, and the cooperative marketing networks finally encompassed nearly the entire country. The number of federations, unions, and village-level cooperative societies expanded dramatically during the implementation of Operation Flood. Simultaneously, infrastructure for obtaining and processing milk was enhanced, and cooperative members were given access to veterinary services, feed, and artificial-insemination services (Singh and Pundir, 2000).

The Anand Model

The three-tier organizational structure of the Anand cooperative is referred to as the "Anand model" or "Anand pattern." Primary producers are organized into "Dairy Cooperative Societies" (DCS) at the local level. They primarily serve as a collection place for milk produced by a single hamlet. The fat percentage of each producer's milk is checked at the DCS, and payment is made on a weekly or fortnightly basis. DCS are linked to district cooperative unions at the second tier, which are involved in milk processing and final product packaging. In addition, most unions provide services to producers such as cattle feed, artificial insemination, and veterinary services. District unions are organized into federations at the state level, which are responsible for marketing and coordination (Verhagen, 1990; Rajendranand Mohanty, 2004).

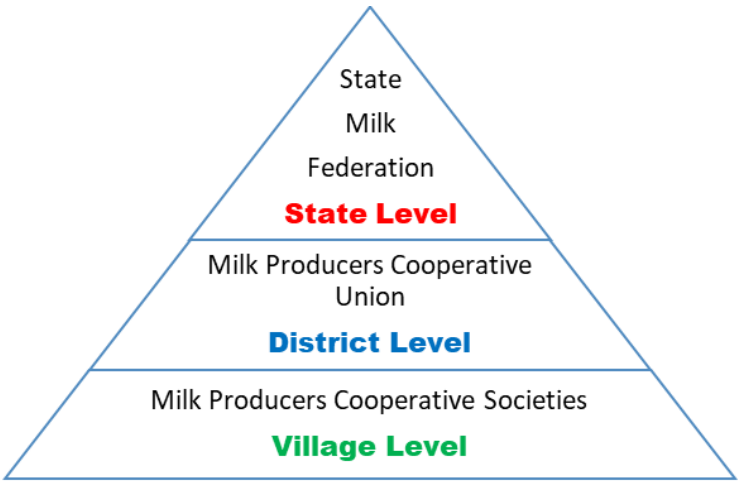


Fig 1.2 Three tier Structure of Dairy Cooperatives in India (Source: NDDB, 2019)

India's dairy development has been hailed as one of the most successful development programmes in the world. The co-operatives were intended to be the major vehicle for implementing dairy development programmes across the country. Much of the success of India's "White Revolution" can be attributed to the cooperative framework of dairy development strategies. Dairy cooperatives (DCs) are governed on the principle of collective action, which is meant to be inclusive and participatory. It is believed that it will help smallholder farmers participate in milk markets, leading to higher production and productivity and, as a result, increased income and welfare for farmers. Farmers' integration with cooperatives has benefited farmers, according to several studies, and has served as a catalyst for integrating Indian dairy smallholders to domestic and worldwide markets (Birthal *et al.,* 2007, 2009; Candler and Kumar, 1998; Cunningham, 2009; Kumar, 2010). Farmers can work together to create their own collection system and processing facilities, ensuring a stable market and fair prices (Birchall, 2004; Uotila and Dhanapala, 1994). Dairy farming involves a high level of market dependence as well as socio-economic values (Bor, 2014), and DCs assist dairy farmers in vertically integrating to counter oligopolistic power in distribution and retailing (Van der Krogt, Nilsson and Høst, 2007) by organizing dairy supply chains with better strategic logistics between production, processing, and distribution (Berre *et al.,* 2014) in emerging markets (D'antoni and Mishra, 2012), and reducing financial risk and economic uncertainty faced by members in mature markets (Maynard, 2009) due to increasing volatility in milk and feed prices (Wolf and Widmar, 2014) and paying dairy farmers the milk price at levels that far exceeds market prices (Charlebois and Labrecque, 2009), when markets are volatile or even depressed (Yoo, Buccola and Gopinath, 2013) through democratic governance structure controlled by dairy farmers and managed by employees with appropriate skill sets, which help maximize returns and minimize costs of processing inputs, thereby reducing transaction costs (Labrecque, Dulude and Charlebois, 2015).

The success of the dairy business has stemmed from an integrated cooperative system of milk collecting, transportation, processing, and distribution of various dairy products, as well as profit sharing with farmers. The Government of India (GoI) has promoted dairy cooperatives (DCs) through financial and policy support from the launch of Operation Flood in 1970. The National Dairy

Development Board (NDDB) continued to lobby state governments to change legislation that would allow DCs to operate as true social enterprises that help small and marginal dairy producers. Falling milk prices spurred DCs to expand their milk procurement and stockpiles of conserved milk commodities. Despite the worldwide market recession, better procurement prices for dairy cooperatives, and a reduction in procurement volume by major commercial players, milk collection by dairy cooperatives surged by nearly 11 per cent. Dairying has become an important source of income for small and marginal farmers due to increased rainfall uncertainty and its negative impact on crop productivity. Despite the fact that the average production of milk from cattle and buffalo in India is 4.65 kg per day, much lower than in dairy developed nations, DCs buy as little as one litre of milk from members and offer them with a guaranteed market for selling milk. Milk producers are ensured a fair price because the price paid for milk collected from them is determined by the quality of the milk, which is determined at the milk collection centre. DCs provide services such as artificial insemination (AI), the supply of cattle feed and mineral mixtures, and dissemination of knowledge on improved dairy management practises, all of which help milk producers boost productivity, reduce expenses, and increase milk production profits.

Table 1.1 Region-wise Comparison of Dairy Cooperative Societies in India

Sl. No.	Particulars	North	West	South	East	Total
1	Dairy Cooperative Societies (in nos.)	67710	52289	38402	35794	194195
2	Producer Members (in '000)	3009	5808	6533	1866	17216
3	Milk Procurement (in thousand kg/day)	5358	25914	14094	2669	48035
4	Liquid Milk Marketing (in thousand litres/day)	12101	11399	10275	3302	37077
5	Bulk Milk Coolers (TL)	8142	20682	11183	3423	43430
6	Chilling Centre (TLPD)	3267	9164	5286	649	18366
7	Dairy Plant (TLPD)	19128	41253	19656	5809	85846

(Source: NDDB, 2019-20)

*__Northern States (7)__ - Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh Uttarakhand

*__Western States (5)__ - Chhattisgarh, Goa, Gujrat, Madhya Pradesh, Maharashtra

*__Eastern States (10)__ - Assam, Bihar, Jharkhand, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tripura, West Bengal

*__Southern States (6)__ - Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana, Puducherry

The Ministry of Agriculture and Farmers Welfare's Department of Animal Husbandry, Dairying, and Fisheries (DAHD&F) created a National Action Plan (NAP) in 2018 that addressed existing milk potential villages, farmer members, farmer income, milk production growth, milk procurement, and current milk chilling and processing facilities. The Government of India projected to boost national milk output from 163.7 million in 2016-17 to 254.55 million by 2021-22 under the NAP, in order to fulfil rising milk demand while also guaranteeing nutritional security at the household level. Currently, 48 per cent of total milk produced is consumed by producers or sold to non-producers in rural areas, leaving 52 per cent of milk as marketable surplus for sale to consumers in urban areas, with 40 per cent of milk sold handled by the organised sector including DCs and producer companies (20%), private dairies (19%), and the rest by the unorganised sector. In terms of amount of milk handled, the co-operative sector is by far the largest within the organised sector. As part of doubling farmer's income by 2022, it is intended to boost marketable surplus of milk to 60 per cent by 2021-22, which will mostly be handled by the organised sector to improve milk farmers' livelihoods and economic well-being (GoI, 2018). This would necessitate the construction of more chilling capacity, milk processing infrastructure, as well as additional drying capacity, dairy product manufacturing equipment, and feed and feed supplement infrastructure. The Central Government has been implementing many initiatives to develop infrastructure for quality milk production, procurement, processing, and marketing of milk and milk products. Some of the key schemes implemented are National Programme for Dairy Development (NPDD), National Dairy Plan (Phase-I), Dairy Entrepreneurship Development Scheme (DEDS), Support to Dairy Cooperatives, Dairy Processing and Infrastructure Development Fund (DIDF) etc.

Jharkhand State Cooperative Milk Producers Federation (JMF)

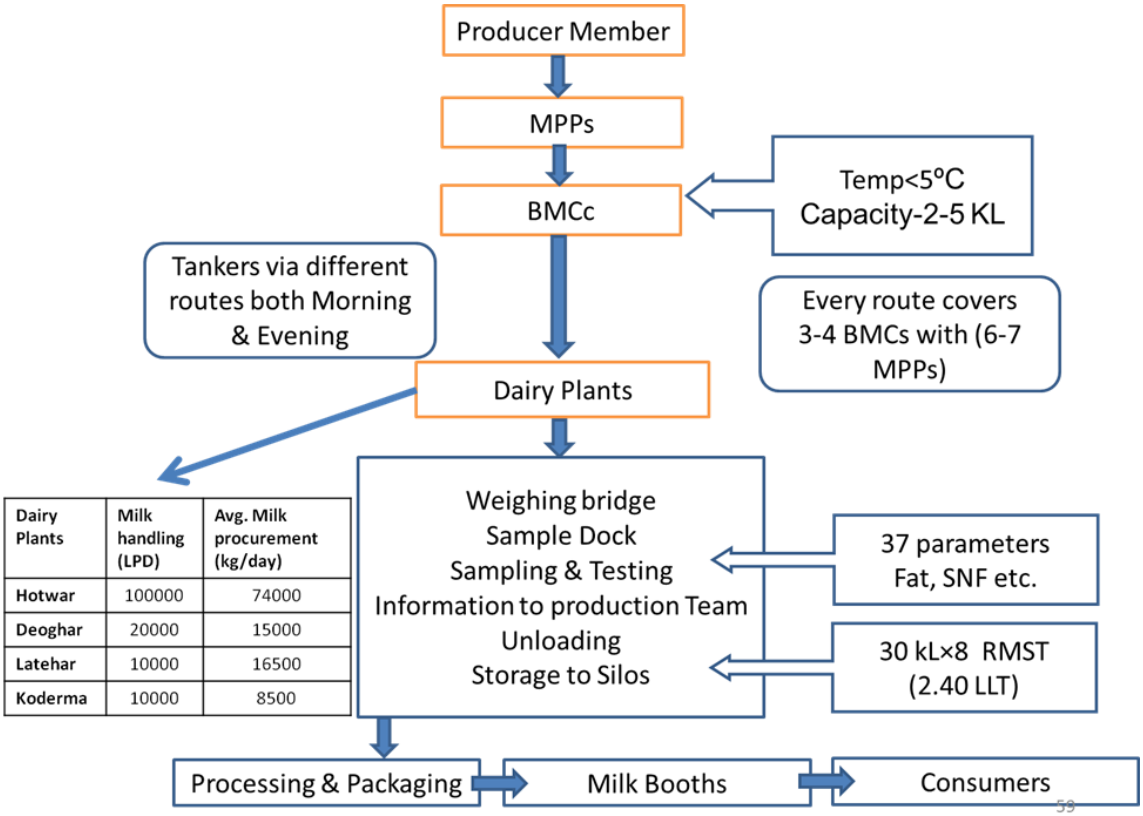
Jharkhand State Cooperative Milk Producers Federation (JMF) was formed in August 2014 under a Memorandum of Understanding (MoU) signed with the Government of Jharkhand and the National Dairy Development Board (NDDB) with the goal of promoting dairying as a source of livelihood in rural areas of the state and propelling Jharkhand toward self-reliance in milk and milk products. JMF at present covers 14 districts out of total 24 districts present throughout the State. Under JMF, the member-producers pour milk directly to the (Milk Pooling Point) MPPs installed at the village level. The milk, after its quality testing, is sent to the Bulk Milk Coolers (BMCs) spread across the district level. Thereafter, the milk is brought to the Dairy processing plants of JMF for processing and pasteurization of milk. And then finally, the manufactured milk and milk product is sold to the consumers through the milk booths and retail shops. So far, under JMF 19,910 member-producers have been registered, with 566 MPPs and 90 BMCs functioning within the State. The average milk procured and marketed per day by JMF was 1.14 and 1.09 LLPD, respectively during 2019-20.

Table 1.2 Year-wise data of some parameters related to dairy scenario of JMF

Year	MPP Functional (nos.)	Farmer Members (nos.)	Milk Procurement (TKgPD)	Milk Marketing (TLPD)
2013-14	160	1753	11.48	11.09
2014-15	348	4318	23.91	21.09
2015-16	410	8518	44.85	36.74
2016-17	480	15272	68.16	53.76
2017-18	554	19259	97.20	81.26
2018-19	562	20553	125.17	86.02
2019-20	630	19999	117.52	102.99

(Source: NDDB, 2019)

Producers' milk is collected twice a day, in the morning and evening shifts, and processed in the ISO-22000: 2005 certified 'Medha Dairy' plant. Only "Medha" is a brand among many that sell milk and milk products in various cities around Jharkhand. Medha only gathers milk from Jharkhand's milk producers. And the benefits go straight to Jharkhand's native milk producers. Medha currently operates three milk production units in the province: Deoghar, Koderma, Latehar, and Hotwar. Given the potential for dairy development in the state, the Government of Jharkhand sanctioned the establishment of three new dairies in the districts of Sahebganj, Deoghar, and Palamu. Apart from milk procurement and processing, JMF also offers productivity enhancement services to its members. The Jharkhand Milk Federation trained 214 Local Resource Persons who offered feed advisory services to 10,464 milk producers and their 14,218 dairy animals in 225 villages. Approximately 555 milk producers and village committee members received training in various capacity-building activities. In addition to NDP-I trainings, JMF delivered scientific animal husbandry training to about 4,000 milk producers. JMF has established a Modern Training and Demonstration Farm on Indigenous Cattle Rearing and Fodder Management on the premises of the Hotwar Dairy Plant. The goal of this farm is to evaluate the performance of indigenous breeds like Rathi (Rajasthan) and Gir (Gujarat) in Jharkhand's agro-climatic conditions. Aside from that, several varieties of green fodder, such as Napier, Marvel Grass, Moringa, Maize, Bajra, Jowar, Cow Peas, Velvet Beans, Thorn-less Cactus, Oats, Berseem, Rye Grass, and Chinese Cabbage, are being demonstrated to raise awareness about green fodder cultivation. Chelated mineral mixtures, protein supplements, and cattle feed are supplied to member-farmers as part of the animal nutrition programme, which also promotes the ration balancing programme. JMF also offers free veterinary and artificial insemination services to its members. JMF is currently working to increase employment opportunities in the dairy industry for persons living in rural areas. JMF has touched many people's lives and helped them to advance financially.



Dairy Plants	Milk handling (LPD)	Avg. Milk procurement (kg/day)
Hotwar	100000	74000
Deoghar	20000	15000
Latehar	10000	16500
Koderma	10000	8500

Fig 1.3 Supply Chain of Milk in JMF

1.1 STATEMENT OF THE PROBLEM

The dairy sector is characterized by small-scale, scattered, and unorganized milk-animal holders; low productivity; inadequate and inappropriate animal feeding and health care; lack of an assured year-round remunerative producer price for milk; an inadequate basic infrastructure for provision of production inputs and services; an inadequate basic infrastructure for procurement, transportation, processing and marketing of milk; and lack of professional management (Bayan, 2018). Other notable features of the dairy industry are the prevalence of mixed crop-livestock farms and the fact that most milk animals are fed low-cost agricultural by-products and residues. Furthermore, current dairy-development policies and initiatives, notably those relating to international commerce, are not conducive to the promotion of sustainable and equitable dairy development. The involvement of middlemen, producers' lack of bargaining power, and a lack of infrastructural facilities for collecting, storage, transportation, and processing are the key issues affecting milk marketing prices. Milk quality assurance, value addition, infrastructural development, and global

marketing are identified as future problems for India's milk marketing (Rajendran and Mohanty, 2004). Despite its challenges, the dairy industry holds great promise as a reliable source of income for the vast majority of the country's small and marginal farmers. Even though India is self-sufficient in milk production following Operation Flood, milk production across the country is not consistently distributed, resulting in a large demand and supply gap for milk and milk products in various other Indian states. The situation is much direr in the northern and eastern parts of the country where the cooperative movement in milk production has not taken off. The erstwhile chairman of NDDB (T. Nanda Kumar) reiterated that, there was need for serious consideration to start the initiative 'Bringing White Revolution in Eastern India, and it was extremely important to develop these three states (*viz.* Jharkhand, Chhattisgarh, Uttarakhand), where poverty was an issue, as dairy development would benefit the states socio-economically' (The Hindu, 2016). The Operation Flood Programme to replicate the Amul pattern has from the start-as the National Dairy Plan has done now - self-selected only "milk shed districts" with an extant tradition of profitable dairying. When the famous White Revolution of the seventies and eighties – Operation Flood – swept through the country, Jharkhand, then a part of undivided Bihar served merely as a market and saw little of its benefits. It was only in August, 2014 when Jharkhand State Cooperative Milk Producers' Federation was formed by the joint initiative of Government of Jharkhand and National Dairy Development Board, with an aim to promote dairying as a source of livelihood in the rural parts of the state and propel Jharkhand towards self-reliance in milk and milk products. Jharkhand is cooperatively, the most backward State of the country. At present, the Jharkhand State is ranked 17th in the position both in terms of milk production as well as milk productivity (GoI, 2019).The livestock census indicated that though, Chhattisgarh and Jharkhand had 7 per cent of India's bovines but produced less than 1 per cent of India's milk output. Jharkhand dairy cooperatives procured only 20,000 litres/ daily (l/d) locally but imported 6,00,000 litres/day from other states to meet local demand (The Hindu, 2014). The NDDB Report also highlighted that, of four major states of Bihar, West Bengal, Jharkhand and Orissa, the state of Jharkhand didn't had any union for procurement, though there were three marketing dairies, created under Operation Flood. According to (World Bank, 2007), weak institutional capacity, poor infrastructure development and lack of rural

opportunities were binding constraints for growth and development of dairy in Jharkhand. Also due to, limited access of the milk producers to organized sector, lack of manufacturing facilities for Value Added Products, inadequate chilling infrastructure at village level, unregulated milk marketing and inefficient cold chain distribution network were the major problems identified in the State. Some extrinsic problems (like lack of feed and fodder for livestock, poor quality animals and poor provision of animal health services, poor access to inputs and markets etc.) and intrinsic problems (like inadequate knowledge, motivation, skill and confidence to invest on commercial dairy farming, fears about the exploitation and/or corruption, social insecurity and conflicts within society) were the major problems prevailing in dairy sector of the State (Deka and Wright, 2011). With a view to give impetus to dairy development in Jharkhand, the State Government formed the Jharkhand State Cooperative Milk Producers' Federation (JMF) with the collaboration of National Dairy Development Board (NDDB) which is credited with bringing about white revolution in the State and making the State self-sufficient in milk production. Therefore, a constructive push for strengthening of cooperative structure in deficient areas like Jharkhand would not only increase the reach of the organized sector but will also promote dairy development in the State.

Considering the above issues, the present study has been designed to answer the following specific research questions:

1. What are the motivational factors that influence dairy farmers' decisions to join a dairy cooperative?
2. What socio-economic benefits are reaped by the beneficiaries along with productive, productive and health benefits in dairy animals?
3. What are the problems and prospects of JMF as perceived by different supply chain and member-producers of JMF?

The questions can be answered by conducting an empirical study. By keeping these facts in mind, the present study entitled **"Impact Assessment of Jharkhand State Cooperative Milk Producers' Federation on Socio-economic Status of Dairy Farmers''** has been conceived with the following objectives:

1. To study the factors that influence farmers' decisions to join Jharkhand State Cooperative Milk Producers' Federation.
2. To assess the impact of Jharkhand State Cooperative Milk Producers' Federation on reproductive, productive and health performance of dairy animals and socio-economic status of dairy farmers.
3. To analyze the problems and prospects of Jharkhand State Cooperative Milk Producers' Federation and their members' perception.

1.2 Scope of the Study

1. The study will help to identify socio-economic benefits reaped by the member-producers while also examining reproductive, productive and health performance of the dairy cattle owned by the members of JMF.
2. Lack of documentation on factors influencing dairy farmers' decision to join dairy cooperative which includes both intrinsic as well as extrinsic factors, will be addressed in the present study.
3. The study will help in identifying SWOT of dairy cooperatives at different supply chain levels including their members' perception.
4. Few studies have been conducted on Jharkhand State Cooperative Milk Producers' Federation, particularly the socio-economic impact study on its member-producers.

1.3 Limitations of the Study

Despite the fact that every feasible effort was made to ensure that this study was as exhaustive and accurate as possible, it was nonetheless subject to the constraints that are inherently associated with the work of a single researcher. Some of limitations are indicated below:

1. A lot of the data included in this study was gleaned from the recollections and opinions of dairy farmers, both members and non-members. Therefore, it is impossible to claim perfect freedom from the biases and preconceptions of individuals.

2. The research was constrained in terms of both time and other resources, therefore it was not possible to use a larger sample for qualitative and quantitative analysis.

3. Even though care has been taken to incorporate all relevant variables for the study, it cannot be ruled out that some relevant variables have been omitted. Nonetheless, it is intended that this study will provide a deeper understanding of the overall impact of JMF on its member-producers, as well as its Strengths, Weaknesses, Opportunities, and Threats.

4. The study is also limited to a small sample of dairy farmers in Jharkhand State, both members and non-members. Consequently, universal application cannot be asserted for outcomes.

In spite of all the restrictions listed above, appropriate care was taken to make this inquiry more fruitful by making it as extensive and methodical as was practicable.

1.4 Organization of Thesis

This dissertation has been organized in five chapters in logical sequence; the first chapter on **Introduction** contains the relevant background information, statement of the problem, objectives and scope of the study along with its limitations. The chapter second deals with **Reviews of Literature**. **Research Methodology** covers locale of the study, sampling plan, operationalization and measurement of selected variables, data collection and statistical tools applied to analyze the data are presented in the third chapter. The findings of the present study along with discussion are presented in fourth chapter *i.e.* **Results and Discussion**. The fifth chapter deals with the **Summary and Conclusions**, which have emerged from the results of the study. **Bibliography** and **Appendices** on information utilized in this study have been presented in the end.

CHAPTER –2

Review of Literature

REVIEW OF LITERATURE

A critical review is an essential component of any research project. The work of previous researchers on comparable or related topic(s) of studies serves as a guideline for comprehending the problem of the study; it aids in the formulation of objectives and the selection of methods. It also highlights and informs readers about the many approaches employed in the field of study. Good literature reviews or surveys are beneficial because they exhibit familiarity with a body of knowledge and create credibility, indicate the road to previous research and how a current effort is linked to it, integrate and synthesize what is known in a field, and help to learn from others and spark new ideas (Neuman, 2000).

Keeping in view the objectives of the study, the 'review of studies' regarding 'Impact Assessment' of the milk producers have been discussed under the following sub-heads:

2.1 Motivating factors influencing farmers' decision to join cooperatives

2.2 Impact of dairy cooperatives on reproductive, productive and health performance of dairy animals and socio-economic status of dairy farmers

2.3 Problems and prospects of dairy cooperatives

2.1 Motivating Factors Influencing Farmers' Decision to Join Cooperatives

Dairy cooperatives play an important role in providing a steady supply of raw milk for the dairy sector by coordinating milk flow from their members and aiding them with dairy farm inputs (Yilma *et al.,* 2011). Despite the attempts made to organize smallholder farmers into cooperatives and facilitate dairy and dairy products' marketing, large part of milk produced in rural India is sold through an informal chain. Most dairy producers have ignored the possibility to participate in formal markets, for instance through cooperative membership. This can be partly attributed to the producers' socio-economic and dairy farms' characteristics (Chagwiza *et al.,* 2016; Tefera *et al.,* 2016). Again low farmer membership in cooperatives has also been cited as one of the primary factors affecting

cooperative societies' performance (Oboh *et al.,* 2008). However, dairy farmers in rural areas can increase their income by forming cooperative groups and increasing milk productivity. Membership in a cooperative has undoubtedly aided members in gaining access to certain benefits that would have been difficult to obtain if they were not members. Successful cooperatives have been shown to be effective in meeting the economic and technical needs of member-producers in previous studies (Nasiri, 2010). According to Gasana (2011), farmers join cooperatives for a variety of reasons, including external support, cooperative performance, market access and collective bargaining, access to input services and credits, wealth generation, and risk sharing. The presence of the aforementioned conditions is logically observable as being crucial to enticing farmers to join cooperatives.

According to a study conducted in Assam, the household head's education level has a significant and beneficial impact on the likelihood of becoming a member of a dairy cooperative society. This was owing to the fact that education allowed a person to better understand the potential benefits of membership. The ownership of crossbred cows and access to institutional credit were two other factors that were positively and significantly linked with DCS membership. Farm households that owned at least one crossbred cattle and had access to formal credit were more likely to join cooperatives. Herd size had a negative and significant ($p<0.01$) effect on the likelihood of becoming a DCS member, showing that herd size may not affect membership decisions. Ownership of high-yielding crossbred cows, on the other hand, was linked to cooperative participation in a favourable and significant way. The distance to the nearest market had a negative impact on the decision to join a cooperative. This suggested that agricultural households in Assam State that were closer to the market had a higher rate of cooperative participation (Bayan, 2018). Another study on motivational factors influencing dairy cooperative membership in Ethiopia highlighted that the household head’s age, gender, education and frequency of extension services were the determining factors that encouraged smallholder dairy producers to become members of dairy cooperatives. Conversely, the distance to dairy marketing cooperative milk collection centers was among the major discouraging factors for joining dairy marketing cooperatives (Fikadu *et al.,* 2019). Similarly, a

Nigerian based study revealed that socio-economic indicators like age, marital status, educational qualification, farm size, family size, subsidized input supply, increased income and collective bargaining was found to be significant determinant of farmers' membership of cooperative societies (Anigbogu *et al.*, 2014). A study in Kenya delineated economic factors, social factors and market access and concluded that all had significant positive effect on the dairy cooperatives membership among dairy farmers in Kiambu County. Out of three, market access was the greatest motivator for dairy cooperative membership (Kigathi, 2016). According to a study done in South Africa, farmers have been deterred from joining agricultural cooperatives due to a variety of factors, including a lack of finance for production and involvement in cooperative activities. Farmers' engagement in agricultural cooperatives was influenced significantly by the services provided by cooperatives, such as financial services, training services, extension services, transportation services and government services. Farmers' participation in agricultural cooperatives was also influenced by the availability of loans, increased profits, the development of rural areas and the adoption of extension agents' innovations (Msimango and Oladele, 2013). However, in the case of cooperative members in four states of India *viz.* Gujarat, Haryana, Punjab and Uttar Pradesh it was spotlighted that, large farmers were opting out and shifting to the modern private sector as they received price incentives for large milk volumes. It was also observed that market infrastructure such as road, provision of veterinary services, distance from milk collection centers, markets, price risks, etc. was found to have significant effects on farmers' membership in dairy cooperatives (Sharma, 2015).Further, total livestock holdings, participation in off-farm activities, credit access and perception of cooperative organizations positively and significantly influence the dairy farmers' participation in dairy marketing cooperatives (Eshetu, 2015).

The socio-economic variables were a significant factor in the evaluation of the farmers' decision to become members of dairy cooperatives. The study of regression models that were carried out by a number of research brought to light the empirical relationship that exists between socio-economic factors and membership in dairy cooperatives. Njiru *et al.* (2015) outlined the socioeconomic factors that drove farmers in Embu County, Kenya, to join dairy cooperatives.

Results indicated that age, gender, household size, herd size, distance to the nearest market, access to credit, and quantity of milk sold all influenced the decision to join cooperative societies. Similarly, Mahida *et al.* (2018) found that socioeconomic factors, such as cooperative membership, non-farm annual income, access to information, and herd size, significantly impacted the technical efficiency of Gujarat dairy producers. Karli *et al.* (2006) examined the factors influencing the likelihood of joining agricultural cooperatives in the South Eastern Anatolian region of Turkey. They came to the conclusion that farmers' decisions to join dairy cooperatives were influenced by a variety of factors, including education level, level of communication, log of gross revenue, size of farm, and level of technological competence. Furthermore, it was discovered that conservative and traditional farmers were less likely to join cooperatives than moderate farmers. Grace (2011) examined the factors that influence farmers' decisions to join dairy farmer cooperatives in Rwanda and found that farmers joined cooperatives for a number of reasons. Among the most compelling factors were the need for access to markets and agro-vet services, the availability of training facilities, and the desire to work with others. According to the data, some farmers have not joined cooperatives due to their inability to pay membership fees, the cooperative's poor performance, and a lack of awareness about cooperatives. Additional research conducted in the Kipkaren division of Kenya's Nandi County, Fredrick (2014) explored the factors that determined the marketing channel preferred by smallholder dairy producers. According to the findings of the study, the amount of milk produced, the condition of the road infrastructure, the services provided by milk chilling plants, and the availability of suitable transportation, all influenced the choice of milk marketing outlet made by smallholder dairy farmers in the Kipkaren division. The method of milk payment in urban and rural areas did not influence the choice of milk market channel made by small-scale dairy producers. The study discovered that smallholder dairy farmers desired a market outlet that provided more than just milk prices, such as credit and inputs. Ishaq *et al.* (2016) used a binary logit model to analyse the likelihood of farmers joining milk marketing cooperatives based on eight socio-economic characteristics of respondents from the southern Punjab region of Pakistan. Five variables demonstrated a significant predisposition for membership in a cooperative, while

three variables did not. The age, dependency ratio, education level, distance from the milk collecting centre, and percentage of female farmers were statistically significant and positively correlated at the 5 per cent level. In contrast, herd size and land ownership had a negative correlation with cooperative participation. Similarly, Kumar *et al.* (2013) conducted a probit analysis with membership in DCS as the dependent variable to examine the influence of various factors in determining the relationship between dairy farmers and dairy cooperative societies in the Indo-Gangetic Plains of India. Independent factors included the educational level of the household, the size of the farm household, the size of the dairy herd, the farmers' years of experience, and the annual income of the household. According to the model's projections, farmers' cooperative memberships were found to have high positive relationships with their educational status, dairying experience, and farm herd size. Exposure obtained through higher education, dairying competence, and large-scale agriculture improved farmers' willingness to join dairy cooperatives. In contrast, neither household size nor socioeconomic level significantly influenced cooperative membership.

In addition to extrinsic factors, intrinsic factors played a significant role in influencing farmers' decision to join cooperatives, as illustrated by a number of studies. According to the findings of a study conducted in the United States of America on members of dairy cooperatives selected from the states of Iowa, Illinois, Minnesota, and Wisconsin, various characteristics of dairy members were identified as having influenced or motivated their participation in a cooperative. This covered views regarding cooperative principles, collective action, individual member identities as associated with cooperative membership, life satisfaction with farming, member satisfaction with the cooperative's operations and representation, member influence on cooperative decision making, and equal treatment among members (Gray and Kraenzle, 1998). Similarly, a study conducted in Turkey indicated that perceptions of democratic administration, relations with other governmental organs, knowledge of cooperative principles, and frequency of visits to cooperatives were among the core characteristics that influenced cooperative membership (Ozdemir, 2005).

From the above review of literature following conclusions can be drawn:

- Extension service contacts, assured market outlet, age, gender, government policies regarding cooperatives play a significant role in determining the members' participation in cooperatives.
- Size of dairy farm and landholding in general had a negative impact on membership in dairy cooperatives, implying that probability of cooperative membership declines with an increase in land size and number of milch animals. Generally farms with more assets are slightly less inclined to join cooperative membership.
- Availability of subsidized material inputs encourages cooperative membership, besides people factors like attitude and knowledge also affect farmers' decision to opt for cooperatives.
- Major extrinsic motivational factors identified were *viz.* better price for milk, input supply, veterinary services, extension facilities, employment opportunities etc. Whereas, major intrinsic motivational factors identified were equitable treatment, individual member identity, member satisfaction, democratic administration, livelihood security etc.

2.2 Impact of Dairy Cooperatives on Reproductive, Productive and Health Performance of Dairy Animals and Socio-Economic Status of Dairy Farmers

The literatures were reviewed in the following two major heads *viz.* Impact of dairy cooperatives on socio-economic status of dairy farmers and reproductive, productive and health performance of dairy animals reared under different management system.

2.2.1 Socio-economic Impact

Dairy cooperatives, in particular, assist dairy producers in meeting their socio-economic goals and aspirations. Dairy cooperatives in India resulted in increased milk production and yield, lower milk production costs, lower transaction costs for accessing inputs, information, technology, and markets, and greater prices and profits (Kumar *et al.,* 2011). The integration of Indian dairy farmers with contemporary dairy value chains, such as dairy cooperatives, has had a beneficial and considerable influence on their food security (measured by net returns and

household consumption expenditures). Whether farmers choose one outlet or a combination of outlets, participation in modern milk-marketing outlets greatly enhanced net returns per year (Kumar *et al.*, 2019). And therefore, at present more than 16 million smallholder dairy farmers in India who are affiliated with cooperative institutions are currently benefiting socio-economically. They supply milk twice a day, in the morning and evening, and receive a guaranteed payment based on the quality of the milk they provide, which supports their daily cash flow. Smallholder farmers receive services such as artificial insemination, veterinary services, feed supplies, and certainty of regular payment, bonus, credit facilities, and technical inputs as part of the package benefits supplied by cooperatives to their producer members. These things pave the way for a development in their socio-economic status and, as a result, a greater standard of living (Sudan, 2019). In this context, several studies have highlighted the socio-economic impact of dairy cooperatives on member producers. The socio-economic study on dairy cooperatives members in Gujarat State indicated that though the average age of member farmers was smaller (43.27), but were more experienced and educated than non-members (44.32). Average operational landholding was higher for member (1.82), but area used for fodder purpose was higher for non-member farmers (0.24). Average herd size (5.43) and yield for all local (4.61), crossbred cow (10.95) and buffalo (5.61) were higher for member farmers. Farmer's access to information was higher for member farmers (0.66) while the distance from dairy cooperative was little higher for non-member (1.09) (Mahida *et al.*, 2018). A survey conducted by Subburaj *et al.* (2004) on impact of demographic interactions and socio-economic parameters of members of dairy co-operative societies in Dindigul district in Tamil Nadu indicated that the total annual family income of member respondents was higher (Rs. 1.31 lakh) than that of non-member respondents (Rs. 60,904). The majority of respondents in both groups had low income, indicating that there was a considerable economic gap between members and non-members. Similarly, according to Singh and Sharma (2006), members of dairy cooperative societies in southern Rajasthan had more income (Rs. 50,375) from dairy enterprises than non-member respondents (Rs. 23,751). This could be due to a larger dairy herd and better animal management procedures. Also, Jayachandra and Naidu (2006) in their study, looked at the influence of dairy cooperatives on income, employment, and asset development for marginal and

small farmers who had benefited greatly from increased income from dairying. Dairying increased the net income of both marginal and small farmers. But the increment was noted to be higher in the case of marginal farmers (25.5%) when compared to that of small farmers (22.98%). In addition to that, total income from all sources grew by 15.07 per cent and 10.84 per cent, respectively. Similar observations were pointed out by Meena *et al.* (2009) who outlined the effectiveness of dairy cooperatives on income and employment generation of dairy farmers in Alwar district (Rajasthan) and witnessed that average net income was significantly higher in the member groups than non-member groups. He also reported that in member groups, overall labour use per household was much higher (207 man days) than in non-member groups (182 man days).Similarly, Seema *et al.* (2013) researched the income and employment generation of dairy cooperatives in Sothern Rajasthan and discovered that labour utilization per household was significantly higher in member groups than non-member groups in respective study and further revealed that dairy cooperatives had positive impact on income and employment generation of milk producers in the study area. Dairy cooperatives also generated greater employment for their members, and therefore the average man-days of employment generated were 0.45 in the member group, whereas it was considerably lower (0.36) in the non-member group (Rathod *et al.*, 2012). On the similar lines, Tanwar *et al.* (2015) investigated the impact of dairy cooperatives on milk production, income, and employment generation in semi-arid Rajasthan, concluding that milk production, net income, and employment generation per household, as well as per milch animal, were higher in member households than in non-member households in the study area. It could be attributed to better animal care and increased milk output in member households. It was clearly demonstrated that dairy cooperatives had a positive impact on milk production, net revenue, and milk producer employment. Further study conducted by Shrinivasaiah and Chellakumar (2016) explored the influence of milk cooperatives in village development in Karnataka State and discovered that between the year 2004-05 and 2013-14, the number of milk products, milk production, and women milk cooperatives increased by 57.50 per cent, 52.37 per cent, and 41.40 per cent, respectively. Dairy cooperatives have proven to be effective economic structures and vehicles for improving the lives of poor rural

people. In rural areas, the farmer cooperative system has resulted in the development of livestock and dairy.

The study conducted by Wani *et al.* (2015) evaluated the performance of dairy cooperative societies that are part of the Jammu & Kashmir Milk Producers Cooperative Limited (JKMPCL) and the milk disposal patterns of member farmers. According to the findings, the overall mean performance of societies in Jammu was 51.83 per cent, while it was 44 per cent in Kashmir, showing that societies in Jammu outperformed those in Kashmir. The better performance of Jammu's dairy cooperative societies was due to higher milk prices and animal productivity. In addition, the study found that average milch animal herd size and average household milk output were higher in Jammu than in Kashmir. In both J&K regions, a significant number of member farmers were selling milk to organisations other than dairy cooperatives. Members were motivated to use other agencies for the sale of their marketed surplus while being members of the co-operative society because the price offered for milk by different stakeholders varied greatly. Another study conducted by Ishaq *et al.* (2016) assessed the economic advantages of milk marketing cooperatives operating in two districts (Vehari and Muzzafargarh), geographically situated in the southern region of Punjab province of Pakistan. The study investigated the importance of milk marketing cooperatives by identifying and analysing potential returns to small dairy farmers. In comparison to non-members, cooperative members had a greater farm income (Rs. 21,456), more milk output (120 litres/day), improved cow breeds, had better access to veterinarian services, and used more nutritious fodder (silage). The study's findings also showed that the establishment of milk marketing cooperatives gave female dairy smallholders more economic prospects and helped them with rural development. Furthermore, a comparison of the socio-economic situation of members of dairy cooperatives and private dairies in Rajasthan indicated that total milk yield in the previous lactation was much higher among the dairy cooperative respondent's animals than among the private dairies. Average milk yield was found to be significantly higher in case of animals of dairy co-operative respondents than the private dairies at 5 per cent level of probability. He attributed these disparities to dairy co-operatives' training, dairy extension services, cattle feed, health care services, and other dairy development programmes that resulted

in significant improvements in cooperative animals' milk output Kumar *et al.* (2016). The evidences from the study conducted by Ghosh and Maharjan (2004) found that dairy cow keepers in non-cooperative villages such as Labutalla and Nohata earned lesser gross dairy income, 9,648 and 8,286 Taka, respectively, in their study on BMPCUL. However, cooperative members' gross dairy income in Vennabari and Potajia villages was significantly higher, at 14,989 and 41,676 Taka, respectively. Furthermore, studies on dairy farming households in three states, namely Uttar Pradesh, Bihar, and Punjab, revealed that co-operative dairy farmers' average herd size was 5.6 Standard Animal Units (SAU), compared to 3.6 SAU for non-cooperative dairy farmers. On average, 54 per cent of bovine milch animals owned by cooperative dairy farmers were of improved breed, compared to just 40 per cent of milch animals owned by non-cooperative dairy farmers. The cooperative farmer contributed roughly 14 litres of milk per day with a productivity of 6 litres per milch cow per day, whereas the independent farmer contributed 8 litres with a productivity of 5.3 litres. Dairy farmers who were members of cooperatives sold 9.5 litres of milk per day on average, compared to 5.5 litres by independent farmers. Members, on the other hand, had a lower per unit cost of milk production than non-member farmers, and therefore received a higher milk price (Kumar *et al.*, 2013). Similar findings were indicated by an Ethiopian based study where milk production, milk productivity and level of commercialization were found to be higher among dairy cooperative members as compared with non-members (Chagwiza *et al*., 2016). Other research suggested that membership in Assam's Dairy Cooperative Societies (DCS) helped improve dairy animal production, farm income, and employment, as well as household milk consumption. Members and non-members were similar to some extent in age, family size, herd size, and farm experience, but not in education, ownership of crossbred cattle, market distance, or access to credit, according to the results corresponding to the observed covariates. Furthermore, 28 per cent of all farmer-members had access to formal credit, compared to 2.5 per cent of non-member farmers (Bayan, 2018).

Kumar *et al.* (2013) in their study entitled “Do Dairy Cooperatives Enhance Milk Production, Productivity and Quality? Evidences from Indo-Gangetic plains of India” concluded that the average milk yield contribution from the cooperative

farmers was about 14 litres per day with a productivity of 6 litres per milch animal per day and the corresponding figures for the independent farmers were 8 litres and 5.3 litres respectively. Dairy farmers affiliated with cooperatives sold 9.5 litres of milk each day on average, compared to 5.5 litres by individual farmers. Independent dairy farmers made an average profit of Rs. 0.30 per litre, whereas cooperative dairy farmers made an average profit of Rs. 2.60 per litre. Similarly, in the Etawah area of Uttar Pradesh, Chandra *et al.* (2014) reported that the cost of milk production per litre of cow and buffalo per lactation was lower in member families than in non-member families. This indicated that members of dairy cooperative societies not only retained superior breeds of cows and buffaloes, but also followed better feeding and management strategies than non-member households, resulting in higher buffalo productivity, which increased their profit. Further, in BEP analysis, member of dairy cooperatives attained Break Event Point earlier while non-member reached that level after some more milk production in buffalo category. However, contrary to previous studies, Singh *et al.* (2012) in their economic assessment of milk production in Bihar State reported that, for crossbred, buffaloes and indigenous cows, the per litre cost of milk production ranged from Rs.10.12 to 13.90 and 13.57 respectively which was higher than the prices paid by the dairy cooperatives for standard milk (Fat - 6% and SNF - 21%).

2.2.2 Reproductive, Productive and Health Performance of dairy animals

India possesses a wealth of huge bovine population (299.6 million) which is the main source of milk production (Livestock Census, 2012), however, the average milk productivity of the dairy animals in India is very low as compare to other developed countries. There is large disparity in state wise as well as regional milk production in India (Kale *et al.,* 2016). Productive and reproductive efficiency are critical factors that have a significant impact on the economics of milk production. In the field, there are a variety of productive and reproductive issues that cause the animal to lose its reproductive function. Any disturbance in the animal's normal reproductive function leads to infertility or sterility, resulting in financial losses owing to the lengthening of the dry period and inter-calving gap, as well as a reduction in calving and lactation during the animal's lifetime (Agarwal *et al.*, 2005). Therefore, milk production needs to be tracked frequently by measuring the productive and reproductive performance under the existing

management system for improvement (Lobago *et al.*, 2007).The previous studies on the productive, reproductive and health performance of dairy animals were customarily studied in a localized manner and for a specific species for instance, a comparative analysis of the members of dairy cooperatives and private dairies in Rajasthan revealed that average milk yield of crossbred, local cows and buffaloes of the member of private dairy were 5.64, 3.39, and 4.37 litres; respectively while in case of member of dairy co-operative average milk yield of crossbred, local cows and buffaloes were 5.64, 3.39, and 4.37 litres respectively. Therefore, average milk yield was found to be significantly higher in case of animals of dairy cooperative respondents than the private dairies at 5 per cent level of probability. Also, total milk yield in last lactation among the dairy co-operative respondent's animals was found significantly higher than the private dairies (Kumar, 2012). Another study on productive and reproductive performance of cattle and buffaloes reared under farmers' management in differential dairy progressive states in India (*viz*. Haryana, Maharashtra and Odisha) revealed that the productive and reproductive performances of buffalos in Haryana were better than Maharashtra and Odisha whereas, the productive and reproductive performances of crossbred were found better in Haryana as well as Maharashtra than Odisha. The reproductive performance of buffalo, indigenous and crossbred cow was assessed on the parameters such as age at first calving, services per conception, service period, and calving interval while, productive performance was assessed based on the parameters such as average daily milk yield, lactation length, dry period, average lactation milk yield, peak yield (Kale *et al.*, 2018). Similarly, the reproductive and productive performance of dairy animals in Karnal district of Haryana State revealed that average daily milk yield, lactation length, lactation yield and peak yield was higher in crossbred cows as compared to buffalo and indigenous cows. The study also revealed that crossbred cows had their lower age at first calving and shorter calving interval than buffalo. Further, it was observed that service period, service per conception and dry period was lower in crossbred cow than buffalo and indigenous cow (Manjusha *et al.,* 2016).The evidences from field level study on productive and reproductive parameters of dairy animals in Uttar Pradesh, India revealed that average daily milk production of Buffalo, CB cow, Indigenous cow, were as 5.75±0.65, 7.55±0.74 and 3.27±0.3 litre/day/animal respectively. The data pertaining to lactation length was (276±14,

274±16 and 294±18) days/animal. The lactation milk yield was (1587.60±113, 2091.35±145 and 964.65±98) litre/animal. The average peak milk yield was (8.56±0.85, 10.42±1.42 and 5.51±0.53) litre/animals. The dry period was (226±13, 211±15 and 264±19) days/animal. The age at first calving was (1288±122, 1170±88 and 1517±131) days/animals. The service period was (189±16, 197±12 and 268±18) days/animal respectively and lastly, calving interval of Buffalo, Crossbred cow, Indigenous cow, were 505±39, 485±32 and 558±55 days/ animal respectively (Meena *et al.*, 2015).Further, Sarkar *et al.* (2007) in his study on productive and reproductive performance of comparatively high yielding indigenous cattle of West Bengal revealed that average age at first oestrous was 988 days, average age at first service was 1027 days, average age at first calving was 1365 days and average calving interval was 453 days without significant variation among different agro-climatic zones. The animals in the study had an average daily milk yield and peak milk yield in the range of 3.59 kg and 4.44 kg respectively with an average of lactation length of 238 days. Furthermore, a detailed study on reproductive and productive performances of Kosali cattle maintained under farmer's management conditions in Central Plain Region of Chhattisgarh state demonstrated that average age at first calving, calving interval, service period and number of services per conception were found 54.64±2.18 months, 430.26±6.33 days, 159.59±2.67 days and 1.4±0.08, respectively. In male, age at first ejaculation and age at first mating were found to be 41.54±1.14 and 51.3±1.05 months, respectively. Production was recorded and average daily milk yield, peak yield, lactation milk yield, lactation length and dry period were estimated to be 0.92±0.23 kg, 1.27±0.15 kg, 210.3±4.19 kg, 230.7±9.11 days and 190.8±8.19 days, respectively. Observed indices showed poor performances which are below the national average (Asit *et al.*, 2019). Another study revealed that among the draught breeds of India, the Bachaur cows were reasonably good milkers with an average lactation yield of 752.10±5.82 kg and peak yield of 4.70±0.07 kg/day. The breed is reported to be regular in reproduction cycle with the age at first calving and calving interval of 31.55±0.35 months and 14.44±0.22 months, respectively in its breeding tract (Chandran *et al.*, 2014). As per standard recommendation for determining the productive performance of crossbred dairy animals, average milk yield is 10-12 litres, lactation length is 305 days, average peak yield is 15 litres and dry period is 3 months, whereas standard

recommendation for reproductive performance of cross breed dairy animals, average age at first calving is 1.5-2 year, average service period is 90 days, average service per conception 1-2 and calving interval is 12-14 months (Kumar, 2014).

Murrah buffalo cow is the finest breed of milk producing buffalo. Introduction of high yielding breed like Murrah buffalo in milk deficient state like Jharkhand can bridge the gap of milk requirement in India. Performance traits like 305-days milk yield, peak milk yield, lactation length, dry period, birth weight, calf mortality rate, age at first calving, service period, calving interval, number of services per conception and conception rate of Murrah buffalo were reported as 2147.6±87.06 kg, 8.87±0.05 kg, 297.8±1.9 days, 110.66±6.62, 34.76±0.54 kg, 29.1% to 39.8%, 43.69±0.46 months, 139.91±2.96, 15.5±4.51 months, 1.17±0.03 and 33.19%, respectively in the Assam State (Boro *et al.*, 2020). Similar findings were reported in the study of reproductive and productive performance of buffalo among small dairy households in Uttar Pradesh, where the overall Average daily milk yield (ADMY) and Lactation length (LL) was estimated to be 5.75±0.65 litre/day/animal and 276±14 days/animal. The average peak yield of buffalo in the field condition was estimated to be 8.56±0.85 litre/animals while Age at first calving (AFC) was 1288±122 days/ animals respectively (Meena *et al.*, 2016). Another study on production performance of Murrah buffaloes under organized dairy farm production system in West Godavari District of Andhra Pradesh highlighted that the Mean Lactation Milk Yield (MKMY), Mean Lactation Length (MLL), Mean 305-Day Milk Yield (M305-DMY) and Mean Peak Yields (MPY) observed were 2270.13±75.74 kg, 299.91±5.01, 2305.9±65.75 kg and 13±1.13 kg, respectively (Babu, 2013). A study based on Murrah buffaloes maintained at National Dairy Research Institute, Karnal, India indicated that the overall age at first calving (AFC), service period (SP), Waiting Period (WP) or days to first service (DFS) and PR of Murrah buffaloes were estimated as 43.97±0.36 months, 139.91±2.96 days, 90.10±1.60 days and 0.36±0.01 days respectively. For production traits, the overall lactation length (LL), 305 Days or less Milk Yield (305 DMY) and 305 Days or less Wet Average (WA) were estimated as 284.38±1.08 days, 2034.42±20.79 kg and 7.29±0.06 kg (Jamuna *et al.*, 2013).

Apart from reproductive and productive performance, health is also one of the important factors which influence economic viability of animals. Among health-related problems, mastitis is the most common disease in lactating cows and it causes great economic loss to the dairy industry (Halasa *et al.*, 2007). Mastitis can also affect product shelf life (Barbano *et al*., 2006) and cheese-making properties (Ma *et al*., 2000). Financial loss to the tune of Rs. 6053.21 crores per year in India has been reported due to mastitis among cattle and buffaloes (Dua, 2001). Inferior udder health in dairy animals results in economic losses to both dairy farmers and milk processors, thereby, depressing milk yield and increasing costs (Huijps *et al*., 2008). One of the studies on performance of dairy animals in commercial dairy farms in Karnataka revealed that majority (53.33%) of respondents' dairy animals had good health scores with a mean health score of 7.09±0.31 in the overall sample. Mastitis had the highest incidence rate among majority (46.67%) of respondents' dairy animals followed by Foot and Mouth Disease (31.85%), Haemorrhagic Septicaemia (9.63%) and Black Quarter (3.7%) (Sathisha *et al.,* 2018). Further study on members and non-members of dairy cooperatives in Rajasthan revealed that treatment to anoestrus animals and repeat breeders were followed by 55.0% and 63.33% in members in comparison to non-member (33.33% and 39.17%) (Tanwar, 2012). In majority of the cases, it was observed that during poor transition period (the period 2 to 3 weeks before and after calving in dairy animals) which led to development of sub-clinical and clinical post-partum diseases ultimately affected the health performance of dairy animals and posed great economic loss to the dairy farmers (Raheja *et al.,* 2018). Meena *et al.* (2016) in their study conducted in Uttarakhand state revealed that in cattle, highest incidence of haematuria (16.74%) was recorded followed by repeat breeding (14.97%). Whereas, urinary problem and parasitic infestation was 3rd and 4th rank. Anoestrus (8.37%) in cow ranked fifth and was also a very important disease which was the cause of huge economic losses in the region. Other Disease/ disorder observed were emaciation / weakness, tick / lice infestations, mastitis, tympaitis / bloat, warts, abortion, diarrhoea / dysentery and mange.Whereas in case of buffalo, it was observed that emaciation / weakness (17.24%), GI parasitic infections (16.09%), and tick/ lice infestation (16.09%) were the major problems and having 1st, 2nd, and 3rd ranks, respectively. Repeat breeding (13.79%), anoestrus (12.64%), tympaitis / bloat (5.74%), abortion

(4.59%) diarrhoea/ dysentery (4.59%), mange infestation (4.59%) were other common diseases/ disorder in the buffaloes. Besides all the livestock diseases, heavy infection of gastrointestinal parasites in small and large ruminants is responsible for ill health and production losses (Ram *et al.*, 2007).

India possess huge livestock population, which is endangered by different endemic infectious diseases (bacterial, viral, protozoan and parasitic), which collectively causes significant economic losses to the landless poor farming community. Infectious diseases impose economic losses by causing morbidity, mortality, decreased production (milk, meat, wool etc.), decreased feed conversion ratio which results in reduced weight gain, decreased draught power and fertility (Saminathan *et al.*, 2016). Beside that several other viral diseases of animals in India such as foot and mouth disease (FMD), bluetongue (BT), peste des petits ruminants (PPR), sheeppox, goatpox, camelpox, infectious bovine rhinotracheitis (IBR), malignant catarrhal fever (MCF) and bacterial disease like haemorrhagic septicaemia (HS), black quarter (BQ), anthrax and brucellosis were endemic and has potential of crossing continental boundaries (Benkirane and De Alwis, 2002; Bhanuprakash *et al.*, 2011; Biswal *et al.*, 2012; Saminathan *et al.*, 2013; Chand *et al.*, 2015; Kumar *et al.*, 2015). Foot and mouth disease (FMD) is endemic in India from 1864 onwards (Subramaniam *et al.*, 2013). FMD causes huge economic losses and decrease in milk yield causes 8% of total direct loss (Mathew and Menon, 2008). The disease causes severe damage to the production and international trade. Because of its severity, the OIE and FAO declared it as “High Priority Disease”. Haemorrhagic septicaemia (HS) is also the most significant bacterial contagious infection in cattle and buffaloes with proven endemicity in India (Shivachandra *et al.*, 2011). The disease usually causes devastating and alarming problem in buffaloes and cattle. Similarly, Black Quarter (BQ) is another highly fatal and acute bacterial infection of cattle caused by *Clostridium chauvoei* affecting buffaloes, sheep, and goats. Young cattle and buffaloes with 6 to 24 months of age and good body condition are highly susceptible to BQ. Apart from all these diseases, Anthrax is also highly fatal, acute and febrile zoonotic disease. It is enlisted in top five diseases of zoonotic importance in India where attention has to be prioritizing (Sekar *et al.*, 2011). Cattle and sheep are highly susceptible to anthrax followed by horse, mules and

pig. It is a soil-borne infection, caused by Bacillus anthracis and outbreaks generally occur after the climatic change. The disease is endemic in south Asia and Bangladesh (Thapa *et al.*, 2014), especially enzootic in India and endemic in Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal, Orissa, Maharashtra and Jammu and Kashmir (Gunaseelan *et al.*, 2011). Other diseases include diseases like Enterotoxemia (ET) which is a severe disease of ruminants caused by *C. perfringens* types B, C and D with more case fatality rates resulting in considerable economic losses to the farmers (Rood and Cole, 1991). Brucellosis is also one of the five main notifiable bacterial diseases of zoonotic importance in the world. Brucellosis is a disease of animals with humans as an accidental host (Joshi and Parkash, 1971).

The Body Condition Score (BCS) approach is based on an assessment of the animal's outward appearance, which interacts with its body fat stores and is thus directly influenced by energy balance. It provides a quick assessment of the animal's physical condition and can be easily integrated into operational decision-making. (Gransworthy, 1988). The body weight of animal cannot provide a reliable estimate of the energy reserves, as the reserves vary about 40 per cent in animals with same body weight which directly or indirectly affects the performance of dairy animal (Andrew *et al.*, 1994). To overcome this, Lowman *et al.* (1973) introduced the body condition score system developed for feeding strategies of the animal in such a way that animal is neither too thin nor too obese (Samarutel *et al.*, 2006). The BCS systems were developed earlier by many scientists like Jefferies (1961) using 0 to 5 scale in ewes, Lowman *et al*. (1976) using a 0 to 5 scale in beef cattle and Earle (1976) using a 8 grade system in dairy cows. Edmonson *et al*. (1989) developed a chart for body condition scoring of Holstein dairy cows in a 1 to 5 scale using 0.25 increments. Rao *et al*. (2002) and Anitha *et al*. (2005) have utilized this chart for scoring the crossbred dairy cows in India. The scale used to measure BCS differs between countries, but low values always reflect emaciation and high values equate to obesity among dairy animals. Body condition score can provide insight into the cow’s current health status and previous management efficiency and can be used as a management tool to improve herd nutrition, health, production and pregnancy rate (Heinrichs *et al*., 2017; Kellogg, 2010; Markusfeld *et al*., 1997; Roche *et al*., 2009). Cows that maintain an ideal BCS curve

throughout lactation, dry period and transition period are at a decreased risk for disease occurrence and lower reproductive success (Roche *et al*., 2009; Gomez *et al*., 2018). Therefore, dairy farmers are advised to assess their cows BCS regularly to prevent metabolic failure and maintain cow welfare. In addition, inter-calving BCS profile of dairy cow resembles a mirror image of the milk lactation profile (Roche *et al*., 2009; Banos *et al*., 2004). Both the duration and severity of BCS lose is based on potentiality of milk production (Gallo *et al*., 1996). Higher genetic merit dairy cows have a higher tendency for mobilization of fat reserves to cover milk production demands (Veerkamp, 1998; Pryce *et al*., 2002) than in cows with lesser genetic merit (Buckley *et al*., 2000; Horan *et al*., 2005).

Typically, body condition is managed by appropriate nutrition, and Garnsworthy and Jones (1987) proposed that cows with low BCS (2.0) should be fed a high protein diet which maintains BCS by using excess protein for gluconeogenesis rather than body reserves, whereas fatter cows (BCS 3.5) had a greater loss of condition. Alternatively, high BCS cows can be fed a low fiber, high starch diet to reduce BCS loss, and this type of diet will also increase BCS in cows with a low BCS (Garnsworthy and Jones, 1993). The need to frequently monitor changes in body condition and prevent excessive body condition loss (more than 0.5 BCS) is further supported by studies highlighting associations with poor health, fertility, and ultimately survival. Research has shown that cows with a (high) BCS of 3.5 are twice more likely to develop ketosis than cows with a (low) BCS of 2.0 (Reid *et al.*, 1986); and a 2-4 times higher risk of having ketosis in the next lactation (Rasmussen *et al.*, 1999). Other health risks include increased chance of a retained placenta and ormetritis, and oestrus not being observed if cows have a low BCS (Markusfeld *et al.*, 1997). It is estimated that conception rate decreases by 10 per cent for every 0.5 BCS lost (Butler, 2005) and cows losing >1.0 BCS post-partum take on average 11 days longer to conceive than those that maintained or only lost a 0.5 BCS (Lopez-Gatius *et al.*, 2003). Oestrus in cattle occurs when they are also lactating. For high milk yielding dairy cows this can pose a challenge, as the metabolic demands of milk production, and the mobilizing of body fat to produce milk, tend to take priority over reproduction, and can lead to conception failure due to a low negative energy balance (Collard *et al.*, 2000). Therefore, monitoring individual cow body fat and maintaining adequate body

condition is essential to maintain a productive animal that has appropriate nutrition and fertility, whilst also producing acceptable amounts of milk. While Holstein dairy cows are a popular breed for producing high volumes of milk, they are also characterized by having lower body condition score (BCS), and reduced fertility and survival compared to other breeds (Dillon *et al.*, 2006).

Dairy buffaloes perform well under the tropical conditions and BCS can be used as a marker for milk yield and quality (Mushtaq *et al.*, 2012).There is a need to evaluate and document the effect of BCS on milk production and composition so as to suggest better management practices in order to derive optimum production performance from these buffaloes. The influence of body condition score at calving (BCS) on the reproductive and productive performance studied by Anitha *et al.* (2011) revealed that buffaloes of BCS group 3.5-3.99 showed the best performance among the four BCS groups with earlier ($p<0.05$) resumption of ovarian activity (29.33 days), a shorter ($p<0.01$) postpartum an estrus period (46.66 days), a shorter ($p<0.05$) service period (58.83 days), fewer services per conception (1.50), a higher rate of first service conception (66.66%) with higher ($p<0.01$) breeding efficiency (90.64 per cent). The milk production traits like total milk yield up to 18 weeks of lactation (1658.67 kg), 305 day predicted lactation yield (3187.3 kg), peak milk yield (16.5 kg), milk protein and solids not fat were also higher in BCS of 3.5-3.99 followed by the BCS groups of 4.0-4.49, 3.0-3.49 and 2.5-2.99.Further, ultra-sonographic measurements of BCS in buffalo showed that as the BCS increased, the amount of fat reserves also increased ($p<0.01$), indicating that the BCS adequately reflected the amount of actual fat reserves. BCS was significantly correlated (r=0.860) with the carcass fat reserves as well as the ultra-sonographic fat reserves (r=0.854) (Alapati *et al.*, 2010).

Based on above studies, a few generalised conclusions can be drawn as under:

- Productivity of dairy animals was higher in households associated with dairy cooperatives than their non-cooperative counterparts.
- Net income from dairying was higher in households delivering milk to dairy cooperative societies.
- Per litre cost of milk production was found to be lower in member households as compared to non-member households.

- Farmers' associated dairy cooperative societies reaped higher net returns per month than those not associated with dairy cooperatives.
- Cooperative members reaped higher income, milk production and productivity as compared to non-members.
- Labour cost decreased with increase in herd size categories. The maintenance cost was found to be the highest for buffaloes followed by crossbred cows and local cows.
- Dairy animals reared by cooperative members showed better reproductive and productive performance that their non-member counterparts.
- Body Condition Score (BCS) played important role in accessing the reproductive, productive and health status of dairy animals.

2.3 Problems and Prospects of Dairy Cooperatives

The dairy sector in India is composed of small, fragmented, and poorly organized milk-animal holders with low productivity. Some of the challenges experienced by dairy cooperative members include a lack of a guaranteed year-round remunerative producer price for milk, an inadequate basic infrastructure for milk procurement, transportation, processing, and marketing, and a lack of professional management. The most serious issues, according to the majority of milk producers, were the uncompetitive prices for milk products (Kumar *et al.,* 2012; Meganathan *et al.***,** 2010)**.** But on the contrary, earlier studies have also suggested that farmers' participation in dairy co-operatives has resulted in a significant increase in milk production and productivity and has reduced per-unit cost of milk production thereby enabling them to achieve higher output prices, reduced transaction costs and increased profits (Kumar, 2010; Birthal *et al.,* 2009). Several studies conducted on dairy cooperatives have highlighted the problems and prospects using SWOT analysis to evaluate the Strength, Weaknesses, Opportunities and Threats faced by different stakeholders in dairy cooperatives. A study on SWOT analysis of Jammu and Kashmir Milk Producer's Co-Operative Limited (JKMPCL) highlighted that; the major Strengths of JKMPCL in the order of their preference were the regular and weekly milk payment system (81.95%), dairy as a source of livelihood (80.46%) and good commitment from the government for dairy industry (76.76%). The top-ranked weaknesses were low

productivity of animals and high cost of milk production (83.17%), lack of structured and clear benefit packages (81.68%) and low price for milk as compared to other private competitors (80.12%). Among major opportunities identified, more milk producers were willing to join cooperative (82.23%) which was ranked first; however, scope for convergence with allied departments and substantial scope for modernization of the unit (80.15%) were the other potential opportunities. Whereas, among major threats faced by the JKMPCL; loss of interest among farmers in dairying (85.70%), heavy competition from private units (82.43%) and high cost of credit for dairy farming (81.62%) were ranked as first, second and third in the order of the perceived threats; respectively (Wani *et al.*, 2014). Another study on MILMA in Kerala revealed that availability of resources, purchasing power of middle-class consumers and increasing demand of milk were the major strengths. Whereas, F.M.D. diseases to cattle, high cost of production and inadequate supply of milk to the interior and rural areas were the major weaknesses. Among perceived opportunities, adequate availability of wasteland for conversion into fodder cultivation, and export potential for indigenous milk products were key focus areas. While large competition due to liberalization and land fragmentation were the major threats perceived by the dairy farmers (Kumar, 2017). Similarly, a Gujarat based study on the dairy cooperative members illustrated that presence of young and literate milk producers across all milk producer categories (*viz.* Marginal, Small, Medium, Large and commercial) was found to be a major strength. However, low yield of milch animals was one of the major weaknesses. Constantly rising milk prices, increasing demand of milk and milk products, increasing population and increasing incomes and changing lifestyles of consumers were some of the major opportunities; followed by fluctuations in milk production due to vagaries of climate change were some of the perceived threats (Makwana and Gurjar, 2017). Further studies on SWOT analysis of KMF in Karnataka confirmed that dairy farmers were getting inputs and services at subsidized price (50%) and also received fair prices for their milk (Rs. 25-26/litre) which was perceived as major strength. Whereas, lack of awareness to scientific dairy farming, delay in supply of inputs (green fodder), and problem of seasonality in milk supply were the common constraints. However, the major opportunities observed were increase in the cooperative membership and demand of milk and milk products, processing and value addition of milk products. Among

the major threats, it was observed that small and marginal farmers incurred high maintenance costs as compared to large farmers and realized low prices for their milk (Vanishree *et al.*, 2018). The evidence from Ethiopia depicted that the fortnight based milk payment system of the dairy cooperative helped members to get accumulated money for further investment. Also, the provision of mobile A.I., concentrate feed using its feed processing machine and animal health services were some of the perceived strengths. While, poor internal communication and mutual trust between management bodies and members, lack of training and employment opportunities, under-capacity of the feed processing machine to supply concentrate feed were found to be the major weaknesses. However, improved field level technical support services vis-à-vis organizing intermittent dairy farm management training to members as well as providing market information, establishment of the newly established processing machine were potential opportunities. Whereas, lack of appropriate policy favoring the dairy sector concerning feed policy and credit, lack of packing supplier organizations in the local market etc. were some of the major threats noticed in the study (Tefera, 2008).

A SWOT analysis on Ada's Dairy Cooperative revealed that strong market segment, sustainable marketing avenues for processed dairy farms, expansion of new milk collection centers and provision of mobile A.I. and animal health services at reasonable prices were some of the key drivers/ strengths of dairy cooperative. Whereas, less accountability and transparency , low commitment from members', low linkage of cooperative with external financial institutions, lack of cooling tanks and laboratory equipment and lack of quality control measures were some of the major weaknesses. However, processing capacity of large volumes of milk, presence of good government policy on dairy cooperatives, presence of high income customers were some of the underlying opportunities. While, high competition for milk from informal/ local markets, absence of milk quality control were the major threats apropos dairy cooperative (Debele and Verschuur, 2014). Another, SWOT analysis conducted by Rathod *et al.* (2011) revealed some interesting facts about Gokul Dairy Cooperatives in Western Maharashtra. Access to knowledge about dairy production, marketing and innovations; women's participation and employment in dairy cooperatives; provision of mobile A.I.,

concentrate feed; animal health services; educated board members; newly established milk processing plant and weekly milk payment system were the major strengths. Whereas, shortage of professional manpower; poor internal communication and mutual trust between staff members and members; inadequate and untimely provision of feed, concentrate and medicines were some of the notable weaknesses. However, improved field level technical support services vis-à-vis organizing intermittent dairy farm management training to members as well as providing market information; the infrastructure like processing machine, chilling centres and feed manufacture units provided good opportunity and encouraged members and others to supply more milk to the cooperative. Besides this, challenge to waste disposal, illicit plastic packaging concerning environment degradation, poor quality of feed and lack of appropriate policies were some potential threat. Similarly, the experiences of SWOT analysis conducted by Subburaj *et al.* (2015) on Tamil Nadu Cooperative Milk Producers Federation's (TNCMPF) supply chain network also revealed some fascinating results. Existence of traditional farming community; adoption of Anand Model, *i.e.*, "three tier structure", no major complaints about the quality of milk and milk products, good supply chain network were the major strengths. Whereas, no elected representation in the management body; lack of E-initiatives, such as, "KIOSKS", GIS; lack of implementation of modern quality management tools were some the striking weaknesses. However, vast market for milk and milk products; constant demand from the customer; access to international market, availability of human resources were some key opportunities. Contrarily, urbanisation, deterioration of graze landing, migration of farmers' community, increasing cost of cattle feed, scarcity of water resources (pond, lake), no guaranteed year round remuneration to milk producers, growth of unorganised sector, the presence of middleman in milk marketing were some of the predominant threats.

The above review of literature regarding problems and prospects of dairy cooperatives can be summarised in following points:

- Fair price of milk, availability of inputs, resources and services at subsidized price, regularly milk payment system, provision of mobile A.I., concentrate feed, animal health services were some of the identified strengths pertaining to dairy cooperatives.

- Delay in supply of inputs, high cost of production, low yield of milch animals, low price for milk, less accountability and transparency, lack of training and employment opportunities were some the major weaknesses.
- Increase in cooperative membership, demand for milk and milk products, modernization of processing units, good government policy were some of the key opportunities.
- Market competition, land fragmentation, fluctuations in milk production due to climate change, absence of milk quality control were some of the potential threats identified.

CHAPTER –3

Research Methodology

RESEARCH METHODOLOGY

Research methodology is considered to be a 'blue-print' of research architect. The term methodology, in broad sense, refers to process, principles and procedures by which we approach our problem and seek its answer. In social science, the term "methodology" is applied to know about how one carries out the process of research. In this chapter various methods and procedures followed to investigate the problem has been explained with the following sub-heads:

3.1 Research Design
3.2 Locale of the study
3.3 Sampling plan
3.4 Variables and their measurements
3.5 Measurement of Motivating Factors Influencing Farmers' Decision to Join Dairy Cooperative (JMF)
3.6 Impact of JMF on Reproductive, Productive and Health Performance of Dairy Animals
3.7 Measurement of Impact of JMF on Socio-Economic Status of Dairy Farmers
3.8 Measurement of Problems and Prospects of JMF
3.9 Method of Data Collection
3.10 Statistical tools used for analysis of data

3.1 RESEARCH DESIGN

Research design is the entire process of scheduling and carrying out research. Kerlinger (1964) defined "Research design as the plan, structure, and strategy of investigation so as to obtain answers to research questions and to control variance". An ex-post-facto research design was adopted for the present study. According to Kerlinger (1964) "an ex-post facto is a systematic empirical enquiry in which the researcher does not have direct control over the variables because their manifestations have already occurred or because they are inherently not manipulable". The manifestation of the variables presumably had

already occurred and there was no scope for manipulation of any variable, hence ex-post facto research design was used in the present study.

3.2 LOCALE OF THE STUDY

The study was conducted during the year 2020-21. The present study was conducted in the purposively selected milk federation of Jharkhand State i.e. Jharkhand State Cooperative Milk Producers' Federation (JMF) for the following reasons:

- Jharkhand State ranks 17th in position in total milk production in India. (NDDB,2018-19)
- The per capita milk availability (165g/day) of Jharkhand is less than the national average of 394 g/day. (NDDB,2018-19)
- Jharkhand is having highest level of poverty in India at 36.96 per cent as against All-India average of 21.92 per cent. (% of BPL) (RBI,2018-19)
- Jharkhand is ranked as 2nd worst affected states in terms of "Hunger Index". (HIS=28.67 Alarming) (IIPS,2007)
- In Jharkhand, Draught cattle comprise 42 per cent of the indigenous cattle stock as against 32 per cent at all India level. (19th Livestock Census)
- The state has suitable agro-climatic conditions for rearing exotic and crossbred cattle, adequate water sources for fodder cultivation and huge market demand for milk and milk products from various industrial cities of Jharkhand.
- Small and marginal farmers dominate the rural economy of the state and are dependent on rain-fed agriculture and livestock for their livelihood.

3.2.1 SELECTION OF STATE

Brief Description of the Study Area-Jharkhand State

The State of Jharkhand formerly a part of Bihar was formed on November 15th, 2000 with Ranchi as its capital. The 28th state of the Indian Union, Jharkhand has a total geographical area of 79714 sq. Km. The State extends between 22 degrees North to 25.5 degrees North latitudes and 83 degree East and 87.75 East latitudes. Jharkhand largely comprises of the forest tracks of

Chhotanagpur plateau and Santhal Pargana and has distinct cultural traditions. The State has 24 districts, 212 blocks and 32,260 revenue villages. The territory of the State is bound by Bihar in the North, West Bengal in the East, Orissa in the South and Chhattisgarh in the West. Located on an elevation of 300 to 610 meter above sea level, the climate of the state ranges from dry semi-humid to humid semi-arid types. The state comes under Agro - Climatic Zone VII i.e. Eastern Plateau and Hills Region. This region is further subdivided into three zones namely, Central and North Eastern Plateau Zone, Western Plateau Zone and South Eastern Plateau Zone. As per the agro-ecological characterization of the country Jharkhand falls in Zone 12 and 13. The annual rainfall in the plateau and sub-plateau region is 1400 mm on an average, of which 82.1 per cent is received during the period June to September and the rest 17.9 per cent in remaining months. There are a number of perennial rivers and streams flowing through the State. The important rivers are Damodar, Subarnarekha, Koel Karo, Barakar and Sankh. A mineral rich State, Jharkhand is also blessed with rich fauna and flora. The total population of the State as per 2011 census is 3.30 crore with average density of population of 414 per sq.km as against all India average of 420. Jharkhand ranks 14th in terms of population, accounting for 2.73 per cent of All India population (Census of India, 2011). The Share of tribal population is about 28% of the total population. Jharkhand has one of the highest levels of poverty in India at 40.3% as against the All India Average of 27.5 %. In Jharkhand, 70% of its population depend mainly on agriculture and allied activities for their livelihood contributing about 15% to Gross Domestic Product .Out of the total 79 lakh hectares geographical area of Jharkhand state, the cultivable area is estimated around 41.80 lakh hectares out of which the net sown area is 18.08 lakh ha.

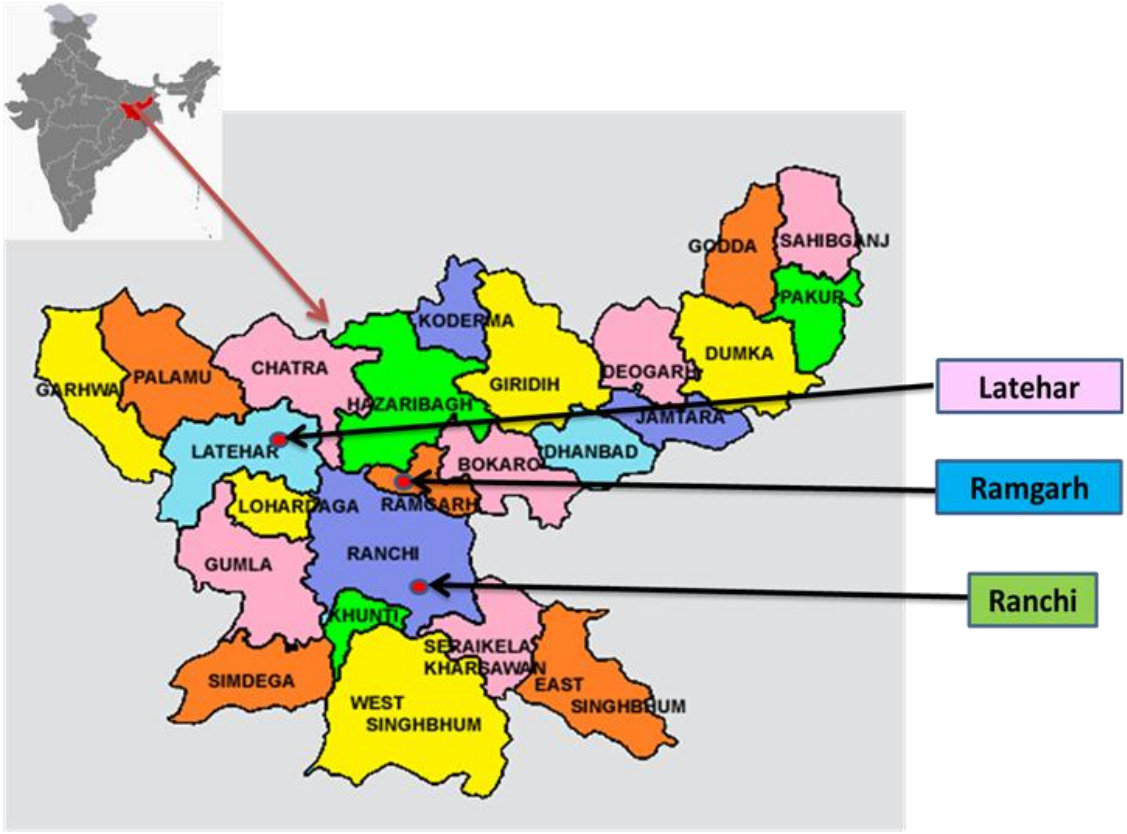


Fig 3.1 Map of Jharkhand showing the districts selected for sampling

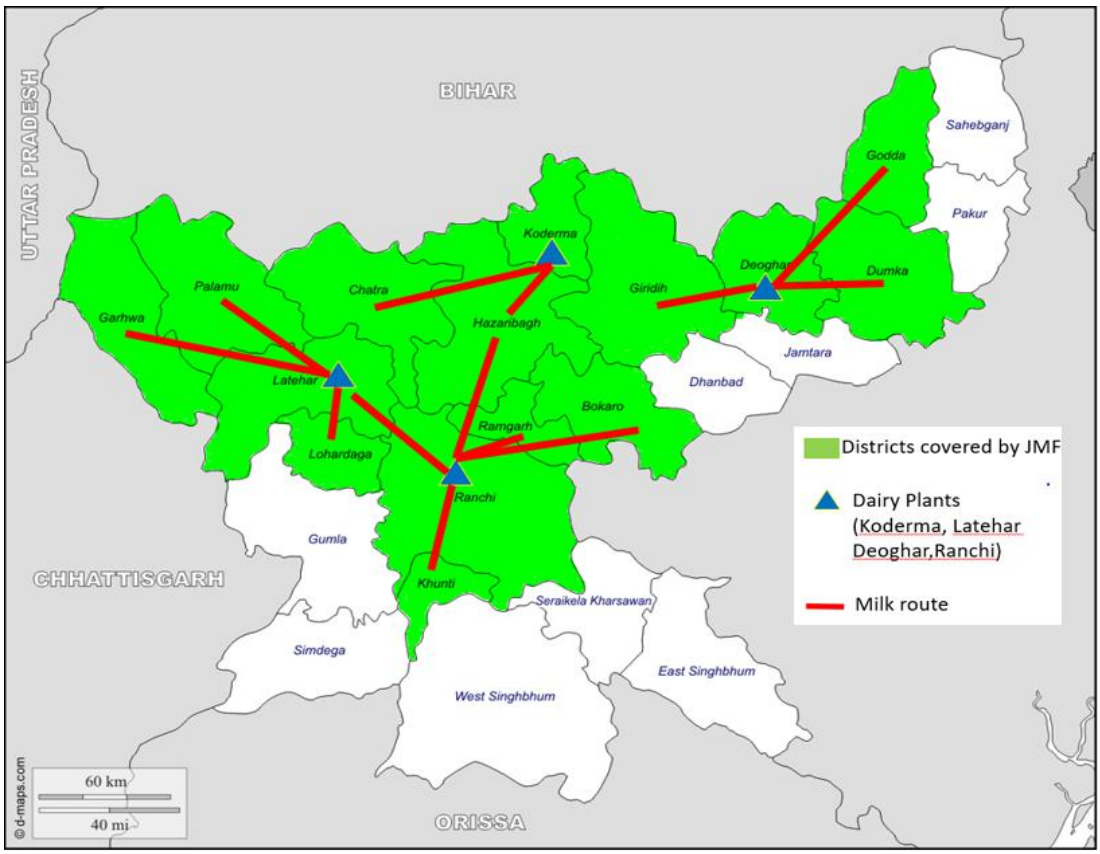


Fig 3.2 Milk Route of JMF

3.3 SAMPLING PLAN

A sampling plan in research studies provide an outline on the basis of which research is conducted. It tells which category is to be surveyed, what should be the sample size and how the respondents should be chosen out of the population.

3.3.1 SELECTION OF JHARKHAND STATE COOPERTAIVE MILK PRODUCERS' FEDERATION (JMF)

The Jharkhand State Cooperative Milk Producers' Federation Limited (JMF) was registered under the Jharkhand Cooperative Societies Act 1935 in June 2013 with an aim to promote dairying and make the state self-sufficient in milk. At present, the National Dairy Development Board is managing Jharkhand State Cooperative Milk Producers Federation (JMF) under an Memorandum of Understanding (MoU) signed with the Government of Jharkhand with an aim to promote dairying as a source of livelihood in the rural parts of the State and propel Jharkhand towards self-reliance in milk and milk products.

Table 3.1 Profile of Jharkhand State in Dairying

Sl. No.	Parameter		Quantity
1.	Milk Production – 2017-18 (in 000 tonnes)		2015.62
2.	Per Capita Availability – 2017-18 (in gram/day)		165
3.	Total Number of Villages (2011 Census)		32394
4.	No. of Milk Potential Villages (% of total no. of villages)		4925 (15.20%)
5.	Number of organized Dairy Cooperative Societies (DCS)		614
6.	No. of Milch Animal owning Households (MAH) (in Lakh)		17.35
7.	Number of Farmer members enrolled under DCS		36599
8.	Average Milk Procurement by DCS (in TKgPD) (% of Milk Production)		121 (2.19%)
9.	Chilling Centres	Number	1
		Capacity (TLPD)	10
10.	Bulk Milk Cooler (BMC)	Number	61
		Capacity (TLPD)	144
11.	Processing Plants	Number	7
		Capacity (TLPD)	695

Table 3.2 In-Milch Animal Statistics of Jharkhand State (2017-18)

	Particulars	Number (in 000)	Average Yield (in Kg/ day)	Milk Production (in 000 tonnes)
Cattle	Exotic	14.13	9.64	49.70
	Crossbred	206.72	7.12	537.38
	Indigenous	244.13	3.07	273.17
	Non-Descript	1344.70	1.30	637.71
Buffalo	Indigenous	100.92	5.25	193.55
	Non-Descript	209.56	2.42	185.23

Source: GoI (2019). Bimonthly Report, September, 2019. State Dairy Profiles, Dairy Development Schemes. Department of Animal Husbandry and Dairying. Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India

The Jharkhand State Cooperative Milk Producers' Federation Limited (JMF); formed by Govt. of Jharkhand, is engaged in milk procurement from more than 20,000 farmers of Jharkhand, processing and marketing of milk & milk products under the popular brand name "Medha" with an annual turnover of Rs. 173 crores, handling 1.30 lakh litres per day across Jharkhand and having ISO: 22000:2005 certified milk processing plant at Hotwar, Ranchi apart from plants at Deoghar, Koderma & Latehar. The cooperative is catering to the needs of the State, by collecting the milk from 566 MPPs (Milk Pooling Point) and 90 BMCs (Bulk Milk Coolers) distributed in 14 districts of the State. From August 2014, JMF took over the dairy operations, in a phased manner, in different districts and since, has been currently working in fourteen districts of Jharkhand, procuring milk by forming village based milk producers' groups. Milk is collected at the village level, where electronic facilities for milk sample testing and weighing are provided to check the quality of milk supplied by each farmer, to decide on price of milk. The price of milk increases with improvement in milk quality. The amount towards the milk supplied by farmers is deposited directly in to their bank accounts every 10 days. With a view to maintain the quality of milk, bulk milk coolers (BMC) have been installed in villages, in a phased manner. The procured milk is processed in

four dairies situated in Ranchi, Koderma, Latehar and Deoghar and marketed as Standard milk, Toned milk, Tea Special milk under the brand name of “Mother Dairy Medha”.The Federation is currently marketing products like Paneer, Dahi, Misti Dahi, Misti Lassi and other products like Salted Lassi, Peda, Ghee etc. in the market.

In order to improve milk production and reproductive efficiency of dairy animals in the State, JMF is providing quality cattle feed to its milk producers at subsidized rate, veterinary helpline service through “*Gaupalak Sahayata Kendra*”, Productivity Enhancement Camps in villages by engaging experienced veterinary doctors, arrangement of training and workshop for the milk producers etc. To address the serious issue of mineral deficiencies specific to the State, the Federation is manufacturing Area Specific Mineral Mixture (ASMM) based on composition assessed through mineral mapping of the state, at its mineral mixture plant (12 MT per day) located at Hotwar, Ranchi. In addition to this, the state of the art bypass protein plant with a manufacturing capacity of 20MT per day has been established at Hotwar, Ranchi to improve the utilization of protein by the milch animals.

3.3.3 SELECTION OF THE DISTRICTS

For the present study, out of, the total 14 districts, covered by JMF during (2019-20), the districts have been first classified into High (More than 1000), Medium (Between 500-999) and Low (1-499) Categories based on the size of member-producers of JMF available in each districts as shown in Fig.3**.** Accordingly, three (3) districts viz. RANCHI, LATEHAR and RAMGARH districts were purposively selected from each categories based on the maximum number of member-producers, BMCs and MPPs present in total of 14 districts covered by the JMF.

3.3.4 SELECTION OF BULK MILK COOLERS (BMC)

After selecting the districts, one BMC from each district was randomly selected. Thus, a total of 3 BMCs viz. Poriya, Banhardi and Barkakana were selected from each districts.

Table 3.3 District-wise no. of cooperative members, BMCs and MPPs under JMF

Sl. No.	Category	Districts	Member-producers (nos.)	Bulk Milk Coolers (BMCs) (nos.)	Milk Pooling Points (MPPs) (nos.)
1	HIGH	**Ranchi**	6833	37	185
2		Lohardaga	2918	10	87
3		Palamu	2009	10	48
4		Hazaribagh	1739	5	49
5		Deoghar	1700	5	50
6		Dumka	1000	3	28
7	MEDIUM	**Latehar**	895	3	25
8		Garhwa	883	2	22
9		Godda	815	4	22
10	LOW	**Ramgarh**	392	3	7
11		Bokaro	284	3	15
12		Chatra	200	2	10
13		Khunti	123	2	5
14		Koderma	119	1	12
		Total	**19910**	**90**	**566**

Source: Secondary data retrieved from JMF Procurement Dept. (2019-20 Data)

3.3.5 SELECTION OF MILK POOLING POINTS (MPP)

From each BMCs randomly selected, 3 MPPs were randomly selected, where from 20 members and 20 non-members were randomly selected from each operational area of respective MPPs. Thus, from Puriya BMC, three MPPs (Bedo, Kesa Tikratoli, Bharno) were randomly selected, similarly from Banhardi BMC, three MPPs (Rajwar, Tenki, Aragundi) were randomly selected and finally from Barkakana BMC three MPPs (Barkakana, Manjhla Chumba, Aragadda) were selected randomly.

3.3.6 SELECTION OF RESPONDENTS

A suitable sample size of the respondents was selected from each MPPs. For this study, Members were those who were having at least one milch animal and supplying milk to JMF for at least last one year. And, Non-members were the dairy farmers from the operational areas of the Milk Pooling Point (MPPs) under JMF who have at least one milch animal and not supplying the milk to JMF.

Under each operational area of MPPs, 20 members/beneficiaries and 20 non-members/non-beneficiaries of JMF were selected randomly.Therefore, a total of 360 respondents (i.e. 180=members and 180=non-members) were selected from the study area.

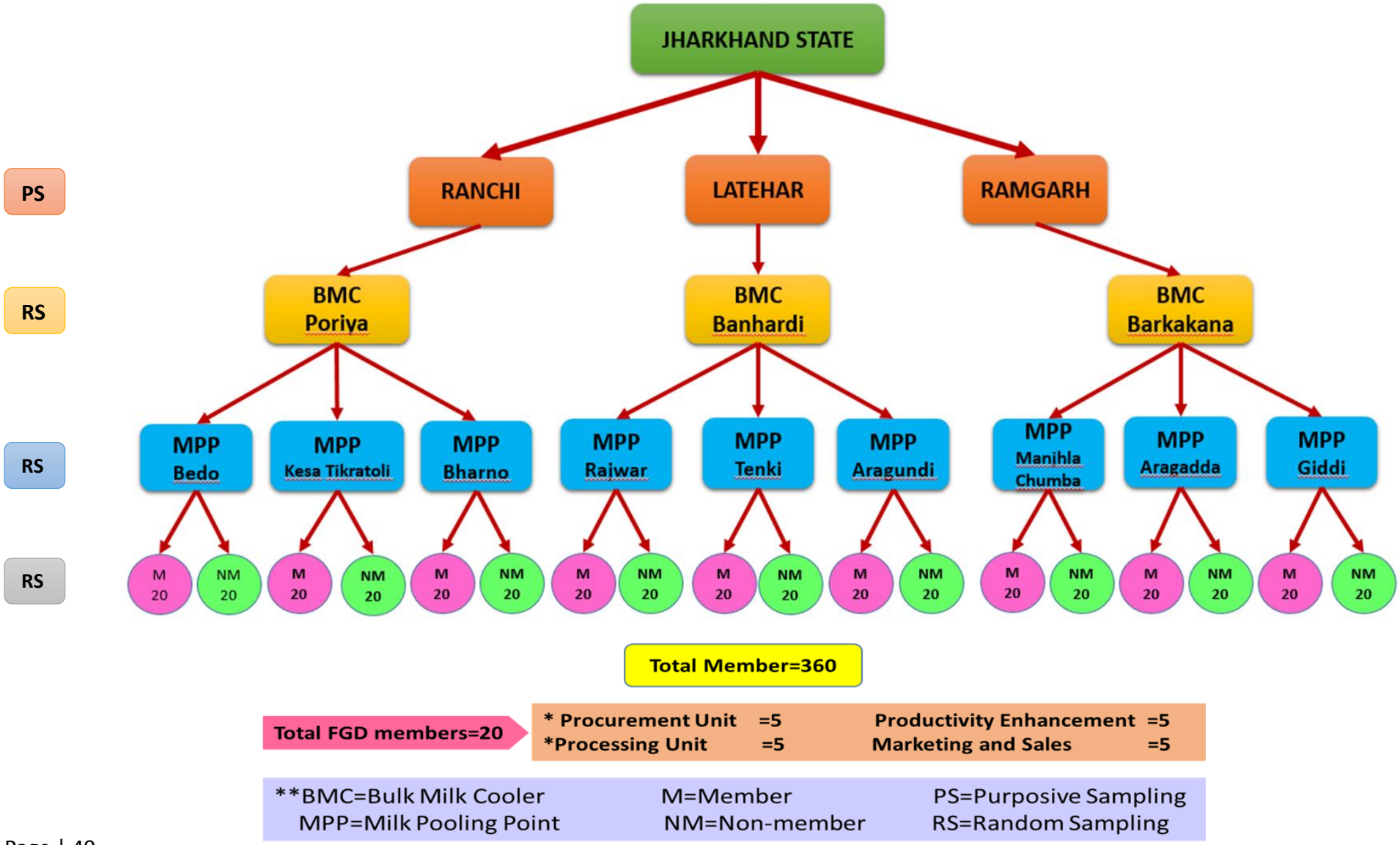
Additionally, for Focused Group Discussions (FGD), a total of 20 experts were selected from the respective departments of JMF viz. Procurement (5), Processing (5), Marketing (5) and Productivity Enhancement (5).

Table 3.4 Brief description of the Sampling Area under study

Sl. No.	Selected Districts	Selected BMC/MPP	No. of MPPs covered (nos.)	Avg. daily procurement (l/day)	Total member (nos.)
1	**RANCHI**	BMC (Poriya)	10	2600	565
		MPP-1 (Bedo)		500	80
		MPP-2 (Kesa Tikratoli)		164	47
		MPP-3 (Bharno)		200	30
2	**LATEHAR**	BMC (Banhardi)	14	1500	400
		MPP-1 (Rajwar)		155	45
		MPP-2 (Tenki)		115	34
		MPP-3 (Aragundi)		136	39
3	**RAMGARH**	BMC (Barkakana)	12	800	320
		MPP-1 (Manjhla Chumba)		75	32
		MPP-2 (Aragadda)		150	38
		MPP-3 (Giddi)		50	20
4	**BOKARO** (pilot study)	BMC (Jaridih)	5	880	400
		MPP-1 (Petarwar)		126	65

Source: Primary data collected by the investigator during field survey

Fig 3.3 Sampling Plan



3.4 VARIABLES AND THEIR MEASUREMENTS

It is customary to precisely mention the variables used for the study with their working concepts and measurement procedures. After the collection of review of literature and consultation with the experts, relevant variables were selected for the study. Table 3.4 depicts the variables and their respective measurement at a glance. The selected variables and their operational definitions and measurement procedures have been dealt in detail as follows:

Table 3.5 List of variables and their measurement

Sl. No.	Variables	Measurement
A.	**Socio-personal variables**	
1	Age	Classification as reported by GoI (2011)
2	Gender	Observation
3	Education	Schedule was developed
4	Occupation	Schedule was developed
5	Family Size	Schedule was developed
6	Experience in Dairy Farming	Direct Questioning
B.	**Socio-economic variables**	
7	Herd Size	Schedule was developed
8	Milk production	
9	Milk consumption	
10	Milk sale	
11	Per capita milk availability	
12	Milk price	
13	Annual Household Income	
14	Operational land holding	
C.	**Other variables**	

15	Social Participation	Schedule was developed
16	Access to Information	
17	Access to Extension Services	
18	Provision of Veterinary Services	
19	Access to Input Supply	
20	Access to Credit	
21	Distance from milk collection centre	
22	Market Distance	
23	Labour utilization	
D.	**Productive performance**	
a	Avg. daily milk yield (l)	Schedule was developed
b	Lactation length (days)	
c	Dry periods (days)	
d	Avg. lactation milk yield (l)	
e	Peak yield (l/day)	
E.	**Reproductive performance**	Schedule was developed
a	Age at first calving (months)	
b	Services per conception (nos.)	
c	Service period (days)	
d	Calving intervals (days)	
F.	**Health performance**	Semi-structured interview schedule was developed
G.	Member- producers' perception of SWOT on JMF	Semi-structure schedule was developed
H.	Motivational factors influencing dairy farmers to join dairy cooperative	Semi-structure interview schedule was developed
I.	SWOT Analysis	Analytical Hierarchy Process

3.4.1 OPERATIONALISATION OF VARIABLES

Operationalization is the process of defining a concept so as to make concept clearly distinguishable or measurable and to understand it in terms of empirical observations. In a wider sense it refers to the process of specifying the extension of a concept. The “operational definitions” of the variables studied under the study have been given below:

3.4.1.a SOCIO-PERSONAL VARIABLES

1) Age

It was operationalised as number of completed years of respondents at the time of data collection and it was determined by direct questioning. The respondents were classified on the following three categories (Census report, GoI, 2011)

Table: Age categories based on years

Category	Year
Young	Up to 35
Middle	36-50
Old	More than 50

2) Gender

It refers to the sex of the respondent. The respondents were assigned score as:

Table: Categories based on Gender

Gender	Score
Male	1
Female	2

3) Education

It was operationalised as the level of formal education attained by an individual respondent. It was measured by direct questioning. The scoring

procedure followed by Somasundaram (1995) was followed with modification. The respondents were assigned score as:

Table: Categories based on years of education completed

Category	Score
Illiterate	0
Functionally literate	1
Primary	2
Middle	3
Higher Secondary	4
Secondary	5
Graduate and above	6

4) Occupation

Occupation is operationally defined in terms of farmer's source of earning viz. agriculture, dairying, business, services and labour. Respondents were asked to indicate their main (more than 50% income) and subsidiary occupation separately.

5) Family size

It refers to the number of individuals living under the same roof and sharing kitchen together in a household. The respondents were classified into small, medium and large family size on the basis of cumulative square root frequency method.

Table: Categories based on family size

Category	Family size (nos.)
Small	<6
Medium	6 to 9
Large	>9

6) Experience in dairy farming

It refers to the total number of completed years of which the dairy farmer involved in dairy farming or experience of dairy activities at the time of interview. The respondents were classified into low, medium and high experience in dairying on the basis of cumulative square root frequency method.

Table: Categories based on experience in dairy farming

Category	Experience (in years)
Low	<8
Medium	8 to 11
High	>11

3.4.1.b SOCIO-ECONOMIC VARIABLES

7) Herd Size

It refers to the total number of cattle and buffaloes owned by the respondent at the time of investigation. This was determined by a schedule developed for the same. The respondents were classified into small, medium and large herd size on the basis of cumulative square root frequency method.

Table: Categories based on herd size

Category	Herd size (in nos.)
Low	<8
Medium	8 to 13
High	>13

8) Milk production

It was defined as total quantity of milk produced in litres by the dairy animals (cows and buffalo), one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high milk production on the basis of cumulative square root frequency method.

Table: Categories based on milk production

Category	Litres/day
Low	<8
Medium	8 to 15
High	>15

9) Milk consumption

It was operationalized as the total quantity of milk consumed (in litres) by the family members, one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high milk production on the basis of cumulative square root frequency method.

Table: Categories based on milk consumption

Category	Litres/day
Low	<1.25
Medium	1.25 to 3.20
High	>3.20

10) Milk sale

It refers to the total quantity of milk sold (in litres/day) by the household, one day prior to investigation. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high milk production on the basis of cumulative square root frequency method.

Table: Categories based on milk sale

Category	Litres/day
Low	<2.60
Medium	2.60 to 10.82
High	>10.82

11) Per capita milk availability

It is defined as the average quality of milk available (grams/day) for consumption per person in each household. It was determined by developing a schedule for the same. The respondents were classified into low, medium and high milk production on the basis of cumulative square root frequency method.

Table: Categories based on per capita milk availability

Category	grams/day
Low	<152.64
Medium	152.64 to 299.70
High	>299.70

12) Milk price

It refers to the average price (in Rupees) accrued by the member-producer on total quantity of milk poured to JMF in litres per day on an average basis by the household throughout the year. And for non-members, it refers to the total quantity of milk sold in litres per day on an average basis by the household throughout the year.

13) Annual household income

It refers to the total income of the respondent and other family members obtained from their land, dairy herd and/or from any other sources on annual basis. Income from different enterprises were enquired from the respondents with the help of the developed schedule for the same. Respondents were categorized into low, medium and high categories on the basis of total annual income, using the cumulative square root frequency method.

Table: Categories based on annual household income

Category	Range (Rs./annum)
Low	40,000 to 1,42,000
Medium	1,42,000 to 2,44,000
High	2,44,000 to 5,50,500

14) Operational land holding

It was operationally defined as the total number of hectares of land owned and leased in by an individual family at the time of investigation. It was determined by a schedule developed for the same. The respondents were classified into landless, marginal, small, semi-medium, medium and large categories as follows (suggested by GOI, 2011):

Category	No. of hectares
Landless	0
Marginal	upto 1
Small	1.1 – 2.0
Semi-medium	2.1 – 4.0
Medium	4.1 – 10.0
Large	>10

3.4.1.c OTHER VARIABLES

15) Social participation

Sadamate (1978) defined social participation as participation of individual in various formal social institutions either as a member or as office bearer. It was operationally defined as the degree of involvement of group members in social organizations as a member or as an office bearer and the regularity in attending the activities of these organizations. The score were assigned as follows:

Table: Score assigned to different level of social participation

Category	Score
No membership in organisation	0
Membership in each organisation	1
Office bearer in each organisation	2

The respondents were classified in terms of having low, medium and high level of social participation on the basis of cumulative square root frequency method.

Table: Categories based on level of social participation

Category	Range
Low	<7
Medium	7 to 12
High	>12

16) Access to information

It refers to the frequency of information received by the dairy farmers about the dairy farming through different sources like newspapers, radio, T.V, mobiles, neighbours, dairy cooperative, seminars/training etc.The response of the respondents was obtained on three point continuum i.e. regularly, seldom and never and score of 3, 2 and 1 were assigned respectively. The respondents were classified in terms of having low, medium and high level of access to information on the basis of cumulative square root frequency method.

Table: Categories based on access to information

Category	Range
Low	<18
Medium	18 to 21
High	>21

17) Frequency of Extension Services Accessed

It was operationalised as the frequency at which dairy farmers availed extension services rendered by dairy cooperative (JMF) and other extension functionaries such as, VLDA, Agril. Officer, Vet. Officer, Stockman, NGO's etc. The response of the respondents was obtained on three point continuum i.e. regularly, seldom and never and score of 3, 2 and 1 were assigned respectively. The respondents were classified in terms of having low, medium and high frequency of extension services accessed by the members and non-members of JMF on the basis of cumulative square root frequency method.

Table: Categories based on frequency of extension services accessed

Category	Range
Low	<14
Medium	14 to 17
High	>17

18) Provision of veterinary services

It refers to the frequency at which veterinary services were rendered to the dairy farmers by dairy cooperative (JMF), Vet. Officer, Stockman, NGO's etc. The response of the respondents was obtained on three point continuum i.e. regularly, seldom and never and score of 2, 1 and 0 were assigned respectively. The respondents were classified in terms of having low, medium and high on the basis of cumulative square root frequency method.

Table: Categories based on the provision of veterinary services

Category	Range
Low	<11
Medium	11 to 14
High	>14

19) Access to Input Supply

It was operationalised as the frequency at which dairy farmers received inputs and supply services rendered by dairy cooperative (JMF), input dealers, private firm, NGO's etc. The response of the respondents was obtained on three point continuum i.e. regularly, seldom and never and score of 2, 1 and 0 were assigned respectively. The respondents were classified in terms of having low, medium and high on the basis of cumulative square root frequency method.

Table: Categories based on the access to input supply

Category	Range
Low	<8
Medium	8 to 11
High	>11

20) Access to credit

It refers to the frequency of monetary facilities availed by the dairy farmers from different institutes such as dairy cooperative (JMF), banks, NGO's or private bodies etc. The response of the respondents for access to credit was obtained on 'Yes' and 'No' with an assigned score of 1 and 0 respectively. The respondents who actually availed the credit facilities from different institutions previously were also determined based on frequency and percentage. Further, to ascertain the level of access to credit facilities; the response of the respondents was obtained on three point continuum i.e. regularly, seldom and never and score of 2, 1 and 0 were assigned respectively. The respondents were classified in terms of having low, medium and high on the basis of cumulative square root frequency method.

Table: Categories based on the access to credit

Category	Range
Low	<7
Medium	7 to 10
High	>10

21) Distance from milk collection centre

It refers to the average distance covered by the respondent to reach the milk collection centre from his/her residential home. It was measured in metre (m) or kilometer (km).

22) Market distance

It refers to the average distance covered by the respondent to reach the market place from his/her residential home. It was measured in metre (m) or kilometer (km).

23) Labour utilization

It refers to the number of labours (persons/day) utilized for performing various dairy related activities or managing dairy farms. It may include family labour apart from additional labour hired by both members and non-member producers.

3.5 MEASUREMENT OF MOTIVATING FACTORS INFLUENCING FARMERS' DECISION TO JOIN DAIRY COOPERATIVE (JMF)

For delineation of motivational factors preferential ranking method will be followed in order to rank factors in the order of their perceived preferences by the respondents. Various factors like Intrinsic and Extrinsic factors will be taken into consideration for mapping their motivational factors influencing dairy farmers for joining dairy cooperative.

RANK BASED QUOTIENT (RBQ)

Rank Based Quotient (RBQ) is used to quantify the data collected by preferential ranking by first ranking the parameters and then calculating the Rank Based Quotient given by Sabarathnam (1988) which is as follows:

Formula:

$$\boldsymbol{RBQ} = \Sigma \frac{(Fi) \times (n + 1 - i)}{N \times n} \times 100$$

Where,

F_i = Frequency of the farmers for the i^{th} rank of the attribute

N = Number of farmers identified for factor identification

n = The maximum number of ranks given for various factors

i = Rank of the attributes

The factors with highest RBQ score will be ranked first and hence considered the most important factors by the farmers

3.6 IMPACT OF JMF ON REPRODUCTIVE, PRODUCTIVE AND HEALTH PERFORMANCE OF DAIRY ANIMALS

For the purpose of present study, three milch animals of the area, i.e. Buffalo, Indigenous cow and Crossbred cow were taken into consideration. The

average milk yield of each of these animals in its lactation period in respect of each of the respondent was recorded. Following criteria were used for determining the level of productive and reproductive performance of animals. Productive performance includes determination of parameters like lactation milk yield (LMY), average daily milk yield (AMY), lactation length (LL), peak yield (PY), dry period (DP), etc. And reproductive performance includes calving interval (CI), service period (SP), service per conception (SPC), age at first calving (AFC) etc. These above mentioned productive and reproductive performance were estimated through interview schedule with the help of difference parameter specific equation to measure their performance.

3.6.1 REPRODUCTIVE PARAMETERS

i. **Age at first calving (AFC):** The actual age of animals at the time of its first calving for cows and buffaloes separately. It is expressed in days.

ii. **Service period (SP):** It is the period required to get conceive after calving and expressed in days. It should be as minimum as possible for better production of the animals.

iii. **Service per conception (SPC):** It is defined as an average no. of insemination or natural service required by a cow to become pregnant.

iv. **Calving Interval (CI):** It is the period between two successive calving i.e. the period between the calving of the first calf to the calving of immediate next calf and was expressed in days.

$$\text{Average calving interval} = \frac{\sum_{i=1}^{n} P_i}{n}$$

Where,

P_i = Calving interval of i^{th} animal (i=1-----n)

n = Total number of milch animal with farmer

3.6.2 PRODUCTIVE PARAMETERS

i. **Average Daily Milk Yield (AMY):** It refers to the average milk yield of an animal during the lactation. This was measured in litres/day by using the following formula:

Average milk yield (lit./day)= Lactation yield/305 days

ii. **Lactation Length (LL):** It is the number of days a cow or buffalo remain in milk from the date of calving to the date of dry. It is expressed in days or months.

$$\text{Average lactation length} = \frac{\sum_{i=1}^{n} L_i}{n}$$

Where

L_i = Lactation Length of i^{th} animal (i=1 ----n)

n = Total number of milch animal with farmer

iii. **Lactation Milk Yield (LMY):** It is conceptualized as the average total quantity of milk produced by an animal in its lactation period. It is expressed in litre and calculated by following formula:

1. Lactation Milk Yield (litres) for indigenous cow and Buffalo: Peak yield × 180
2. Lactation Milk Yield (litres) for Cross-bred Cow: Peak yield × 200

iv. **Peak yield (PY):** It is measured as the highest milk produced by the milch animal in its lactation length. It is expressed in litres.

v. **Dry Period (DP):** It refers to the number of months a cow or buffalo remained dry i.e. the interval between the date of dry to the date of next calving and was expressed in days.

$$\text{Average dry period} = \frac{\sum_{i=1}^{n} D_i}{n}$$

Where,

D_i = Dry period of i^{th} animal (i=1-----n)

n = Total number of milch animal with farmer

3.6.3 HEALTH PERFORMANCE OF DAIRY ANIMALS

The goal of health performance is to ascertain the state of illness or physical injury identified in dairy animal herd caused due to disease and management errors. It is obtained based on the combined routine health examinations, review of selected herd performance records, and decisions and actions related to

specific herd management issues as perceived by veterinarian and the dairy producer. A Semi-structured Interview Schedule was developed to determine the health performance of dairy animals both in members and non-members of JMF.

3.6.4 BODY CONDITION SCORE (BCS)

The body condition score (BCS) system is a subjective scoring method of evaluating the energy reserves of dairy animals which provides a better understanding of biological relationship between body fat, milk production and reproduction that helps in adopting the optimum managemental practices to derive maximum production and maintain better health status. It is based on evaluation of the outer appearance of the animal that interacts with its body fat reserves and therefore is directly influenced by energy balance. It gives an immediate appraisal of the body state of the animal and is readily incorporated in operational decision making (Gransworthy, 1988). BCS systems have been developed earlier by many scientists like Jefferies (1961) using 0 to 5 scale in ewes, Lowman *et al.* (1976) using a 0 to 5 scale in beef cattle and Earle (1976) using a eight grade system in dairy cows. Edmonson *et al.* (1989) developed a chart for body condition scoring of Holstein dairy cows on a 1 to 5 scale using 0.25 increments. Sarjan Rao *et al.* (2002) and Anitha *et al.* (2005) have utilized this chart for scoring the crossbred dairy cows in India. The most widely used and traditional method of body condition scoring is by manual observation and/or physical examination of the animal to form an assessment of overall body condition (Edmonson *et al.*, 1989; Roche *et al.*, 2009).

The body condition score was studied on 5 point scale as per Edmonson *et al.* (1989). The following eight skeletal check points had been examined by vision and palpation to indicate the body condition in a 1 to 5 scale using 0.25 increments. The eight locations to be examined will be kept in three major regions:

A. Loin:

1. Spinous processes (the vertical prominence of the lumber vertebrae).
2. Depression between the spinous and transverse processes.
3. Transverse processes (the transverse prominence of the lumber vertebrae).

4. Overhanging shelf formed by the transverse processes above the flank.

B. Pelvis:

5. Tuber coxae (hooks) and Tuber ischia (pin bones) bony prominence.

6. Depression between the hook and pin bones.

7. Depression between the hooks.

C. Tail head:

8. Spinous and transverse processes of the coccygeal vertebrae and ischiorectal fossa (depression beneath the tail).

Considering the above points Edmonson *et al.* (1989) formulated a score chart which had been adopted in the present study. The body condition scoring chart has been presented as below:

Scale for Body Conditioning Scoring

Score	Body Condition Description
1	Deep cavity around tail head. Bones of pelvis and short ribs sharp and easily felt. No fatty tissue in pelvic or loin area. Deep depression in loin.
2	Shallow cavity around tail head with some fatty tissue lining it and covering pin bones. Pelvis easily felt. Ends of short ribs feel rounded and upper surfaces can be felt with slight pressure. Depression visible in loin area.
3	No cavity around tail head and fatty tissue easily felt over whole area. Pelvis can be felt with slight pressure. Thick layer of tissue covering top of short ribs which can be still be felt with pressure. Slight depression in loin area.
4	Folds of fatty tissue are seen around tail head with patches of fat covering pin bones. Pelvis can be felt with firm pressure. Short ribs can no longer be felt. No depression in loin area.
5	Tail head is buried in thick layer of fatty tissue. Pelvic bones cannot be felt even with firm pressure. Short ribs covered with thick of fatty tissue.

To study the effect of BCS, animals were divided into three groups for proper conclusion. These groups were as follows:

Classification of body condition of dairy animals based on Body Condition Score (BCS)

Category	BCS (Range)
Low	<1.5
Medium	2.5-3.5
High	3.5-4.5

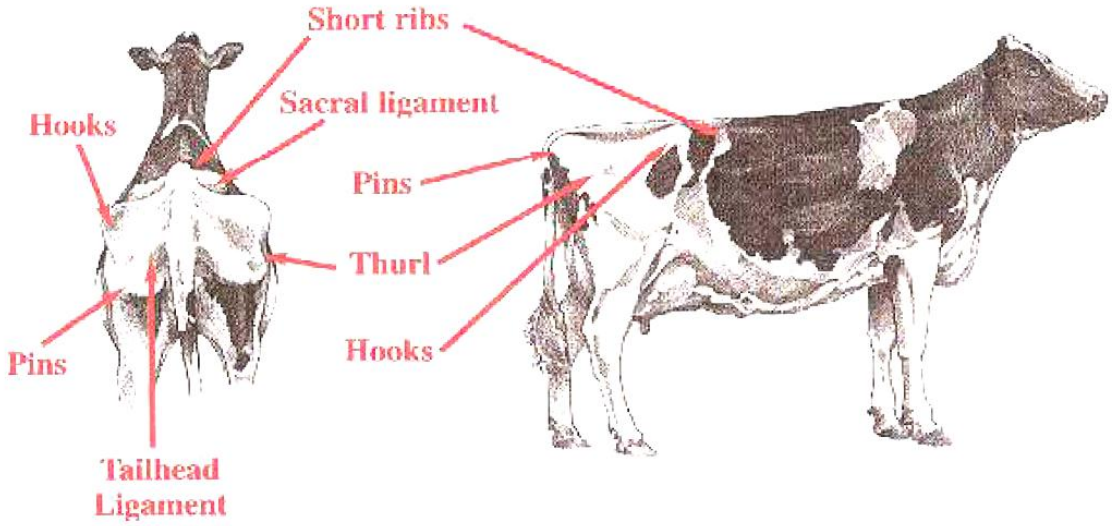


Fig 3.4 Anatomical areas used for scoring body condition in cow (Source: Wildman *et al.,* 1982)

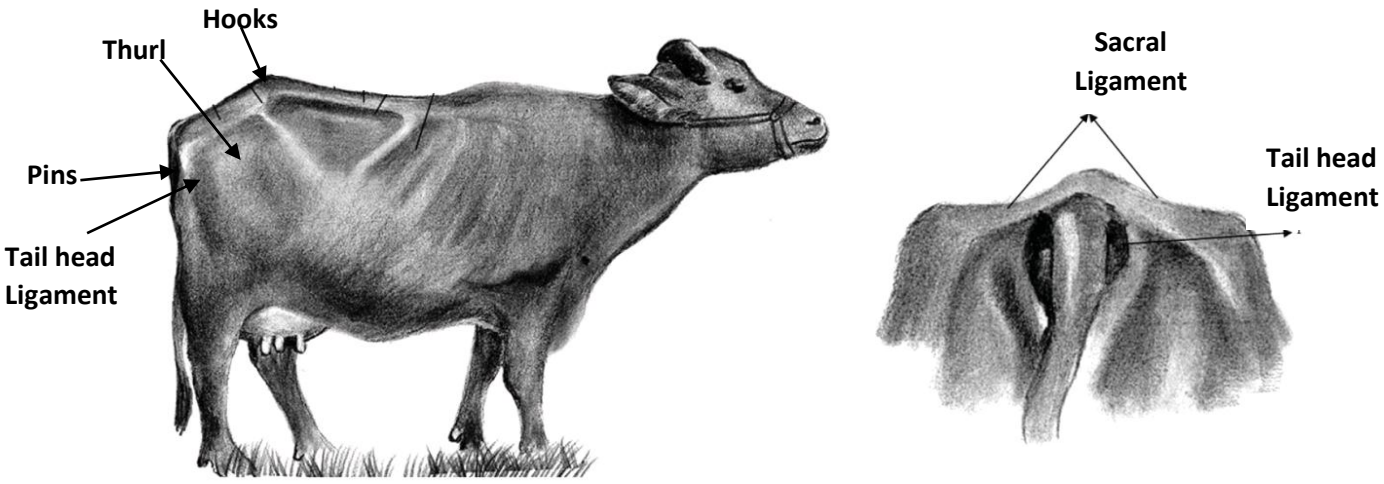


Fig 3.5 Anatomical areas used for scoring body condition in buffalo (Source: Anitha *et al.,* 2011)

3.6.5 MORBIDITY AND MORTALITY

Morbidity and mortality are two related terms that are commonly used in the field of epidemiology.

a. **Morbidity** refers to the state of being unhealthy. It applies to all the animals affected by a disease in a particular region. The morbidity rate refers to the number of animals affected by a particular disease.

$$\textbf{Morbidity rate} = \frac{\text{No. of diseased animal}}{\text{Total herd population}} \times 100$$

b. **Mortality** shows the number of deaths in a particular herd population.

$$\textbf{Mortality rate} = \frac{\text{No. of dead animal}}{\text{Total herd population}} \times 100$$

3.7 MEASUREMENT OF IMPACT OF JMF ON SOCIO-ECONOMIC STATUS OF DAIRY FARMERS

Impact Assessment

It is an important exercise to assess the impact of any programme/project operational in any area, as it shows the extent up to which that programme/project was able to bring change, in terms of economic, socio-cultural and technological conditions of the beneficiaries. There are two well -known approaches which are much prevalent in measuring the impact of any programme/project viz., 'Before and After' and 'With and Without' approaches (Singh, 1986). Ideally, both of these approaches should be used together, if possible. The 'Before and After' approach purges the programme impact of the cumulated effect of the past programmes, and the 'With and Without' approach eliminates the effects of the natural process of development as well as of the other development programmes underway in the study area. But the 'Before and After' approach can be used only when the baseline data for the year immediately preceding the year when the programme to be evaluated was launched, are available. For the 'With and Without approach, the households who are otherwise eligible for assistance under the programme, but could not get either due to the limited target of the programme or their personal reasons, constitute the 'control' (without programme) group and the beneficiaries would constitute the 'project' (with programme) group.

Propensity Score Matching (PSM)

In social science studies, aiming at estimation of impact of interventions, obtaining a suitable counterfactual is a challenge. Often the units in treatment are different from the units in control, in variable other than treatment. Measuring impact without accounting for such dissimilarity can lead to sample selection bias. One way of circumventing the problem of bias is to match the dairy farmers in treatment and control groups based on the variables, which can determine the program participation and then measure impact as average difference in the matched pair. This is the principle behind Propensity Score Matching (PSM) technique (Wu *et al.,* 2010).The first step in the application of PSM is to estimate the propensity score, also known as the conditional probability which allows identifying similar farmers.

The propensity score can be estimated as follows:

$$P(Z_i)= Prob(C_i=1 \mid Z_i)$$

Where, the propensity score, $P(Z_i)$ is estimated by a probit model. Next step is to check the common support or overlap condition it rules out perfect predictability of C_i given Z_i, given as

$$0<P (C_i =1 \mid Z_i) <1$$

The common support assumption improves the matching quality by excluding dairy farmers at the tails of the propensity score distribution. It ensures the characteristics observed in member-producers group can also be observed among non-member producers group (Bryson*,* 2002)

The second step in the implementation of the PSM method is to choose a best matching estimator. Several alternative indicators of matching quality are suggested in the literature. A good matching estimator does not estimate too many of the original observations from the final analysis while it should at the same time yield statistically equal covariate means for households in the treatment and control groups (Caliendo and Kopeinig, 2008). It is a common practice to experiment with different matching estimators to check for the robustness of estimates. In the present study, nearest neighbor method (with 1:1, 1:3 and 1:5 matching) and caliper matching (with caliper of 0.2) will be used. However, conventional standard error is not valid due to matching process. Hence, in

nearest neighbor matching, analytical standard error will be used for testing the statistical significance, as bootstrapping is not valid with nearest neighbor matching. In the case of caliper matching bootstrapped standard error will be used.

The average treatment effect on the treated (ATT) will be estimated as follows (Becker and Ichino, 2002):

ATT= E { Y_{1i}^k - Y_{0i}^k | C_i= 1} = E [E{Y_{1i}^k - Y_{0i}^k | C_i =1, p (Z_i)}]

=E [E { Y_{0i}^k | C_i =1, p (Z_i)} - E{ Y_{0i}^k | C_i =0, p (Z_i)}| C_i =1],

Where Y_1 and Y_0 are, values of the outcome variables of interest for member and non-member producers respectively, 'i' refers to households, 'k' refers to the outcome variable being analyzed (income, milk yield).

3.8 MEASUREMENT OF PROBLEMS AND PROSPECTS OF JMF

Problem and prospects of the dairy cooperative will be assessed by using SWOT analysis of the cooperative at basically 4 levels i.e. procurement, processing, marketing and productivity enhancement levels. So, in order to enquire about strength, weakness, opportunity and threat, a focused group discussions will be conducted to identify different factors within those domain by the help of experts in those respective departments.

After the identification of various factors within each category, an interview schedule will be prepared, and SWOT analysis will be performed by combining Analytical Hierarchy Process (AHP) (Saaty, 1980). AHP utilizes pair-wise comparison method to know the overall priority of each factor considered by dairy farmers; which, in turn determines the problems and prospects of dairy cooperative (JMF) in Jharkhand State. Different identified factors within 'strength, weakness, opportunity and threat' will be compared paired-wise on a 9 point scale of importance. Thus, two questions will be answered: 1.Which factors have more relative importance and 2. How much importance one factor has got as compared to the other, within a particular category? Then, calculation will done for finding out relative local priorities, based on 'Eigen-value Technique'. Finally global priorities will be calculated by multiplying local priorities with the scaling factor. So, with the help of AHP, quantitative importance of each factor on the problems and prospects of JMF at different supply chain will be measured, separately.

Procedure for Analytical Hierarchy Process (AHP):

When application of AHP is done for any decision making, the first requirement is the breaking up of decision problem into decision elements in a hierarchical fashion. The predecessor of AHP is pair-wise comparison in psychological measurement. AHP is based on pair-wise comparison, but associated with hierarchic formulation of multiple-criteria. Thus this has obvious advantage of providing 'objective decision', based on subjective and personal preference of an individual or a group of individuals. The advantage of AHP includes its ability to make both qualitative and quantitative decision attributes commensurable, and its flexibility with regard to the setting of objectives (Kangas, 1992). Subjective preferences, expert knowledge and objective information can all be included in one and the same decision analysis (Kurttila *et al.,* 2000).

Step-wise description of application of Analytical Hierarchy Process (AHP)

Step I: Problem Modelling

Better understanding of decision problem is necessary. Based on that what goal is to be achieved should be made clear at the outset. Then identify various factors, which are essential to achieve the goal. Under each of the factor, then derive criteria. These are the essential features of 'problem modelling' in AHP. The problem structure should include less number of criteria yet covering a vast aspect.

Step II: Pair-wise comparison

In the next step different factors are compared, pair-wise; and, in the next level, criteria are also compared, pair-wise among themselves. Thus, based on comparison, in each case (both factor and criteria) the 'comparison matrix' can be formed.

$$\mathbf{M=}\ (a_{ij}) = \begin{matrix} \boldsymbol{D_1} \\ \boldsymbol{D_2} \\ \vdots \\ \boldsymbol{D_n} \end{matrix} \begin{Bmatrix} \boldsymbol{D_1} & \boldsymbol{D_2} & \cdots & \boldsymbol{D_n} \\ \mathbf{1} & \boldsymbol{a_{12}} & \cdots & \boldsymbol{a_{1n}} \\ \mathbf{1}/\boldsymbol{a_{12}} & \mathbf{1} & \cdots & \boldsymbol{a_{2n}} \\ \cdots & \cdots & \cdots & \cdots \\ \mathbf{1}/\boldsymbol{a_{1n}} & \mathbf{1}/\boldsymbol{a_{2n}} & \cdots & \mathbf{1} \end{Bmatrix}$$

M=pair-wise comparison matrix

Table 3.6 Problem modelling for SWOT in Procurement Unit of JMF

Criteria		STATEMENTS
STRENGTH	S1	Weekly milk payment system and regular payment of bonus
	S2	Ease of access to milk collection centres
	S3	Good supply chain network
	S4	Automatic milk collection and milk testing equipment
	S5	Good sanitary status
	S6	Proper facilities for quality testing of milk
	S7	Regular and guaranteed supply of raw milk from the milk producers
	S8	Proper maintenance of milk collection records using computers
WEAKNESS	W1	Lack of coordination in the supply chain management
	W2	Low productivity of animals and high cost of milk production
	W3	Low procurement price for milk as compared to other unorganized competitors
	W4	Milk collection centres are not well equipped
	W5	Lack of trained and skilled technical and support staff members.
	W6	Inadequate infrastructural facilities for procurement and transportation
	W7	Difficulties in provision of inputs services
OPPORTUNITY	O1	More milk producers willing to join JMF
	O2	Growing milk demand and expandable market share
	O3	Modern infrastructural facilities for procurement, processing and chilling of milk
	O4	Expansion of milk route
THREAT	T1	Farmers losing interest in dairy farming
	T2	Increasing cost of inputs
	T3	Fluctuations in milk production due to vagaries of climate change, pandemic etc.
	T4	High incidence of bovine diseases
	T5	Distant location of milk collection centres
	T6	Decline of grazing lands due to urbanization
	T7	Adulteration of milk at producer's level
	T8	Transportation problem
	T9	Seasonal variation in procurement of milk

Step III: Judgmental Scale

The strength of AHP lies in the possibility to evaluate quantitative as well as qualitative criteria and alternatives on the same preference scale. Here, the response may be in numerical, verbal or in graphical form, but it can be converted into cardinal measurement. Saaty (2008) proposed one nine-point scale (see Table.3.7) to have a pair-wise comparison of different factors and criteria. In Saaty's AHP, the verbal statements are converted into integers from one to nine, based on the intensity of importance of one over other.

Table 3.7 The fundamental scale of absolute number

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favour one activity over other
4	Moderate plus	
5	Strong importance	Experience and judgment slightly favour one activity over other
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation

(Adopted from Saaty, 2008)

Step IV: Aggregation of Judgment

In AHP, several processes are used to aggregate the decision maker's opinions, with the two most popular being: (1) aggregating individual judgments

regarding each set of pair-wise comparisons to produce an aggregate hierarchy, (2) synthesizing each of the individual hierarchies and aggregating the resulting priorities (Forman and Peniwati, 1998). These two processes are also termed the 'Aggregation of Individual Judgment' (AIJ), and the 'Aggregation of Individual Priorities' (AIP). Forman and Peniwati (1998) explained that the optimal mathematical procedure for aggregation depends on whether the group is assumed to be a synergistic unit or merely a collection of individuals. 'Aggregating Individual Judgment' (AIJ) with geometric mean in case of former and 'Aggregating Individual Priorities' (AIP) with either geometric mean or arithmetic mean should be used in the latter case, respectively. However, Wu *et al.* (2010) compared different aggregation methods and categorically stated that methods of aggregation did not influence the final results. However, the judgments of every expert and then get their arithmetic mean is inefficient. Here, AIP method will be used by taking geometric mean, while calculating the priorities of SWOT factors, and arithmetic mean will be calculated to aggregate the priorities among the criteria. By taking the derived value from AIP method, comparison matrix will be developed for the group of individuals.

Step V: Determination of Consistency Ratio

As priorities only would be usable and valid, if derived from matrices that are consistent; so, a consistency check must be applied. Saaty (1977) has proposed a consistency index (CI), which is related to the Eigen value method. The 'Eigen value' (λ_{max}) can be obtained by summing of products of each element of 'Eigen vector' multiplied by the total of columns of reciprocal matrix. He also proved that biggest 'Eigen value' is equal to the number of comparisons (λ_{max}=n). Therefore 'Consistency Index' can be calculated by the following formula

$CI=\frac{(\lambda \max - n)}{(n-1)}$ Where, n= dimension of the matrix

λ_{max} = maximal eigen value

The consistency ratio, the ratio of CI and RI, is given by;

CR= CI/RI,

Where, RI is the random index

Table 3.8 Table of Random Indices

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

(Adopted from Saaty and Forman, 1992; actual calculation made by Saaty, 1977)

The thumb rule for consistency of the matrix is, consistency ratio should be less than 0.1

Step VI: Calculation of priorities

Identification of scaling factor is of utmost importance, as the scaling factor or priority would show how much importance a particular factor has, in terms of overall goal. Various criteria would have local priority (priority/scaling factor within a particular factor) and global or overall priority (priority/scaling factor in relation to overall goal). Thus, these priorities would tell about cardinal importance of each of the criteria or factor in overall scale. Priority or local weights are calculated by dividing each elements of row by the sum of each column in 'comparison matrix'. Then normalize the 'Eigen vectors' by averaging the value of the factors criteria across the new rows to identify scaling factors or priority vector. In this way, calculation of priority of SWOT factors to overall goal and local priority of criteria are achieved. But, to get the global priority of the criteria towards overall goal, the priority vector of SWOT groups has to be multiplied with local priorities of respective criteria within that particular SWOT group.

3.8.1 MEASUREMENT OF MEMBER-PRODUCERS PERCEPTION OF SWOT ON JMF

According to Schacter *et al.* (2009): "Perception is the organization, identification, and interpretation of a sensation in order to form a mental representation". In this study, perception refers to the key idea of dairy farmers' judgment. Liker-type rating interview schedule was constructed to measure the perceptions of respondent dairy farmers towards dairy cooperative's (JMF's) Strengths, Weakness, Opportunity and Threats.

After informally discussing the research problem with the dairy farmers, extension workers, experts, and also consulted secondary sources. For example,

in our case we discussed the topic with the cooperative dairy farmers, *Doodh Mitras* and veterinarians involved in various operations of the JMF and experts in the field. Reviewed literature with respect to farmers' perceptions towards dairy cooperatives and referred journals, books, articles and net sources. Literature review helped in the process of item generation for the scale. Simple statements were used for construction of statements. The interview schedule comprised of nine statements from Strengths, six statements from Weaknesses, six statements from Opportunities and seven statements from Threats. The responses were obtained on a 5-point continuum i.e. Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. The scores assigned to these were 5, 4, 3, 2 and 1, respectively. The maximum obtainable score on each statement was 900 and minimum was 180. The total score of each statement was also calculated and subsequently their weighted mean score was calculated, based on which the statements were ranked accordingly. Overall, the results of dairy farmers perception on SWOT of cooperative (JMF) were classified into 3 levels: strong (≥0.65), medium (0.41-0.64), weak (≤0.40) based on equal stratification of the class interval of their weighted mean scores.

Validity and consistency of statements

Validity is the extent to which the measure provides an accurate representation of what one is trying to measure. Lindquist (1951) defined validity of a test as the accuracy with which it measures that which is intended to measure. Consistency ensures that same scores is obtained by the same individuals when re-examined with test on different occasions, or with different sets of equivalent items, or under variable examining conditions. For assessing the validity and consistency of the statements, Spearman's rank order correlation was used. The correlation coefficient of more than 0.80 confirmed that the statements selected for the study were consistent with each other.

Spearman's rank order correlation (for nominal data)

There are two methods to calculate Spearman's correlation depending on whether:

(1) your data does not have tied ranks or (2) your data has tied ranks.

The formula for when there are no tied ranks is:

$$\rho = 1 - \frac{\sigma \sum d_i^2}{n(n^2 - 1)}$$

Where,

di = difference in paired ranks and *n* = number of cases. The formula to use when there are tied ranks is:

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{s\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}}$$

Where, *i* = paired score. It ranges from -1 to +1.

3.8.2 Constraints perceived by member-producers of JMF due to Covid-19 pandemic

It refers to impediments or obstacles in following a particular way. Constraints for the present study have been operationalised as obstacles or hurdles experienced by the dairy farmers during Covid-19 pandemic. The respondents were asked to rank each of the constraint relevant to them according to the degree of importance as perceived by them. As all the items were not ranked same by all the respondents the method of combining of incomplete order of merit ratings as suggested by Garret (1981) was followed.

Garrett's ranking technique

To find out the most significant factor which influences the respondent, Henry Garrett's (1981) ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcome of such ranking has been converted into score value with the help of the following formula:

$$\text{Per cent position} = \frac{100(\text{Rij} - 0.5)}{\text{Nj}}$$

Where;

Rij = Rank given for the ith variable by jth respondents

Nj = Number of variable ranked by jth respondents

With the help of Garrett's Table, the per cent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important constraint.

3.8.3 Major suggestions as perceived by member-producers for improving the overall performance of the JMF

Major suggestions were recorded from the member-producers, with regard to overall improvement of the performance JMF. These suggestions were obtained directly through personal interaction from dairy farmers during data collection, and they broadly covered all the aspects of procurement, processing, productivity enhancement and marketing activities of JMF. Accordingly, the respondents were asked to rank each of the statement relevant to them according to the degree of importance as perceived by them. The response was calculated using multiple response method by the respondents and accordingly ranks were assigned based on frequency and percentage.

3.9 METHOD OF DATA COLLECTION

A well-structured interview schedule was developed for the data collection purpose and the entire schedule was pre-tested for elimination in the non-sampling area, alteration and modification, if any. Data for the study were collected from the study area with the help of a pre-structured and pre-tested interview-schedule, developed in the light of objectives of the study. The primary data was collected from respondents by personal interview method, survey technique and group discussions. Apart from primary data the secondary data were also collected from the authentic sources like published annual reports, statistical hand books, economic survey reports and government official websites.

Pre-testing of interview-schedule

The interview-schedule was pre-tested with non-sampled dairy farmers of Bokaro district in Jharkhand State selected as per the convenience. One MPP located in Petarwar village was selected randomly, wherein 20 member-producers and 20 non-member producers were randomly selected for pre-testing. The interview schedule was then revised in accordance with pretesting outcome in

order to remove ambiguities and ensure that the questions are clearly stated and response options are comprehensive, mutually exclusive, and relevant, thus, making the interview-schedule more workable.

3.10 STATISTICAL TOOLS USED FOR ANALYSIS OF DATA

The collected data were classified and tabulated in order to measure the objectives of the study. Based on the nature of the study, the tabulated data were analysed statistically with the help of the explained statistical methods.

1. Frequency

This was used to find out the number of respondents in each cell.

2. Percentage

The percentage value was calculated to make simple comparisons. Percentage value was calculated by dividing the frequency in the particular cell by number of respondents and multiplies it by 100.

$$\textbf{Percentage } (\mathbf{P}) = \frac{\mathbf{n}}{\mathbf{N}} \times \mathbf{100}$$

Where,

n = Frequency of particular cell

N = Total number of the respondents in a particular cell.

3. Mean

The Arithmetic average of the set of data had to be often computed during the analysis of data. This measurement was used to see the central tendency of the data. The mean score of a series of data was equal to the sum of individual measures divided by the total number of respondents. The mean scores for each group were worked out by computing with this formula.

$$\overline{\mathbf{X}} = \frac{\sum \mathbf{Xi}}{\mathbf{N}}$$

Where,

$\overline{X}$ = Mean

ΣXi = Sum of each of the individual, measurement of the scores.

N = Number of respondents.

4. Standard Deviation

The Standard Deviation is defined as the square root of the mean of the squared deviations of individual values from their means. It indicates a sort of group standard spread of values around their mean.

5. Standard Error of the Mean

Standard Error of the Mean is defined as the standard deviation of the sampling distribution of the mean. The formula for the standard deviation of error of the mean is as follows

$$\sigma_M = \frac{\sigma}{\sqrt{N}}$$

6. Statistical tests for difference between two means 'Independent sample t-test'

To test the significance of group characteristics between members and non-members, this test was used to test the difference between the mean value of different parameters for treatment and control groups.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

n_1 = number of observations for member group

n_2 = number of observations for non-member group

$\bar{X}_1$ = mean of the member group

$\bar{X}_2$ = mean of the non-member group

s_1^2 = sample variance for the member group

s_2^2 = sample variance for the non-member group

The pooled variance for member and non-member was calculated as under:

$$S^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

The parameters for which tests for difference between means were employed are age, experience in dairy farming, herd size, annual household income etc. IBM SPSS 25 software was used to analyse the data.

7. Mann- Whitey 'U'-test

To test the significance of group characteristics between members and non-members, this test was administered.

The test criterion

$$Z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}}$$

where U, the statistic = $n_1 n_2 + \frac{n_1(n_1+1)}{2} - T_1$

or

$$n_1 n_2 + \frac{n_2(n_2+1)}{2} - T_2$$

n_1 = size of the first sample

n_2 = size of the second sample

T_1 = Sum of the ranks of first sample

T_2 = Sum of the ranks of second sample

If the calculated 'Z' value is greater than 1.96, we conclude that the samples differ significantly and vice-versa, at 5 per cent level of significance. The calculated value is compared with 2.58 at 1 per cent level of significance.

8. Cumulative square root frequency

Cumulative square root frequency method was followed as the standard method to classify the farmers based on their socio-economic characteristics. The same approach was used for the classification of farmers based on their attitude into unfavourable, neutral and favourable categories. Cumulative square root frequency (CSRF) method allows greater efficiency for setting stratum boundaries. This methodology breaks down the population into intervals, which can be of equal or unequal width. The steps involved in its calculation are given below:

a. Evaluate the data and determine the units that can be reviewed on an actual basis.

b. Stratify the remaining data into ranges or classes. Number of classes and class interval are determined using the formulas given as below:

$$\text{No. of classes} = 2.5 \times (\text{number of samples})^{1/4}$$

$$\text{Class interval} = \frac{(\text{Largest figure} - \text{Smallest figure})}{\text{No.of classes}}$$

c. Determine the frequency for each range. This is the number of units within the range.

d. Calculate the square root of the frequency for the first range. Then calculate the square root of the next range. Continue this process for each of the ranges.

e. Sum of the square root of the first and second range gives cumulative square root of the second range; sum of first, second and third gives the third range and so on for all the ranges.

f. The cumulative square root frequency value of the last class is divided by the number of sample strata desired (can vary 3-9) to get the cumulative square root value for each item.

g. Suppose we desire to have 3 strata, then the upper limit of the first strata is determined using the formula as given below:

$$\text{Li} = \text{Y}_{\text{i}-1} + \frac{(\text{Yi}-\text{Yi}-1)}{\sqrt{\text{f}}} * \left\{\left(\frac{\text{S}_\text{k}}{\text{L}}\right) * 1 - \text{S}_{\text{i}-1}\right\} \ldots\ldots\ldots\ldots\text{Value 1}$$

Where,

L_i = Upper limit of the i^{th} strata (in this case first strata)

L = Number of strata

Y_i = Upper limit of the class in which L_i lies

Y_{i-1} = Lower limit of the class in which L_i lies

S_k = Cumulative square root frequency value

$\sqrt{f}$ = Square root of the frequency of the i^{th} class in which L_i (S_k/L) lies

S_{i-1} = Cumulative square root frequency of the preceding class in which L_i (S_k/L) lies

$Y_i - Y_{i-1}$ = Width of the class in which L_i (S_k/L) lies

For the upper limit of second strata, the formula is:

$$\mathrm{Li} = \mathrm{Y_{i-1}} + \frac{(\mathrm{Yi}-\mathrm{Yi}-1)}{\sqrt{\mathrm{f}}} * \{(\mathrm{S_k}/\mathrm{L}) * 2 - \mathrm{S_{i-1}}\}$$.....Value 2

For the upper limit of third strata, the formula is:

$$\mathrm{Li} = \mathrm{Y_{i-1}} + \frac{(\mathrm{Yi}-\mathrm{Yi}-1)}{\sqrt{\mathrm{f}}} * \{(\mathrm{S_k}/\mathrm{L}) * 3 - \mathrm{S_{i-1}}\}$$.....Value 3

In this way, three strata were found i.e., below value 1, between value 1and value 2 and above value 2 up to value 3.

CHAPTER –4

Results and Discussion

RESULTS AND DISCUSSION

In the light of selected objectives of the study, the collected data were tabulated and analysed by using appropriate analytical techniques as already discussed. This chapter presents the results and their analysis under the following subheadings:

4.1 Socio-personal and socio-economic profile of the respondents

4.2 Factors influencing farmers' decisions to join JMF

4.3 Impact of JMF on reproductive, productive and health performance of dairy animals and socio-economic status of dairy farmers.

4.4 Problems and prospects of Jharkhand State Cooperative Milk Producers' Federation and their members' perception.

4.1 SOCIO-PERSONAL AND SOCIO-ECONOMIC PROFILE OF THE RESPONDENTS

The socio-personal and economic profile of the population that was sampled became essential to obtain information on the various indicators through which the impact could be evaluated and compared with the beneficiaries and non-beneficiaries. Therefore, the variables that were under investigation were analysed, and the results have been described under the following subheading:

4.1.1 Age

The age of respondents was chosen because it defines a person's level of maturity and influences their thought processes, life experiences, decision-making, and exposure.

Result in Table 4.1.1 indicates that majority of the members (45.00 %) were middle age category, whereas majority of the non-members (47.22 %) were in the old age category. It was observed that, one-fourth (25.00%) of the members belonged to young age group, while around 17.78 per cent belonged to young age group. It could clearly be inferred that majority of the member dairy farmers belonged to young to middle age group categories, whereas most of the non-members belonged to middle to old age group categories.

Table 4.1.1 Overall distribution of respondents based on their age

(n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Young (below 35) yrs.	32	17.78	45	25.00	77	21.39
2	Middle (36 to 50) yrs.	63	35.00	81	45.00	144	40.00
3	Old (above 50) yrs.	85	47.22	54	30.00	139	38.61
	Total	180	100	180	100	360	100

4.1.2 Gender

Table 4.1.2 showed that majority of the respondents in both the members (70.00%) and non-members (77.78%) were dominated by male, whereas female representation among members and non-members were 30.00 and 22.22 per cent respectively. However, female representation was slightly more in case of members than non-members.

Table 4.1.2 Distribution of respondents based on gender

(n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Male	140	77.78	126	70.00	266	73.89
2	Female	40	22.22	54	30.00	94	26.11
	Total	180	100	180	100	360	100

4.1.3 Education

Education is typically seen to have an influence on broadening the mental horizon of a person, which in turn prepares and predisposes that individual to be open to the introduction of novel concepts. It is evident from Table 4.1.3 that majority of the members (38.89%) and non-members (28.89%) were found to be educated up to middle school level. It also indicated that around 12.22 per cent of members and 20.00 per cent of non-members studied up to primary school level, while 11.67 per cent of members and 7.22 per cent of non-members were found be educated till higher secondary school level. A critical observation revealed that majority of the non-members were found to be illiterate (4.44%) and functionally literate (18.33%), as compared to members. However, there were no illiterate found among members of JMF. The lower educational level among non-members may be explained in terms of poverty and ignorance of importance towards education.

4.1.4 Occupation

Results presented in the Table 4.1.4 indicated that, cent per cent of the members had dairy and animal husbandry as their main or primary occupation from where they earned more than half of their income. However, it was observed that three fifth (60.00%) of the members were engaged in agriculture, followed by business (13.33%), service (7.78%), labour (10.00%) and others (8.89%) as a subsidiary or secondary occupation.

The same table also revealed that majority of the non-members (72.22%) had dairy and animal husbandry as their main or primary occupation, followed by agriculture (12.78%), business (6.11%), service (3.89%), labour (3.33%) and others (1.67%). Whereas, it was noticed that more than one-fourth (27.78%) of the non-members were engaged in dairy and animal husbandry followed by agriculture (18.33%), business (18.33%), service (10.00%), labour (15.56%) and others (10.00%) as a subsidiary or secondary occupation.

Table 4.1.3 Distribution of respondents based on their educational qualification (n=360)

Sl. No.	Education Qualification	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Illiterate	8	4.44	0	0.00	8	2.22
2	Functionally Literate	33	18.33	6	3.33	39	10.83
3	Primary School	36	20.00	22	12.22	58	16.11
4	Middle School	52	28.89	70	38.89	122	33.89
5	High School	30	16.67	45	25.00	75	20.83
6	High Secondary School	13	7.22	21	11.67	34	9.44
7	Graduation and Above	8	4.44	16	8.89	24	6.67
	Total	180	100	180	100	360	100

Table 4.1.4 Distribution of respondents based on their occupation (n=360)

Sl. No.	Occupation	Non-Member (n=180)				Member (n=180)				Pooled (n=360)			
		Main		Subsidiary		Main		Subsidiary		Main		Subsidiary	
		f	%	f	%	f	%	f	%	f	%	f	%
1	Agriculture	23	12.78	33	18.33	0	0	108	60.00	23	6.39	141	39.17
2	Dairy and Animal Husbandry	130	72.22	50	27.78	180	100	0	0	310	86.11	50	13.89
3	Business	11	6.11	33	18.33	0	0	24	13.33	11	3.06	57	15.83
4	Service	7	3.89	18	10.00	0	0	14	7.78	7	1.94	32	8.89
5	Labour	6	3.33	28	15.56	0	0	18	10.00	6	1.67	46	12.78
6	Others	3	1.67	18	10.00	0	0	16	8.89	3	0.83	34	9.44
	Total	180	100	180	100	180	100	180	100	360	100	360	100

4.1.5 Family Size

Table 4.1.5 revealed that more than half (58.87%) of the family members from member group consisted of males followed by females (41.13%). Whereas, among non-members, majority of the family members comprised of males (62.89%) followed by females (37.11%). Therefore, it can be inferred that members fairly encouraged females to participate in dairy related activities.

Table 4.1.5 Distribution of respondents based on their family size

(n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Male	727	62.89	790	58.87	1517	60.73
2	Female	429	37.11	552	41.13	981	39.27
	Total	1156	100	1342	100	2498	100

Results presented in the Table 4.1.5.a indicated that around 38.89 per cent of the members had small family size (<6) nos., followed by 33.89 per cent had medium family size (6-9) nos. and 27.22 per cent had large family size (>9) nos. On the other hand in case of non-members, nearly half (49.44%) of the respondents had medium family size (6-9) followed by 39.44 per cent had small (<6) and 11.11 per cent had large family size. Family size influences various activities in terms of family labour availability, annual income of family etc.

Table 4.1.5.a Overall distribution of respondents based on their family size

(n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Small (<6) nos.	71	39.44	70	38.89	141	39.17
2	Medium (6 to 9) nos.	89	49.44	61	33.89	150	41.67
3	Large (>9) nos.	20	11.11	49	27.22	69	19.17
	Total	180	100	180	100	360	100

4.1.6 Experience in Dairy farming

It was observed from Table 4.1.6 that, more than half (56.67%) of member group had medium level of experience (between 8-11 years) in dairy farming, followed by 36.67 per cent were highly experienced (more than 11 years) and 6.67 per cent had less experience (less than 8 years). Similarly, it was observed that, in case of non-members, exactly half (50.00%) of the respondents had medium level of experience (between 8-11 years) in dairy farming, followed by 28.89 per cent were highly experienced (more than 11 years) and 21.11 per cent were less experienced (less than 8 years). The findings were logically justified as respondents developed skills through animal rearing practices since ages.

Table 4.1.6 Overall distribution of respondents based on their experience in dairy farming (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Less (<8) yrs.	38	21.11	12	6.67	50	13.89
2	Medium (8 to 11) yrs.	90	50.00	102	56.67	192	53.33
3	High (>11) yrs.	52	28.89	66	36.67	118	32.78
	Total	180	100	180	100	360	100

4.1.7 Herd Size

It could be seen from Table 4.1.7 that, the total herd size maintained by overall members and non-members (*i.e.* 360 respondents) cumulatively was 3514 approximately which included crossbred, indigenous cattle and buffalo altogether. Firstly, the herd size pattern in case of member-farmers indicated that a significant majority of the crossbred cattle (45.93%), indigenous cattle (33.27%) and buffalo (40.98%) were in milking condition. A notable percentage of crossbred (11.34%), indigenous (24.28%) and buffalo (13.98%) were in the dry state.

Table 4.1.7 Distribution of respondents based on herd size **(n=360)**

Sl. No.	Category	Non-member (n=180)						Member (n=180)						Pooled (n=360)					
		Crossbred		Indigenous		Buffalo		Crossbred		Indigenous		Buffalo		Crossbred		Indigenous		Buffalo	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1	**In milk**	253	45.02	58	32.77	219	56.88	575	45.93	174	33.27	252	40.98	828	45.64	232	33.14	471	47.10
2	**Dry**	101	17.97	17	9.60	48	12.47	142	11.34	127	24.28	86	13.98	243	13.40	144	20.57	134	13.40
3	**Calves**	50	8.90	40	22.60	41	10.65	342	27.32	76	14.53	149	24.23	392	21.61	116	16.57	190	19.00
4	**Heifer**	105	18.68	24	13.56	39	10.13	128	10.22	59	11.28	87	14.15	233	12.84	83	11.86	126	12.60
5	**Bull/Bullock**	53	9.43	38	21.47	38	9.87	65	5.19	87	16.63	41	6.67	118	6.50	125	17.86	79	7.90
	Total	562	100.00	177	100.00	385	100.00	1252	100.00	523	100.00	615	100.00	1814	100.00	700	100.00	1000	100.00
	Total herd size	**1124**						**2390**						**3514**					
	Avg. Herd Size	**6.24**						**13.28**						**9.76**					

A considerable percentage *i.e.* 27.32 per cent, 14.53 per cent and 24.23 per cent comprised of calves proportionately distributed among crossbred, indigenous and buffalo, respectively. Similarly, a sizeable percentage of heifers among crossbred, indigenous and buffalo comprised of 10.22 per cent, 11.28 per cent and 14.15 per cent, respectively. And lastly a countable few consisted of bull/ bullock *i.e.* 5.19 per cent, 16.63 per cent and 6.67 per cent from crossbred, indigenous and crossbred, respectively. Therefore, the overall herd size was around 2390 animals (approx.).

The herd size scenario in case of non-member also revealed similar pattern, where it was found that a significant majority of the crossbred cattle (45.02%), indigenous cattle (32.77%) and buffalo (56.88%) were in milking state. A notable percentage of crossbred (17.97%), indigenous (9.60%) and buffalo (12.47%) were in the dry state. A considerable percentage *i.e.* 8.90 per cent, 22.60 per cent and 10.65 per cent comprised of calves proportionately distributed among crossbred, indigenous and buffalo, respectively. Similarly, a sizeable percentage of heifers among crossbred, indigenous and buffalo comprised of 18.68 per cent, 13.56 per cent and 10.13 per cent, respectively. While, a countable few consisted of bull/ bullock *i.e.* 9.43 per cent, 21.47 per cent and 9.87 per cent from crossbred, indigenous and crossbred, respectively. Thus, totalling to a herd size of 1124 animals (approx.).

It was noteworthy to mention from Table 4.1.7 that majority of the herd size of different bovine animals maintained by both members and non-members were in milking state. This is attributed due to dairy farming being the major interest and primary source of regular income for majority of the respondents. But the overall population of milking animals were higher in case of members than non-members. Also it was clearly observed that, the overall herd size of crossbred, indigenous cattle and buffalo of different categories were comparably higher in case of members than their counterparts.

A perusal of Table 4.1.7.a revealed that a significant 36.11 per cent of the members fell in the category of small herd size (*i.e.* <8 nos.), followed by 33.33 per cent were in the category of medium herd size (8-13 nos.) and considerable

30.56 per cent under large herd size (*i.e.* >8 nos.). Whereas in case of non-member producers, more than half (55.56%) of the respondents fell under the category of small herd size followed by notable 25.56 per cent under medium herd size category and remaining 18.89 per cent under large herd size category. Farmers reared dairy animals generally for their self-consumption and surplus milk were sold either to the milk vendor or to the milk collection centre of JMF.

Table 4.1.7.a Overall distribution of respondents based on herd size

(n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Small (<8) nos.	100	55.56	65	36.11	165	45.83
2	Medium (8 to 13) nos.	46	25.56	60	33.33	106	29.44
3	Large (>13) nos.	34	18.89	55	30.56	89	24.72
	Total	180	100	180	100	360	100

4.1.8 Milk Production

A perusal of Table 4.1.8 revealed that more than half (54.44%) of the member dairy farmers belonged to medium category (8-15 litres/day) of milk production, followed by a significant 30.56 per cent fell under low category (<8 litres/day) and a considerable 15.00 per cent belonged to high category of milk production (>15 litres/day). Similarly, in case of non-members, it was observed that majority (45.56%) belonged to medium category (8-15 litres/day) of milk production, followed by 44.44 per cent as low (<8 litres/day) and a sizeable 10.00 per cent belonged to high milk production category.

Table 4.1.8 Overall distribution of respondents based on milk production in litres per day (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<8 litres)/day	80	44.44	55	30.56	135	37.50
2	Medium (8 to 15 litres)/day	82	45.56	98	54.44	180	50.00
3	High (>15 litres)/day	18	10.00	27	15.00	45	12.50
	Total	180	100	180	100	360	100

4.1.9 Milk Consumption

It is evident from Table 4.1.9 that more than half of the members (52.22%) and a considerable percentage of non-members (46.11%) were consuming milk from 1.25 to 3.20 litres per day. About 30.00 per cent of members and a notable 42.22 per cent of non-members fell under low consumption category *i.e.* less than 1.25 litres per day. It was noteworthy to mention that a reasonable 17.78 per cent of members and fewer non-members (11.67%) were consuming milk more than 3.20 litres per day and were thus grouped in high milk consumption category. **4.1.10 Milk Sale**

A glance of Table 4.1.10 revealed that a fair majority of members (49.44%) and non-members (47.78%) were selling 2.60 to 10.82 litres of milk per day. Further, a considerable 31.67 per cent of members and 41.67 per cent of non-members were selling milk less than 2.60 litres per day. However, it was interesting to note that a sizeable 18.89 per cent of members and a countable 10.56 per cent of non-members were selling more than 10.82 litres of milk per day and were classified under high milk selling category. All the members pooled their milk at their respective MPPs, well defined by JMF. However, non-members sold the milk directly to the customers or to the local *dudhiyas,* private milk processors and local confectionary.

Table 4.1.9 Overall distribution of respondents based on milk consumption in litres per day (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<1.25 litres)/day	76	42.22	54	30.00	130	36.11
2	Medium (1.25 to 3.20 litres)/day	83	46.11	94	52.22	177	49.17
3	High (>3.20 litres)/day	21	11.67	32	17.78	53	14.72
	Total	180	100	180	100	360	100

Table 4.1.10 Overall distribution of respondents based on milk sale in litres per day (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<2.60 litres)/day	75	41.67	57	31.67	132	36.67
2	Medium (2.60 to 10.82 litres)/day	86	47.78	89	49.44	175	48.61
3	High (>10.82 litres)/day	19	10.56	34	18.89	53	14.72
	Total	180	100	180	100	360	100

4.1.11 Per Capita Milk Availability

Results presented in the Table 4.1.11 indicated that more than half of the members (53.33%) and a considerable majority of non-members (47.22%) were

having per capita milk availability of 152.64 to 299.7 grams per day. A notable 30.00 per cent of members and 41.67 per cent of non-members were falling under the category of low per capita milk availability with less than 152.64 grams per day. Further, it was also observed that a sizeable 16.67 per cent of members and a fewer 11.11 per cent of non-members were having per capita milk availability of more than 299.7 grams per day.

Table 4.1.11 Overall distribution of respondents based on per capita milk availability in grams per day (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<152.64grams)/day	75	41.67	54	30.00	129	35.83
2	Medium (152.64 to 299.7grams)/day	85	47.22	96	53.33	181	50.28
3	High (>299.7grams)/day	20	11.11	30	16.67	50	13.89
	Total	180	100	180	100	360	100

4.1.12 Milk price

Data presented in Table 4.1.12 revealed that, non-members sold their milk to their customers at an average selling price of Rs. 37.14 per litre. Whereas, in case of members, they disposed their milk to JMF with an average procurement price of Rs.33.26 per litre. As per pooled data, the average milk price realized by both members and non-members was Rs. 35.20 per litre. It was noteworthy to mention that milk rate or price was higher in case of non-members as compared to members. The milk price in case of JMF is determined based on their Fat and SNF content. The higher the percentage of Fat and SNF, the higher is the procurement price of milk.

Table 4.1.12 Distribution of respondents based on milk price

(n=360)

Sl. No.	Milk price	Non-Member (n=180)	Member (n=180)	Pooled (n=180)
		Rate (Rs./litre)	Rate (Rs./litre)	Rate (Rs./litre)
1	Average procurement price(as fixed by JMF)	-	33.26 ± 6.63	35.20 ± 4.54
2	Average selling price of milk (for customers)	37.14 ± 2.46	-	

*Mean± S.D.

4.1.13 Annual Household Income

Table 4.1.13 revealed that the major source of earning for most of the respondents was due to agriculture and allied activities, dairying and animal husbandry, services, business, labour etc. It was noteworthy to observe that average annual income received from agriculture and allied activities was Rs.80,502.11 for members and Rs.37,071.43 for non-members. From dairy and animal husbandry the average annual income accrued was Rs.1,05,614.29 and Rs.90,606.67 for members and non-members respectively. Similarly, the average annual income derived from service was Rs.1,15,097.50 and Rs.87,545.45 for members and non-members respectively. Further, business activities fetched an average annual income of Rs.1,11,330.86 and Rs.66,240.00 for members and non-members respectively. Labour activities accrued an average annual income of Rs.57000.00 and Rs.27,705.88 for members and non-members respectively. Apart from these, few members and non-members were engaged in other miscellaneous activities like market middleman, broker etc. from where they earned an average annual income of Rs.33,000.00 and Rs.26,343.43 per annum in case of members and non-members, respectively. However, on an overall basis, members earned total average annual income of Rs.1,86,554.29 per annum, whereas non-members earned Rs.1,41,046.73 annually.

Table 4.1.13 Distribution of respondents based on annual household income (n=360)

Sl. No.	Sources of Income	Non-Member (n=180)	Member (n=180)	Pooled (n=360)
		Rs./annum	Rs./annum	Rs./annum
1	Agriculture and Allied	37071.43 ± 611.31	80502.11 ± 727.73	5472.68 ± 1853.99
2	Dairy and Animal Husbandry	90606.67 ± 4570.18	105614.29 ± 6553.26	8175.87 ± 5676.19
3	Services	87545.45 ± 378.46	115097.50 ± 1467.96	8105.81 ± 1433.02
4	Business	66240.00 ± 714.14	111330.86 ± 2198.90	6868.87 ± 2304.51
5	Labour	27705.88 ± 348.48	57000.00 ± 257.25	3153.85 ± 1214.85
6	Others	26343.43 ± 583.54	33000.00 ± 258.20	2435.16 ± 542.75
	Total average annual income	141046.73 ± 79078.82	186554.29 ± 98848.50	163800.51 ± 92244.79
	Total average annual expenditure	98732.71 ± 55355.18	130587.99 ± 69193.95	114660.36 ± 64571.35

The pooled data represented that both members and non-members cumulatively earned total average annual income of Rs.1,63,800.51. Similarly, the total average annual expenditure incurred by members and non-members was Rs.1,30,587.99 and Rs.98,732.71 per annum, respectively. The pooled data revealed that both members and non-members cumulatively incurred total average annual expenditure of Rs.1,14,660.36 per annum.

A cursory look at the annual household income data in Table 4.1.13.a indicated that a notable percentage (40.56%) of members fell under the category of medium income group, followed by 38.33 under low income group and 21.11 per cent under high income group category. It is noteworthy to mention that more than half (57.78%) of the non-members belonged to low income group, followed by 26.11 under medium income group and the rest (16.11%) belonged to high income group category. The pooled data depicted that, a majority (48.06%) of the respondents fell under low household income, followed by 33.33 per cent under medium and 18.61 per cent under high income group. It can be inferred that the majority of the members fell under medium income category as compared to non-members who largely belonged to low income group category. This is because members had assured and regular income from JMF and other secondary occupation as compared with non-members.

Table 4.1.13.a Overall distribution of respondents based on annual household income (n=360)

Sl. No.	Category	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<1.42 lakh) per annum	104	57.78	69	38.33	173	48.06
2	Medium (1.42 to 2.44 lakh) per annum	47	26.11	73	40.56	120	33.33
3	High (>2.44 lakh) per annum	29	16.11	38	21.11	67	18.61
	Total	180	100	180	100	360	100

4.1.14 Operational Land Holding

Results presented in the Table 4.1.14 indicated that, based on operational land holding a sizeable 11.11 per cent of member were landless farmers, more than one- fourth (26.11%) were marginal farmers, a significant 31.11 per cent belonged to the small farmer category, 16.11 per cent belonged to the semi-medium category, around 10.00 per cent fell under medium category and a notable few (5.56%) belonged to large farmer category.

It was noteworthy to mention that, in the case of non-member farmers, exactly one- fourth (25.00%) were landless farmers, a considerable majority (32.22%) belonged to the category of marginal farmers, a notable 30.00 per cent belonged to the small farmer category, around 7.78 per cent fell under semi-medium group, 3.89 per cent under medium and a meagre 1.11 per cent belonged to large farmer category.

Table 4.1.14 Distribution of respondents based on operational land holding

(n=360)

Sl. No.	Category (in ha.)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Landless (0) ha	45	25.00	20	11.11	65	18.06
2	Marginal (upto 1) ha	58	32.22	47	26.11	105	29.17
3	Small (1.1-2.0) ha	54	30.00	56	31.11	110	30.56
4	Semi-medium (2.1-4.0) ha	14	7.78	29	16.11	43	11.94
5	Medium (4.1-10.0) ha	7	3.89	18	10.00	25	6.94
6	Large (>10) ha	2	1.11	10	5.56	12	3.33
	Total	180	100	180	100	360	100

It was further observed that average operational landholding in the case of JMF member producers (2.46 ha) was significantly higher than the non-member producers (1.01 ha). Overall pooled data revealed that the average operational landholding area was 1.73 ha and a majority of the respondents belonged to marginal (29.17%) and small farmer (30.56%) categories based on operational landholding.

4.1.15 Social Participation

Upon perusal of' Table 4.1.15 indicated that cent per cent of the members were socially active and participated in all the events conducted by JMF. Around 16.67 per cent had membership in Youth Club wherein 2.22 per cent of the members were office bearers. Similarly, 14.44 per cent were members of SHG with 2.22 per cent as office bearers. A sizeable 13.33 per cent and 1.11 per cent of members socially participated in NGOs as members and office bearers, respectively. Further 12.78 per cent were members of *Panchayat* with 3.89 per cent being the office bearers of *Panchayat* as ward members, *Sarpanch* etc. However, a countable few (9.44%) were members of local political party, out of which 2.22 per cent were office bearer as well; a countable few (8.89%) were also active members of religious committee wherein 3.89 per cent were heads or in-charge of the religious committee. A scanty 4.44 per cent were active members and office bearers (1.67%) of other miscellaneous institutions like village schools, *Mahila samiti* etc. It was evident from the Table 4.1.15 that non-members had less social participation with different institutions in comparison to members. However, it was observed that around 10.56 per cent were members of Youth Club with 1.11 per cent as office bearers. About 8.89 per cent were active members of political party with 1.67 per cent working as office bearers. A sizeable 7.78 per cent and 2.78 per cent of non-members actively participated in NGOs as members and officer bearers, respectively. Similarly, in SHGs 7.22 per cent served as members and 3.33 per cent were serving as office bearers. Apart from these, a sizeable few (6.11%) were active members of religious committee while a countable few (5.56%) were active members of village *panchayat*. Also, a meagre 5.00 per cent worked as active members and office bearers (3.89%) in other miscellaneous institutions like village schools, *Mahila samiti* etc.

Table 4.1.15 Distribution of respondents based on their social participation (n=360)

Sl. No.	Organization	Non-Member (n=180)				Member (n=180)				Pooled (n=360)				Non-Member (n=180)	Member (n=180)	Pooled (n=360)
		Member		Office bearer		Member		Office bearer		Member		Office bearer				
		f	%	f	%	f	%	f	%	f	%	f	%	Mean Scores		
1	**Panchayat**	10	5.56	3	1.67	23	12.78	7	3.89	33	9.17	10	2.78	1.36	1.61	1.48
2	**JMF**	0	0.00	0	0.00	180	100	0	0.00	180	50.00	0	0.00	1.00	3.00	1.50
3	**Youth club**	19	10.56	2	1.11	30	16.67	4	2.22	49	13.61	6	10.91	1.44	1.73	1.59
4	**SHG**	13	7.22	6	3.33	26	14.44	4	2.22	39	10.83	10	20.41	1.48	1.67	1.57
5	**Religious committee**	11	6.11	5	2.78	16	8.89	7	3.89	27	7.50	12	30.77	1.23	1.38	1.31
6	**Political organization**	16	8.89	3	1.67	17	9.44	4	2.22	33	9.17	7	17.50	1.34	1.42	1.38
7	**NGO**	14	7.78	5	2.78	24	13.33	2	1.11	38	10.56	7	15.56	1.29	1.54	1.42
8	**Others**	9	5.00	7	3.89	8	4.44	3	1.67	27	7.50	10	27.03	1.11	1.08	1.09

Further assessment of the frequency of social participation, indicated that almost all the members actively participated in all the affairs of JMF with a mean score of 3.00. Besides this, majority of members participated in Youth Club (scored 1.73); followed by SHGs, village *panchayat*, NGOs, political organization, religious committee and other organizations (*viz.* schools, *Mahila Samiti* etc.) in the order of their frequency of social participation. Whereas in case of non-members it was noteworthy to mention that majority of them had frequent social participation in SHGs (scored 1.48) and Youth Clubs (scored 1.44), followed by the *panchayat*, political organizations, NGOs, religious committee and other organizations in the order of their frequency of social participation. While none of the non-members participated with JMF.

Table 4.1.15.a Overall distribution of respondents based on their level of social participation (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<7)	121	67.22	98	54.44	219	60.83
2	Medium (7 to 12)	41	22.78	55	30.56	96	26.67
3	High (>12)	18	10.00	27	15.00	45	12.50
	Total	180	100	180	100	360	100

It is apparent from Table 4.1.15.a that more than half (54.22%) of the members and a considerable majority (67.22%) of non-members had a low level of social participation, a sizeable 30.56 per cent of members and 22.78 per cent of non-members fell under the category of medium level of social participation, and countable 15.00 per cent of members and 10.00 per cent of non-members belonged to the high level of social participation. It could be ascertained from the results that beneficiaries were having more social participation probably for a reason they are more inclined towards dairying.

4.1.16 Access to Information

A cursory look on Table 4.1.16 revealed that majority of the members had access to information through peer groups (mean score 2.69) (like friends,

neighbours, community members etc.) with whom they interacted on a daily basis. Newspaper (scored 2.50) was the second most preferred mass media channel from where they received everyday news regarding specific schemes and government initiatives regarding dairying and animal husbandry. Internet (scored 2.49) was the third-most preferred channel accessed particularly through their handheld mobile devices. Television (scored 2.48) was another popular mass media channel that gave access to information related to agriculture and dairy-related activities through dedicated television channels like *Krishi Darshan*, DD *Kisan* etc. It was noteworthy to mention that many members read magazines, leaflets, bulletins etc. (scored 1.70) to gain comprehensive knowledge on improved dairy farming technologies. JMF also distributed their quarterly bulletin "*Medha Doodhwani*" among their member-producers to spread knowledge and create awareness about scientific dairy farming. Many members also visited exhibition (scored 1.63) organised by the State Agriculture and Animal Husbandry Department, JMF, NGOs etc. where they got direct exposure to latest advancements and breakthrough technologies in the field of dairying. Besides this, many also attended Dairy and Agri. *Melas* (scored 1.54) organised by SAUs, State Govt. Dept. etc. and got enormous benefits from live demonstrations and interactions. Radio (scored 1.51) was another outdated mass media channel that was occasionally used by members; followed by folk media (scored 1.27) channel like "*Jatra*" which was quite famous in rural areas of Jharkhand. Other sources (scored 1.27) for access to information included personal localites and personal cosmopolites who gave direct advisory services regarding dairy farming. A notable few also watched films (scored 1.07) related to dairy like "*Manthan*".

Whereas, among non-members, it was observed that; similar to members peer group (2.63) and newspaper (2.44) were first and second preferred source for access to information as per their mean scores. After that, Television (scored 2.37) and Internet (scored 2.33) were third and fourth preferred source of information access. Few non-members read magazines, leaflets, bulletins etc. (scored 1.64) and kept themselves updated with latest information. Very few listened to radio (scored 1.60); and very scattered population of non-members attended exhibitions (scored 1.36) and Dairy/ Agri. *Melas* (scored 1.29) occasionally. A very thin population had access to information from folk media

(scored 1.20) and other sources (scored 1.19) (like personal localites and personal cosmopolites etc.), while none watched films related to dairy farming (scored 1.00).

Table 4.1.16 Distribution of respondents based on their access to information (n=360)

Sl. No.	Particulars	Mean Scores		
		Non-Member (n=180)	Member (n=180)	Pooled (n=360)
1	Newspapers	2.44	2.50	2.47
2	Film regarding dairy farming	1.00	1.07	1.03
3	Radio	1.60	1.51	1.56
4	Television	2.37	2.48	2.43
5	Dairy/Agri. *Melas*	1.29	1.54	1.41
6	Exhibition	1.36	1.63	1.49
7	Magazines/ Leaflets/Bulletins	1.64	1.70	1.67
8	Folk media	1.20	1.27	1.23
9	Internet	2.33	2.49	2.41
10	Peer group	2.63	2.69	2.66
11	Others	1.19	1.27	1.23

Results presented in the Table 4.1.16.a indicated that a significant majority of both the members (62.78%) and non-members (67.78%) had a medium level of access to information, a considerable 21.11 per cent of non-members had a low level of access to information in comparison to members (11.11%). Further, it was observed that a notable 26.11 per cent of members were having a high level of access to information, while only 11.11 per cent of non-members had high access to information. The probable reason for low access to information in the case of non-members was due to low education level and poverty. It was found that

television and newspaper were mostly used mass media channels to update their knowledge regarding dairying.

Table 4.1.16.a Overall distribution of respondents based on their level of access to information (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<18)	38	21.11	20	11.11	58	16.11
2	Medium (18 to 21)	122	67.78	113	62.78	235	65.28
3	High (>21)	20	11.11	47	26.11	67	18.61
	Total	180	100	180	100	360	100

4.1.17 Access to Extension Services

A perusal of Table 4.1.17 revealed that, majority of cooperative members frequently received extension services from VLW or VEO (scored 2.57) who extended help related to any health issues of dairy animals, prescribed medicines and performed A.I. etc. Veterinary officers (VOs) (scored 2.44) were the second most important extension functionary including Veterinary Surgeon and VLDAs who timely rendered veterinary services. Progressive farmers (scored 2.38) who were the innovators and early adopters in the village helped their fellow farmers by giving them practical solution and advisory services on improved dairy farming, processing of dairy products, silage making etc. Besides these, different line extension workers like Agricultural Development Officers (ADO), Block Development Officers (BDO) and District Development officers (DDO) (scored 2.18) also facilitated member dairy farmers by providing necessary dairy inputs and subsidies; implementing dairy development programme; creating income generation opportunities and training and development activities. Further, extension services were also offered by KVKs, SAUs and ICAR Research Stations (scored 2.08) through various technology outreach programme and gave exposure through method and result demonstrations. Another important extension functionary included NGOs like BAIF (scored 1.91) who provided extension

services by organising regular health camps, performed A.I. services free of cost and created awareness on clean milk production. A few members also received extension services from other paid extension functionary (scored 1.11) occasionally.

In the case of non-members, it was evident that the majority of the respondents sought extension services regularly from progressive farmers (scored 2.21). The second most active extension functionary were line extension workers like Agricultural Development Officers (ADO), Block Development Officers (BDO) and District Development officers (DDO) (scored 2.15). The third in order of preference were NGOs (scored 2.05). A considerable few non-members could avail of the extension services offered by VLW/ VEO (scored 1.99) followed by Veterinary officers (VOs) or VLDAs (scored 1.89) since there was less extension contact with these extension functionary. Further, a sizeable few non-members attended training and capacity building workshops conducted by KVKs, SAUs and ICAR Research Stations etc. (scored 1.61). A negligible few could only avail of paid services from other private extension functionary (scored 1.14).

Table 4.1.17 Distribution based on frequency of extension services accessed by the respondents (n=360)

Sl. No.	Particulars	Mean Scores		
		Non-Member (n=180)	Member (n=180)	Pooled (n=360)
1	Progressive farmers	2.21	2.38	2.29
2	VLW/VEO	1.99	2.57	2.28
3	VO/VLDA	1.89	2.44	2.16
4	BDO/ADO/DDO	2.15	2.18	2.16
5	KVKs/ Research Stations/SAU	1.61	2.08	1.84
6	NGO	2.05	1.91	1.98
7	Others	1.14	1.10	1.12

The members were largely benefitted from a wide range of extension and input services offered by JMF. The grassroots extension workers and dedicated staffs employed by JMF offered solutions and catered to various aspects of dairy farming *viz.* breeding, feeding, healthcare, management and extension and advisory needs of the member-producers from time to time. It is apparent from Table 4.1.17.a that a significant majority of the JMF members (84.44%) regularly received veterinary healthcare service (scored 2.84) from veterinarian employed by JMF once in a fortnight or month. A vast majority (80.56%) of members were regularly supplied with mineral mixture, supplements, feed etc. at subsidised price (scored 2.81). It was noteworthy to mention that a considerable majority (69.44%) of members had access to A.I. facilities (scored 2.57) regularly by the JMF. Further, it was noticed that around 61.67 per cent of the members had regular and around 26.67 per cent had occasional and equal access to each of these extension services like training on ration balancing, demonstrations on fodder development, and training, workshops and advisory services on scientific dairy farming (scored 2.50) conducted in a phase-wise manner. Besides these, around 36.11 per cent of JMF members regularly took an active part in exposure visits (scored 1.97) to modern dairy processing plants, fodder crop cafeteria etc. both within and outside the state. However, in addition to these, a significant majority of members (84.44%) had access to other miscellaneous extension services (scored 2.84) conducted regularly by JMF like animal health camps, awareness drive, seminars, meetings, *Kisan Gosthi* etc.

Table 4.1.17.a Distribution based on frequency of extension and input services accessed by member-producers of JMF (n=180)

Sl. No.	Particulars	Member (n=180)								
		Regular (3)		Seldom (2)		Never (1)		Total		Mean Scores
		f	%	f	%	f	%	f	%	
1	Veterinary health care service	152	84.44	28	15.56	0	0.00	180	100	2.84
2	Supply of mineral mixture/supplements/feed etc. at subsidized price	145	80.56	35	19.44	0	0.00	180	100	2.81
3	A.I. facility	125	69.44	32	17.78	23	12.78	180	100	2.57
4	Training on Ration balancing	111	61.67	48	26.67	21	11.67	180	100	2.50
5	Demonstrations on fodder cultivation	111	61.67	48	26.67	21	11.67	180	100	2.50
6	Training/Workshops/Advisory services on scientific dairy farming	111	61.67	48	26.67	21	11.67	180	100	2.50
7	Exposure visits	65	36.11	45	25.00	70	38.89	180	100	1.97
8	Others	152	84.44	28	15.56	0	0.00	180	100	2.84

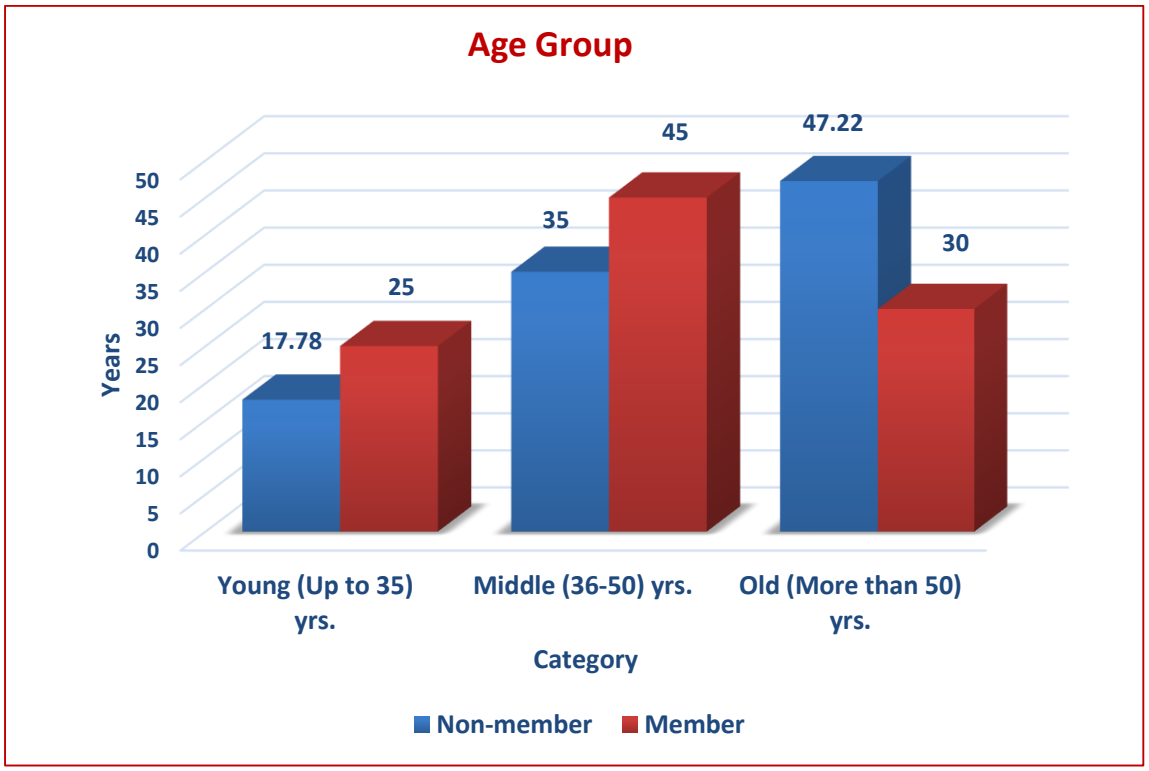


Fig 4.1. Distribution of respondents based on their age

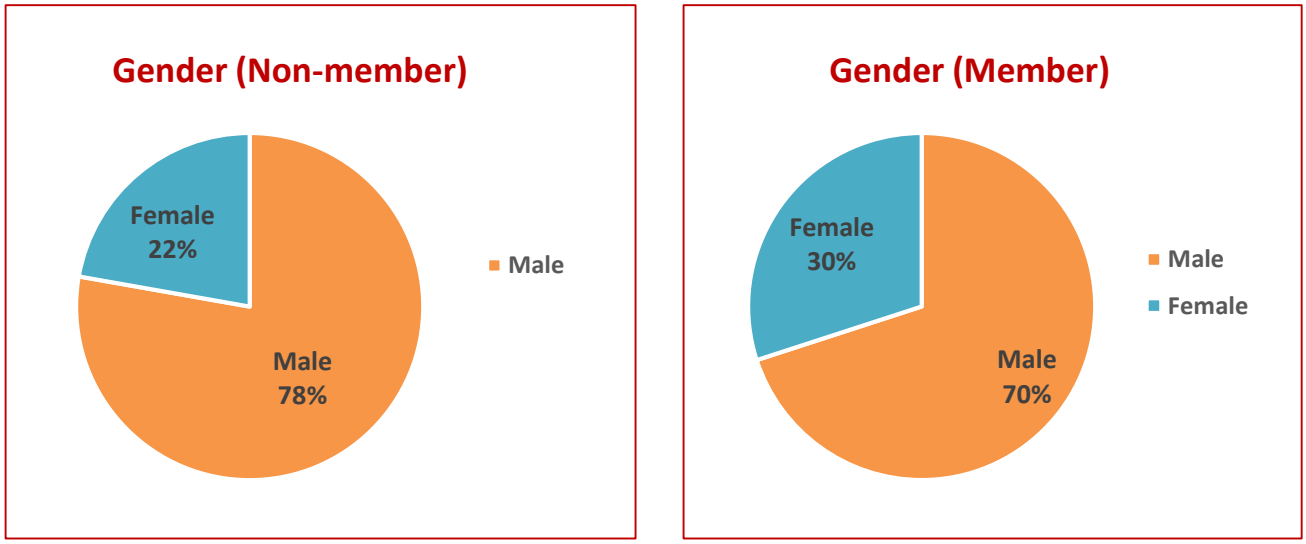


Fig 4.2. Distribution of respondents based on Gender

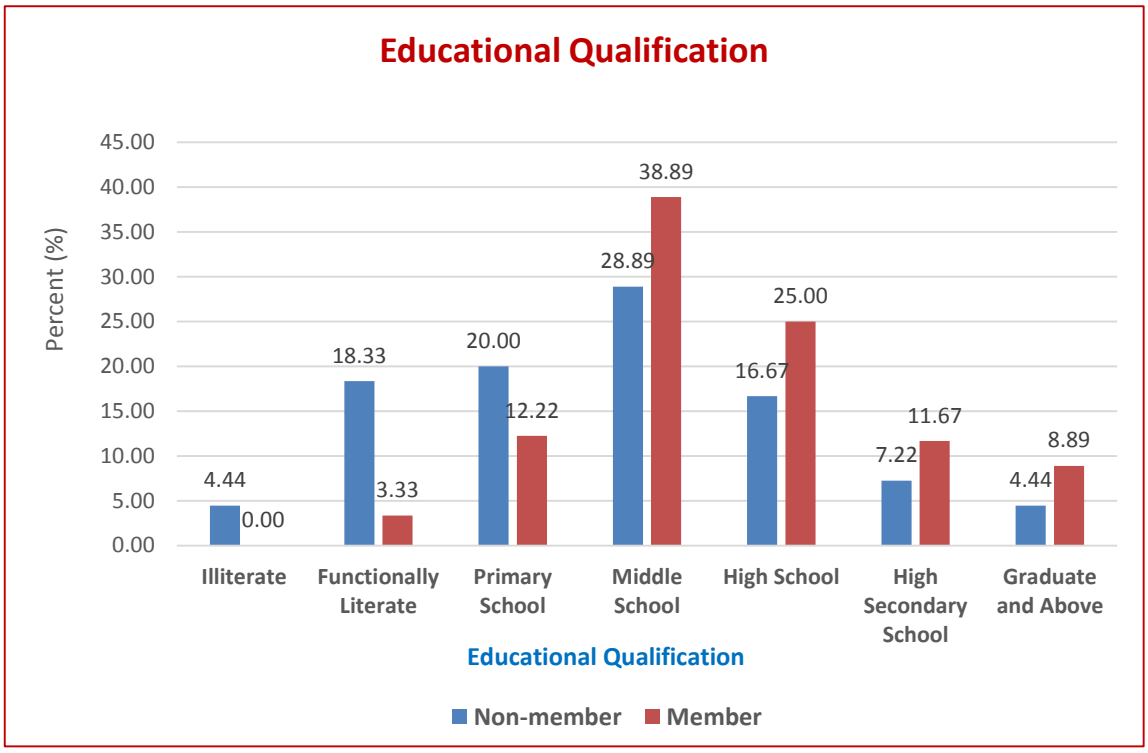


Fig 4.3. Distribution of respondents based on their educational qualification

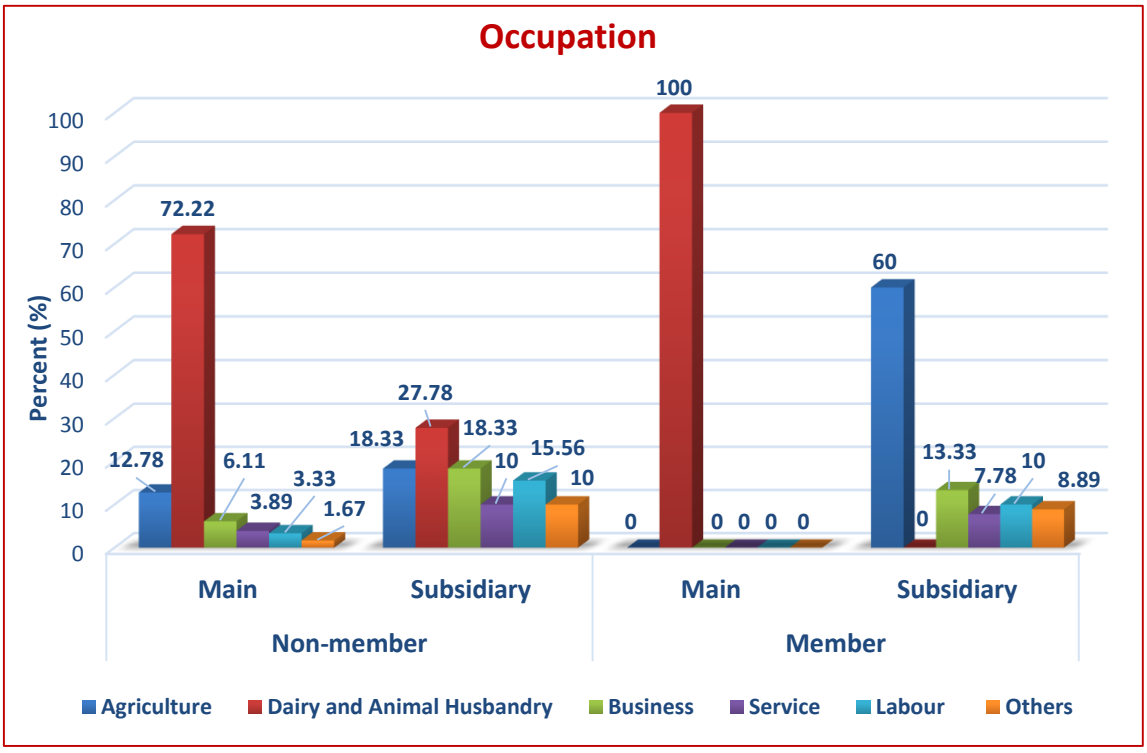


Fig 4.4. Distribution of respondents based on their occupation

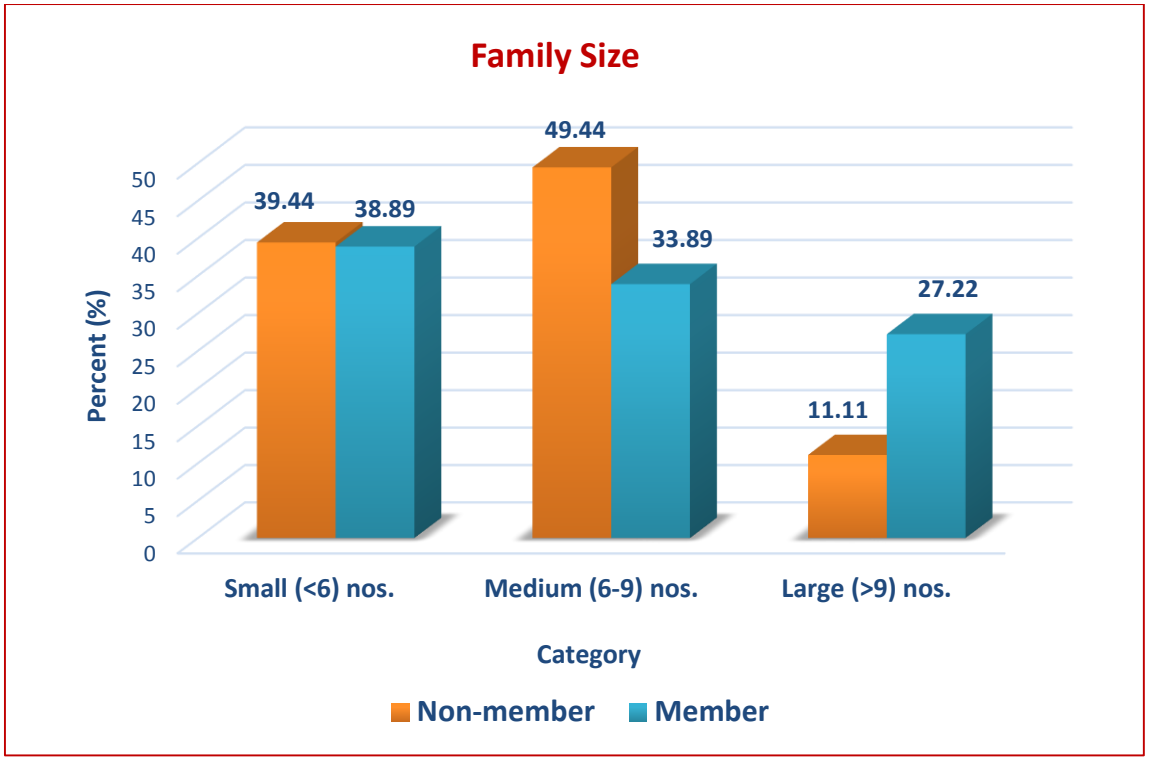


Fig 4.5. Distribution of respondents based on their family size

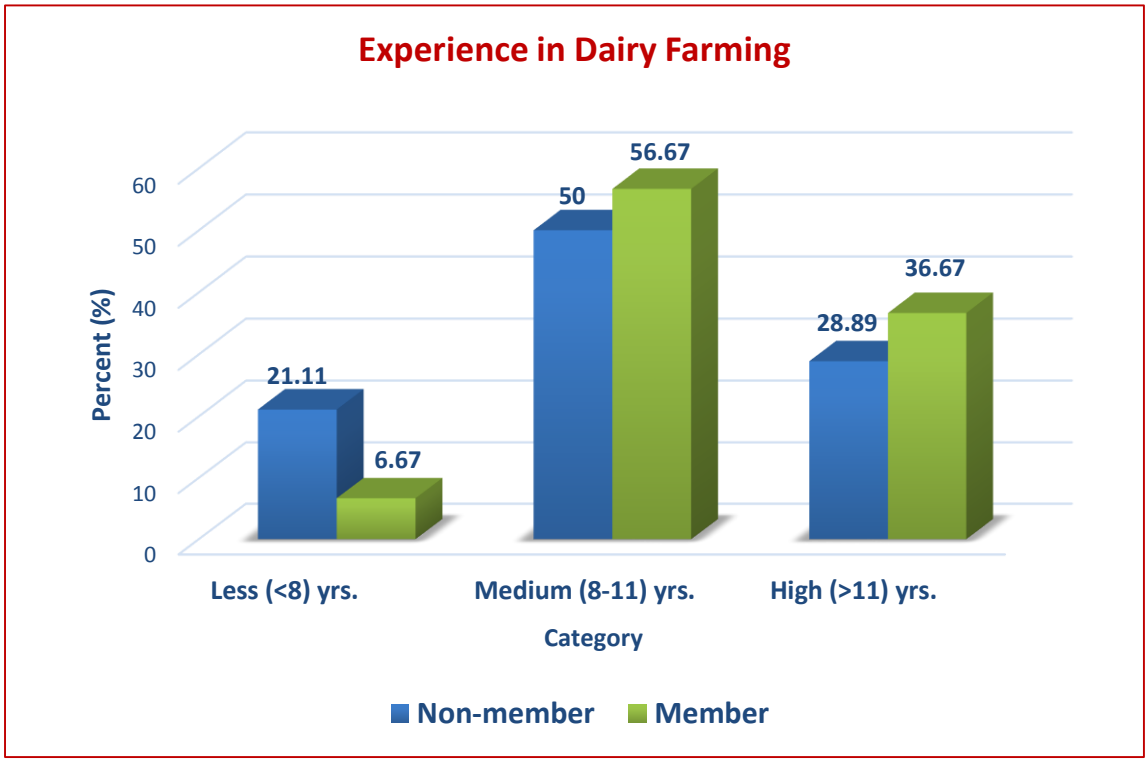


Fig 4.6. Overall distribution of respondents based on their experience in dairy farming

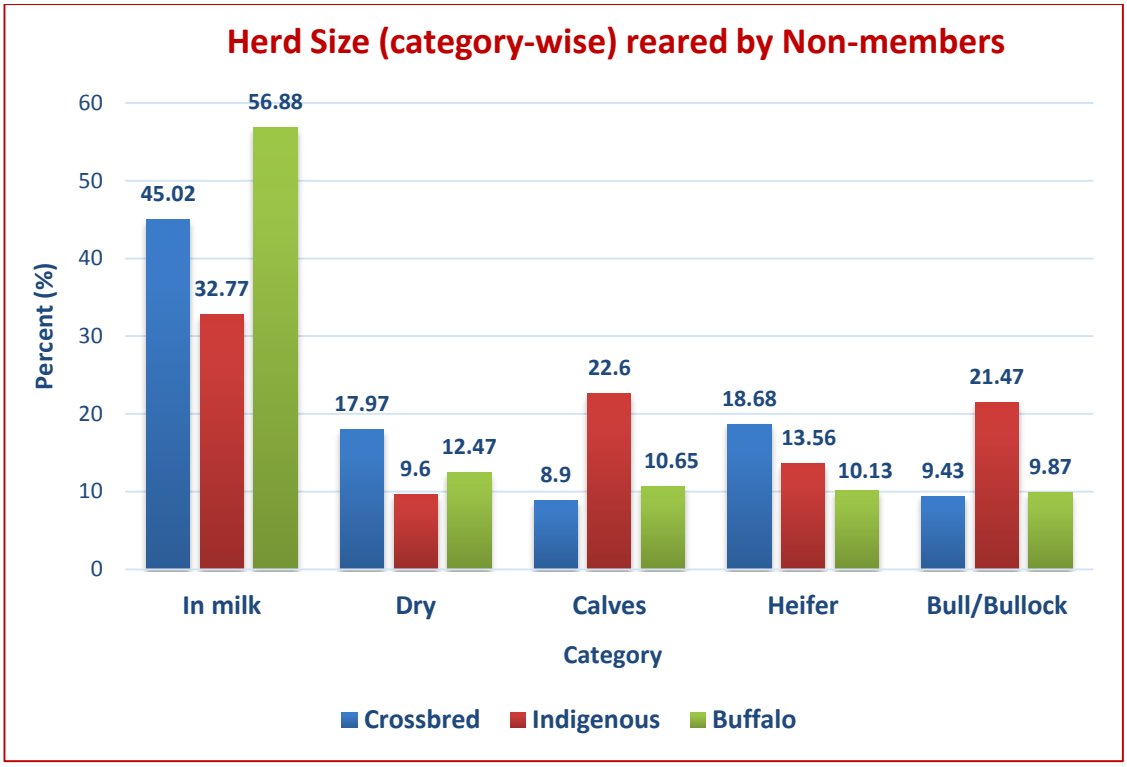


Fig 4.7. Herd Size (category-wise) reared by Non-members

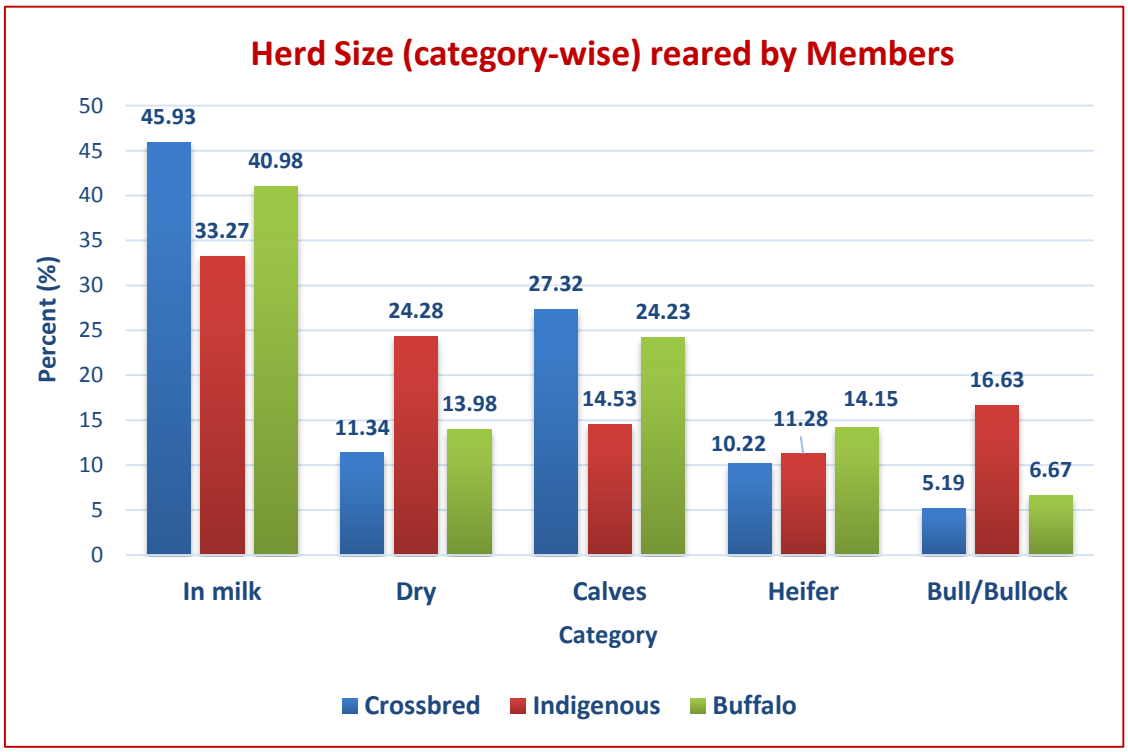


Fig 4.8. Herd Size (category-wise) reared by Members

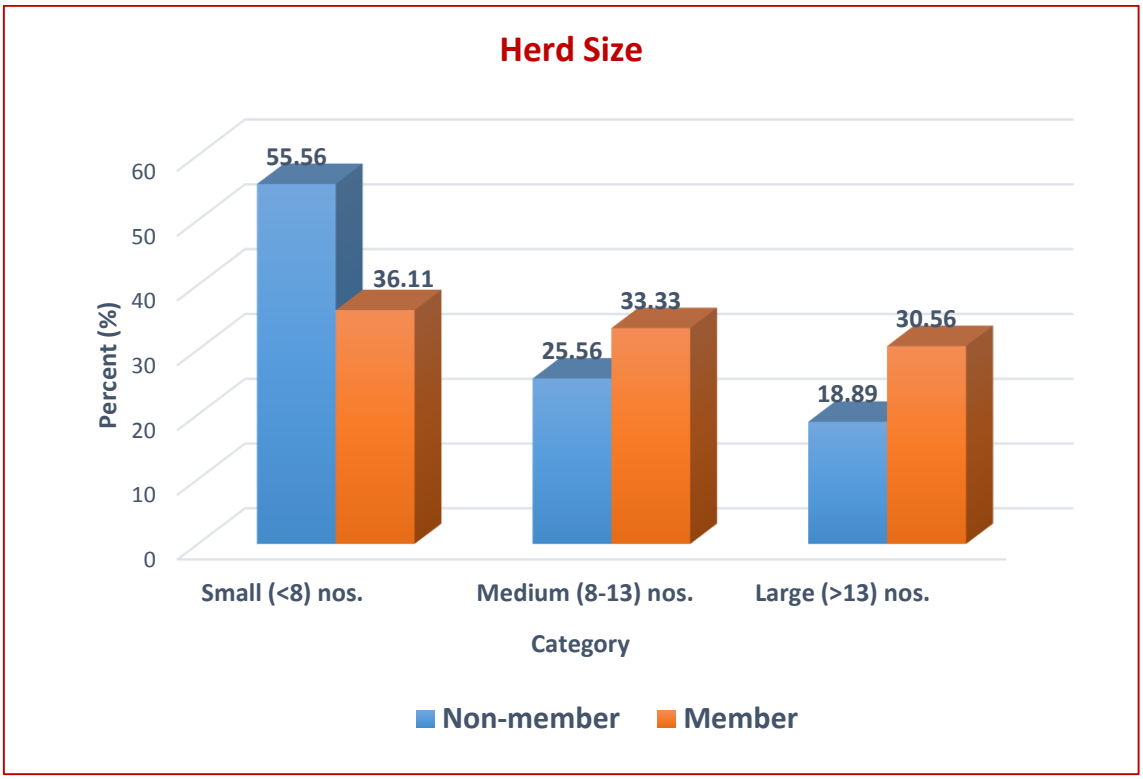


Fig 4.9. Overall distribution of respondents based on herd size

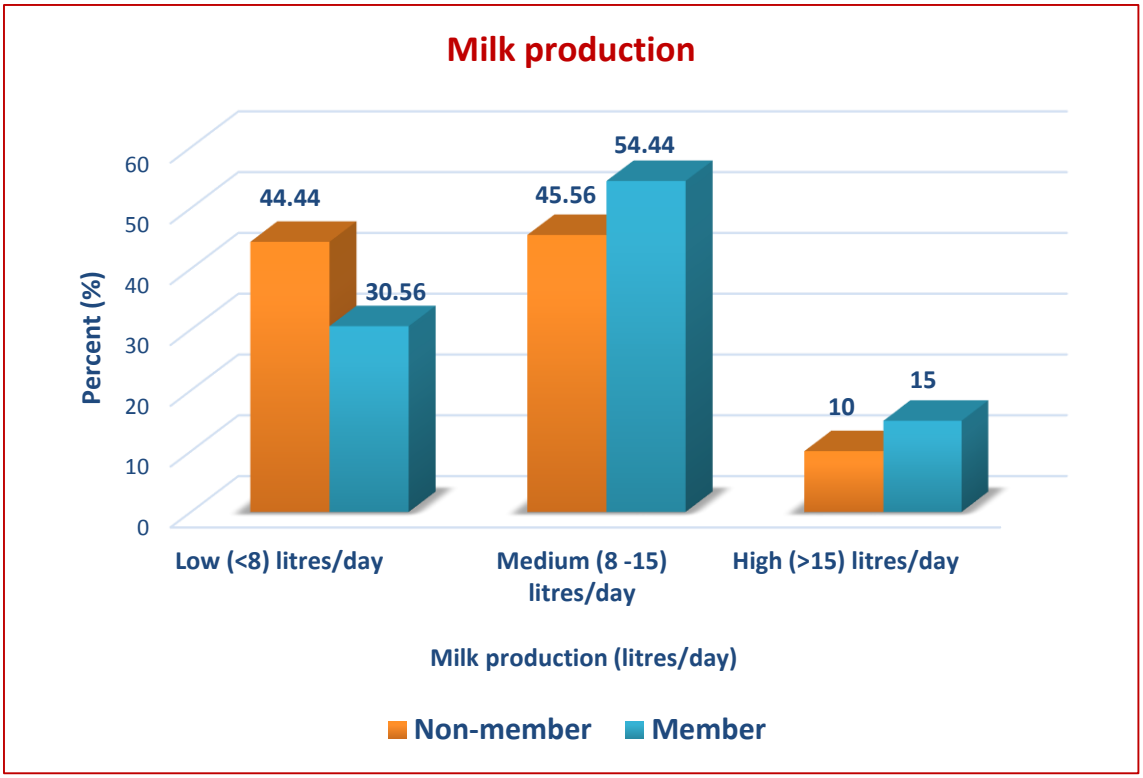


Fig 4.10. Overall distribution of respondents based on milk production

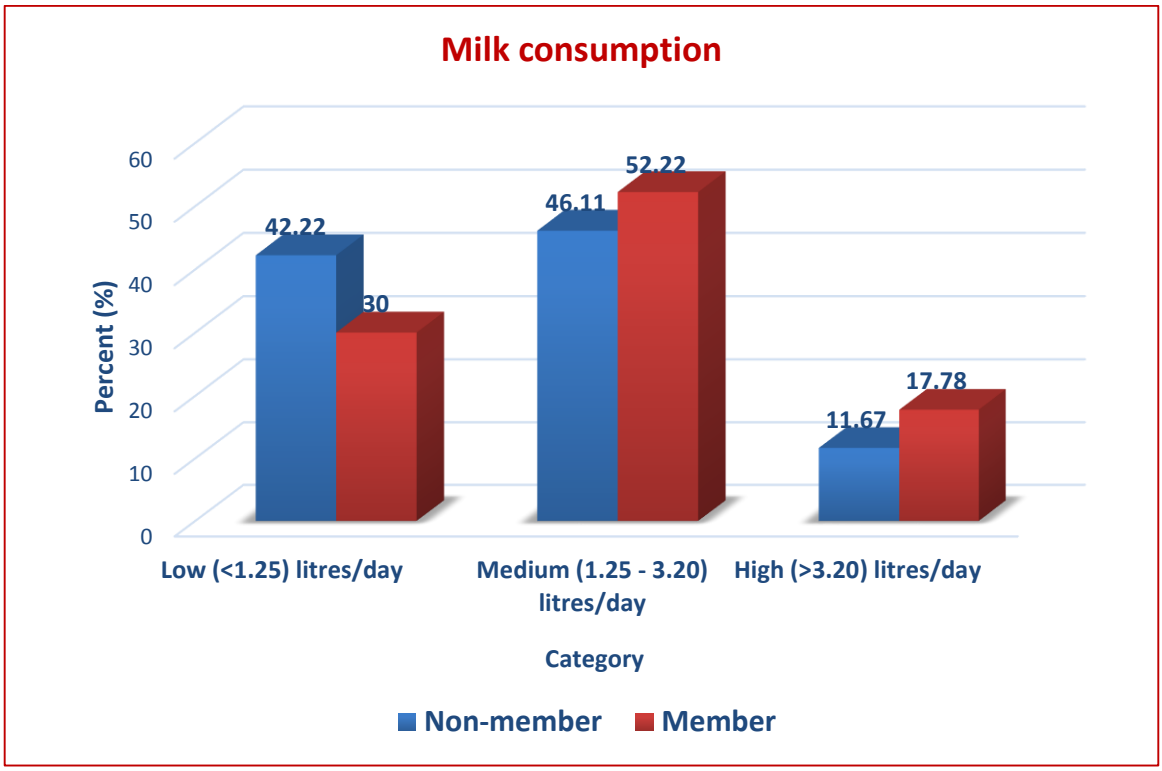


Fig 4.11. Overall distribution of respondents based on milk consumption

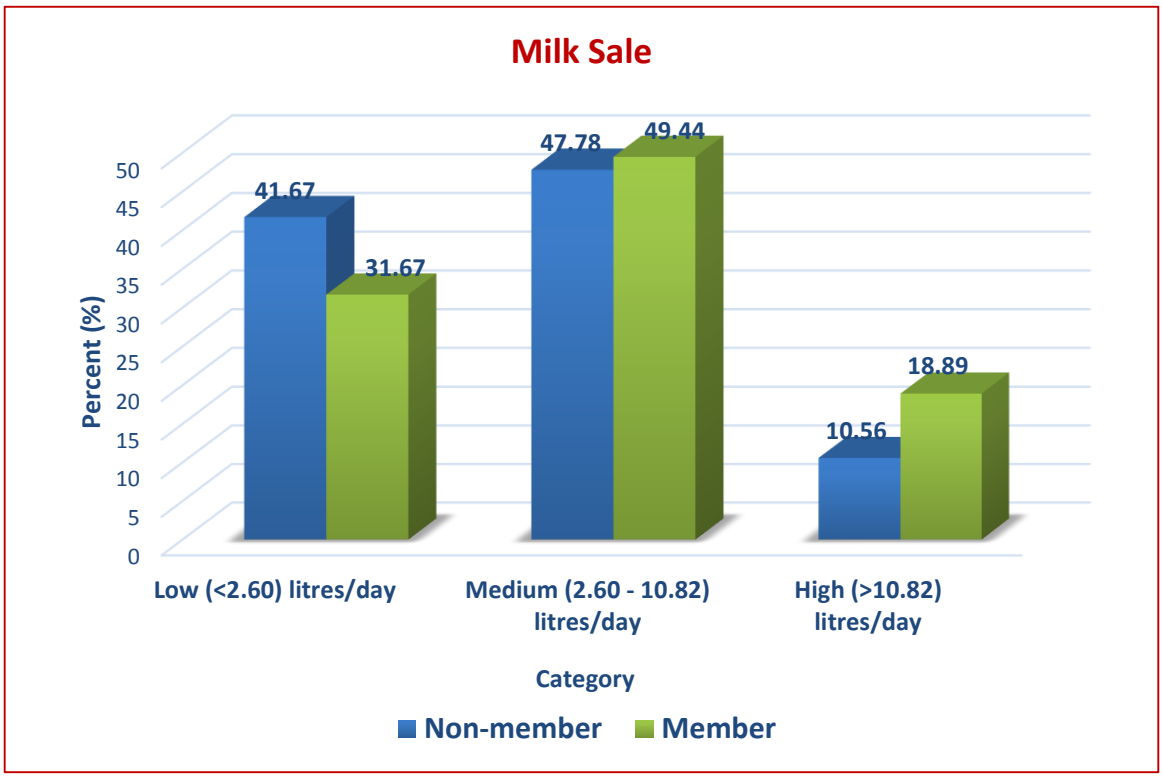


Fig 4.12. Overall distribution of respondents based on milk sale

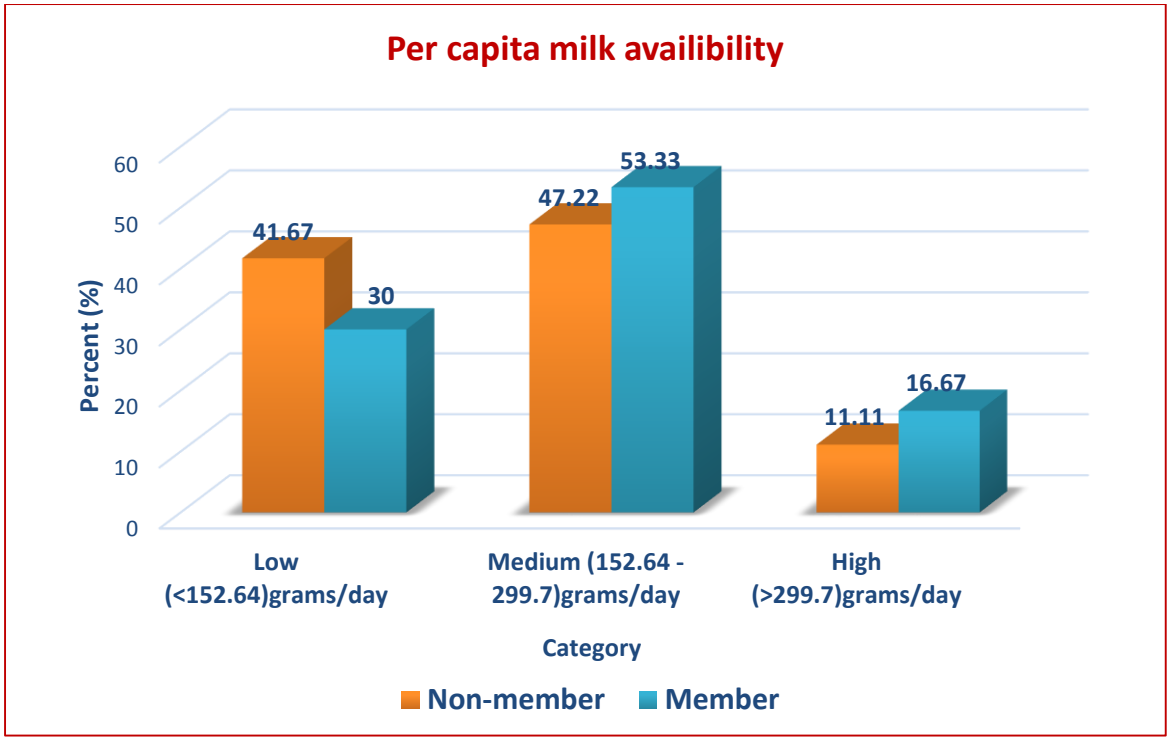


Fig 4.13. Overall distribution of respondents based on per capita milk availability

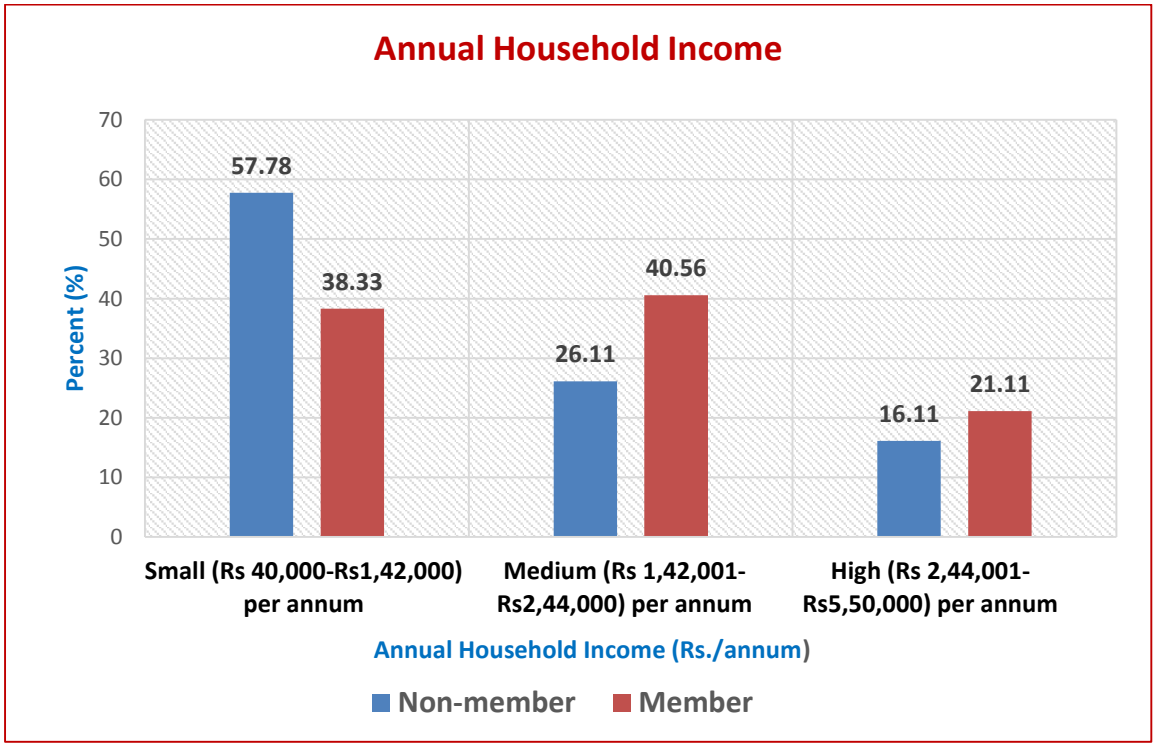


Fig 4.14. Overall distribution of respondents based on annual household income

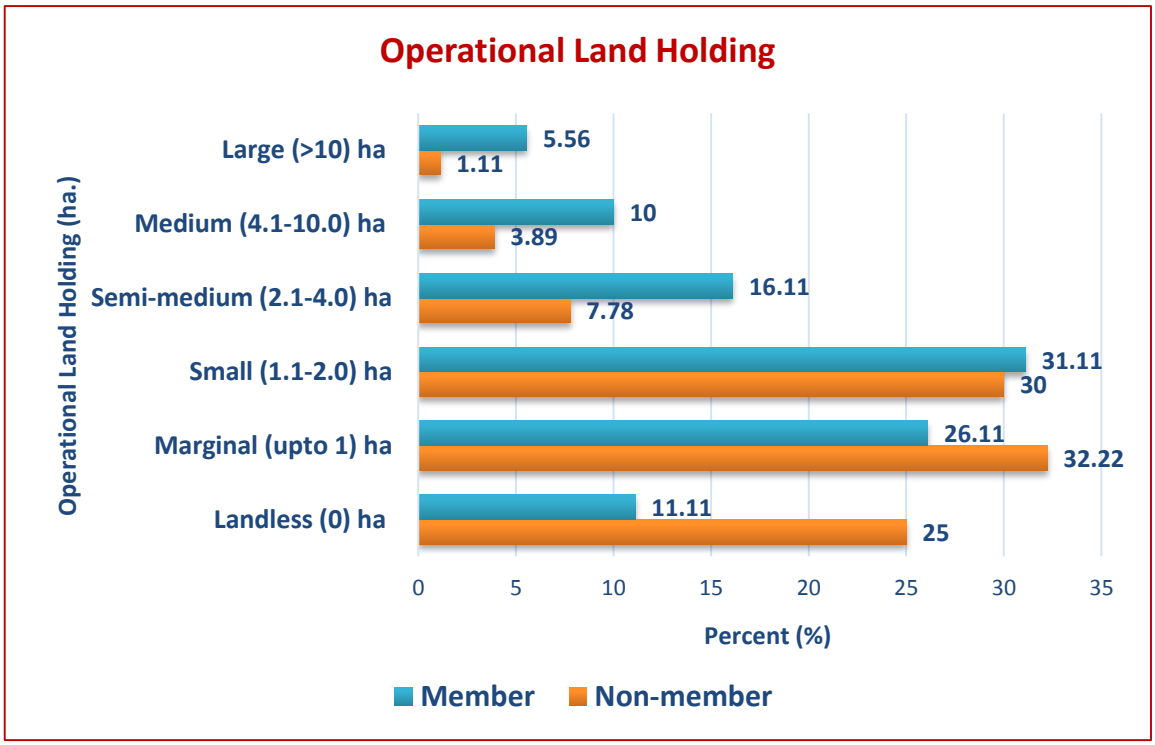


Fig 4.15. Distribution of respondents based on operational land holding

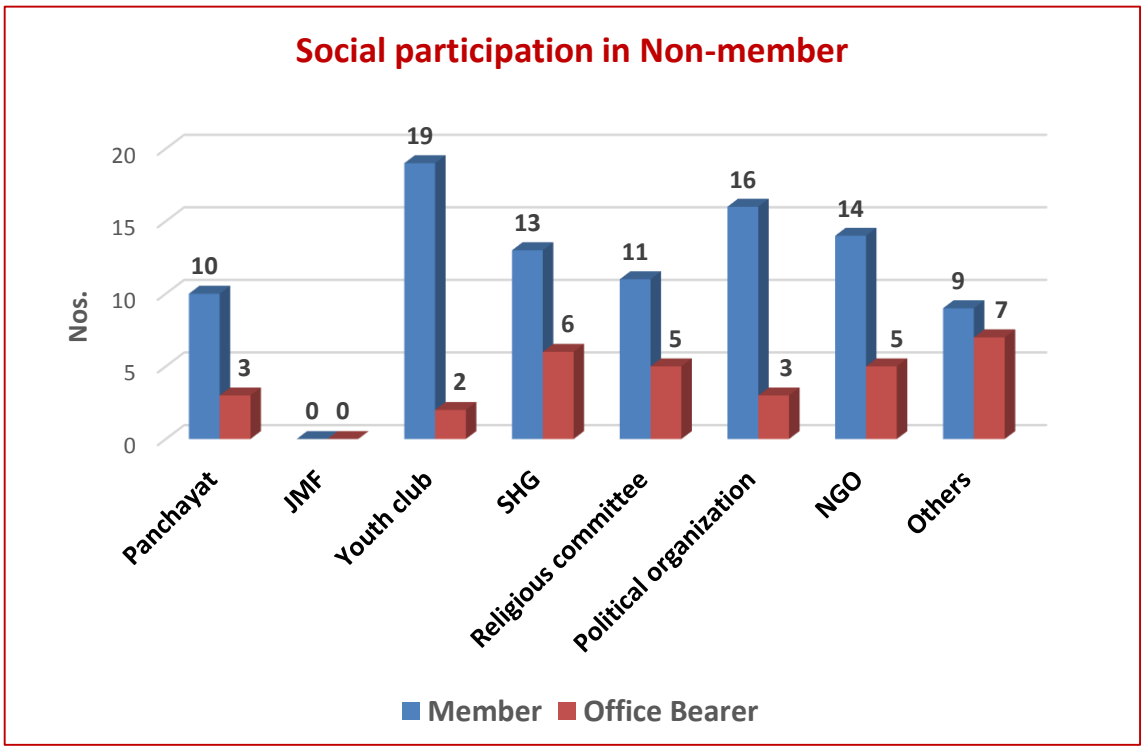


Fig 4.16. Social participation in Non-members

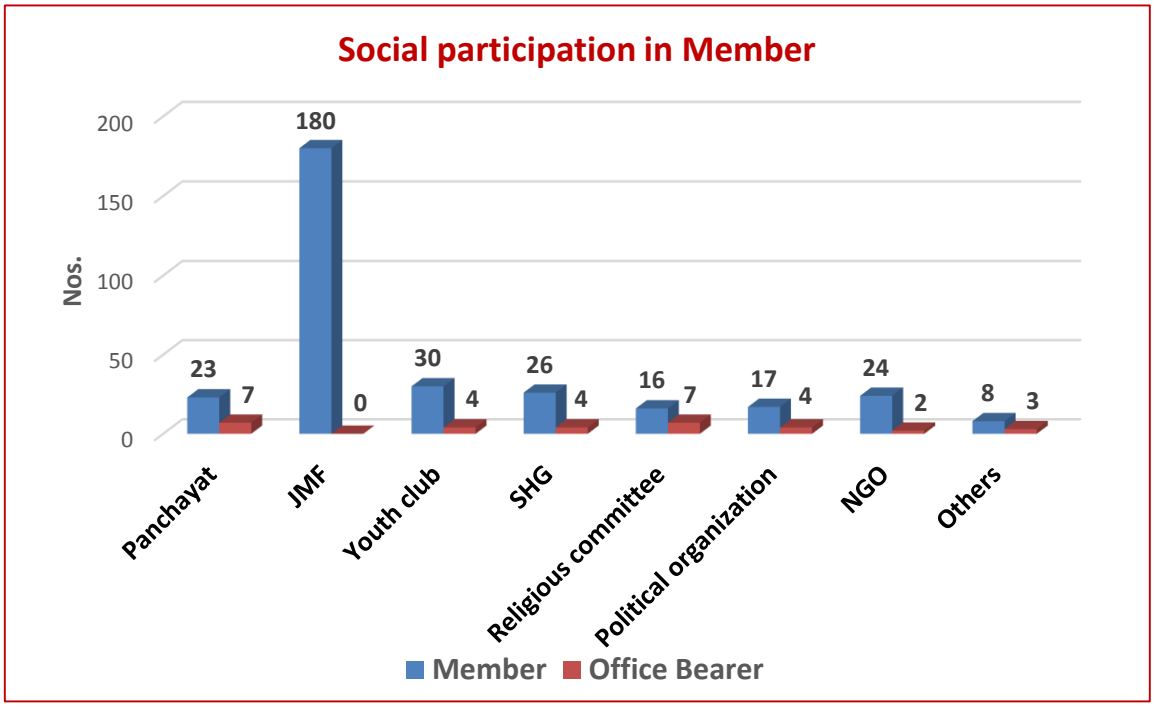


Fig 4.17. Social participation in Member

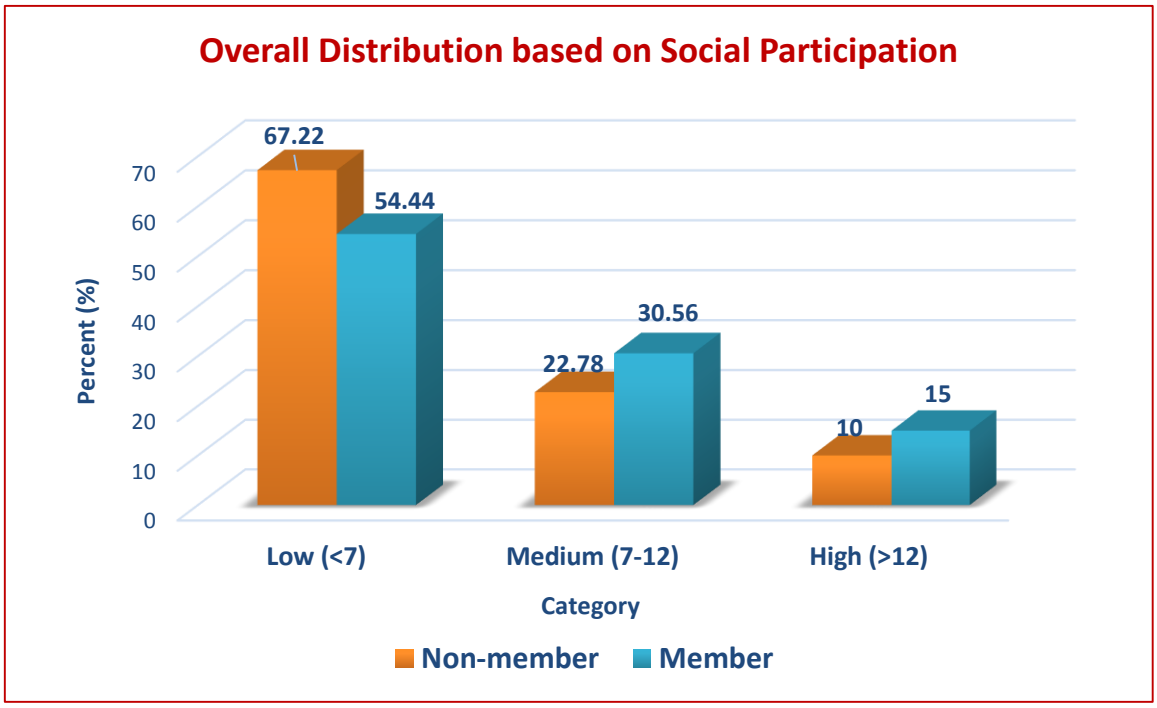


Fig 4.18. Overall distribution of respondents based on their level of Social participation

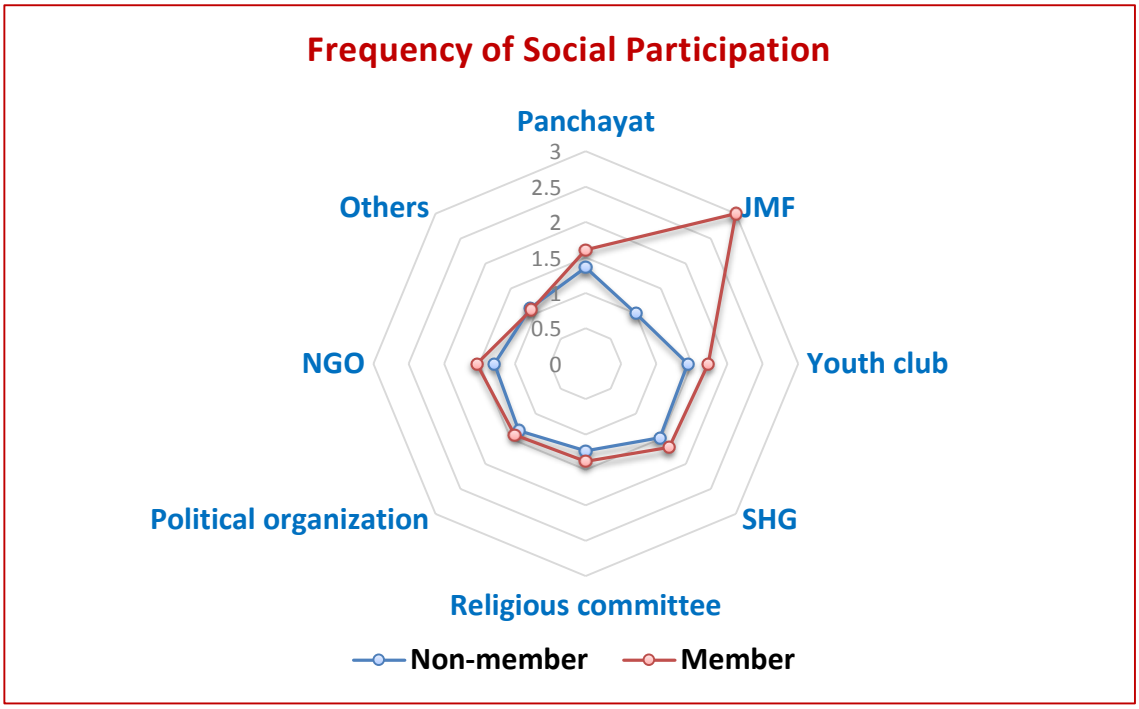


Fig 4.19. Frequency of Social participation among respondents

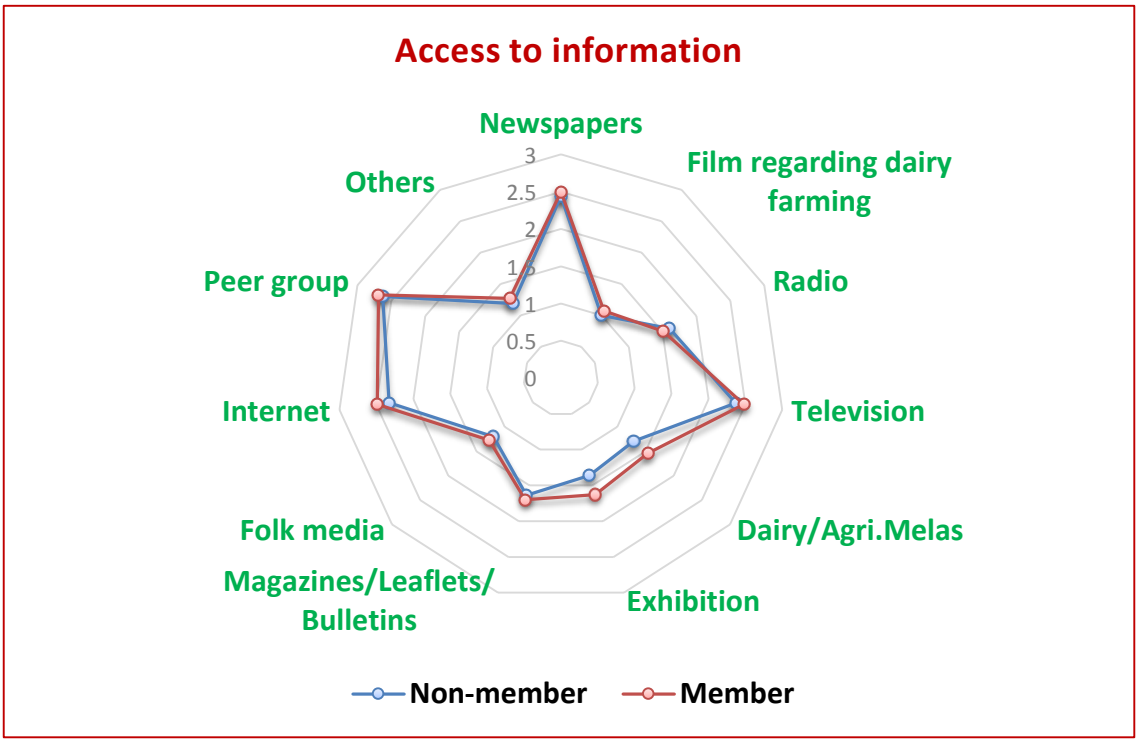


Fig 4.20. Access to Information among respondents

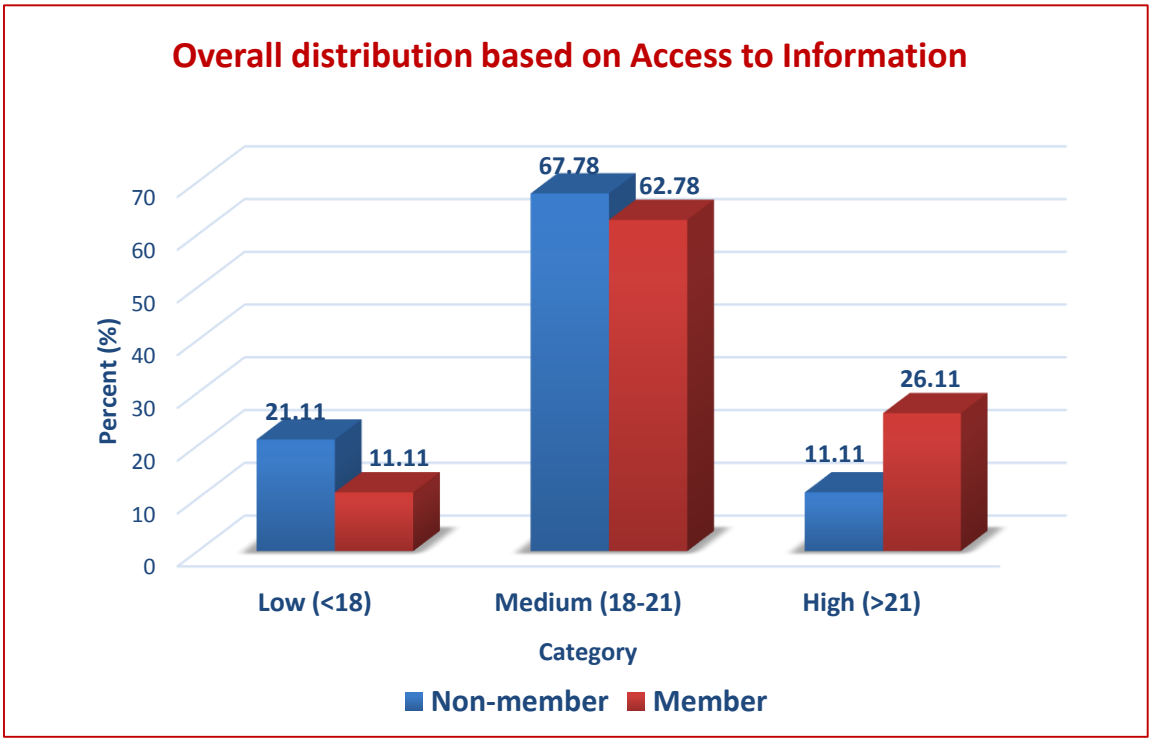


Fig 4.21. Overall distribution of respondents based on their access to information

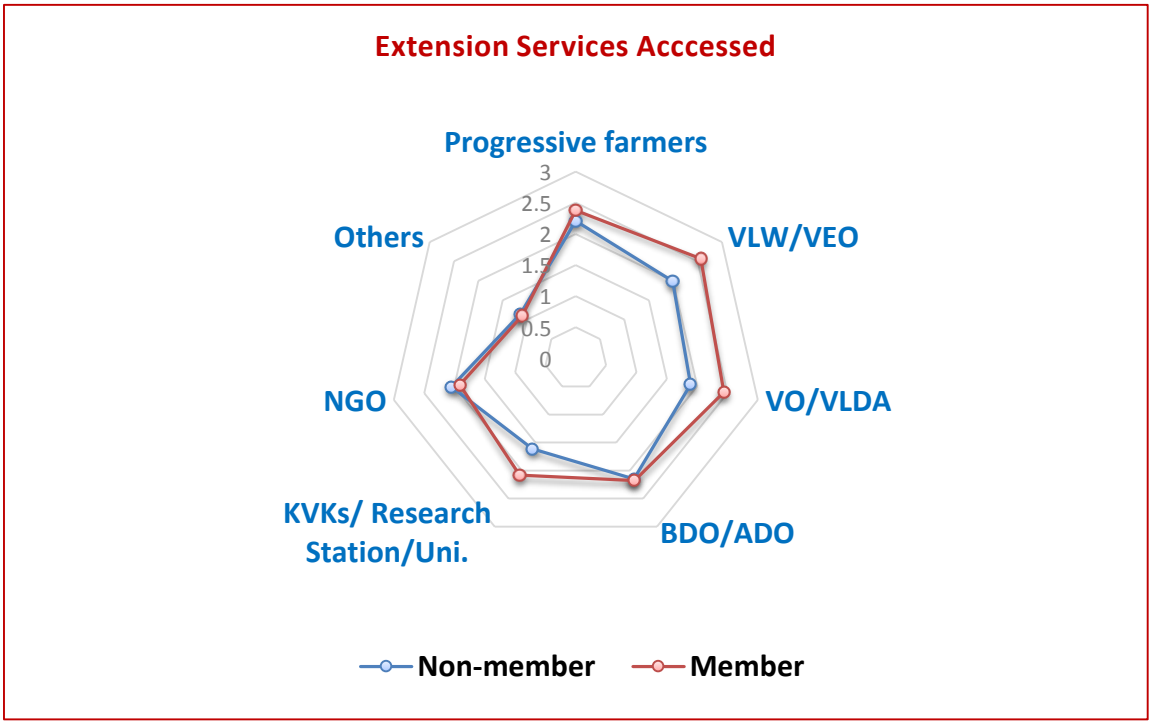


Fig 4.22. Extension services accessed by the respondents

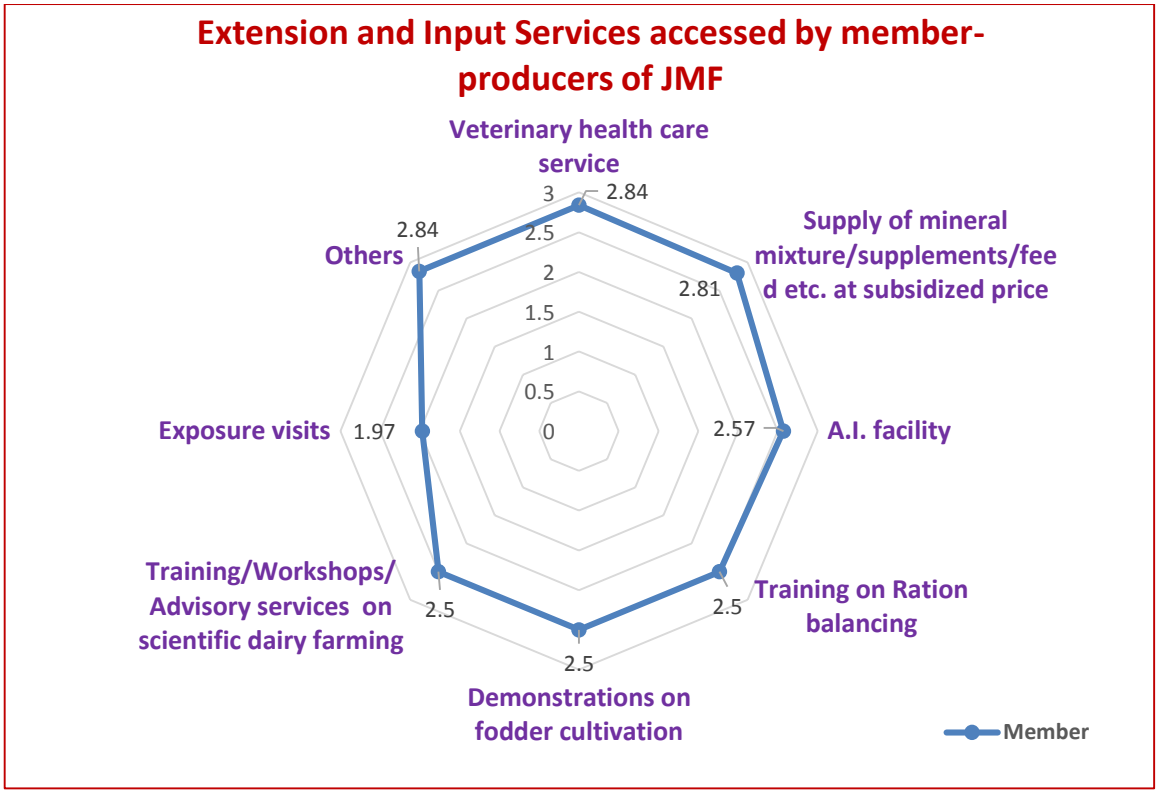


Fig 4.23. Extension services accessed by member-producers of JMF

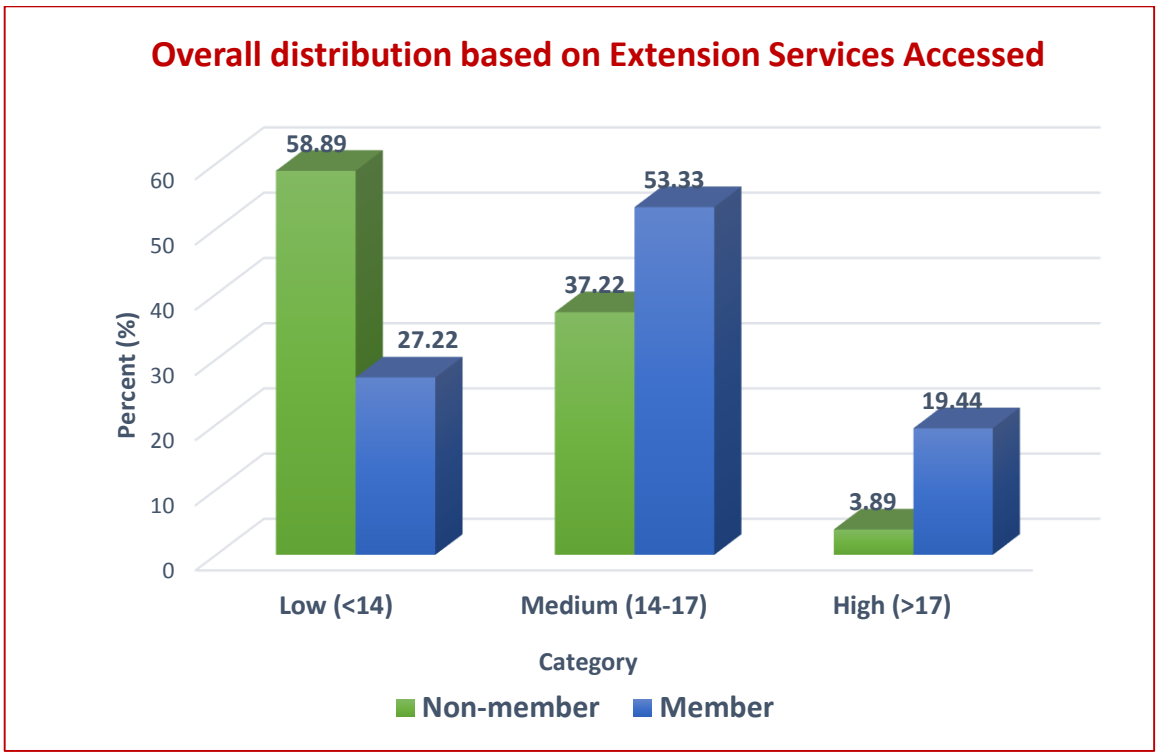


Fig 4.24. Overall distribution of respondents based on Extension Services accessed

Table 4.1.17.b depicted that more than half (53.33%) of the members had medium level of access to extension services, followed by 27.22 per cent had low access and a sizeable 19.22 per cent had high frequency of access to extension services. It was noteworthy to mention that, among non-members more than half (58.89%) of the respondents had low frequency of access to extension services, followed by a considerable 37.22 per cent had medium level and a countable few 3.89 per cent had high level or frequency of access to extension services. It is interpreted from the table that, the majority of the JMF members had better access to extension services as compared to non-members. This could probably be due to their information-seeking behaviour, keen interest towards improved dairy farming and good rapport with different extension functionary.

Table 4.1.17.b Overall distribution based on frequency of extension services accessed by the respondents (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<14)	106	58.89	49	27.22	155	43.06
2	Medium (14 to 17)	67	37.22	96	53.33	163	45.28
3	High (>17)	7	3.89	35	19.44	42	11.67
	Total	180	100	180	100	360	100

4.1.18 Provision of Veterinary Services

After going through Table 4.1.18 it could be observed that majority of the members had access to veterinary services from veterinarians appointed by JMF (scored 2.84). The second preferred veterinary service providers were local Para Vets (scored 2.57); who were specially trained personnel in treating common health related problems of livestock. Next, in order of preference were veterinary officers (scored 2.44) which included veterinary surgeon and VLDAs; during any critical cases, the diseased animals were referred to these experts. Besides these

NGOs (scored 1.91) like BAIF also played important role in providing veterinary services at regular intervals in the form of conducting veterinary health camps, vaccination drive etc. Some members also resorted to local Quacks (scored 1.57) for urgent diagnosis of disease symptoms especially during paucity of time and unavailability of para vets or veterinary officers. Few members also sought veterinary help from Local *Pashu Hakim* or *Vaidya* (scored 1.37), who treated animals using indigenous technical knowledge and administered ethno-veterinary practices to treat all sorts of acute and chronic diseases in animals. A countable few took veterinary services from other private veterinary professionals (scored 1.07) who treated animals on a call basis.

On the other hand, non-members majorly depended on NGOs (scored 2.05) for veterinary-related problems in cattle and buffaloes. The next most preferred and active veterinary service providers were Para Vets (scored 1.99), followed by Veterinary Officers (scored 1.89) and local Quacks (scored 1.62). Very few resorted to Local *Pashu Hakim* or *Vaidya* (scored 1.42) and other private veterinary professionals (scored 1.07) for veterinary-related help. While none reaped benefits of veterinary services from JMF (scored 1.00); since they were non-members.

Table 4.1.18 Distribution of respondents based on provision of veterinary services (n=360)

Sl. No.	Particulars	Mean Scores		
		Non-Member (n=180)	Member (n=180)	Pooled (n=360)
1	JMF	1.00	2.84	1.92
2	Para Vets	1.99	2.57	2.28
3	VO/VLDA	1.89	2.44	2.16
4	Quacks	1.62	1.57	1.59
5	Local *pashu hakim/vaidya*	1.42	1.37	1.40
6	NGO	2.05	1.91	1.98
7	Others	1.07	1.09	1.08

A quick glance at Table 4.1.18.a depicted that an appreciable majority of members (61.67%) and non-members (61.11%) had medium level of provision of veterinary services. It was noteworthy to highlight that only countable few (3.33%) members belonged to low category as compared with non-members, where a notable percentage of 37.78 per cent had low level of provision of veterinary services. Also, it was observed that a considerable percentage (35.00%) of members had high level of provision of veterinary services as compared with non-members (1.11%). It can be inferred from the Table 4.1.18.a that majority of the members fell under the category of medium to high level of provision of veterinary services as compared with non-members. The main reasons could be timely availability of veterinary services, regular provision of health camps, and accessibility and availability to veterinary health facilities nearby the village.

Table 4.1.18.a Overall distribution of respondents based on level of provision of veterinary services (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<11)	68	37.78	6	3.33	74	20.56
2	Medium (11 to 14)	110	61.11	111	61.67	221	61.39
3	High (>14)	2	1.11	63	35.00	65	18.06
	Total	180	100	180	100	360	100

4.1.19 Access to Input Supply

A glance at Table 4.1.19 revealed that almost all the members had access to input supply from JMF (scored 3.00). Inputs like mineral mixture, feed, milk cans etc. were distributed to all the members regularly. The State Department of Animal Husbandry and Dairying (scored 2.52) also supplied inputs at subsidised price like fodder seeds, chaff cutter etc. at regular intervals. The third most important input suppliers were local input dealers (scored 1.97) who catered cattle feed, concentrates, mineral mixture, medicines etc. at retail price. Since majority of the

input dealers' outlets or shops were near to the vicinity of the village, most of them preferred to buy from these input dealers. However, it was also noteworthy to mention that few NGOs like BAIF (scored 1.63) also provided input services like deworming tablets, liver tonic etc. for cattle and buffalo. Very few respondents also dealt with other private input suppliers (scored 1.22) for feed and healthcare products of cattle and buffalo.

Contrarily, in the case of non-members, majority of them were dependent on local input dealers (scored 2.33) due to their good accessibility and availability. The State Department of Animal Husbandry and Dairying (scored 1.72) played important role in providing dairy inputs at subsidised price to the non-members. The third most active input suppliers were NGOs (scored 1.57) who through their welfare programmes supplied inputs free of cost. A countable few also bought inputs from other private input dealers (scored 1.30), while none got benefits from the dairy cooperative (JMF) (scored 1.00).

Table 4.1.19 Distribution of respondents based on their access to input supply (n=360)

Sl. No.	Particulars	Mean Scores		
		Non-Member (n=180)	Member (n=180)	Pooled (n=360)
1	Milk Fed. (JMF)	1.00	3.00	2.00
2	Local Input Dealers	2.33	1.97	2.15
3	State Dept.	1.72	2.52	2.12
4	NGOs	1.57	1.63	1.60
5	Others	1.30	1.22	1.26

Inspection of the Table 4.1.19.a portrayed that an ample majority (48.89%) of the members had high level of access to input supply followed by 40.56 per cent had medium level of access and rest 10.56 per cent had low level of access to input supply. In contrast to this, a significant majority (64.44%) of the non-members had low access to input supply, followed by 29.44 had medium level of

access and a fewer 6.11 per cent had high access to input supply. It was extrapolated from the results that majority of the members had better access to input supply than non-members, this was due to better availability and accessibility to local input dealers and timely supply of inputs by JMF.

Table 4.1.19.a Overall distribution of respondents based on their level of access to input supply (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<8)	116	64.44	19	10.56	135	37.50
2	Medium (8 to 11)	53	29.44	73	40.56	126	35.00
3	High (>11)	11	6.11	88	48.89	99	27.50
	Total	180	100	180	100	360	100

4.1.20 Access to Credit Facilities

It can be inferred from Table 4.1.20 that a significant majority (87.78%) of members had access to credit from rural cooperative banks or nationalised banks. In this aspect, JMF also helped their members in getting loans and credit facilities from banks by sanctioning them written quotation on behalf of JMF, which served as a creditworthiness instrument or guarantor for banks. Half (50.00%) of the members got credit facilities through govt. welfare schemes and central aided funds. A sizeable percentage (13.33%) of members sought short term loans from private moneylenders with comparatively higher interest rates. Few members (10.00%) borrowed money from other informal sources like their friends and relatives to meet their urgent credit requirement. Further, it was observed that out of total members who had accessibility to credit facilities, around 66.67 per cent had already availed credit from rural cooperative banks or nationalised banks, exactly half (50.00%) of the members availed from govt. sponsored schemes, around 6.67 per cent had already availed credit from private money lenders, and meagre 5.56 per cent had availed from other informal sources.

Tables 4.1.20 Distribution of respondents based on their access to credit facilities (n=360)

Sl. No.	Particulars	Non-Member (n=180)						Member (n=180)						Non-member (n=180)	Member (n=180)	Pooled (n=360)
		Yes		No		Credit Availed		Yes		No		Credit Availed				
		f	%	f	%	f	%	f	%	f	%	f	%	Mean Scores		
1	Private Money lenders	32	17.78	148	82.22	21	11.67	24	13.33	156	86.67	12	6.67	1.29	1.20	1.25
2	Cooperative Banks/ Nationalized Banks	130	72.22	50	27.78	102	56.67	158	87.78	22	12.22	120	66.67	2.29	2.54	2.42
3	Govt. Schemes/ Fund	65	36.11	115	63.89	65	36.11	90	50.00	90	50.00	90	50.00	1.72	2.00	1.86
4	Others	24	13.33	156	86.67	15	8.33	18	10.00	162	90.00	10	5.56	1.22	1.16	1.19

On the other hand, it was noticed that a considerable majority (72.22%) of non-members had access to credit facilities from rural cooperative banks or nationalised banks, followed by a notable 36.11 per cent had access through govt. welfare schemes and central aided funds, and a sizeable 17.78 per cent and 13.33 per cent had access to private moneylenders and other informal sources, respectively. Whereas, in terms of credit facilities already availed, more than half (56.67%) of the non-members had availed credit facilities from banks followed by govt. schemes (36.11%), private money lenders (11.67%) and other informal sources (8.33%).

Based on the frequency of access to credit facilities, it could be inferred from Table 4.1.20 that majority of the members had regular access to credit facilities from rural cooperative banks or nationalised banks, followed by govt. schemes, private money lenders and other informal sources having a mean score of 2.54, 2.00, 1.20 and 1.16 respectively. A similar trend was also seen in the case of non-members where a majority of them had regular access to credit facilities from rural cooperative banks or nationalised banks, followed by govt. schemes, private money lenders and other informal sources having a mean score of 2.29, 1.72, 1.29 and 1.22 respectively.

It could be seen from Table 4.1.20.a that a significant majority of both members (40.00%) and non-members (51.67%) had low level of access to credit facilities, followed by a considerable percentage of both members (34.44%) and non-members (36.11%) fell under medium category. However, it was noteworthy to observe that more than one-fourth of members (25.56%) had high level of access to credit facilities, which was slightly higher than non-members (12.22%). This was due to frequent transaction made by members to meet the daily expenses of dairy farming. The creditworthiness of the dairy farmer was also an important reason for getting better access to credit facilities from banks etc.

Table 4.1.20.a Overall distribution of respondents based on their level of access to credit facilities (n=360)

Sl. No.	Category (Scores)	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Low (<7)	93	51.67	72	40.00	165	45.83
2	Medium (7 to 10)	65	36.11	62	34.44	127	35.28
3	High (>10)	22	12.22	46	25.56	68	18.89
	Total	180	100	180	100	360	100

4.1.21 Distance to Market and MPP

It was evident from Table 4.1.21 that, the average market distance for members and non-members was 6.64km and 3.62 km, respectively. However, the average distance of milk pooling point (MPP) from the place of residence in case of members and non-members was 2.00km and 4.50km, respectively. Since, non-members were near to market they had the opportunity to sell their milk produce to alternative channels as compared to members.

Table 4.1.21 Distance to Market and MPP (n=360)

Sl. No.	Category	Market Distance (km)	MPP Distance (km)
1	Member	6.64 ± 3.43	2.00 ± 0.85
2	Non-member	3.62 ± 1.67	4.50 ± 0.38

MPP=Milk Pooling Point, * Mean ± S.D.

4.1.22 Labour Utilization

A bird's eye view of labour profile of respondents in Table 4.1.22 revealed that, out of total labour employed by member-producers in different dairy activities, a significant majority (89.19%) of labours (family members) were engaged in dairy farming. Besides these, an additional 10.81 per cent of additional labour excluding

family labours were hired by the member-produces to perform activities like fodder cultivation, chaff cutting, maintaining cowsheds and were engaged in other miscellaneous jobs like herdsmen etc.

Among non-members, a significant majority (89.34%) of family labours were engaged in dairy farming activities. Around 10.66 per cent consisted of additional labours hired by non-member dairy farmers who were engaged in other management activities. On an overall basis, there was total of 516 labours present among members and 583 labours among non-members who were engaged in different dairy-related activities. However, the animal is to manpower ratio among members and non-members were 2.18 and 4.10 respectively. It was noteworthy to mention that except for additional labour hired; a majority of the labours engaged in various activities came from within the family of members and non-members.

Table 4.1.22 Labour Utilization **(n=360)**

Sl. No.	Particulars	Non-Member (n=180)		Member (n=180)		Pooled (n=360)	
		f	%	f	%	f	%
1	Family members engaged in dairy farming	461	89.34	520	89.19	981	89.26
2	Additional labours hired	55	10.66	63	10.81	118	10.74
	Total Manpower	516	100.00	583	100.00	1099	100.00
	Total Herd Size	1124	-	2390	-	3514	-
	Animal : Manpower Ratio	2.18	-	4.10	-	3.20	-

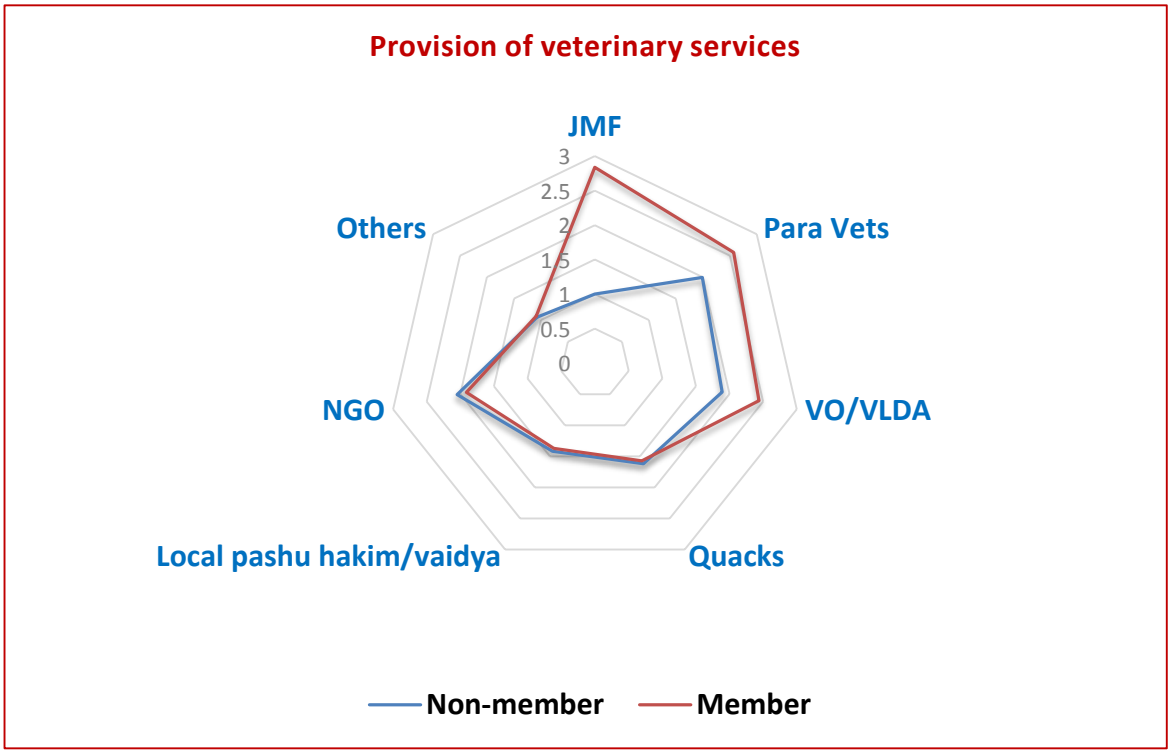


Fig 4.25. Provision of veterinary services among respondents

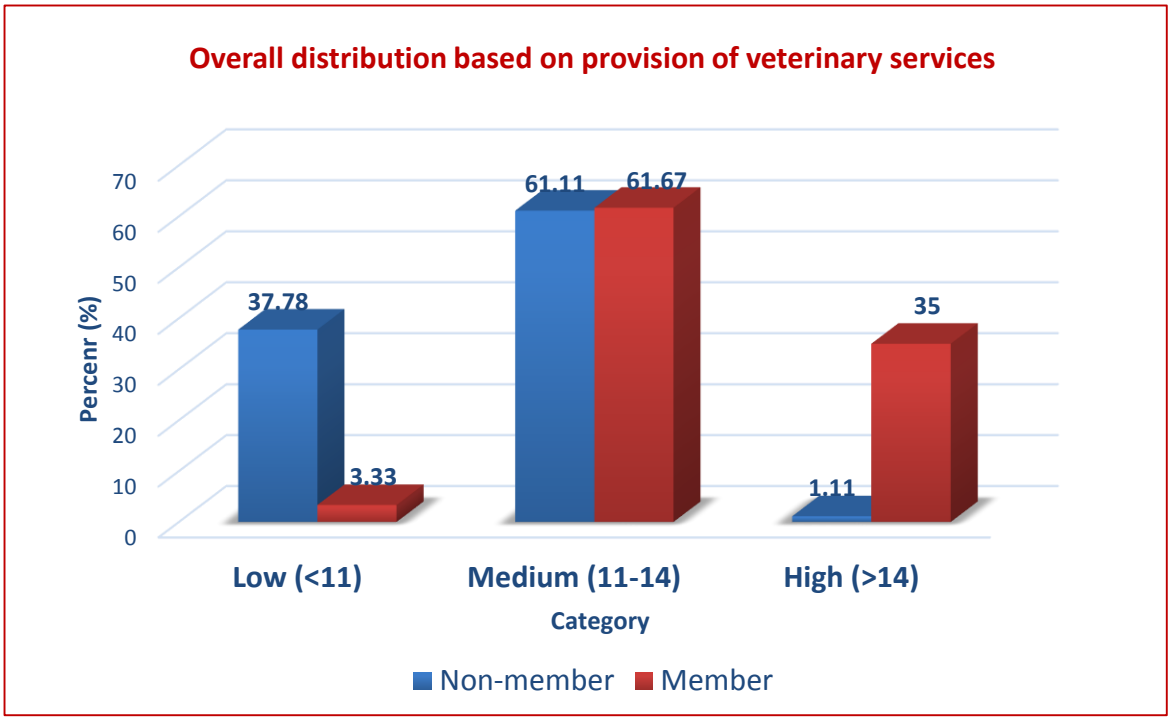


Fig 4.26. Overall distribution of respondents based on provision of veterinary services

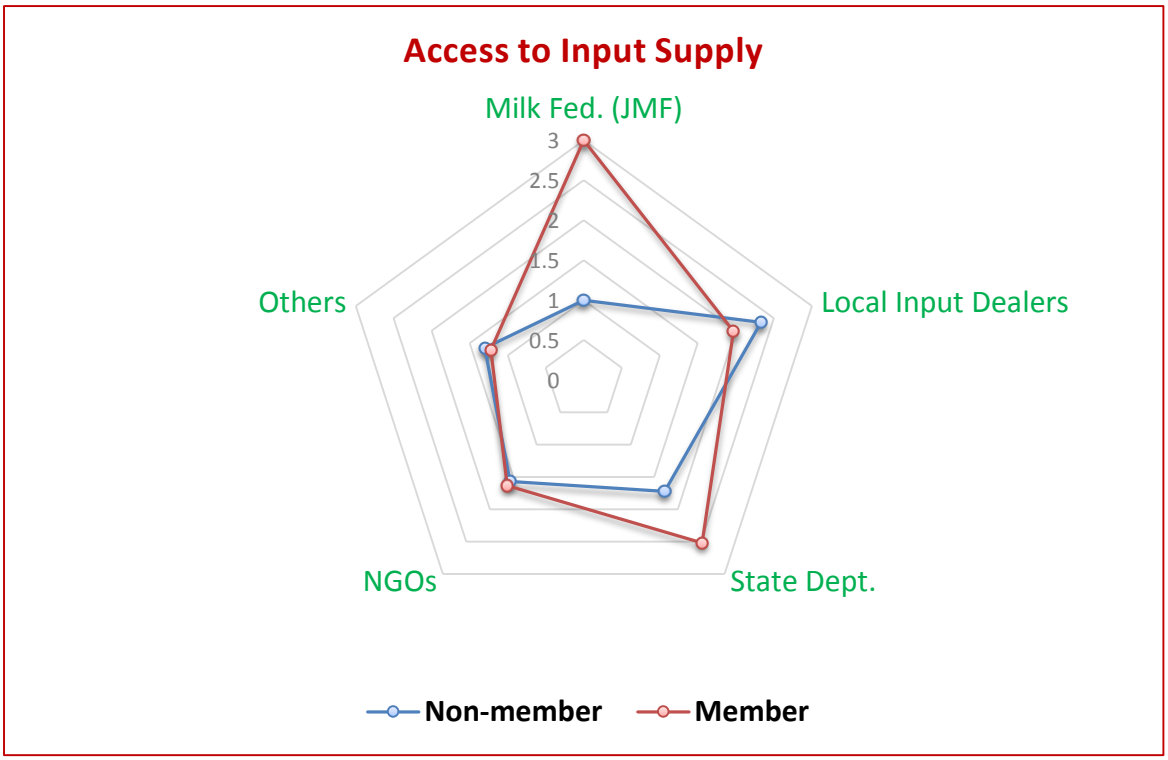


Fig 4.27. Access to Input Supply among respondents

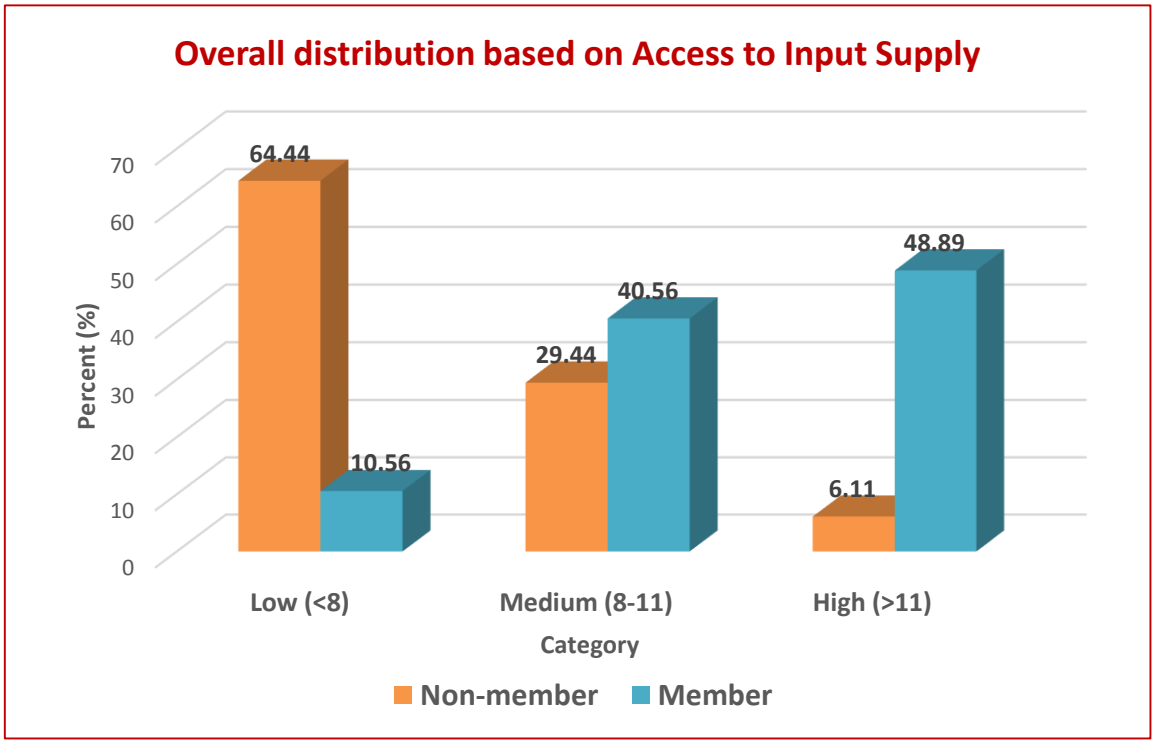


Fig 4.28. Overall distribution of respondents based on access to Input Supply

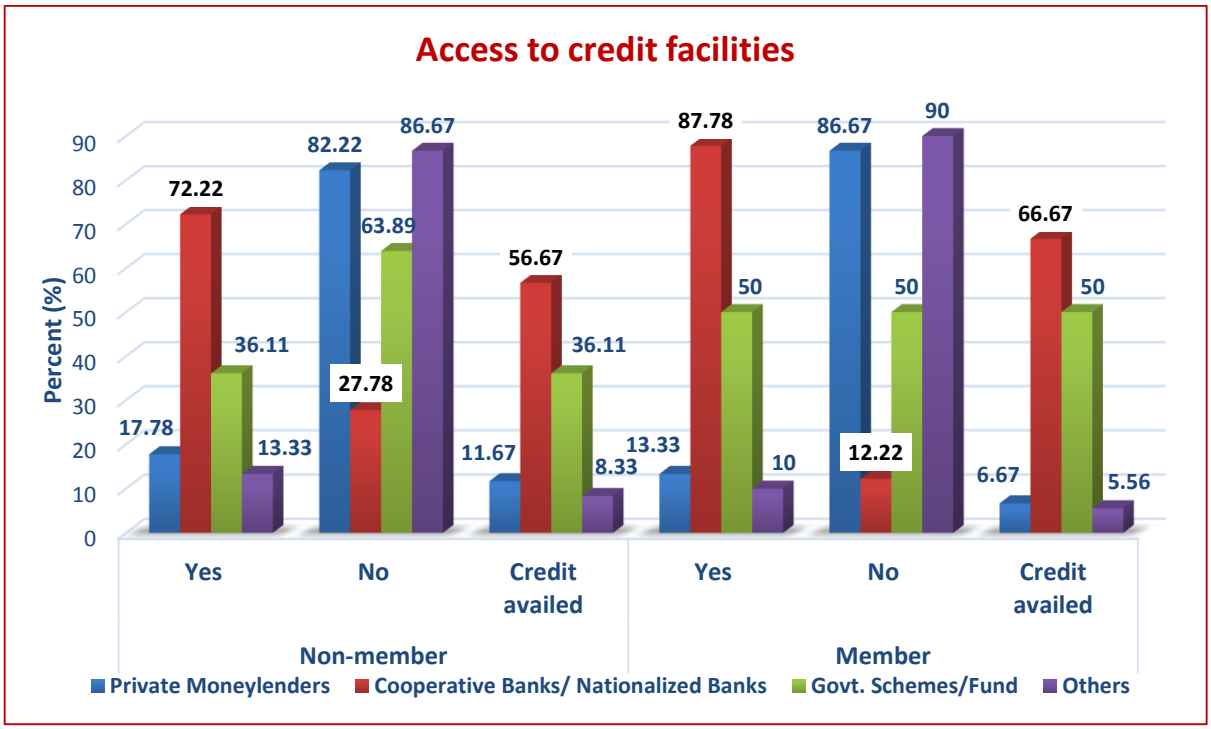


Fig 4.29. Access to credit facilities among respondents

4.1.23 Comparison of selected variables of members and non-members

The computed 't' values were highly significant for most of the selected variables. The values obtained indicated that both members and non-members differs significantly in terms of their education, milk production, milk consumption, milk sale, per capita milk availability, milk price, annual household income, net dairy income, annual household expenditure, operational land holding, market distance and distance from milk collection centre. However, it was found that there was no significant difference between members and non-members in terms of their age, family size experience in dairy farming and herd size. Except milk sale and net dairy income, all the 't' values were significant at 1 percent level of significance, whereas, the 't' value for milk sale and net dairy income was significant only at 5 percent level (Table 4.1.23).

After comparing the selected variables of the members and non-members of JMF, it was found that calculated 't' values for most of the selected variables were significant at 1 and 5 percent level of significance. As a whole it has interpreted that beneficiary diary farmers were benefited in the area of dairying. There was impact of JMF on the beneficiary dairy farmers.

Table 4.1.23 Comparison of selected characteristics of member and non-members of JMF (n=360)

Sl. No.	Parameter	Non-member	Member	Mean Difference	t(p) value
		1	2	(2-1)	3
1	Age (years)	42.27 ± 14.43	46.22 ± 14.54	3.95	2.58 (0.070)
2	Education (years)	8.02 ± 0.29	10.08 ± 0.25	2.06	2.72**(0.006)
3	Family Size (nos.)	6.42 ± 2.53	7.45 ± 3.70	1.03	3.09 (0.152)
4	Experience in dairy farming (years)	10.15 ± 3.85	10.99 ± 3.11	0.84	2.29(0.053)
5	Herd size (nos.)	6.24 ± 2.69	13.28 ± 5.35	7.03	15.74(0.090)
6	Milk production (l/day)	8.81 ± 3.59	11.59 ± 7.84	2.78	4.331**(0.000)
7	Milk consumption (l/day)	1 ± 0.40	1.61 ± 0.79	0.61	9.247**(0.000)
8	Milk sale (l/day)	7.81 ± 3.65	9.20 ± 7.64	1.39	2.207*(0.028)
9	Per capita milk availability (g/day)	1.65 ± 0.80	2.52 ± 1.20	0.87	49.15**(0.000)
10	Milk price (Rs/litre)	37.14 ± 2.48	33.26 ± 6.64	-3.88	-7.355**(0.000)
11	Annual household income (Rs/annum)	141046.73 ± 79078.82	186554.28 ±98848.49	45507.55	4.823**(0.000)
12	Net Dairy income (Rs/annum)	90606.67 ± 54842.17	105614.28 ± 78639.18	15007.62	2.100*(0.036)
13	Annual household expenditure (Rs/annum)	98732.71 ± 55355.18	130587.99 ± 69193.95	31855.29	4.823**(0.000)
14	Operational land holding (ha)	1.01 ± 1.46	2.46 ± 2.66	1.45	6.42** (0.000)
15	Market distance (km)	3.62 ± 1.68	6.64 ± 3.43	3.02	10.610**(0.000)
16	Distance from milk collection centre (km)	4.50 ± 0.38	2.00 ± 0.85	-2.50	-35.77**(0.000)

*Note: Mean ± Std. Deviation, *Significant at p<0.05, **Significant at p<0.01*

4.2 Factors influencing farmers' decisions to join JMF

This objective of the present study delineates several motivational and demotivational factors that influenced farmers' decision to join JMF. Motivational factors were divided into two category *viz.* extrinsic and intrinsic motivational factors. The farmers were personally interviewed with the help of semi-structured interview schedule to enlist the factors influencing farmers' decision to join JMF. The factors were further categorized into different sub-groups *viz.* social, economic, technical and administrative; and ranks were assigned to each statements under each sub-groups based on the perceived importance or priority of each respondents. As mentioned in Methodology, for this objective Rank Based Quotient (RBQ) technique was used to rank the factors.

4.2.1 Motivational factors influencing farmers' decision to join JMF

There are number of motivational factors influencing farmers' decision to join JMF. Many of these factors are inter-related and exert variable prospects on the operational efficiency and more importantly, the productivity of JMF. For the present study, both extrinsic and extrinsic motivational factors were identified and listed during pilot survey under different sub-heads. The ranked statement was collected from 180 registered members-producers of JMF. The results for both extrinsic and intrinsic motivational factors are presented in Table 4.2.1.

4.2.1.1 Extrinsic motivational factors

These are the driving force which motivated farmers externally. This include various social, administrative, technical and economic factors which affected the decision of the farmers' to become member of dairy cooperative (JMF). The factors along with mean score and rank are presented in Table 4.2.1.

4.2.1.1 a Social factors

It was observed from Table 4.2.1 that, the first and foremost important motivational factor was 'Assured market for the milk and milk products', this was due to the rising popularity of customers for *Medha* dairy products in the markets. The second factor ranked in order of preference was 'Growing demand for milk and milk products' since there was rise in consumption of milk products from both rural and urban areas across the State. 'Presence of large size of milking animal herd' was also the key reason for joining JMF as there was surplus milk available

for selling to JMF apart from the household consumption. After, this 'Wide coverage of milk shed area with more membership in JMF' was ranked fourth in the order of preference due to increase in the cooperative membership from both rural and urban areas where there was a huge hidden potential for milk production; also a result of membership; initially by few members; other neighbouring dairy farmers of the village were also interested to join JMF. Another attracting factor for joining JMF was 'Brand name and image of JMF at State level'. As, JMF is the only State Govt. owned dairy cooperative with the brand name "*Medha* Dairy", so it largely appealed people and dairy farmers due its state symbolism and quality. The last ranked motivational factor in the order of priority was 'Better employment opportunity and job security'; since few people from members' families were employed in JMF particularly in MPPs, BMCs and dairy processing plants in various technical and non-technical jobs.

4.2.1.1.b Economic factors

Economic motivation was an important indicator for joining JMF for most of the dairy farmers. Six motivational factors under sub-heading economic factors were identified and ranks were given as per their preference. It was noteworthy to mention from Table 4.2.1 that 'Better price realization and competitive advantage in market' was ranked first, this was attributed to the fact that dairy farmers earned remunerative price for their milk produce by pooling it to JMF, which further sold the packaged milk at competitive price as compared with other milk brands in the market. The second important factor was 'Timely payment of the dividends'. Since, JMF paid their members timely; the money was directly credited to their account *i.e.* after 10 days intervals. Besides this, when cooperative made extra profits, the bonus was shared within the members either biannually or annually. 'Value addition of the milk to widen the market' was ranked third for the reason that JMF apart from liquid milk, it also marketed other value added products like, lassi, paneer, ghee, curd etc. The fourth motivational factor was 'Increment in income since joining the cooperative', as many member-producers were economically poor, the regular income from JMF significantly enhanced their livelihood security after joining JMF. Further, 'Provision of credit facilities/bank linkage from the cooperative' was also perceived an important factor for the reason that JMF indirectly facilitated members in getting loans from the banks by acting as a

guarantor. 'Provision of incentives, insurance etc.' was ranked last since it was not timely disbursed among members like bonuses; furthermore JMF also helped their members in getting livestock insurance for their cattle and buffaloes.

4.2.1.1.c Technical factors

Among technical aspects of JMF, it was observed that 'Modern infrastructural facilities for procurement, processing and chilling of milk' was identified as the most important motivational factors; it was due to the reason that JMF was equipped with modern facilities and updated technology throughout the supply chain system. The second important factor was 'Computerized Data Management System throughout supply chain'. Due to this facility, JMF could keep track of their progress in real time and avoid any kind of human error and mismanagement. Next, perceived motivational factor was 'Structured forward and backward linkage' due to the reason that JMF had well organised network of supply chain system with forward and backward linkage across the State. Another factor in the order of preference was 'Timely provision of A.I. service, animal healthcare services and dairy inputs (feed, veterinary medicines etc.)' this is attributed to the presence of good backward linkage system of JMF. The fifth motivational factor was 'Better access to improved dairy technology'; and therefore JMF members were exposed to modern dairy equipment at MMPs, BMCs and dairy plants.

4.2.1.1 d Administrative factors

In total there were five administrative factors were identified by respondents which apparently motivate them to join JMF. The presence of 'Skilled managers and staff with professionalism (in terms of planning, monitoring and control of financial & human resources)' was the foremost reason since presence of skilled staffs heightened the efficiency and productivity of the JMF. 'Provision of frequent training & extension advisory services from the cooperative' was the second motivational factor; this was due to the fact that JMF regularly conducted extension activities either at their training centres or directly at farmers' field level and gave them need-based training on dairying and animal husbandry. The third-ranked factor was 'Structured channels for timely dissemination of information regarding the latest schemes, subsidies, technology, meetings etc. among the member

producers' this was attributed to the fact that JMF officials regularly interacted with their members directly through various platforms like field visits, seminars, workshops etc.; besides this, they also used mass media channels for information dissemination like bulletins, magazines, folders etc. published by JMF at regular intervals. Further, it was noted that 'Coordination with other govt. and non-govt. agencies' was also another reason for joining JMF since this gave better economic, social and political stability to the cooperative organization (JMF) in the long run. The last factor in the order of ranking was 'Swift mechanism for redressal of grievance'; this was attributed to the fact that JMF encouraged transparency and took strict compliance of the complaints and grievances while working on the same for future improvement.

The above findings were supported by Anigbogu *et al.* (2014), Bayan (2018), Eshetu (2015), Fredrick (2014), Gasana (2011) and Nasiri (2010) who in their studies, accentuated about different factors influencing farmers' decision to join cooperative.

4.2.1.2 Intrinsic motivational factors

Intrinsic motivation is described as the inner reasons or desires to achieve goals. It generally includes self-interest, curiosity, independent mastery and judgement, internal criteria for success etc. as major important indicators for ascertaining farmers' decision to join JMF. For the present study, a total of eleven intrinsic motivational factors were identified and ranked in the order of preference. The responses of the farmers are presented in the Table 4.2.1.

Based on the overall ranking, the most important intrinsic motivational factor was 'Voluntary participation and democratic control' for the reason that JMF was self-governed by their member-producers which gave them freedom to join or quit as per their will. Next factor was 'Expectation for equal treatment among members (without social, gender, cultural and other discrimination)' this was because JMF believed in quality and unity in diversity. 'Accountability and transparency in usage of member's fund' was ranked third since JMF kept good record of their financial transactions and timely announced their annual budget. 'Regularity in conduct of meetings' was also an important decisive factor for joining JMF since this gave them opportunity to clarify their queries and kept them

updated about latest initiatives and technologies. Besides these 'Trust in the board members and dedicated staffs with diversified experience and knowledge in the dairy sector' also motivated dairy farmers intrinsically. Also since many members successfully 'Acquired knowledge, attitude & skills in advanced dairy production techniques'; other dairy farmers were also motivated to join JMF which this intent. Another major factor was 'Better access to social support services during time of crises; especially during the time of pandemic, drought and natural disaster it announced special package and relief fund for their members and supplied them need based inputs. Other important intrinsic motivational factors in the order of their ranking was '*Esprit de corps* among members of the cooperatives', 'Create forum for experiential and information sharing among members', 'Good commitment from the State govt. and NDDB to ensure better growth of JMF' and 'Less interferences of State with the cooperative administration and helping in matters such as finance, legislation, investment projects, subsidies etc.'

The findings were in agreement with the findings of Gray and Kraenzle (1998) and Ozdemir (2005) who highlighted the salient intrinsic factors influencing dairy cooperative membership.

Table 4.2.1 Motivational factors influencing farmers' decisions to join JMF

(N=180)

Sl. No.	**Motivational factors**		
A.	**Extrinsic motivational factors**		
	I. Social	**RBQ**	**Rank**
1	Better employment opportunity and job security	38.98	**VI**
2	Assured market for the milk and milk products	76.67	**I**
3	Presence of large size of milking animal herd	61.30	**III**
4	Brand name and image of JMF at State level	46.67	**V**
5	Growing demand for milk and milk products	69.35	**II**
6	Wide coverage of milk shed area with more membership in JMF	53.80	**IV**

	II. Economic	**RBQ**	**Rank**
1	Increment in income since joining the cooperative	54.17	**IV**
2	Better price realization and competitive advantage in marketplace	75.00	**I**
3	Provision of incentives, insurance etc.	41.20	**VI**
4	Timely payment of the dividends	67.87	**II**
5	Value addition of the milk to widen the market	60.93	**III**
6	Provision of credit facilities/bank linkage from the cooperative	47.59	**V**
	III. Technical	**RBQ**	**Rank**
1	Better access to improved dairy technology	38.11	**V**
2	Timely provision of A.I. service, animal healthcare services and dairy inputs (feed, veterinary medicines etc.)	48.56	**IV**
3	Modern infrastructural facilities for procurement, processing and chilling of milk	78.11	**I**
4	Structured forward and backward linkage	60.78	**III**
5	Computerized Data Management System throughout supply chain	72.22	**II**
	IV. Administrative	**RBQ**	**Rank**
1	Skilled managers and staff with professionalism (in terms of planning, monitoring and control of financial & human resources)	75.11	**I**
2	Provision of frequent training & extension advisory services from the cooperative	67.11	**II**
3	Coordination with other govt. and non-govt. agencies	50.00	**IV**
4	Swift mechanism for redressal of grievance	42.67	**V**

5	Structured channels for timely dissemination of information regarding the latest schemes, subsidies, technology, meetings etc. among the member producers	62.89	**III**
B.	**Intrinsic motivational factors**	**RBQ**	**Rank**
1	Expectation for equal treatment among members (without social, gender, cultural and other discrimination).	73.64	**II**
2	Better access to social support services during time of crisis	49.60	**VII**
3	Create forum for experiential and information sharing among members	40.61	**IX**
4	Voluntary participation and democratic control	78.79	**I**
5	Acquired knowledge, attitude & skills in advanced dairy production techniques	54.04	**VI**
6	Less interferences of State with the cooperative administration and helping in matters such as finance, legislation, investment projects, subsidies etc.	32.02	**XI**
7	*Esprit de corps* among members of the cooperatives	45.05	**VIII**
8	Trust in the board members and dedicated staff with diversified experience and knowledge in the dairy sector	58.79	**V**
9	Regularity in conduct of meetings	63.64	**IV**
10	Good commitment from the State govt. and NDDB to ensure better growth of JMF	36.26	**X**
11	Accountability and transparency in usage of member's fund	68.59	**III**

4.2.2 Demotivational factors as perceived by dairy farmers apropos JMF

The list of demotivating factors was formed according to previous research that investigated this aspect on dairy cooperatives. It generally indicated dissatisfaction or disenchantment expressed by dairy farmers regarding various aspects of JMF For assessing demotivational factors, a sample of 180 respondents (registered members of JMF) were taken who ranked the statements in the order of their preference. Finally, the factors were categorized into social, economic, technical and administrative factors are were represented in Table 4.2.2.

4.2.2.a Social factors

Under this category, the first demotivational factor ranked by majority of respondents was 'Lack of cooperation among member producers belonging to different caste, community, tribe etc.' as it was commonly observed that there was conflict of interest between dairy farmers belonging to different caste, community, religion and tribe. Next in order of ranking was 'Prejudiced and biased practices espoused by *Doodh Mitra* at MPP' like discrimination, favouritism, corruption etc. It was noteworthy to highlight that in few MPPs; *Doodh Mitras* adopted unfair practices and had inclination towards particular community while discriminating farmers from backward communities; also in rare occasions they were also indulged in corruption. Another demotivational factor was 'Rejection of milk due to delay in disposal of milk at scheduled procurement time at MPP'; due to quality issues JMF only collected fresh milk both morning and evening at the scheduled time slot. Also due to 'Remote location of milk collection centre' many dairy farmers sometimes failed to bring their milk on the scheduled time in MPPs. 'Communication gap and lack of mutual trust between staff and producer members' was ranked last in order of preference. This was attributed to cultural difference, lack of rapport building, communication gap between JMF staff and dairy farmers who were commonly observed as impersonal cosmopolite by most of the villagers.

4.2.2.b Economic factors

It could be inferred from Table 4.2.2 that, five economic factors were identified by the respondents as demotivating factors. The most important factor was 'No revision in the rate chart of milk procurement price by JMF since long time' and therefore farmers expressed disappointments and frequently complained to JMF officials regarding revision of rate chart. The next important factor was 'Low milk price as compared to other unorganized sector' .This was one of the main reasons for not joining JMF as it was observed that non-members sold their milk directly to their customers, restaurants, sweet shops, milk vendors at higher price as compared with members where the milk price per litre was fixed by JMF and followed old price rate chart as discussed earlier. 'Untimely and irregular distribution of bonus, incentives, perks etc.' was ranked third due to the reason that distribution of bonus, incentives, and perks was dependent on annual profits and business growth rate of JMF; which was quite unpredictable at times and therefore there was delay and irregularity in distribution. Further, 'Low productivity of milch animals' was also perceived major demotivational factors by many dairy farmers as majority of them belonged to low milk production category, they didn't had surplus milk to cater to JMF apart from family consumption. Also, since many farmers fell under low income category, they were not able to bear 'High cost of maintenance of dairy cattle' which included major costs on feeding, healthcare and management.

4.2.2.c Technical factors

In case of technical factors, the results in Table 4.2.2 revealed that 'Irregularity and delay in provision of input services' was the major demotivational factor; through JMF regularly supplied input services to their beneficiaries but many times input services were delayed due to inevitable reasons. The second important perceived factor was 'Frequent rejection of milk due to less Fat and SNF content in milk sample'; This was routine phenomena observed among members where their milk was frequently rejected due to less Fat and SNF content indicated by lactometer; whereas opposite to this; most of the non-members easily sold their milk without quality testing to their customers at comparatively higher prices. Also, due to 'Frequent malfunctioning of milk testing equipment like stellar, lactometer

etc.', the farmers had to face rejection of their milk. Another important demotivational factor was 'Inadequate and inappropriate animal feeding and health care facilities' this was due to the reason that there was shortage of supply of animal feeding and healthcare facilities and also it was not timely delivered to the members. The fifth factor in the order of ranking was 'Defective management and shortage of skilled man power' which was quite prevalent in BMCs where most of the JMF staffs lacked skills in testing milk, operating bulk miller coolers, recording of data etc. However, few farmers from remote villages also expressed that there was 'Poor basic infrastructural facilities for procurement, transportation, processing of milk and marketing etc.'

4.2.2.d Administrative factors

Under the purview of administrative factors as depicted in Table 4.2.2, the most important demotivational factor identified by majority was 'Lack of representation of member-producers among the board of directors or top level administration'. It was observed that unlike other dairy cooperatives of India, JMF was not having any official representative from member-producers among the top decision making authority due to which many farmers felt that their voices will not be heard. The second factor in order of ranking was 'Procedural complications for registration of new members'. It was mainly due to the fact that sometimes the applications were deliberately delayed by the *Doodh Mitra*; who strictly verified their documents while registering new members. 'Irregular visit and supervision by JMF officials at the MPP and BMC' was ranked third especially in case of MPPs and BMCs located in remote locations. Many dairy farmers expressed that due to 'Poor keeping of records/accounts' at MPPs and BMCs they had to incur huge monetary loss. Other demotivational factors in order of ranking were 'Illegitimate policies, bylaws and rules framed by JMF disfavouring dairy farmers', 'Weak unity of command, unity of direction and scalar chain among line and staff authority in JMF' and 'Existence of corruptive practices or Red tapism'.

The findings were in conformity with results of Msimango and Oladele (2013) and Sharma (2015) who also emphasized about demotivational factors in their study.

Table 4.2.2 Demotivational factors as perceived by dairy farmers apropos JMF (n=180)

Sl. No.	Demotivational factors	RBQ	Rank
	I. Social		
1	Communication gap and lack of mutual trust between staff and producer members	42.89	**V**
2	Lack of cooperation among member producers belonging to different caste, community, tribe etc.	76.67	**I**
3	Remote location of milk collection centre	51.00	**IV**
4	Prejudiced and biased practices espoused by *Doodh Mitra* at MPP	67.89	**II**
5	Rejection of milk due to delay in disposal of milk at scheduled procurement time at MPP	59.33	**III**
	II. Economic	**RBQ**	**Rank**
1	Low milk price as compared to other unorganized sector	68.56	**II**
2	Low productivity of milch animals	50.78	**IV**
3	Untimely and irregular distribution of bonus, incentives, perks etc.	59.22	**III**
4	No revision in the rate chart of milk procurement price by JMF since long time	77.00	**I**
5	High cost of maintenance of dairy cattle	42.22	**V**
	III. Technical		
1	Inadequate and inappropriate animal feeding and health care facilities	53.61	**IV**
2	Poor basic infrastructural facilities for procurement, transportation, processing of milk and marketing etc.	38.43	**VI**

3	Defective management and shortage of skilled man power	45.93	**V**
4	Irregularity and delay in provision of input services	77.78	**I**
5	Frequent malfunctioning of milk testing equipment like stellar, lactometer etc.	61.48	**III**
6	Frequent rejection of milk due to less Fat and SNF content in milk sample	69.54	**II**
	IV. Administrative	**RBQ**	**Rank**
1	Irregular visit and supervision by JMF officials at the MPP and BMC	63.57	**III**
2	Illegitimate policies, bylaws and rules framed by JMF disfavouring dairy farmers	49.37	**V**
3	Poor keeping of records/accounts	56.27	**IV**
4	Existence of corruptive practices or Red tapism	35.71	**VII**
5	Procedural complications for registration of new members	70.56	**II**
6	Lack of representation of member-producers among the board of directors or top level administration	77.94	**I**
7	Weak unity of command, unity of direction and scalar chain among line and staff authority in JMF	42.14	**VI**

RBQ=Rank Based Quotient

4.3 Impact of JMF on reproductive, productive and health performance of dairy animals and socio-economic status of dairy farmers

The present objective was divided into two section, the first section deals with the impact of JMF on reproductive, productive and health performance of dairy animals; while the second section discusses about impact of JMF on socio economic status of dairy farmers.

4.3.1 Impact of JMF on reproductive, productive and health performance of dairy animals

Under this section, the reproductive, productive and health performance of the selected dairy animals were accessed separately. For analysis of productive performance; indicators like avg. daily milk yield, lactation length, avg. lactation milk yield, peak yield and dry period were taken into consideration, whereas in case of productive performance, indicators like age at 1st calving, services per conception, service period, and calving intervals was studied. The health performance of animals were accessed based on the past occurrences and diagnosis of diseases/disorders, Body Condition Score and the rate of mortality and morbidity.

4.3.1.1 Reproductive performances of dairy animals

Reproductive performances of dairy animals reared by members and non-members of Jharkhand State is presented in Table 4.3.1.The reproductive performance of buffalo, Indigenous and crossbred cow was assessed on the parameters such as age at first calving, services per conception, service period, calving interval.

4.3.1.1.a Age at first calving (in months)

This is one of the most important parameter in the reproductive performances of dairy animals. The reproductive performance of milch animals improves as the age at first calving decreases, and vice versa. The data from the Table 4.3.1 revealed that the average age at first calving of buffalos was, 48.18±4.34 and 48.61±4.50 (in months) respectively in members and non-members. The average age at first calving of crossbred cattle was 39.24±3.15 and 40.57±3.58 in months respectively in members and non-members. The average age at first calving of Indigenous cattle was 41.90± 3.32 and 42.06±3.08 in months respectively in members and non-members. According to the findings of Bohra *et al.* (2007), the age at first caving in cow and buffalo was 4 (3.6-4.5) years and 4.6 (4.0-5.5) years respectively. This was attributed to the reason that farmers adopted better heifer management practices which resulted in their lower age at first calving. Further, z-score indicated that, in case of buffalo, indigenous and

crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

4.3.1.1.b Services per conception (In nos.)

This is one of the vital factors in the reproductive performances of dairy animals. Lesser number of services per conception, better the reproductive performance of milch animals and vice-versa. Table 4.3.1 revealed that the average services per conception of buffalo were 2.66±0.67 and 2.80 ±0.63 (in numbers) in members and non-members, respectively. The average services per conception of crossbred cattle were 2.38±0.57 and 2.45±0.75 (in numbers) in members and non-members, respectively. The average services per conception of Indigenous cattle were 2.27±0.76 and 2.41±0.89 (in numbers) in members and non-members, respectively. The number of services per conception is also affected by the timely availability of veterinary services and the availability of good quality semen, as well as the proficiency of the A.I. practitioner. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

4.3.1.1.c Service period (In days)

The data in the Table 4.3.1 shows that the average service period of buffalos was 148.67±14.52 and 147.73±17.46, (in days) in members and non-members, respectively. The average service period of crossbred was 106.85±10.88 and 106.07±12.74 (in days) in members and non-members, respectively. The average service period of indigenous was 99.50±15.27 and 101.69±20.46 (in days) in members and non-members, respectively. The optimal service period for dairy animals should be 60-90 days (TNAU agritech portal, 2016), although it was significantly greater in the study area. The longer service period could be owing to a failure to recognise heat signs in milch animals or the lack of insemination facilities in the area. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

Table 4.3.1 Reproductive performance of dairy animals

Sl. No.	Parameters	Crossbred (237)		|z|-test score	Indigenous (94)		|z|-test score	Buffalo (161)		|z|-test score
		Members (135)	Non-members (102)		Members (58)	Non-members (36)		Members (82)	Non-members (79)	
1	**Age at 1st calving (months)**	39.24± 3.15	40.57±3.58	-9.878**	41.90± 3.32	42.06± 3.08	-3.738**	48.18± 4.34	48.61±4.50	-7.841**
2	**Services per conception (in nos.)**	2.38± 0.57	2.45±0.75	-10.811**	2.27±0.76	2.41± 0.89	-4.056**	2.66±0.67	2.80 ±0.63	-7.350**
3	**Service period (days)**	106.85±10.88	106.07±12.74	-8.652**	99.50±15.27	101.69±20.46	-3.247**	148.67±14.52	147.73±17.46	-7.031**
4	**Calving intervals (days)**	391.23±15.26	398.29±17.49	-9.107**	396.03±17.47	395.13±21.51	-3.566**	448.60±15.31	444.44±15.40	-7.429**

*Mann-Whitney U Test **significant at 0.05 probability level*

4.3.1.1.d Calving interval (In days)

Shorter calving interval is the key for the profitable dairy enterprise. The date from Table 4.3.1 shows that the calving interval of buffalo was 448.60±15.31 and 444.44±15.40 days in members and non-members, respectively. The calving interval of Crossbred cattle was 391.23±15.26 and 398.29±17.49 days in members and non-members, respectively. The calving interval of indigenous cattle was 396.03±17.47 and 395.13±21.51 days in members and non-members, respectively. Enhanced calving interval indicates that the farmers received less milk from milch animal. The breeding, feeding and health management of dairy animal by the farmers affect the calving interval. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

4.3.1.2 Productive performance of dairy animals

Comparative analysis of productive performances of dairy animals reared by members and non-members of Jharkhand State is presented in Table 4.3.2.The productive performance of buffalo, indigenous and crossbred cow was assessed on the parameters such as average daily milk yield, lactation length, dry period, average lactation milk yield, peak yield.

4.3.1.2.a Average daily milk yield (in liters)

When evaluating the performance of the animals, the milk yield of the milch animals is crucial. It is revealed from the Table 4.3.2 that the average daily milk yield of buffalos was 4.34±0.20 and 3.87±0.16 in members and non-members, respectively. The average daily milk of crossbred cattle was 6.77±0.38 and 5.76± 0.56 in members and non-members, respectively. While the average daily milk of indigenous cattle was 1.99±0.23 and 1.98±0.37 in members and non-members, respectively. The proportion of indigenous cattle in cattle population is more in non-members and productivity of the indigenous cattle is very low in Jharkhand State. Raja *et al.* (2012) found in their study, that the daily milk yield was 6.69±0.99 litres in crossbreed cows and 1.07±0.10 litres in indigenous cows, which was comparable to the least progressive dairy states. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

4.3.1.2.b Lactation length (in days)

One of the most important measures of milch animal performance is optimal lactation length. It is depicted from Table 4.3.2 that the average lactation length of Buffalo was 264.98±8.40 and 261.39±8.43 (days) in members and non-members, respectively. The average lactation length of Crossbred was 277.26±10.49 and 273.33±7.22 (days) in members and non-members, respectively and the average lactation length of Indigenous cattle was 265.52±7.59 and 264.56±7.74 (days) in members and non-members, respectively. Lactation lengths of 305 days were found to be ideal (Cole et al., 2011). Lactation length was determined to be the longest in crossbred animals, followed by Buffalo and Indigenous cattle in the state. In Sunderban, West Bengal, Raja *et al.* (2012) discovered that the average lactation was 224.88±6.72 days for indigenous cows and 232.00±2.00 days for crossbreed cows. Further, z-score indicated that, in case of indigenous cow and buffalo there was significant difference in their lactation length between members and non-members at 5 per cent level of significance, whereas in crossbred it was significant at 0.01 probability level.

4.3.1.2.c Average lactation milk yield (in liters)

The average lactation milk yield has a positive relationship with the milch animals' total productivity. The average lactation milk yield of Buffalo was 1149.01±10.04 and 1018.51±9.32 (in liters) in members and non-members, respectively. The average lactation milk yield of Crossbred cattle was 1705.63±9.86 and 1599.24±9.62 (in liters) in members and non-members, respectively. While the average lactation milk yield of Indigenous cattle was 527.83±10.98 and 522.11±11.38 (in liters), respectively in members and non-members. Because of the availability of superior germplasm such as Murrah Buffalo and local cattle breeds like Bachaur, Sahiwal, and Tharparkar, the average lactation yield of all species is very high in members compared to non-members. Crossbred cattle performed well in Jharkhand, whereas buffalo and indigenous cattle performed poorly. It could be because local breeds of indigenous cattle were mostly used for draught purposes. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average lactation milk yield between members and non-members at 5 per cent level of significance.

Table 4.3.2 Productive performance of dairy animals

Sl. No.	Parameters	Crossbred (237)		|z|-test score	Indigenous (94)		|z|-test score	Buffalo (161)		|z|-test score
		Members (135)	Non-members (102)		Members (58)	Non-members (36)		Members (82)	Non-members (79)	
1	Avg. daily milk yield (l)	6.77±0.38	5.76± 0.56	-13.824**	1.99±0.23	1.98±0.37	-3.481**	4.34±0.20	3.87±0.16	-11.585**
2	Lactation length (days)	277.26±10.49	273.33±7.22	-2.289*	265.52±7.59	264.56±7.74	-3.217**	264.98±8.40	261.39±8.43	-5.583**
3	Avg. lactation milk yield (l)	1705.63±9.86	1599.24±9.62	-14.162**	527.83±10.98	522.11±11.38	-5.044**	1149.01±10.04	1018.51±9.32	-11.756**
4	Peak yield (l/day)	11.37±1.07	9.37±1.41	-12.123**	3.48±0.31	3.47±0.30	-4.159**	8.91±0.51	8.25±0.44	-8.406**
5	Dry period (days)	119.42±10.29	124.26±12.09	-9.334**	130.35±11.85	131.06±12.65	-4.242**	184.05±9.43	183.42±10.31	-7.464**

*Mann-Whitney U Test **significant at 0.05 probability level*

4.3.1.2.d Peak yield (in liters/day)

A perusal of the Table 4.3.2 revealed that the average peak milk yield of buffalo was 8.91±0.51and 8.25±0.44; (in liters/day) respectively in members and non-members. The average peak milk yield of crossbred cattle was 11.37±1.07 and 9.37±1.41 (in liters/day) respectively in members and non-members. The average peak milk yield of Indigenous cattle was 3.48±0.31 and 3.47±0.30 (in liters/day) respectively in members and non-members. Peak yield is a reliable measure of animal quality. Peak yield is the criterion for determining whether or not to swap animals. The higher the peak yield of a milch animal, the higher the market price.

4.3.1.2.e Dry period (in days)

Longer dry period causes economic losses to the farmers. A glance of the Table 4.3.2 revealed that the average dry period of buffalos was 184.05±9.43 and 183.42±10.31 in members and non-members, respectively. The average dry period of Crossbred cattle was 119.42±10.29 and 124.26±12.09 in members and non-members, respectively. While the average dry period of Indigenous cattle was 130.35±11.85 and 131.06±12.65 in days respectively in members and non-members. Lower the dry period better the conception rate of the animals and vice-versa. Jadoun *et al.,* (2015) found that the average dry period of Integrated Murrah Development Schemes (IMDS) beneficiaries was 102.02 days and for beneficiaries it was 111.49 days in Haryana. The longer dry period in the present study could be attributed to the wide variation of breeds and management practices in the different states.

Overall, the assessment on reproductive and performance of dairy animals were in line with the findings of Kale et al. (2018), Kumar (2012), Manjusha et al. (2016) and Meena et al. (2015).

4.3.1.3 Health performance

For the present study, health performance of the animals was judged based on the past occurrences and diagnosis of any disease/ disorder in cattle and buffalo, separately. In addition to this, their Body Condition Score (BCS) and rate of morbidity/ mortality was also accessed. The results on this aspect are depicted in Table 4.3.3 and 4.3.4.

4.3.1.3.a Occurrences of diseases/disorders in Cattle

For the present study, a total of 135 cattle from non-members and 80 cattle from members, reported the occurrences of various diseases or disorders in cattle and were subsequently examined and treated by the animal health experts.

In case of non-members, highest incidence of mastitis (14.81%) was recorded followed by H.S (10.37%). Whereas repeat breeding (8.89%), F.M.D (7.41%) and endo parasitic infestation (6.67%) was 3rd, 4th and 5th in the order of occurrences. It was noteworthy to mention that equal percentage of cattle (*i.e.* 5.93%) suffered from haematuria, abortion and milk fever, respectively. Around 5.19 per cent had warts especially on their limbs while equal percentages (4.44%) had issues of tympaitis/bloat and anoestrus in cow which caused huge economic losses in the region. Other disease/ disorder observed were urinary problem, emaciation / weakness, ecto parasitic infestation, diarrhoea / dysentery, scars and limb deformity as depicted in Table 4.3.3.

Similarly in case of members, highest incidence of mastitis (17.50%) was recorded followed by H.S (12.5%). Whereas, F.M.D (8.75%) and repeat breeding (8.75%) had equal percentage of occurrences in the field level. Ecto parasitic infestations caused by tick/lice affected 7.5 per cent of the cattle. Further, endo parasitic infestation (6.25%) was reported to 5th and emaciation/weakness (5.00%) was 6th in the order of occurrences. It was also noteworthy to mention that equal percentage of cattle (*i.e.* 3.75%) suffered from haematuria, urinary problem, anoestrus, tympaitis/bloat, scars, limb deformity and milk fever, respectively. A countable few with equal percentages (*i.e.* 2.5%) had health issues related to warts, abortion and diarrhoea/dysentery.

4.3.1.3.b Occurrences of diseases/disorders in Buffalo

For the present study, a total of 95 buffalo from non-members and 60 buffalo from members, reported the occurrences of various diseases or disorders in buffalo and were subsequently examined and treated by the animal health experts.

In case of non-members, it was observed that mastitis (12.63%), H.S. (10.53%), and endo parasitic infestation (9.47%) were the major three problems in the order of severity or occurrences. F.M.D (8.42%), emaciation/weakness

(8.42%), ecto parasitic infestation (6.32%), repeat breeding (6.32%), limb deformity (6.32%), anoestrus (5.26%), diarrhoea/dysentery (5.26%), scars (5.26%), milk fever (5.26%), tympaitis/bloat (4.21%), abortion (3.16%) and mange infestation (3.16%) were other common diseases/ disorder in the buffaloes as indicated in Table 4.3.4.

Table 4.3.3 Occurrences of diseases/disorders in Cattle

Sl. No.	Disease/Disorders	Non-members Cattle (n=135)		Members Cattle (n=80)		Pooled (n=215)	
		f	%	f	%	f	%
1	Foot & Mouth diseases	10	7.41	7	8.75	17	7.91
2	Haemorrhagic Septicaemia	14	10.37	10	12.50	24	11.16
3	Haematuria	8	5.93	3	3.75	11	5.12
4	Repeat breeding	12	8.89	7	8.75	19	8.84
5	Urinary problem	5	3.70	3	3.75	8	3.72
6	Endo parasitic infection	9	6.67	5	6.25	14	6.51
7	Anoestrus	6	4.44	3	3.75	9	4.19
8	Emaciation/weakness	5	3.70	4	5.00	9	4.19
9	Ecto parasitic infestation	4	2.96	6	7.50	10	4.65
10	Tympaitis/bloat	6	4.44	3	3.75	9	4.19
11	Warts	7	5.19	2	2.50	9	4.19
12	Abortion	8	5.93	2	2.50	10	4.65
13	Diarrhoea/dysentery	5	3.70	2	2.50	7	3.26
14	Scars	4	2.96	3	3.75	7	3.26
15	Limb deformity	4	2.96	3	3.75	7	3.26
16	Mastitis	20	14.81	14	17.50	34	15.81
17	Milk fever	8	5.93	3	3.75	11	5.12
	Total	**135**	**100**	**80**	**100**	**215**	**100**

Table 4.3.4 Occurrences of diseases/disorders in Buffalo

Sl. No.	Disease/Disorders	Non-members Buffalo (n=95)		Members Buffalo (n=60)		Pooled (n=155)	
		f	%	f	%	f	%
1	Foot & Mouth diseases	8	8.42	6	10.00	14	9.03
2	Haemorrhagic Septicaemia	10	10.53	8	13.33	18	11.61
3	Emaciation/weakness	8	8.42	5	8.33	13	8.39
4	Endo parasitic infection	9	9.47	6	10.00	15	9.68
5	Ecto parasitic infestation	6	6.32	5	8.33	11	7.10
6	Repeat breeding	6	6.32	4	6.67	10	6.45
7	Anoestrus	5	5.26	3	5.00	8	5.16
8	Tympaitis/bloat	4	4.21	3	5.00	7	4.52
9	Abortion	3	3.16	1	1.67	4	2.58
10	Diarrhoea/dysentry	5	5.26	1	1.67	6	3.87
11	Mange	3	3.16	1	1.67	4	2.58
12	Scars	5	5.26	1	1.67	6	3.87
13	Limb deformity	6	6.32	3	5.00	9	5.81
14	Mastitis	12	12.63	9	15.00	21	13.55
15	Milk fever	5	5.26	4	6.67	9	5.81
	Total	**95**	**100**	**60**	**100**	**155**	**100**

Similarly, in case of members, it was observed that mastitis (15.00%), H.S. (13.33%), endo parasitic infestation (10.00%) and F.M.D (10.00%) were the major four problems in the order of severity or occurrences. Emaciation/weakness (8.33%), ecto parasitic infestation (8.33%), repeat breeding (6.67%), milk fever (6.67%), anoestrus (5.00%), tympaitis/bloat (5.00%), limb deformity (5.00%),

abortion (1.67%), diarrhoea/dysentery (1.67%), mange (1.67%) and scars (1.67%) were other common diseases/ disorder in the buffaloes as indicated in Table 4.3.4.

Even though buffaloes and cattle are raised in the same herd/shed, no incidences of haematuria, urinary problems, or teat warts have been recorded in buffaloes. Bovine mastitis is a common and persistent infection in the buffalo population, resulting in economic losses such as decreased milk output, higher treatment costs, and the culling process (Dhakal and Thapa, 2002; Singh and Bansal, 2004).

4.3.1.3.c Body Condition Score (BCS)

The body condition score is an important indicator of the health performance of a dairy cattle or buffalo. It is a subjective scoring method for evaluating the energy reserves of dairy animals. It allows for a better understanding of the biological relationship between body fat, milk production, and reproduction, which aids in the adoption of the best management practises to maximise production while maintaining good health. A scoring system with 1 to 5 scale as per Edmonson *et al.* (1989) was devised to measure body condition of dairy animals at any point during the lactation cycle. For this study, approximately 102 crossbred, 79 buffalo and 36 indigenous cows were selected among non-member dairy farmers, whereas 135 crossbred cows, 82 buffalo and 58 indigenous cows were selected from member dairy farmers.

Table 4.3.5 depicted that, in case of dairy animals reared by non-members, the average body condition score of crossbred cows was 2.75, while buffalo and indigenous cow had BCS of 2.96 and 2.56, respectively. Similarly in case of members, the average body condition score of crossbred, buffalo and indigenous lactating cow was 3.54, 3.63 and 3.22, respectively. Therefore, it can be summarized that body condition score of dairy animals maintained by members was better in comparison to non-members.

Overall classification of dairy animals based on their BCS presented in Table 4.3.6 revealed that, all the crossbred, buffalo and indigenous cows reared by non-members fell under medium BCS category (between 2.5 to 3.5), whereas in case of dairy animals reared by members, all crossbred and buffalo belonged to high BCS category (between 3.5 to 4.5) while indigenous cows fell under medium BCS category.

Table 4.3.5 Average Body Condition Score (BCS) of dairy animals

Sl. No.	Type	BCS (Non-member)							BCS (Member)						
		1	2	3	4	5	Total	Avg. BCS	1	2	3	4	5	Total	Avg. BCS
1	**Crossbred**	21	22	26	27	6	**102**	2.75	12	9	33	56	25	**135**	3.54
2	**Buffalo**	14	11	23	26	5	**79**	2.96	7	11	14	23	27	**82**	3.63
3	**Indigenous**	6	9	16	5	0	**36**	2.56	2	2	35	19	0	**58**	3.22

Table 4.3.6 Body condition score scale for dairy animals

Sl. No.	BCS Category	BCS (Non-member)			BCS (Member)		
		Crossbred	Buffalo	Indigenous	Crossbred	Buffalo	Indigenous
1	**Low (<1.5)**	-	-	-	-	-	-
2	**Medium (2.5-3.5)**	2.75	2.96	2.56	-	-	3.22
3	**High (3.5-4.5)**	-	-	-	3.54	3.63	-

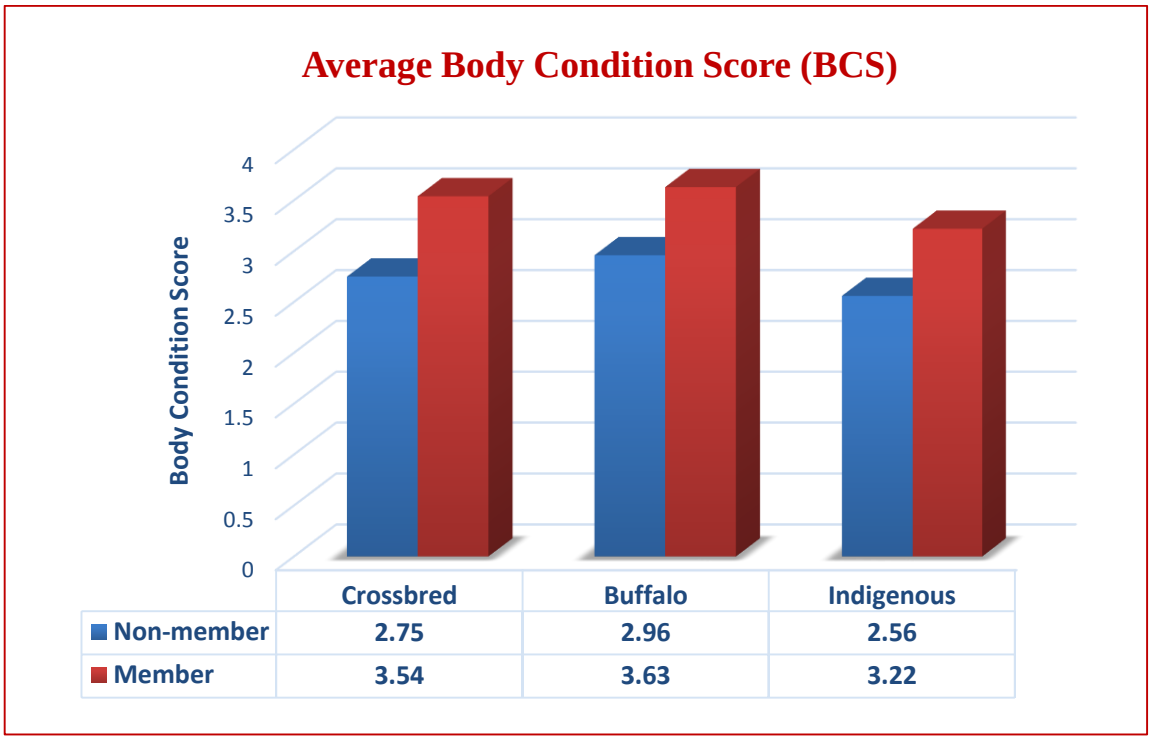


Fig 4.30 Average Body Condition Score (BCS) of dairy animals

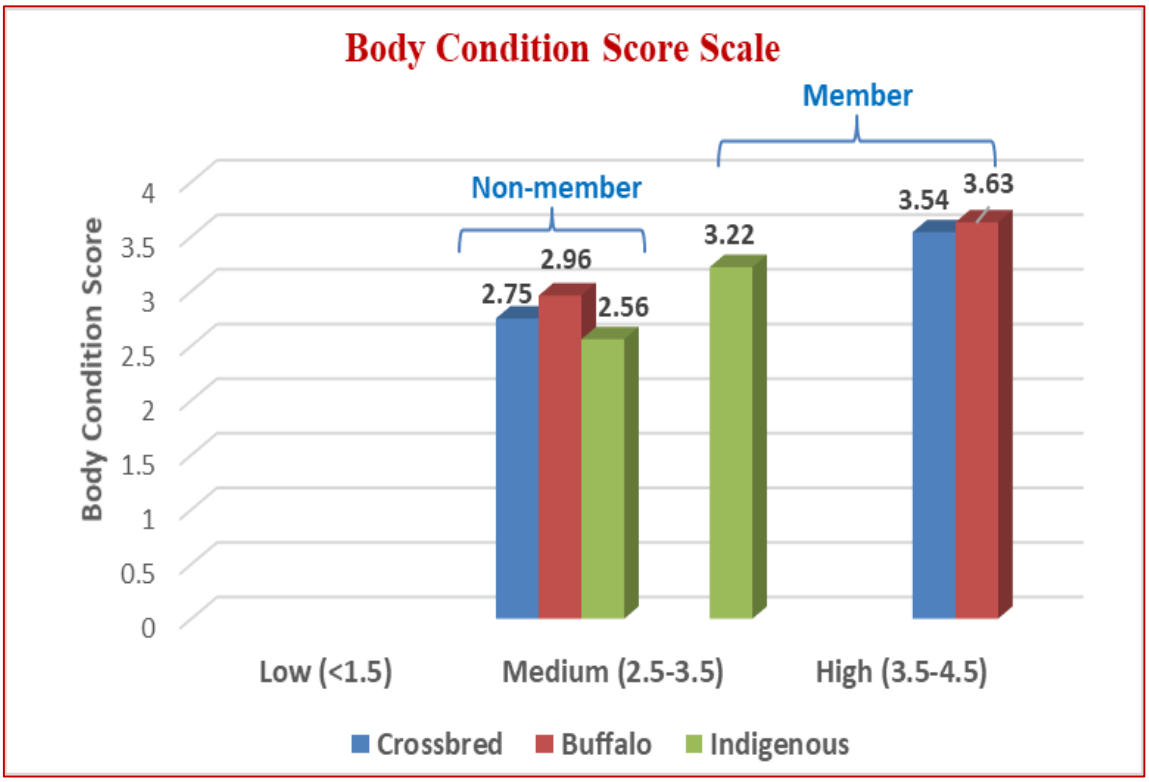


Fig 4.31 Overall distribution of dairy animals based on their BCS

As results indicate, the BCS of crossbred, indigenous cow in case of both members and non-members was more than 2.5 and in case of buffalo the BCS was more than 3.5. The findings were supported by Anitha *et al.* (2011) and Garnsworthy and Jones (1987) who in their findings recommended ideal BCS for cattle and buffalo for better reproductive and productive performance.

4.3.1.3.d Morbidity and Mortality of animals

Morbidity and mortality of animals play important role in determining the overall management and performance of any dairy farm. It can be inferred from Table 4.3.7 that, total number of diseased animals reported in non-members and members were 230 and 140, respectively. Again, total number of deaths reported in non-members and members were 32 and 21, respectively. However, it was noteworthy to mention that the morbidity rate in case of non-members (20.46%) was more than the members (5.8%). Similarly, the mortality rate of animals was found to be more in case of non-members (2.85%) as compared to member (0.87%). On an overall basis, the morbidity rate was 10.53 per cent and mortality rate was 1.5 per cent. Thus, both non-members and members managed their dairy farm very well and maintained mortality rate of less than 5 per cent.

Table 4.3.7 Morbidity and Mortality of animals

Sl. No.	Particulars	Non-Members	Members	Pooled
1	No. of diseased animal (nos.)	230	140	370
2	No. of animals died (nos.)	32	21	53
3	Total herd population (nos.)	1124	2390	3512
4	Morbidity rate (%) (1/3 x 100)	20.46	5.8	10.53
5	Mortality rate (%) (2/3 x 100)	2.85	0.87	1.5

4.3.2 Impact of JMF on socio-economic status of dairy farmers

In this objective we have assessed the impact of dairy cooperatives on some selected farm performance indicators of different dairy production system (members and non-members) in Jharkhand. Due to the non-experimental character of the data, the selection bias was addressed using the propensity score matching technique. The findings show that there is bias in the distribution of variables across treatment and comparison groups, implying that self-selection bias must be taken into account in order to generate unbiased estimates of outcome indicators.

Table 4.3.8 indicates operational definition and the measurement of outcome and explanatory variables. In this paper, we use the following specific outcome variables as indicators of dairy farm performance: (1) milk yield, (2) net dairy income, (3) proportion of dairy income in the total household income, (4) proportion of milk sold as an indicator of intensity of market participation and (5) per capita daily milk consumption. Table 4.3.9 shows the descriptive and inferential statistics. An analysis of t-test indicates that there is statistically significant difference between members and non-members in terms of different socio-economic attributes. Dairy cooperative members differ significantly from non-members in terms of outcome variables. The mean difference value explains that the socio-economic conditions of members is better than non-members. Members and non-members are similar in age, family size, herd size, and dairy farming experience, but not in education, ownership of dairy animals, market distance, access to credit, extension services, veterinary services, or input supply, according to the results corresponding to the observed covariates. Heads of member families, for example, are better educated than their non-member counterparts and are more likely to use advanced breeding, feeding, and healthcare technology. Furthermore, compared to non-member farmers, most farmer-members had better access to credit through formal sources. Members also have better access to extension services, veterinary services, and input supplies than their non-member competitors. This also further indicates that farmers with better access to credit could meet the daily expenses of feed, fodder and mineral mixture for their dairy animal herd. The majority of the members accessed credit facilities through banks and government schemes in the form of

short-term loans. Besides this, extension services like training, demonstration and advisory services are provided through different field level extension functionary regarding improved dairy farming practices. This empowered dairy farmers in better decision making and influenced their participation in dairy cooperatives. Provision of regular veterinary services like vaccination, A.I., treatment of chronic diseases etc. by JMF veterinary staff or government veterinary officers created health awareness among dairy farmers to timely diagnose and treat their animals, thus maintaining proper healthcare of their milch cattle and buffalo. In addition to this, the members are largely benefitted from a wide range of extension and input services offered by JMF. The grassroots extension workers and dedicated staffs employed by JMF offers solutions and caters to various aspects of dairy farming *viz.* breeding, feeding, healthcare, management and extension and advisory needs of the member-producers from time to time. Again, farmers residing farther to market are more inclined to be associated with dairy cooperative (JMF) as most of the member-producers resided near to the vicinity of the milk pooling points (MPPs), wherefrom JMF regularly procured the milk.

4.3.2.1 Determinants of participation

The Probit regression findings are described in Table 4.3.10. The goodness-of-fit tests show that a few observable covariates can be used to estimate the conditional Dairy Cooperative (JMF) membership density. The explanatory variables have a combined statistical significance of 116.42 (LR Chi^2 test statistics) (p-0.000). The pseudo R^2 (0.4368) is relatively high, indicating that the model is a good fit. The education level of the household-head has a significant and positive impact on the likelihood of becoming a member of a dairy cooperative (JMF) ($p<0.01$). Theoretically, knowledge allows a person to better understand the potential benefits of cooperative membership. Other variables that are positively and significantly associated with JMF membership include the number of milch animals, market distance, access to institutional credit, provision of extension services, provision of veterinary services and input supply. Dairy cooperatives are more likely to be joined by farm households that own at least one crossbred cow or buffalo and have access to formal credit.

Table 4.3.8 Definition and measurement of variables

Variable	Unit of measurement	Type of variable	Definition
Outcome variable			
Milk yield	Litre/day	Continuous	Milk production per day
Net Dairy Income	Rs/annum	Continuous	Annual net dairy income of the household
Proportion of dairy income	Ratio	Continuous	Proportion of dairy income in total household income
Milk price	Rs./litre	Continuous	Price of milk per litre
Proportion of milk sold	Ratio	Continuous	Proportion of milk sold out
Per capita milk consumption	Gram	Continuous	Per capita daily consumption of self-produced milk
Explanatory variable			
Age	Years completed	Continuous	Age of dairy farmer
Education	Years completed	Continuous	Years of formal education of dairy farmer
Family size	Numbers	Continuous	Total household members

Herd size	Numbers	Continuous	Total number of bovine animals on the farm
Milch animals	Numbers	Continuous	Total number of milch bovine animals on the farm
Market distance	Kilometer	Continuous	Distance to nearest village market
Access to credit	1 if accessed, 0 otherwise	Dummy	Farmers accessed credit during last one year preceding the survey
Experience in dairy farming	Years completed	Continuous	Number of years of experience in dairy farming
Extension services	1 if accessed, 0 otherwise	Dummy	Farmers accessed extension services during last one year preceding the survey
Provision of veterinary services	1 if accessed, 0 otherwise	Dummy	Farmers accessed veterinary services during last one year preceding the survey
Input supply	1 if accessed, 0 otherwise	Dummy	Farmers accessed input supply during last one year preceding the survey

Table4.3.9 Descriptive statistics for outcome and explanatory variables

Variables	Member		Non-member		Mean difference
	Mean	S.E.	Mean	S.E.	
Milk yield	11.59	0.58	8.81	0.26	2.78**
Net Dairy Income	105614.28	5861.41	90606.66	4087.69	15007.61*
Proportion of dairy income	0.62	0.008	0.52	0.005	0.10**
Milk price	33.26	0.49	37.14	0.18	-3.88**
Proportion of milk sold	1.42	0.03	1.19	0.02	0.23**
Per capita milk consumption	195	0.54	165	0.27	30.0**
Age	46.21	1.08	42.26	1.07	3.95
Education	8.61	0.50	4.64	0.38	3.97**
Family size	7.45	0.27	6.42	0.18	1.03
Herd size	13.27	0.39	6.24	0.20	7.03
Milch animals	5.56	0.20	2.94	0.09	2.61**
Market distance	6.64	0.25	3.62	0.12	3.02**
Access to credit	0.96	0.01	0.86	0.02	0.09**
Experience in dairy farming	10.99	0.23	10.15	0.28	0.84
Extension services	0.85	0.07	0.72	0.21	0.13*
Provision of veterinary services	0.92	0.22	0.68	0.17	0.24*
Input supply	0.82	0.05	0.74	0.02	0.08**

Note: ** and * denote significance at 1 and 5 per cent level, respectively

Table 4.3.10 Probit estimation: Socio-economic variables influencing farmers' decision to join dairy Cooperative (JMF)

Variables	Coefficient	Standard Error	Marginal Effect
Age	0.03	0.03	0.00
Education	0.28*	0.09	0.04
Family size	0.01	0.05	0.00
Herd size	0.10	0.05	0.01
Milch animals	1.78**	0.25	0.57
Market distance	0.23**	0.08	0.08
Access to credit	0.98**	0.33	0.37
Experience in dairy farming	0.32	0.38	0.02
Extension services	0.25*	0.04	0.50
Provision of veterinary services	0.62**	0.02	0.09
Input supply	0.75**	0.29	0.28
Constant	-1.05	0.67	
LR Chi^2 (11)	116.42**		
Prob> Chi^2	0.000		
Pseudo R^2	0.4368		
Number of observation	360		

Note: ** and * denote significance at 1 and 5 per cent level, respectively

Herd size had a positive but non-significant effect (p>0.05) on the likelihood of joining a dairy cooperative, showing that herd size may not be a determinant in membership decisions. Dairy cooperative participation is also unaffected by a farmer's past dairy farming experience. Cooperative membership, on the other hand, shows a positive and significant correlation with access to extension services, veterinary services, and input supply. The decision to join a cooperative is influenced by the distance from the nearest market. This suggests that farm households located farther from market had a higher rate of cooperative participation, confirming the notion that proximity to the market gives farmers additional possibilities for selling their produce through alternate channels.

4.3.2.2 Impact of participation in dairy cooperative

The quality of the matching process is discussed in this section. The propensity score, as noted by Lee (2008), Becerril, and Abdulai (2009), is primarily used to match the distribution of observable covariates between treated and control groups. As a result, the success of the propensity score is dependent on the resultant matching. The quality of the matching between the treatment and comparison groups is shown in Table 4.3.11. The Pseudo R^2 has decreased significantly from 44 per cent before matching to 4-6 per cent after matching, as indicated by the covariate balancing test. The likelihood-ratio of the joint significance of all regressors before matching was high across the matching estimators, showing that the treatment and comparison groups differed in a systematic manner. After matching, the differences between the two groups were eliminated, and the two groups became comparable (insignificant p-values after matching). Furthermore, after matching, there was a significant reduction in bias (66.89-75.45 per cent). Finally, a visual examination of the propensity score distributions for JMF members and non-members after matching reveals that the groups are highly overlapping (Fig. 4.35). Cooperative members and non-members who are a good match are labelled as 'treated on support' and 'untreated,' respectively. JMF members with bad matches from among the non-members are referred on the graph as ‘treated off support’.

Table 4.3.11 Indicators of matching quality before and after matching

Matching algorithm	Pseudo R^2 before matching	Pseudo R^2 after matching	LR χ^2 (p-value) before matching	LR χ^2 (p-value) after matching	Mean standardized bias before matching	Mean standardized bias after matching	Total % bias reduction
NNM[a]	0.44	0.06	116.42 (p=0.000)**	10.36 (p=0.234)	52.9	17.6	66.89
KBM[b]	0.44	0.04	116.42 (p=0.000)**	7.16 (p=0.517)	52.9	15.2	71.34
RM[c]	0.44	0.04	116.42 (p=0.000)**	7.02 (p=0.537)	52.9	12.6	75.45

** indicate significant at 1% level

[a]NNM= five nearest neighbor matching with replacement and common support

[b]KBM= kernel based matching with band width 0.06 and common support

[c]RM= radius matching with caliper 0.1 and common support

Table 4.3.12 Estimation of ATT: Impact of JMF on socio-economic status of the dairy farmers

Outcome variables	NNM(5)[b]	KBM(0.06)[c]	RM(0.1)[d]
		ATT[a]	
Milk yield	1.99 (3.09)**	1.61 (2.05)**	1.80 (2.78)**
Net Dairy Income	70184.69 (2.97)**	67356.44 (2.95)**	68486.11 (2.98)**
Proportion of dairy income	0.09 (1.28)	0.09 (1.73)*	0.09 (1.78)*
Milk price	-4.90 (3.02)**	-4.26 (2.64)**	-4.50 (3.43)**
Proportion of milk sold	0.13 (1.68)*	0.11 (1.62)	0.10 (1.30)
Per capita milk consumption	134.86 (3.10)**	96.39 (1.94)*	110.58 (2.55)**

[a]ATT estimates of all matching algorithms are obtained through implementation of 'psmatch2'command (Leuven & Sianesi, 2003) in STATA 14.

Figures in parentheses are bootstrapped z statistics using 50 replications; * and ** indicate significant at 5% and 1% level, respectively.

[b]NNM (5) = five nearest neighbour matching with replacement and common support.

[c]KBM (0.06) = kernel based mathing with bandwidth 0.06 and common support.

[d]RM (0.1) = radius matching with caliper 0.1 and common support.

Fig 4.32 Distribution of the propensity scores and common support

Table 4.3.12 shows estimates of the influence of dairy cooperatives on selected farm performance indicators as an average treatment effect on the treated (ATT). Although the ATT results for different matching algorithms varied statistically, they are qualitatively identical. The milk yield of cooperative members is shown to be considerably higher than that of non-members. They, on the other hand, receive a lesser price than the open market price. Cooperatives give their members easy access to markets, as well as inputs and services, ensuring a greater yield. As a result, these advantages compensate for the cheaper milk price. Additionally, at the end of the year, cooperative members earn dividends. This is reflected in the higher annual net dairy income, higher consumption and higher milk sales. Furthermore, Kumar *et al.* (2013) discovered that DCS members possessed much more improved cattle breeds than independent farmers, resulting in significantly increased market participation. It is interesting to note that members of dairy cooperative societies have significantly higher per capita household milk consumption compared to that by non-member households. This indicates that the commercialization of milk production has no negative impact on milk consumption. These findings are in line with those of previous investigations (Chagwiza *et al.*, 2016; Kumar *et al.*, 2013; Bardhan and Sharma, 2012). These studies, unlike ours, did not account for confounding factors that could impact farmers' self-selection.

The impact of JMF on smallholder dairy farmers across Jharkhand has been quite significant. It serves as the best alternative source for income generation and employment opportunities among dairy farmers. The data presented in table 5 inferred that member-producers reaped higher milk yield than non-members. This was because members reared large herd sizes of milch animals comprising of high yielding crossbred cattle and buffalo. As a result of this members accrued higher net dairy income, as well as proportions of dairy income since they regularly disposed bulk quality of milk to the dairy cooperative. Besides this, the proportion of milk sold by the member-producer was also higher as compared to the non-members, and a statistically significant difference between them was observed at a 5 per cent level of significance. This also indicated dairy farmers' increased participation in the dairy cooperative. The per capita milk consumption of member-producers was also significantly higher than non-members, indicating that

members had enough market surplus of milk to meet their daily household consumption. However, milk price was the only outcome indicator where non-members outperformed non-members. The non-members reaped better prices for their milk in the market, this was due to a lack of price regulation in the market. Unlike dairy cooperatives, the milk price was fixed based on the Fat and SNF percentage. Even though non-members received higher milk prices but their cost-benefit ratio was less. Unlike JMF members who received all the input, extension and veterinary services at the subsidised price, non-members on other hand had to incur additional transaction costs. Similar findings were revealed by Das *et al.* (2020), Sudhanshu (2019) and Karthikeyan *et al.* (2019). Therefore, the net profit or net dairy income was more in the case of members as compared to the non-members. The ATT estimates of all matching algorithms confirmed that members were socio-economically sound than their non-member counterparts.

4.4 Problems and prospects of Jharkhand State Cooperative Milk Producers' Federation

The current study is aimed to propose a framework for the identification and assessment of the critical SWOT factors in the dairy supply chain of JMF, using the Analytical Hierarchy Process (AHP) approach. Four departments *viz.* Procurement, Processing, Productivity Enhancement and Marketing Unit of JMF were selected for accessing the overall problems and prospects of JMF using SWOT analysis. For this, Focussed Group Discussion (FGD) was employed to accumulate the data from dairy producer members, JMF staffs and executives at BMC and MPP levels, milk booth owners and key informants from different supply chain units to summarize the factors and sub-factors related to strengths, weaknesses opportunities, threats (SWOT) of JMF.

4.4.1 SWOT analysis of procurement unit of JMF

The milk procurement pattern of JMF is a very systematic and dynamic process, where members take milk every day to their nearest Milk Pooling Point (MPP). And then, each member's milk is tested for quality with payments based on the percentage of fat and SNF. The pooled milk from MPPs located at village level is further taken to Bulk Milk Coolers (BMC), where milk is pooled in bulk. And

finally the milk is transported to dairy processing plants using insulated milk tankers through well-defined milk route.

A total of 28 issues, called as SWOT factors here, have been derived on the basis of comprehensive literature assessment, focussed group discussion and a pilot study, conducted in the study area. These 28 factors comprised of eight strength factors, seven weakness factors, four opportunity factors and nine threat factors. Further, these factors were considered for AHP analysis in consultation with the professionals of the dairy industry, JMF staffs, milk booth owners and academicians. The factors are selected based on their applicability and importance to the procurement unit of dairy cooperative (JMF). Following critical factors as shown in the hierarchy model for SWOT factors (Table 4.4.1) have been carried forward for AHP analysis. The model represents various SWOT factors as criteria along with their sub-criteria. During the application of AHP, various pairwise assessment matrix has been finalized in the below Table (4.4.1.a to 4.4.1.d) for SWOT factors (s) analysis. The nine-point scale developed by Saaty (1980) has been adopted for assessing the interaction among the SWOT factors identified for the study. Five experts from procurement unit of JMF during FGD added their understanding to construct the SWOT factors. Then, the pairwise comparisons of SWOT groups using a Saaty's nine-point comparison scale were carried out in consultation with the expert's group. And finally, the SWOT factors were compared in view of every SWOT group.

4.4.1.a Strength Analysis of procurement unit of JMF

The strength factors have been analysed for priority matrix, weight matrix and the calculations of strength as shown in Table 4.4.1.

Among the selected items to diagnose the strengths of the procurement unit of JMF, the analysed data indicated that weekly milk payment system and regular payment of bonus was the major strength which motivated dairy farmers in large scale to join JMF as this assured them of regular income. Ease of access to milk collection centres was also important factor which gave dairy farmers opportunity to timely dispose their surplus milk at MPPs operating at village levels. It was also observed that provision of good supply chain network with good forward and backward linkage facilitated procurement process in JMF.

Based on the outcome of AHP for strength factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.1.a). Also, consistency among the strength factors was confirmed since CR value (0.08) was less than (0.10).

4.4.1.b Weakness Analysis of procurement unit of JMF

The weakness factors have been analysed for priority matrix, weight matrix and the calculations of weaknesses as shown in Table 4.4.1.

Ascertained information in the area of weaknesses of the procurement unit of JMF revealed that there was lack of coordination in the supply chain management due to which there was frequent delay in delivery of services to the members, this was attributed to lack of cohesion among line and staff members which impeded the productivity of JMF. The second major weakness was low productivity of animals and high cost of milk production. In order to deal with this problem, JMF focussed on various productivity enhancement activities for enhancing the productivity of dairy animals and also supplied subsidised dairy inputs to reduce the cost of milk production. Further, it was observed that member-producers fetched low procurement price for milk as compared with their non-member counterparts who sold their milk directly to their customers at comparatively higher prices without any quality testing of their milk, so it stands third as among the weaknesses and it needs to be focused first by the JMF management and make revision in the milk procurement rate.

Based on the outcome of AHP for weakness factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.1.b). Also, consistency among the weakness factors was confirmed since CR value (0.03) was less than (0.10).

4.4.1.c Opportunity Analysis of procurement unit of JMF

The opportunity factors have been analysed for priority matrix, weight matrix and the calculations of opportunities as shown in Table 4.4.1.

Due to JMF's growing popularity in the State, many farmers are interested to become its full time member. This would further enhance the volume of procurement due to increase in the membership. Also, due it's ever growing demand for milk products in both rural and urban areas its market share has significantly escalated. The third priority among the opportunities was provision of modern infrastructural facilities for procurement, processing and chilling of milk.

Thus, it saved lot of time and labour and increased the efficiency of procurement unit of JMF.

Based on the outcome of AHP for opportunity factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.1.c). Also, consistency among the weakness factors was confirmed since CR value (0.09) was less than (0.10).

4.4.1.d Threat Analysis of procurement unit of JMF

The threat factors have been analysed for priority matrix, weight matrix and the calculations of threats as shown in Table 4.4.1.

Amongst the various items listed to study the threats prevalent or expressed in procurement unit of JMF, it was found that due to industrialization many famers were losing interest in dairy farming. Increasing cost of dairy inputs was ranked second for the reason that this increased the cost of production and drastically reduced the profits. Further, fluctuations in milk production due to vagaries of climate change, pandemic etc. was prioritized as third serious threat since farmers incurred huge economic loss due to climate change or pandemic.

Table 4.4.1 AHP Model for SWOT analysis of Procurement Unit of JMF

Criteria		STATEMENTS
STRENGTH	S1	Weekly milk payment system and regular payment of bonus
	S2	Ease of access to milk collection centres
	S3	Good supply chain network
	S4	Automatic milk collection and milk testing equipment
	S5	Good sanitary status
	S6	Proper facilities for quality testing of milk
	S7	Regular and guaranteed supply of raw milk from the milk producers
	S8	Proper maintenance of milk collection records using computers

WEAKNESS	W1	Lack of coordination in the supply chain management
	W2	Low productivity of animals and high cost of milk production
	W3	Low procurement price for milk as compared to other unorganized sectors
	W4	Milk collection centres are not well equipped
	W5	Lack of trained and skilled technical and support staff members
	W6	Inadequate infrastructural facilities for procurement and transportation
	W7	Difficulties in provision of inputs and services
OPPORTUNITY	O1	More milk producers willing to join JMF
	O2	Growing milk demand and expandable market share
	O3	Modern infrastructural facilities for procurement, processing and chilling of milk
	O4	Expansion of milk route
THREAT	T1	Farmers losing interest in dairy farming
	T2	Increasing cost of inputs
	T3	Fluctuations in milk production due to vagaries of climate change, pandemic etc.
	T4	High incidence of bovine diseases
	T5	Distant location of milk collection centres
	T6	Decline of grazing lands due to urbanization
	T7	Adulteration of milk at producer's level
	T8	Transportation problem
	T9	Seasonal variation in procurement of milk

SWOT Analysis of Procurement Unit in JMF

Table 4.4.1.a Priority calculations for Strength factors of Procurement Unit in JMF

	Priority Matrix (a)								Weight Matrix (W)								Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**				
S1	1	3.12	2.13	2.2	3.12	3.18	2.35	4.5	0.30	0.53	0.26	0.22	0.23	0.21	0.13	0.19	0.26	2.37	1	9.02
S2	0.32	1	3.2	3.15	2.3	2.12	4.56	5.1	0.09	0.17	0.40	0.31	0.17	0.14	0.25	0.21	0.22	2.01	2	9.36
S3	0.47	0.31	1	2.3	3.16	2.15	3.16	4.1	0.14	0.05	0.12	0.23	0.23	0.14	0.17	0.17	0.16	1.41	3	9.07
S4	0.45	0.32	0.43	1	3.18	3.21	2.62	2.1	0.13	0.05	0.05	0.10	0.23	0.21	0.14	0.09	0.13	1.11	4	9.44
S5	0.24	0.43	0.32	0.31	1	3.11	2.18	2.16	0.07	0.07	0.04	0.03	0.07	0.20	0.12	0.09	0.09	0.75	5	8.36
S6	0.24	0.32	0.47	0.31	0.31	1	2.4	2.45	0.07	0.05	0.06	0.03	0.02	0.06	0.13	0.10	0.07	0.56	6	8.23
S7	0.43	0.22	0.32	0.38	0.28	0.29	1	2.54	0.13	0.04	0.04	0.04	0.02	0.02	0.05	0.11	0.05	0.46	7	8.19
S8	0.22	0.20	0.18	0.48	0.46	0.41	0.31	1	0.07	0.03	0.02	0.05	0.03	0.03	0.02	0.04	0.04	0.32	8	9.20
∑	**3.38**	**5.92**	**8.04**	**10.13**	**13.81**	**15.47**	**18.58**	**23.95**												
																			λ_{max}	8.85
																			CI	0.15
																			RI	1.41
																			CR= CI/RI	0.08

Table 4.4.1.b Priority calculations for Weakness factors of Procurement Unit in JMF

	Priority Matrix (a)							Weight Matrix (W)							Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**				
1	1	2.56	3.52	2.2	2.12	2.26	2.08	0.30	0.48	0.41	0.25	0.18	0.17	0.15	0.28	2.10	1	7.54
S2	0.28	1	2.26	2.15	2.5	3.14	2.02	0.09	0.19	0.27	0.24	0.21	0.24	0.15	0.20	1.49	2	7.55
S3	0.28	0.23	1	2.05	3.18	2.04	2.4	0.09	0.04	0.12	0.23	0.27	0.15	0.17	0.15	1.15	3	7.45
S4	0.45	0.47	0.49	1	2.16	2.17	2.02	0.14	0.09	0.06	0.11	0.18	0.16	0.15	0.13	0.91	4	7.17
S5	0.47	0.40	0.31	0.46	1	2.21	2.18	0.14	0.08	0.04	0.05	0.09	0.17	0.16	0.10	0.70	5	6.87
S6	0.31	0.20	0.49	0.46	0.33	1	2.14	0.09	0.04	0.06	0.05	0.03	0.08	0.15	0.07	0.49	6	6.88
S7	0.48	0.47	0.42	0.50	0.46	0.42	1	0.15	0.09	0.05	0.06	0.04	0.03	0.07	0.07	0.48	7	7.11
∑	**3.28**	**5.32**	**8.49**	**8.82**	**11.75**	**13.24**	**13.84**											
																	λ_{max}	7.22
																	CI	0.04
																	RI	1.32
																	CR= CI/RI	0.03

Table 4.4.1.c Priority calculations for Opportunity factors of Procurement Unit in JMF

	Priority Matrix (a)				Weight Matrix (W)				Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S1**	**S2**	**S3**	**S4**				
S1	1	2.8	2.12	2.61	0.45	0.64	0.31	0.28	0.42	1.91	1	4.54
S2	0.36	1	3.2	3.5	0.16	0.23	0.47	0.37	0.31	1.35	2	4.38
S3	0.47	0.31	1	2.25	0.21	0.07	0.15	0.24	0.17	0.69	3	4.10
S4	0.38	0.29	0.44	1	0.17	0.06	0.07	0.11	0.10	0.43	4	4.14
∑	**2.21**	**4.40**	**6.76**	**9.36**								
											λ_{max}	4.29
											CI	0.09
											RI	0.98
											CR= CI/RI	0.09

Table 4.4.1.d Priority calculations for Threat factors of Procurement Unit in JMF

	Priority Matrix (a)									Weight Matrix (W)									Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**				
S1	1	2.24	2.13	2.3	3.12	3.08	2.03	4.32	2.4	0.24	0.41	0.26	0.21	0.20	0.18	0.13	0.20	0.10	0.21	2.19	1	10.17
S2	0.45	1	3.2	3.14	3.55	4.1	2.25	2.5	5.06	0.11	0.18	0.38	0.28	0.22	0.24	0.14	0.12	0.21	0.21	2.17	2	10.39
S3	0.47	0.31	1	2.7	3.16	2.25	3.16	4.1	3.15	0.11	0.06	0.12	0.24	0.20	0.13	0.20	0.19	0.13	0.15	1.57	3	10.20
S4	0.43	0.32	0.37	1	3.18	3.21	2.18	2.02	2.31	0.11	0.06	0.04	0.09	0.20	0.19	0.14	0.09	0.10	0.11	1.15	4	10.18
S5	0.32	0.28	0.32	0.31	1	2.21	2.18	2.14	2.45	0.08	0.05	0.04	0.03	0.06	0.13	0.14	0.10	0.10	0.08	0.80	5	9.89
S6	0.32	0.24	0.44	0.31	0.45	1	2.2	2.42	2.1	0.08	0.04	0.05	0.03	0.03	0.06	0.14	0.11	0.09	0.07	0.69	6	9.76
S7	0.49	0.44	0.32	0.46	0.46	0.45	1	2.54	3.01	0.12	0.08	0.04	0.04	0.03	0.03	0.06	0.12	0.13	0.07	0.68	7	9.51
S8	0.23	0.40	0.24	0.50	0.47	0.41	0.39	1	2.22	0.06	0.07	0.03	0.04	0.03	0.02	0.03	0.05	0.09	0.05	0.46	8	9.73
S9	0.42	0.20	0.32	0.43	0.41	0.48	0.33	0.45	1	0.10	0.04	0.04	0.04	0.03	0.03	0.02	0.02	0.04	0.04	0.38	9	9.62
∑	**4.14**	**5.44**	**8.34**	**11.15**	**15.80**	**17.19**	**15.73**	**21.49**	**23.70**													
																					λ_{max}	9.98
																					CI	0.12
																					RI	1.45
																					CR= CI/RI	0.08

Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.1.d). Also, consistency among the threat factors was confirmed since CR value (0.08) was less than (0.10).

The above findings were supported by the findings of Debele and Verschuur (2014), Kumar kk (2017), Makwana and Gurjar (2017), Rathod *et al.* (2011), Subburaj *et al.* (2015), Tefera (2008) ,Vanishree *et al.* (2018) and Wani *et al.* (2014).

4.4.2 SWOT analysis of processing unit of JMF

The processing unit is the heart and soul of JMF where the milk after procurement from BMCs and MPPs are brought to the state of art dairy processing plants located at four places *viz.* Ranchi, Latehar, Koderma and Deoghar by milk tankers where milk after quality testing is further processed into fluid milk and milk products.

A total of 35 issues, called as SWOT factors here, have been derived on the basis of comprehensive literature assessment, focussed group discussion and a pilot study, conducted in the study area. These 35 factors comprised of ten strength factors, eight weakness factors, seven opportunity factors and ten threat factors. Further, these factors were considered for AHP analysis in consultation with the professionals of the dairy industry, JMF staffs, workers and academicians. The factors are selected based on their applicability and importance to the processing unit of dairy cooperative (JMF). Following critical factors as shown in the hierarchy model for SWOT factors (Table 4.4.2) have been carried forward for AHP analysis. The model represents various SWOT factors as criteria along with their sub-criteria. During the application of AHP, various pairwise assessment matrix has been finalized in the below Table (4.4.2.a to 4.4.2.d) for SWOT factors (s) analysis. The nine-point scale developed by Saaty (1980) has been adopted for assessing the interaction among the SWOT factors identified for the study. Five experts from processing unit of JMF during FGD added their understanding to construct the SWOT factors. Then, the pairwise comparisons of SWOT groups using a Saaty's nine-point comparison scale were carried out in consultation with the expert's group. And finally, the SWOT factors were compared in view of every SWOT group.

4.4.2.a Strength Analysis of processing unit of JMF

The strength factors have been analysed for priority matrix, weight matrix and the calculations of strength as shown in Table 4.4.2.

As JMF processing unit is fully computerised with self-automated infrastructure facilities; thus enabling JMF to monitor and process bulk quantity of milk without much involvement of manpower. Also, due provision of adequate milk handling capacity; JMF was able to process large quantity of milk on a daily basis. The presence of large silos and tanks with large storage capacity handled surplus milk available during flush season, besides this JMF also had highest milk powder production capacity which was major strength factor as it converted excess fluid milk into milk powder during the flush season.

Based on the outcome of AHP for strength factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.2.a). Also, consistency among the strength factors was confirmed since CR value (0.08) was less than (0.10).

4.4.2.b Weakness Analysis of processing unit of JMF

The weakness factors have been analysed for priority matrix, weight matrix and the calculations of weaknesses as shown in Table 4.4.2.

The major weakness factor was ‘high cost of operation’. It was observed that cost incurred for processing liquid milk was more in comparison to milk based product. Another important weakness was ‘more energy consumption’. Therefore, JMF should efficiently utilize and resort to renewable source of energy for reducing the operational cost. It was opined by majority that storage capacity for butter & cream products was not sufficient and therefore JMF should focus on increasing the storage capacity for sufficient production.

Based on the outcome of AHP for weakness factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.2.b). Also, consistency among the weakness factors was confirmed since CR value (0.08) was less than (0.10).

4.4.2.c Opportunity Analysis of processing unit of JMF

The opportunity factors have been analysed for priority matrix, weight matrix and the calculations of opportunities as shown in Table 4.4.2.

The processing unit of JMF had many opportunities, the most important ones prioritized by majority was value-addition of milk products. The JMF has better scope of developing wide range of new products apart from packaged milk like flavoured lassi, chesse, butter, kalakand etc. which would enhance the cooperative business. Besides this, JMF has planned for installation of processing units in other parts of the State in future, which would further enhance production and give employment opportunities to the local people. The in-plant training often conducted by JMF gave better exposure to interns, budding entrepreneurs and new employees regarding dairy processing and value addition of milk products.

Based on the outcome of AHP for opportunity factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.2.c). Also, consistency among the weakness factors was confirmed since CR value (0.08) was less than (0.10).

4.4.2.d Threat Analysis of processing unit of JMF

The threat factors have been analysed for priority matrix, weight matrix and the calculations of threats as shown in Table 4.4.2.

The major threat expressed was high cost of labour. In JMF, there was acute shortage of labour due to which they had to hire labour at high cost which in turn increased the operational cost. Another important threat ranked in order of priority was ‘challenge to waste disposal and cleanliness’. Therefore, JMF should adopt proper waste management practices and keep the environment clean and hygienic. Further, it was noticed that frequent interruption in the production process due to technical or mechanical problems incurred huge losses in the processing unit.

Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.2.d). Also, consistency among the threat factors was confirmed since CR value (0.09) was less than (0.10).

Table 4.4.2 AHP Model for SWOT in Processing Unit of JMF

Criteria		STATEMENTS
STRENGTH	S1	Fully computerised system with self-automation facilities
	S2	Surplus milk handling capacity
	S3	Adequate milk powder production capacity
	S4	Modern equipment and machinery for processing different milk products
	S5	Well-equipped quality control laboratory
	S6	Space and plant hygiene are quite good due to proper design
	S7	Maintaining quality and purity of the products
	S8	Good supply of steam and refrigeration
	S9	Attractive and quality packaging
	S10	ISO:9000 and HACCP certification
WEAKNESS	W1	High operational cost for processing liquid milk
	W2	More energy consumption
	W3	Insufficient storage capacity for butter & cream products
	W4	Low processing capacity for other milk based products
	W5	Underutilized equipment
	W6	Less product range
	W7	Lack of technically experienced workers
	W8	Overstaffing

OPPORTUNITY	O1	Development of new product and value addition
	O2	In-plant training for the interns, dairy entrepreneurs etc.
	O3	Installation of processing units in other parts of the State
	O4	Installation of energy efficient equipment
	O5	Expansion of milk processing capacity
	O6	Collaboration for R&D with other institutes, dairy firms etc.
	O7	Upgradation of plant and products
THREAT	T1	High labour cost or shortage of labour
	T2	Challenge to waste disposal and cleanness
	T3	Frequent interruption due to technical or management problems
	T4	Milk adulteration
	T5	Mishandling or careless operation leading to accidents or hazards
	T6	Problem of contamination
	T7	Unhygienic practices during handling raw milk
	T8	No food safety control measures
	T9	Poor microbiological quality of milk
	T10	Careless monitoring and supervision

SWOT Analysis of Processing Unit of JMF

Table 4.4.2.a Priority calculations for Strength factors of Processing Unit of JMF

	Priority Matrix (a)										Weight Matrix (W)										Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**				
S1	1	2.42	2.15	2.4	2.25	3.08	2.01	3.2	2.14	2.5	0.22	0.40	0.24	0.21	0.17	0.18	0.13	0.15	0.10	0.10	0.19	2.33	1	11.49
S2	0.41	1	3.3	3.04	3.42	4.3	2.24	2.41	5.12	2.1	0.09	0.17	0.37	0.27	0.26	0.25	0.14	0.11	0.24	0.09	0.20	2.19	2	11.75
S3	0.47	0.30	1	2.6	2.12	2.21	3.12	4.05	2.03	2.05	0.10	0.05	0.11	0.23	0.16	0.13	0.20	0.19	0.09	0.09	0.14	1.56	3	11.50
S4	0.42	0.33	0.38	1	2.15	3.11	2.18	2.05	2.31	2.14	0.09	0.06	0.04	0.09	0.16	0.18	0.14	0.10	0.11	0.09	0.11	1.21	4	11.48
S5	0.31	0.29	0.32	0.32	1	2.2	2.08	2.24	2.12	2.44	0.07	0.05	0.04	0.03	0.08	0.13	0.13	0.11	0.10	0.10	0.08	0.93	5	11.39
S6	0.32	0.23	0.45	0.32	0.45	1	2.22	2.7	2.15	3.02	0.07	0.04	0.05	0.03	0.03	0.06	0.14	0.13	0.10	0.13	0.08	0.86	6	11.14
S7	0.50	0.45	0.32	0.46	0.48	0.45	1	2.54	2.08	4.04	0.11	0.07	0.04	0.04	0.04	0.03	0.06	0.12	0.10	0.17	0.08	0.83	7	10.70
S8	0.24	0.28	0.25	0.33	0.45	0.37	0.28	1	2.04	2.16	0.05	0.05	0.03	0.03	0.03	0.02	0.02	0.05	0.10	0.09	0.05	0.50	9	10.79
S9	0.47	0.20	0.32	0.43	0.47	0.47	0.48	0.49	1	2.66	0.10	0.03	0.04	0.04	0.04	0.03	0.03	0.02	0.05	0.11	0.05	0.51	8	10.65
S10	0.40	0.48	0.49	0.32	0.41	0.33	0.20	0.32	0.38	1	0.09	0.08	0.05	0.03	0.03	0.02	0.01	0.02	0.02	0.04	0.04	0.42	10	10.96
∑	**4.53**	**5.98**	**8.98**	**11.22**	**13.20**	**17.52**	**15.81**	**21.00**	**21.37**	**24.11**														
																							λ_{max}	11.19
																							CI	0.13
																							RI	1.49
																							CR= CI/RI	0.08

Table 4.4.2.b Priority calculations for Weakness factors of Processing Unit of JMF

	Priority Matrix (a)								Weight Matrix (W)								Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**				
S1	1	2.33	2.09	2.04	2.05	3.5	2.04	3.12	0.25	0.43	0.24	0.20	0.18	0.20	0.14	0.17	0.18	1.65	1	9.07
S2	0.43	1	3.51	3.02	3.24	4.2	2.31	2.04	0.11	0.18	0.40	0.30	0.28	0.24	0.16	0.11	0.18	1.63	2	9.30
S3	0.48	0.28	1	2.3	2.12	2.12	2.51	2.05	0.12	0.05	0.11	0.23	0.18	0.12	0.17	0.11	0.11	0.98	3	8.96
S4	0.49	0.33	0.43	1	2.06	3.05	2.08	2.16	0.12	0.06	0.05	0.10	0.18	0.17	0.14	0.12	0.09	0.84	4	8.98
S5	0.49	0.31	0.47	0.49	1	3.14	2.14	2.24	0.12	0.06	0.05	0.05	0.09	0.18	0.15	0.12	0.08	0.73	5	8.93
S6	0.29	0.24	0.47	0.33	0.32	1	2.01	3.2	0.07	0.04	0.05	0.03	0.03	0.06	0.14	0.18	0.06	0.51	6	8.52
S7	0.49	0.43	0.40	0.48	0.47	0.50	1	2.45	0.12	0.08	0.04	0.05	0.04	0.03	0.07	0.13	0.06	0.48	7	8.45
S8	0.32	0.49	0.49	0.46	0.45	0.31	0.41	1	0.08	0.09	0.06	0.05	0.04	0.02	0.03	0.05	0.04	0.36	8	8.78
∑	**3.98**	**5.42**	**8.86**	**10.12**	**11.70**	**17.82**	**14.50**	**18.26**												
																			λ_{max}	8.87
																			CI	0.12
																			RI	1.41
																			CR= CI/RI	0.08

Table 4.4.2.c Priority calculations for Opportunity factors of Processing Unit of JMF

	Priority Matrix (a)							Weight Matrix (W)							Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**				
S1	1	2.5	2.08	3.1	2.55	3.1	2.6	0.30	0.48	0.25	0.33	0.21	0.19	0.17	0.21	1.68	1	7.87
S2	0.40	1	3.5	2.04	3.21	4.3	2.3	0.12	0.19	0.42	0.22	0.26	0.27	0.15	0.18	1.44	2	8.00
S3	0.48	0.29	1	2.11	2.12	2.18	3.2	0.15	0.05	0.12	0.22	0.17	0.13	0.21	0.12	0.90	3	7.67
S4	0.32	0.49	0.47	1	2.51	3.03	2.13	0.10	0.09	0.06	0.11	0.20	0.19	0.14	0.10	0.75	4	7.61
S5	0.39	0.31	0.47	0.40	1	2.11	2.04	0.12	0.06	0.06	0.04	0.08	0.13	0.13	0.07	0.51	5	7.43
S6	0.32	0.23	0.46	0.33	0.47	1	2.2	0.10	0.04	0.06	0.03	0.04	0.06	0.14	0.05	0.39	6	7.41
S7	0.38	0.43	0.31	0.47	0.49	0.45	1	0.12	0.08	0.04	0.05	0.04	0.03	0.06	0.05	0.35	7	7.53
∑	**3.30**	**5.25**	**8.30**	**9.45**	**12.35**	**16.17**	**15.47**											
																	λ_{max}	7.64
																	CI	0.12
																	RI	1.32
																	CR= CI/RI	0.08

Table 4.4.2.d Priority calculations for Threat factors of Processing Unit of JMF

	Priority Matrix (a)										Weight Matrix (W)										Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**				
S1	1	3.12	2.07	2.04	2.06	3.56	2.3	3.12	2.41	2.31	0.21	0.44	0.23	0.18	0.16	0.20	0.14	0.15	0.11	0.10	0.19	2.24	1	11.65
S2	0.32	1	3.16	3.08	3.24	4.32	2.24	2.51	2.14	2.11	0.07	0.14	0.35	0.27	0.25	0.24	0.14	0.12	0.10	0.09	0.18	2.08	2	11.76
S3	0.48	0.32	1	2.54	2.31	2.24	3.21	4.1	2.16	2.45	0.10	0.04	0.11	0.22	0.18	0.13	0.20	0.20	0.10	0.10	0.14	1.58	3	11.44
S4	0.49	0.32	0.39	1	2.16	3.11	2.16	2.03	2.33	2.05	0.11	0.05	0.04	0.09	0.17	0.17	0.13	0.10	0.10	0.09	0.10	1.19	4	11.38
S5	0.49	0.31	0.43	0.46	1	2.03	2.04	2.42	2.21	4.21	0.10	0.04	0.05	0.04	0.08	0.11	0.12	0.12	0.10	0.18	0.09	1.05	5	11.13
S6	0.28	0.23	0.45	0.32	0.49	1	2.11	2.15	2.51	3.2	0.06	0.03	0.05	0.03	0.04	0.06	0.13	0.11	0.11	0.13	0.07	0.83	6	11.18
S7	0.43	0.45	0.31	0.46	0.49	0.47	1	2.45	2.06	2.1	0.09	0.06	0.03	0.04	0.04	0.03	0.06	0.12	0.09	0.09	0.07	0.73	7	11.16
S8	0.32	0.40	0.24	0.49	0.41	0.47	0.41	1	5.06	2.25	0.07	0.06	0.03	0.04	0.03	0.03	0.02	0.05	0.23	0.09	0.06	0.72	8	11.06
S9	0.41	0.47	0.46	0.43	0.45	0.40	0.49	0.20	1	2.08	0.09	0.07	0.05	0.04	0.04	0.02	0.03	0.01	0.04	0.09	0.05	0.52	9	10.94
S10	0.43	0.47	0.41	0.49	0.24	0.31	0.48	0.44	0.48	1	0.09	0.07	0.05	0.04	0.02	0.02	0.03	0.02	0.02	0.04	0.04	0.44	10	11.05
∑	**4.66**	**7.09**	**8.93**	**11.32**	**12.86**	**17.91**	**16.43**	**20.42**	**22.36**	**23.76**														
																							λ_{max}	11.27
																							CI	0.14
																							RI	1.49
																							CR= CI/RI	0.09

4.4.3 SWOT analysis of productivity enhancement unit of JMF

JMF provides a range of inputs and services to their members like feed, veterinary care, artificial insemination etc. to sustain the growth of milk production and the cooperatives' business. Besides providing training and advisory services; JMF staff train and provide consulting services to support members through various productivity enhancement activities.

A total of 25 issues, called as SWOT factors here, have been derived on the basis of comprehensive literature assessment, focussed group discussion and a pilot study, conducted in the study area. These 25 factors comprised of seven strength factors, eight weakness factors, five opportunity factors and five threat factors. Further, these factors were considered for AHP analysis in consultation with the professionals of the dairy industry, JMF staffs, workers and academicians. The factors are selected based on their applicability and importance to the productivity enhancement unit of dairy cooperative (JMF). Following critical factors as shown in the hierarchy model for SWOT factors (Table 4.4.3) have been carried forward for AHP analysis. The model represents various SWOT factors as criteria along with their sub-criteria. During the application of AHP, various pairwise assessment matrix has been finalized in the below Table (4.4.3.a to 4.4.3.d) for SWOT factors (s) analysis. The nine-point scale developed by Saaty (1980) has been adopted for assessing the interaction among the SWOT factors identified for the study. Five experts from processing unit of JMF during FGD added their understanding to construct the SWOT factors. Then, the pairwise comparisons of SWOT groups using a Saaty's nine-point comparison scale were carried out in consultation with the expert's group. And finally, the SWOT factors were compared in view of every SWOT group.

4.4.3.a Strength Analysis of productivity enhancement unit of JMF

The strength factors have been analysed for priority matrix, weight matrix and the calculations of strength as shown in Table 4.4.3.

The major strength of productivity enhancement unit of JMF is that it regularly supplied dairy inputs like chelated mineral mixture, bypass protein supplement and compound cattle feed at subsidised price to their member-producers' which they could individually neither afford nor manage. In addition to

this, veterinary services like artificial insemination, vaccination etc. was provided by JMF veterinary doctors on call basis. Further, animal health camps were conducted occasionally by JMF to create awareness and distribute free medicines and drugs for dairy animals. Other productivity enhancement activities include conducting ration balancing programme, provision of workshop, training and advisory services, fodder development activities and distribution of fodder seeds.

Based on the outcome of AHP for strength factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.3.a). Also, consistency among the strength factors was confirmed since CR value (0.07) was less than (0.10).

4.4.3.b Weakness Analysis of productivity enhancement unit of JMF

The weakness factors have been analysed for priority matrix, weight matrix and the calculations of weaknesses as shown in Table 4.4.3.

Among weakness, lack of funding from government sources was perceived as the major weakness since JMF had to depend on government funds for regular and mass production of dairy inputs to meet the requirement of large number of member producers. Also, it was opined by majority that due to under-capacity of the feed processing unit; JMF was unable to supply sufficient quantity of cattle feed to their members regularly. Besides this, lack of trained and skilled technical and support staff members was also the major weakness expressed by many farmers. Due to this poor extension practices; many farmers failed to adopt or discontinue new technology.

Based on the outcome of AHP for weakness factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.3.b). Also, consistency among the weakness factors was confirmed since CR value (0.09) was less than (0.10).

4.4.3.c Opportunity Analysis of productivity enhancement unit of JMF

The opportunity factors have been analysed for priority matrix, weight matrix and the calculations of opportunities as shown in Table 4.4.3.

The major opportunity ranked by majority was provision of research and development facilities for developing new products with better quality. Further, establishment of large feed processing plant with large scale production capacity can meet the future demand of cattle feed during the lean season. Also,

collaboration with other firms like NGOs and private companies will give opportunity to improve quality of inputs.

Based on the outcome of AHP for opportunity factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.3.c). Also, consistency among the weakness factors was confirmed since CR value (0.09) was less than (0.10).

4.4.3.d Threat Analysis of productivity enhancement unit of JMF

The threat factors have been analysed for priority matrix, weight matrix and the calculations of threats as shown in Table 4.4.3.

It was observed that many times farmers were supplied with expired inputs especially medicines and drugs which caused serious threat to dairy animals. Another major threat seen in productivity enhancement unit was shortage of labour. Due to shortage of manpower and high labour cost there was increase in the cost of production with reduced volume of output. Another major threat highlighted was bacterial or fungal infestation due to improper storage facilities thus, leading to huge spoilage of dairy inputs.

Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.3.d). Also, consistency among the threat factors was confirmed since CR value (0.06) was less than (0.10).

The above findings were supported by the findings of Debele and Verschuur (2014), Kumar kk (2017), Makwana and Gurjar (2017), Rathod *et al.* (2011), Subburaj *et al.* (2015), Tefera (2008) ,Vanishree *et al.* (2018) and Wani *et al.* (2014).

Table 4.4.3 AHP Model for SWOT in Productivity Enhancement Unit of JMF

Criteria		STATEMENTS
STRENGTH	S1	Provision of chelated mineral mixture, bypass protein supplement and compound cattle feed at subsidised price
	S2	On call veterinary health care services
	S3	Regular Animal health camps
	S4	Ration balancing programme
	S5	Provision of workshop, training, field visits and advisory services
	S6	Fodder development activities
	S7	Distribution of quality fodder seeds
WEAKNESS	W1	Lack of funding from govt. sources
	W2	Under-capacity of the feed processing unit to meet the demand of members
	W3	Lack of trained and skilled technical and support staff members
	W4	Poor quality of inputs
	W5	Difficulty in access to inputs due to lack of awareness and contact with JMF service providers
	W6	High transportation and high input production costs
	W7	Inadequate and irregular supply of dairy inputs
	W8	Inadequacy in providing drugs and medicines during animal health services

OPPORTUNITY	O1	Research and Development facilities
	O2	Development of feed processing plant with large scale production capacity
	O3	Collaboration with other firms to improve quality of inputs
	O4	Enhancing the quality and quantity of inputs
	O5	Improved field level technical support services
THREAT	T1	Supply of expired inputs like medicines and drugs
	T2	Shortage of labour
	T3	Bacterial or fungal infestation due to improper storage facilities
	T4	Shortage of water for fodder cultivation
	T5	Climate change, natural disaster, pandemic etc.

SWOT Analysis of Productivity Enhancement Unit of JMF

Table 4.4.3.a Priority calculations for Strength factors of Productivity Enhancement Unit of JMF

	Priority Matrix (a)							Weight Matrix (W)							Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**				
S1	1	2.19	2.05	2.40	2.52	3.02	3.20	0.29	0.45	0.26	0.24	0.21	0.21	0.20	0.23	1.79	1	7.74
S2	0.46	1	3.11	3.05	3.24	2.15	3.40	0.13	0.20	0.39	0.30	0.27	0.15	0.21	0.21	1.63	2	7.88
S3	0.49	0.32	1	2.50	2.12	2.20	2.01	0.14	0.07	0.13	0.25	0.18	0.15	0.13	0.13	1.01	3	7.79
S4	0.42	0.33	0.40	1	2.15	3.40	2.08	0.12	0.07	0.05	0.10	0.18	0.24	0.13	0.11	0.84	4	7.60
S5	0.40	0.31	0.47	0.47	1	2.07	2.22	0.12	0.06	0.06	0.05	0.08	0.14	0.14	0.08	0.60	5	7.43
S6	0.33	0.47	0.45	0.29	0.48	1	2.13	0.10	0.09	0.06	0.03	0.04	0.07	0.13	0.07	0.48	6	7.38
S7	0.31	0.29	0.50	0.48	0.45	0.47	1	0.09	0.06	0.06	0.05	0.04	0.03	0.06	0.05	0.37	7	7.51
∑	3.40	4.91	7.98	10.19	11.96	14.31	16.04											
																	λ_{max}	7.61
																	CI	0.10
																	RI	1.32
																	CR= CI/RI	0.07

Table 4.4.3.b Priority calculations for Weakness factors of Productivity Enhancement Unit of JMF

	Priority Matrix (a)								Weight Matrix (W)								Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**				
S1	1	2.08	2.6	2.1	2.25	3.12	2.01	2.1	0.25	0.39	0.29	0.21	0.18	0.18	0.13	0.11	0.22	2.00	1	9.16
S2	0.48	1	3.16	3.2	2.43	4.12	2.4	2.05	0.12	0.19	0.35	0.32	0.20	0.24	0.16	0.11	0.21	2.00	2	9.51
S3	0.38	0.32	1	2.2	2.21	2.23	2.6	2.11	0.09	0.06	0.11	0.22	0.18	0.13	0.17	0.11	0.13	1.28	3	9.47
S4	0.48	0.31	0.45	1	3.25	3.45	2.7	2.32	0.12	0.06	0.05	0.10	0.27	0.20	0.18	0.12	0.14	1.27	4	9.35
S5	0.44	0.41	0.45	0.31	1	2.56	2.15	5.2	0.11	0.08	0.05	0.03	0.08	0.15	0.14	0.27	0.11	0.99	5	8.66
S6	0.32	0.24	0.45	0.29	0.39	1	2.03	2.04	0.08	0.05	0.05	0.03	0.03	0.06	0.13	0.11	0.07	0.58	6	8.67
S7	0.50	0.42	0.38	0.37	0.47	0.49	1	2.22	0.12	0.08	0.04	0.04	0.04	0.03	0.07	0.12	0.07	0.57	7	8.54
S8	0.48	0.49	0.47	0.43	0.19	0.49	0.45	1	0.12	0.09	0.05	0.04	0.02	0.03	0.03	0.05	0.05	0.47	8	8.64
∑	**4.08**	**5.27**	**8.97**	**9.90**	**12.19**	**17.46**	**15.34**	**19.04**												
																			λ_{max}	9.00
																			CI	0.14
																			RI	1.41
																			CR= CI/RI	0.09

Table 4.4.3.c Priority calculations for Opportunity factors of Productivity Enhancement Unit of JMF

	Priority Matrix (a)					Weight Matrix (W)					Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S1**	**S2**	**S3**	**S4**	**S5**				
S1	1	2.5	2.2	2.4	2.05	0.36	0.57	0.31	0.25	0.18	0.34	1.91	1	5.71
S2	0.40	1	3.01	3.05	4.2	0.14	0.23	0.43	0.32	0.37	0.30	1.66	2	5.58
S3	0.45	0.33	1	2.5	2.12	0.16	0.08	0.14	0.26	0.19	0.17	0.89	3	5.35
S4	0.42	0.33	0.40	1	2.02	0.15	0.07	0.06	0.11	0.18	0.11	0.60	4	5.31
S5	0.49	0.24	0.47	0.50	1	0.18	0.05	0.07	0.05	0.09	0.09	0.46	5	5.28
∑	**2.76**	**4.40**	**7.08**	**9.45**	**11.39**									
													λ_{max}	5.44
													CI	0.11
													RI	1.12
													CR= CI/RI	0.09

Table 4.4.3.d Priority calculations for Threat factors of Productivity Enhancement Unit of JMF

	Priority Matrix (a)					Weight Matrix (W)					Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S1**	**S2**	**S3**	**S4**	**S5**				
S1	1	2.05	2.16	2.2	2.04	0.34	0.49	0.30	0.24	0.22	0.32	1.73	1	5.43
S2	0.49	1	3.21	3.12	2.12	0.17	0.24	0.44	0.34	0.23	0.28	1.57	2	5.53
S3	0.46	0.31	1	2.4	2.19	0.16	0.08	0.14	0.26	0.23	0.17	0.91	3	5.26
S4	0.45	0.32	0.42	1	2.02	0.16	0.08	0.06	0.11	0.22	0.12	0.63	4	5.10
S5	0.49	0.47	0.46	0.50	1	0.17	0.11	0.06	0.05	0.11	0.10	0.53	5	5.20
∑	**2.90**	**4.15**	**7.24**	**9.22**	**9.37**									
													λ_{max}	5.30
													CI	0.07
													RI	1.12
													CR= CI/RI	0.06

4.4.4 SWOT analysis of marketing unit of JMF

Marketing is the most important parts of any business activity. It is what creates customers and generates income, guides the future course of a business and defines whether it will be a success or a failure. Without marketing, a business is like sitting in the dark and expecting people to find you without a light.

A total of 26 issues, called as SWOT factors here, have been derived on the basis of comprehensive literature assessment, focussed group discussion and a pilot study, conducted in the study area. These 26 factors comprised of seven strength factors, six weakness factors, seven opportunity factors and six threat factors. Further, these factors were considered for AHP analysis in consultation with the professionals of the dairy industry, JMF staffs, workers and academicians. The factors are selected based on their applicability and importance to the marketing unit of dairy cooperative (JMF). Following critical factors as shown in the hierarchy model for SWOT factors (Table 4.4.4) have been carried forward for AHP analysis. The model represents various SWOT factors as criteria along with their sub-criteria. During the application of AHP, various pairwise assessment matrix has been finalized in the below Table (4.4.4.a to 4.4.4.b) for SWOT factors (s) analysis. The nine-point scale developed by Saaty (1980) has been adopted for assessing the interaction among the SWOT factors identified for the study. Five experts from processing unit of JMF during FGD added their understanding to construct the SWOT factors. Then, the pairwise comparisons of SWOT groups using a Saaty's nine-point comparison scale were carried out in consultation with the expert's group. And finally, the SWOT factors were compared in view of every SWOT group.

4.4.4.a Strength Analysis for Marketing Unit of JMF

The strength factors have been analysed for priority matrix, weight matrix and the calculations of strength as shown in Table 4.4.4.

An analysis of strengths revealed that JMF products largely dominated in the markets due to wide array of quality products available for the customers. Also, due to presence of strong and intelligent marketing team with vast experience in marketing, JMF was able to execute strategic marketing plan with long term growth. Another, major strength of marketing unit was it strong distribution

channels; this was attributed to the fact that JMF was having sufficient number of milk booths with franchise shops spread across the state.

Based on the outcome of AHP for strength factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.4.a). Also, consistency among the strength factors was confirmed since CR value (0.06) was less than (0.10).

4.4.4.b Weakness Analysis for Marketing Unit of JMF

The weakness factors have been analysed for priority matrix, weight matrix and the calculations of weaknesses as shown in Table 4.4.4.

Even though JMF had strong marketing team but they lacked experience in the domain of marketing and sales which was the major weakness of marketing unit. Also, it was observed that many prospective customers were unaware about Medha dairy products in the markets especially in rural pockets of the state. Therefore, JMF should focus on brand promotion and advertisement for attracting more number of customers. Another, major weakness expressed by majority was that due to low export potential, JMF remained only as a domestic player unlike other national brands like Amul, Mother Dairy etc.

Based on the outcome of AHP for weakness factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.4.b). Also, consistency among the weakness factors was confirmed since CR value (0.07) was less than (0.10).

4.4.4.c Opportunity Analysis for Marketing Unit of JMF

The opportunity factors have been analysed for priority matrix, weight matrix and the calculations of opportunities as shown in Table 4.4.4.

Among opportunities it was observed that due to wide market penetration, JMF had potential to capture new markets in both rural and urban areas and expand its market presence throughout the state. Further, it was perceived that more investment from external sources apart from government sources should be encouraged for better brand positioning in the market. Besides this, JMF should also focus more on advertisement and promotional activities in order to appeal large customers.

Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.4.c). Also, consistency among the threat factors was confirmed since CR value (0.06) was less than (0.10).

4.4.4.d Threat Analysis for Marketing Unit of JMF

The threat factors have been analysed for priority matrix, weight matrix and the calculations of threats as shown in Table 4.4.4.

It was observed that during lean season or during the time of festival there was shortage in the supply of fluid milk in the markets which was perceived as major threat to the marketing department. The second threat was heavy competition from national and local players. JMF faced stiff market competition from other reputed milk brands like Amul, Mother Dairy, Ossam dairy etc. apart from unorganized milk vendors. Further, due to this reason there was frequent fluctuations in the price of the milk and milk products, thus severely affecting the cooperative business.

Based on the outcome of AHP for threat factors, all the CI, RI and CR scores are valid for AHP criteria (Table 4.4.4.d). Also, consistency among the threat factors was confirmed since CR value (0.05) was less than (0.10).

Table 4.4.4 AHP Model for SWOT in Marketing Unit of JMF

Criteria		STATEMENTS
STRENGTH	S1	Wide range of quality product
	S2	Intelligent marketing team executing strategic marketing plan
	S3	Sufficient number of Milk Booths and Franchise shops
	S4	Attractive and quality packaging
	S5	Strong supply chain and distribution network
	S6	Large customer base
	S7	Strong brand image/ Brand equity
WEAKNESS	W1	Absence of strong sales/marketing experience
	W2	Lack of awareness among prospective customers
	W3	Low exports in comparison to production
	W4	Focus may be too narrow
	W5	High selling price
	W6	Declining profit margin
OPPORTUNITY	O1	New markets offer greater potential
	O2	Investment from external sources
	O3	Wise advertisement and promotion for better brand image
	O4	Partnership
	O5	Online marketing
	O6	Product diversification/ Value Addition of products
	O7	Increasing demand for healthy drinks
THREAT	T1	Seasonal sales slump
	T2	Heavy competition from national and local players
	T3	Price fluctuation due to existing competitors
	T4	Legal and regulatory restrictions
	T5	Problem of Taxation
	T6	Economic slowdown

SWOT Analysis of Marketing Unit of JMF

Table 4.4.4.a Priority calculations for Strength factors of Marketing Unit of JMF

	Priority Matrix (a)							Weight Matrix (W)							Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**				
S1	1	2.09	2.02	2.2	2.25	3.2	2.1	0.28	0.44	0.26	0.22	0.19	0.19	0.15	0.25	1.97	1	7.69
S2	0.46	1	3.08	3.2	3.42	4.05	2.42	0.13	0.21	0.39	0.33	0.29	0.25	0.17	0.25	1.91	2	7.82
S3	0.49	0.32	1	2.14	2.21	2.25	2.04	0.14	0.07	0.13	0.22	0.19	0.14	0.15	0.15	1.11	3	7.61
S4	0.42	0.33	0.40	1	2.03	3.24	2.05	0.12	0.07	0.05	0.10	0.17	0.20	0.15	0.12	0.92	4	7.53
S5	0.40	0.31	0.47	0.47	1	2.26	2.11	0.11	0.07	0.06	0.05	0.08	0.14	0.15	0.09	0.70	5	7.45
S6	0.33	0.24	0.45	0.29	0.48	1	2.31	0.09	0.05	0.06	0.03	0.04	0.06	0.16	0.07	0.52	6	7.33
S7	0.45	0.42	0.50	0.48	0.45	0.47	1	0.13	0.09	0.06	0.05	0.04	0.03	0.07	0.07	0.49	7	7.40
∑	**3.54**	**4.70**	**7.92**	**9.78**	**11.84**	**16.47**	**14.03**											
																	λ_{max}	7.54
																	CI	0.09
																	RI	1.32
																	CR= CI/RI	0.06

Table 4.4.4.b Priority calculations for Weakness factors of Marketing Unit of JMF

	Priority Matrix (a)						Weight Matrix (W)						Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**				
S1	1	2.14	2.05	2.02	2.01	3.25	0.31	0.47	0.28	0.22	0.17	0.21	0.28	1.84	1	6.66
S2	0.47	1	3.05	3.12	4.02	2.05	0.14	0.22	0.42	0.34	0.34	0.13	0.27	1.81	2	6.79
S3	0.49	0.33	1	2.14	2.22	4.12	0.15	0.07	0.14	0.24	0.19	0.26	0.17	1.12	3	6.42
S4	0.50	0.32	0.47	1	2.15	3.14	0.15	0.07	0.06	0.11	0.18	0.20	0.13	0.82	4	6.29
S5	0.50	0.25	0.45	0.47	1	2.06	0.15	0.06	0.06	0.05	0.08	0.13	0.09	0.56	5	6.22
S6	0.31	0.49	0.24	0.32	0.49	1	0.09	0.11	0.03	0.04	0.04	0.06	0.06	0.40	6	6.45
∑	**3.26**	**4.52**	**7.26**	**9.06**	**11.89**	**15.62**										
															λ_{max}	6.47
															CI	0.09
															RI	1.24
															CR= CI/RI	0.07

Table 4.4.4.c Priority calculations for Opportunity factors of Marketing Unit of JMF

	Priority Matrix (a)							Weight Matrix (W)							Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**				
S1	1	2.15	2.31	2.01	2.05	3.02	2.2	0.27	0.44	0.29	0.21	0.18	0.19	0.14	0.25	1.93	1	7.78
S2	0.47	1	3.04	3.02	3.24	4.04	2.04	0.13	0.21	0.38	0.32	0.28	0.25	0.13	0.24	1.92	2	8.00
S3	0.43	0.33	1	2.08	2.12	2.15	4.12	0.12	0.07	0.12	0.22	0.18	0.14	0.26	0.17	1.21	3	7.21
S4	0.50	0.33	0.48	1	2.22	3.04	2.11	0.14	0.07	0.06	0.11	0.19	0.19	0.13	0.12	0.95	4	7.80
S5	0.49	0.31	0.47	0.45	1	2.16	2.08	0.13	0.06	0.06	0.05	0.09	0.14	0.13	0.09	0.70	5	7.71
S6	0.33	0.25	0.47	0.33	0.46	1	2.21	0.09	0.05	0.06	0.04	0.04	0.06	0.14	0.07	0.50	6	7.53
S7	0.45	0.49	0.24	0.47	0.48	0.45	1	0.12	0.10	0.03	0.05	0.04	0.03	0.06	0.07	0.47	7	7.15
∑	**3.67**	**4.86**	**8.01**	**9.36**	**11.57**	**15.86**	**15.76**											
																	λ_{max}	7.60
																	CI	0.09
																	RI	1.32
																	CR= CI/RI	0.06

Table 4.4.4.d Priority calculations for Threat factors of Marketing Unit of JMF

	Priority Matrix (a)						Weight Matrix (W)						Criteria Wt. (CW)	Wt. Sum (WS) a*W	Rank	C= WS/ CW
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**				
S1	1	2.15	2.3	2.12	2.02	2.3	0.31	0.48	0.29	0.24	0.18	0.17	0.28	1.85	1	6.60
S2	0.47	1	3.4	3.02	3.2	2.5	0.15	0.22	0.44	0.34	0.29	0.18	0.27	1.80	2	6.66
S3	0.43	0.29	1	2.04	2.22	2.16	0.14	0.07	0.13	0.23	0.20	0.16	0.15	0.99	3	6.44
S4	0.47	0.33	0.42	1	2.04	3.4	0.15	0.07	0.05	0.11	0.19	0.25	0.14	0.84	4	6.16
S5	0.40	0.31	0.45	0.49	1	2.2	0.12	0.07	0.06	0.05	0.09	0.16	0.09	0.58	5	6.17
S6	0.43	0.40	0.24	0.29	0.45	1	0.14	0.09	0.03	0.03	0.04	0.07	0.07	0.42	6	6.21
∑	**3.20**	**4.48**	**7.81**	**8.96**	**10.93**	**13.56**										
															λ_{max}	6.37
															CI	0.07
															RI	1.24
															CR= CI/RI	0.05

4.4.5 Member- producers' perception of SWOT on JMF

The perceptions of member dairy farmers were recorded to know about the various aspects of dairy cooperatives and the results are presented in Table (4.4.5 to 4.4.8). The perceptions of members were collected on different aspects of cooperatives functioning namely, membership, management, decision making, transparency in procedures, distance between farm and milk collection centers, provision of inputs, sanitation and hygiene, timely payments, payment of bonus and price comparison etc. and accordingly their perceived strength, weakness, opportunity and threats were chalked out with the help structured interview schedule. The response of the farmers were measured on five point continuum scale as "strongly agree", "agree", "undecided", "disagree" and "strongly disagree". Overall, the rank was assigned to each statement based on their weighted mean scores to summarize the results of dairy farmers' perception of SWOT on JMF.

4.4.5.a Member- producers' perception of Strengths on JMF

The survey from JMF indicated that, more than half (54.40%) of the members agreed that weekly milk payment system and regular payment of bonus provided by the JMF was the foremost strength perceived by the farmers. Exactly fifty per cent of the respondents perceived ease of accessibility to milk collection centres to be the second major strength. A considerable 49.40 per cent appraised that JMF has good supply chain network. Similarly, around 47.20 per cent of the members acknowledged and agreed that there was regular provision of mobile A.I., concentrate, feed, health services etc. under JMF. Further, 45.00 per cent also agreed that there was ample provision of training and advisory services under JMF. Moreover, as dairy farming is a major and primary livelihood occupation to the majority of member-producers, a notable 42.20 per cent agreed and perceived this to be the major strength of JMF. An appreciable percentage (40.00%) of farmers agreed and encouraged women's participation in dairy cooperative while a noteworthy 37.80 per cent agreed with this notion that, State government's full stake and commitment would ensure long term growth in JMF. A sizeable few (36.10%) also agreed upon this fact that JMF maintained strict sanitary and hygiene practices during collection & transportation of milk. Similar pattern of findings were highlighted by Kumar (2010), Birthal *et al.* (2009), Rathod *et al.* (2011).

Table 4.4.5 Member- producers' perception of Strengths on JMF **(N=180)**

Sl. No.	STRENGTHS	Strongly Agree F (%)	Agree F (%)	Undecided F (%)	Disagree F (%)	Strongly Disagree F (%)	Total F (%)	Weighted Mean Score	S.D.	Rho (ρ)	Rank (Overall Perception)
1	Weekly milk payment system and regular payment of bonus provided by the co-operatives	48 (26.7)	98 (54.4)	18 (10.0)	10 (5.6)	6 (3.3)	180 (100)	3.95	0.94	0.906**	**I (S)**
2	Dairy farming is a livelihood occupation of the majority of member-producers	22 (12.2)	76 (42.2)	43 (23.9)	25 (13.9)	14 (7.8)	180 (100)	3.37	1.11	0.954**	**VI (M)**
3	Ease of accessibility to milk collection centres	39 (21.7)	90 (50.0)	25 (13.9)	15 (8.3)	11 (6.1)	180 (100)	3.73	1.08	0.930**	**II (S)**
4	Good supply chain network	39 (21.7)	89 (49.4)	25 (13.9)	17 (9.4)	10 (5.6)	180 (100)	3.72	1.07	0.932**	**III (S)**
5	Provision of mobile A.I., concentrate, feed, health services etc.	33 (18.3)	85 (47.2)	32 (17.8)	19 (10.6)	11 (6.1)	180 (100)	3.61	1.09	0.941**	**IV (M)**
6	Provision of training and advisory services	28 (15.6)	81 (45.0)	37 (20.6)	22 (12.2)	12 (6.7)	180 (100)	3.50	1.10	0.947**	**V (M)**
7	Encouraging women participation in dairy cooperative	18 (10.0)	72 (40.0)	45 (25.0)	29 (16.1)	16 (8.9)	180 (100)	3.26	1.12	0.958**	**VII (M)**
8	Full stake and commitment from the state govt. to ensure long term growth of JMF	12 (6.7)	68 (37.8)	51 (28.3)	32 (17.8)	17 (9.4)	180 (100)	3.14	1.09	0.959**	**VIII (M)**
9	Strict sanitary and hygiene practices followed during collection & transportation of milk	7 (3.9)	65 (36.1)	54 (30.0)	36 (20.0)	18 (10.0)	180 (100)	3.04	1.06	0.959**	**IX (M)**

*Note: ** Spearman Correlation is significant at the 0.01 level (2-tailed) Overall level of perception characterized as S: Strong ((≥3.66); M: Medium (*2.33-3.66*); W: Weak (≤*2.33*).*

4.4.5.b Member- producers' perception of Weaknesses on JMF

An analysis of member- producers' perception of weaknesses on JMF is represented in Table 4.4.6. A significant majority (47.20%) of farmers agreed that due to low productivity of animals and high cost of milk production farmers were not able to realise optimum profit. A considerable majority (45.00%) apprehended and agreed that member-producers were fetching low price for their milk as compared with other unorganized competitors like milk vendors, non-member dairy farmers, private dairy firms etc. A reasonable 41.10 per cent agreed and expressed that there was untimely and inadequate provision of support services like A.I., animal health services and farm inputs. This was due to inadequate production and shortage of supply of the inputs which caused irregularity in supply of inputs. Around 38.30 per cent agreed that milk collection centre were not well equipped as, it was commonly observed that most of the MPPs were operating with defunct equipment and machinery which caused problem while recording data during milk collection. A sizeable percentage (32.80%) of members agreed and 30.60 per cent remained neutral on this fact that there was lack of structured and clear benefit packages available to keep up the motivation of member farmers. Though farmers received regular income from JMF, but distribution of bonus, incentives and other packages were not clearly defined, as it was contingent on the business profits and growth rate of JMF. Further, it was reported and agreed upon by few members (27.20%) that the employment opportunities provided by JMF was very low as against its available capacity. The spearman correlation coefficient (ρ) indicated that there was high correlation among the Weakness factors; also overall perception of member-producers indicated that there was medium to strong level of perception of Weaknesses on JMF. The findings were in corroboration with the findings of Kumar *et al.* (2012) and Meganathan *et al.* (2010) who pointed out major weaknesses and problems perceived by dairy cooperative members.

Table 4.4.6 Member- producers' perception of Weaknesses on JMF **(N=180)**

Sl. No.	WEAKNESSES	Strongly Agree F (%)	Agree F (%)	Undecided F (%)	Disagree F (%)	Strongly Disagree F (%)	Total F (%)	Weighted Mean Score	S.D.	Rho (ρ)	Rank (Overall Perception)
1	Low productivity of animals and high cost of milk production	45 (25.0)	85 (47.2)	29 (16.1)	16 (8.9)	5 (2.8)	180 (100)	3.83	0.99	0.937**	**I (S)**
2	Lack of structured and clear benefit packages available to keep up the motivation of member farmers	22 (12.2)	59 (32.8)	55 (30.6)	29 (16.1)	15 (8.3)	180 (100)	3.24	1.12	0.966**	**V (M)**
3	Low price for milk as compared to other unorganized competitors	38 (21.1)	81 (45.0)	35 (19.4)	18 (10.0)	8 (4.4)	180 (100)	3.68	1.05	0.946**	**II (S)**
4	Inadequate and untimely provision of support services *viz.*, A.I. service and animal health services and farm inputs like cattle feed or veterinary medicine.	31 (17.2)	74 (41.1)	45 (25.0)	20 (11.1)	10 (5.6)	180 (100)	3.53	1.07	0.955**	**III (M)**
5	Lack of employment opportunities	16 (8.9)	49 (27.2)	63 (35.0)	35 (19.4)	17 (9.4)	180 (100)	3.07	1.09	0.966**	**VI (M)**
6	Milk collection centres are not well equipped	26 (14.4)	69 (38.3)	50 (27.8)	22 (12.2)	13 (7.2)	180 (100)	3.40	1.10	0.960**	**IV (M)**

*** Spearman Correlation is significant at the 0.01 level (2-tailed); Overall level of perception characterized as S: Strong ((≥3.66); M: Medium (2.33-3.66); W: Weak (≤2.33).*

4.4.5.c Member- producers' perception of Opportunities on JMF

A perusal of Table 4.4.7 revealed the member-producers' perception of opportunities on JMF. A significant majority (63.90%) of members agreed that development of infrastructure like processing equipment, bulk milk coolers, chilling centres and feed manufacturing units will provide better opportunity to strengthen procurement, processing and productivity enhancement based activities in JMF. A considerable 56.70 per cent agreed that provision of well-equipped quality control laboratory would further enhance food safety and quality control standards in milk. A slightly more than half of the members (51.10%) agreed and expressed that due to rise in the membership among their peers and neighbours, many farmers were enthusiastically willing to join dairy cooperative. Around 46.10 per cent firmly agreed that there was substantial scope for modernization of the unit and new product development which would further help in leveraging the production capacity. Similarly, a notable 43.90 per cent agreed that a growing demand for Medha dairy products had expanded market share. A considerable 41.70 per cent of members believed and agreed that JMF should work holistically in convergence with allied departments like State Animal Husbandry and Dairying Department, State Agricultural Department etc. along with other NGOs like BAIF, BASIX, NABARD, Nationalised Banks etc. for both financial and developmental forms of investment. The spearman correlation coefficient (ρ) indicated that there was high correlation among the Opportunity factors; also overall perception of member-producers indicated that there was medium to strong level of perception of Opportunities on JMF. The finding had similarity with the SWOT analysis of Wani *et al.* (2014) and Vanishree *et al.* (2018).

Table 4.4.7 Member- producers' perception of Opportunities on JMF **(N=180)**

Sl. No.	OPPORTUNITIES	Strongly Agree F (%)	Agree F (%)	Undecided F (%)	Disagree F (%)	Strongly Disagree F (%)	Total F (%)	Weighted Mean Score	S.D.	Rho (ρ)	Rank (Overall Perception)
1	More producers willing to join JMF	34 (18.9)	92 (51.1)	38 (21.1)	14 (7.8)	2 (1.1)	180 (100)	3.78	0.87	0.934**	**III (S)**
2	Scope for convergence with allied departments and other agencies for funds	18 (10.0)	75 (41.7)	47 (26.1)	32 (17.8)	8 (4.4)	180 (100)	3.35	1.02	0.963**	**VI (M)**
3	Substantial scope for modernization of the unit and new product development	28 (15.6)	83 (46.1)	46 (25.6)	18 (10.0)	5 (2.8)	180 (100)	3.61	0.95	0.951**	**IV (M)**
4	Growing milk demand and expandable market share	22 (12.2)	79 (43.9)	46 (25.6)	26 (14.4)	7 (3.9)	180 (100)	3.46	1.01	0.958**	**V (M)**
5	Developing infrastructure like processing equipment, bulk milk coolers, chilling centres and feed manufacturing units	42 (23.3)	115 (63.9)	18 (10.0)	5 (2.8)	0 (0)	180 (100)	4.07	0.66	0.863**	**I (S)**
6	Well-equipped quality control laboratory	38 (21.1)	102 (56.7)	28 (15.6)	12 (6.7)	0 (0)	180 (100)	3.92	0.79	0.909**	**II (S)**

*Note: ** Spearman Correlation is significant at the 0.01 level (2-tailed); Overall level of perception characterized as S: Strong ((≥3.66); M: Medium (*2.33-3.66*); W: Weak (*≤2.33*).*

4.4.5.d Member- producers' perception of Threats on JMF

Table 4.4.8 depicted some of the major threats perceived by member-producers with respect to JMF. A substantial majority (62.20%) of members affirmed that there were unprecedented fluctuations in milk production due to climate change (cyclonic rain, drought etc.) and pandemic situation like COVID-19. A significant majority (58.90%) supported and agreed to this fact that increasing cost of inputs was the major threat particularly for small and marginal farmers. A considerable majority strongly stressed (23.30%) and agreed (52.20%) that there was drastic decline of grazing lands due to urbanization, thus leading to shortage of supply of green fodder during lean season. Many also agreed (48.3%) and expressed that there was high incidence of bovine diseases like H.S., F.M.D. and Mastitis especially during summer and rainy season which drastically reduced the productivity of milch animals. Further, 43.30 per cent agreed that there was lack of implementation of appropriate government policy, which impeded the overall growth of dairy sector in the State. Another, important threat was 'distant location of milk collection centres', due to this reason many times dairy farmers failed to reach on scheduled time for procurement at MPPs thus leading to heavy wastage of their milk lot. However, a notable few (36.10%) agreed and revealed that due to more labour and less income involved in dairy farming many farmers were losing interest in dairy farming and were resorting to other non-agricultural activities. The spearman correlation coefficient (ρ) indicated that there was high correlation among the Threat factors; also overall perception of member-producers indicated that there was medium to strong level of perception of Threats on JMF. The findings were in alignment with the findings of Vanishree *et al.* (2018) and Subburaj *et al.* (2015) who listed out similar threats in their studies.

Table 4.4.8 Member- producers' perception of Threats on JMF **(N=180)**

Sl. No.	THREATS	Strongly Agree F (%)	Agree F (%)	Unsure F (%)	Disagree F (%)	Strongly Disagree F (%)	Total F (%)	Weighted Mean Score	S.D.	Rho (ρ)	Rank (Overall Perception)
1	Farmers losing interest in dairy farming	18 (10.0)	65 (36.1)	51 (28.3)	32 (17.8)	14 (7.8)	180 (100)	3.22	1.09	0.965**	**VII (M)**
2	Increasing cost of inputs	48 (26.7)	106 (58.9)	18 (10.0)	8 (4.4)	0 (0)	180 (100)	4.07	0.73	0.884**	**II (S)**
3	Fluctuations in milk production due to vagaries of climate change, pandemic etc.	52 (28.9)	112 (62.2)	12 (6.7)	4 (2.2)	0 (0)	180 (100)	4.17	0.64	0.861**	**I (S)**
4	High incidence of bovine diseases	37 (20.6)	87 (48.3)	30 (16.7)	18 (10.0)	8 (4.4)	180 (100)	3.70	1.04	0.938**	**IV (S)**
5	Distant location of milk collection centres	26 (14.4)	72 (40.0)	40 (22.2)	30 (16.7)	12 (6.7)	180 (100)	3.38	1.12	0.962**	**VI (M)**
6	Lack of appropriate government policy favouring the dairy sector	32 (17.8)	78 (43.3)	35 (19.4)	25 (13.9)	10 (5.6)	180 (100)	3.53	1.10	0.954**	**V (M)**
7	Decline of grazing lands due to urbanization	42 (23.3)	94 (52.2)	28 (15.6)	14 (7.8)	2 (1.1)	180 (100)	3.88	0.88	0.921**	**III (S)**

*Note: ** Spearman Correlation is significant at the 0.01 level (2-tailed); Overall level of perception characterized as S: Strong ((≥3.66); M: Medium (*2.33-3.66*); W: Weak (≤*2.33*).*

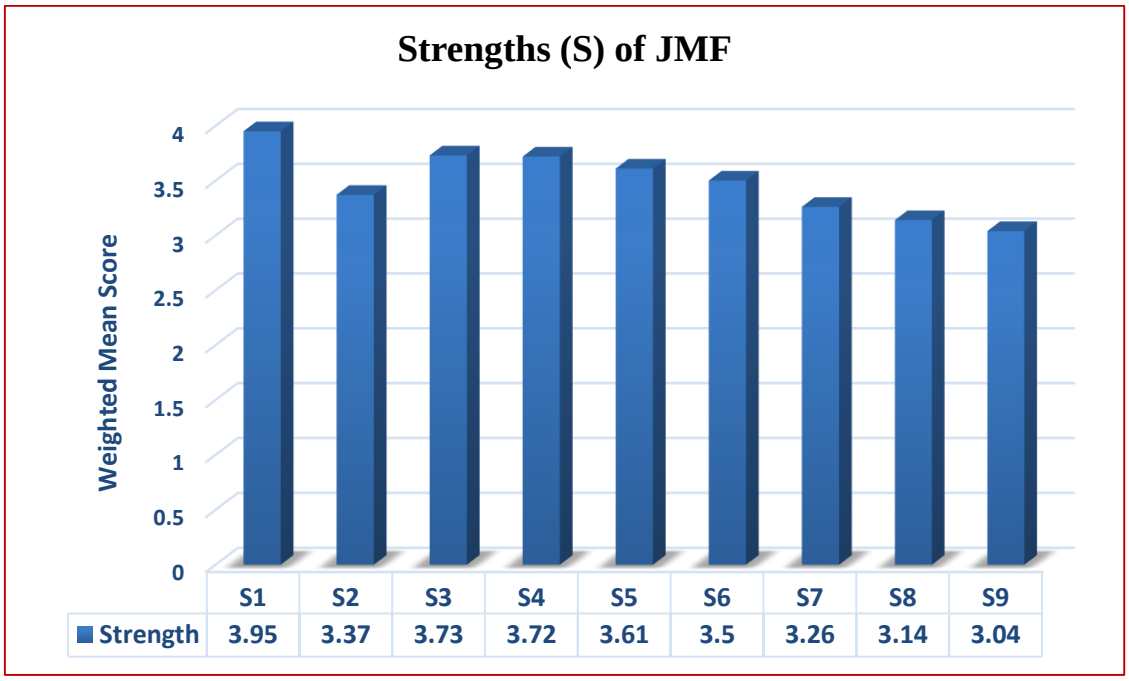


Fig 4.33 Member- producers' perception of Strengths on JMF

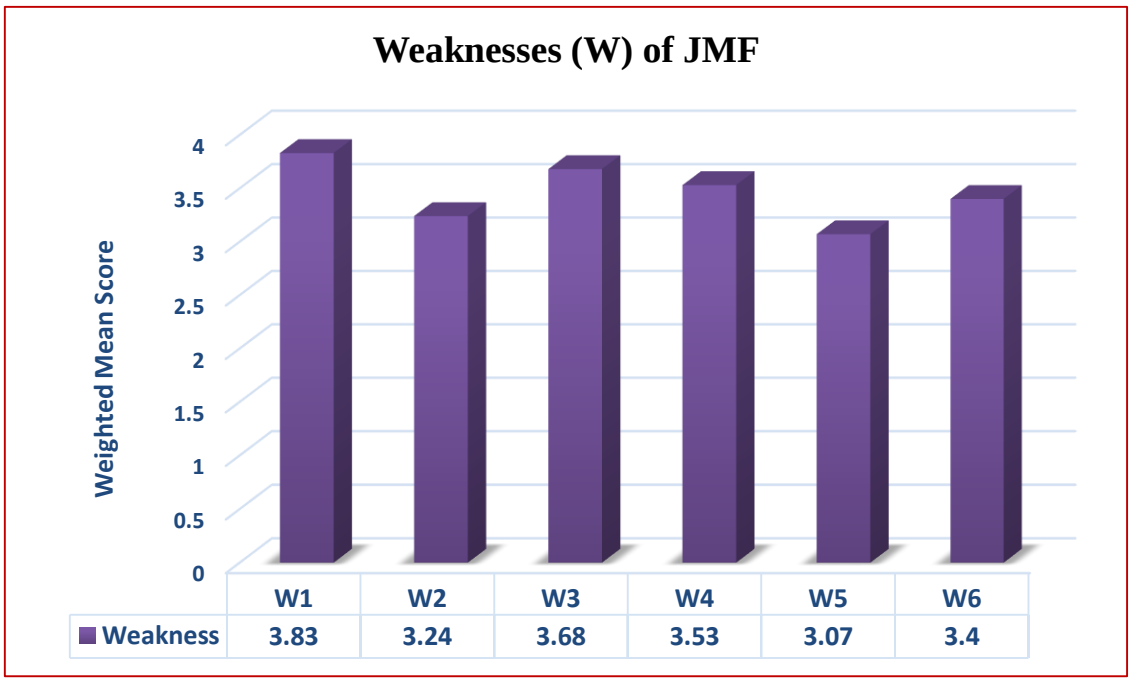


Fig 4.35 Member- producers' perception of Weaknesses on JMF

Fig 4.34 Member- producers' perception of Opportunities on JMF

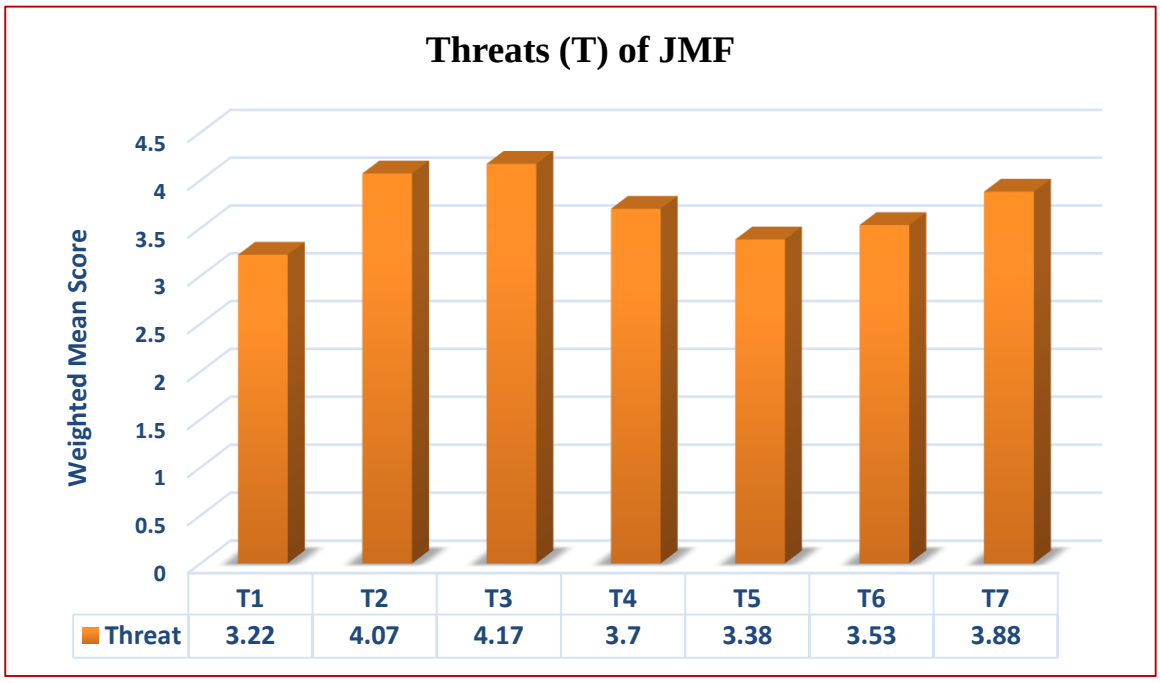


Fig 4.36 Member- producers' perception of Threats on JMF

4.4.6 Suggestions as perceived by member-producers for improving the overall performance of the JMF

Some important suggestions pertaining to overall improvement of JMF were documented in Table 4.4.10 through personal interaction and focused group discussions with member-producers during the survey. After that, the respondents were asked to rank each statements based on their order of preference or priority to summarize the suggestions on an overall basis.

Table 4.4.9 Major Suggestions as perceived by member-producers for improving the overall performance of the JMF (n=180)

Sl. No.	Major Suggestions	f	%	Rank
1	Provision of short term and long term financial support at subsidized interest rate	136	75.55	**III**
2	Timely provision of extension, veterinary and input services	148	82.22	**I**
3	Upgradation of infrastructural facilities	109	60.55	**VII**
4	Dynamic milk procurement price policy	141	78.33	**II**
5	Generate more employment	116	64.44	**VI**
6	Creation of feed bank and increasing fodder productivity	130	72.22	**IV**
7	Integrated animal health plan and information system	123	68.33	**V**

**Multiple responses*

Major suggestions depicted in Table 4.4.10 revealed that, a significant majority (82.22%) of members suggested that there should be timely provision of extension, veterinary and input services so that farmers develop favourable attitude and motivated to adopt improved dairy farming. A substantial majority

(78.33%) opined that there should be ‘dynamic milk procurement price policy’ in JMF as many members demanded for revision in the milk price. A slightly more than three-fourth (75.55%) of the respondents mentioned that there should be provision of short term and long term financial support at subsidized interest rate. Keeping in view the urgent monetary needs among dairy farmers to meet the expenses, JMF should lend short or long term loans to the farmers at less interest rate. A considerable majority (72.22%) recommended that JMF should focus towards creation of feed bank and increasing fodder productivity in order to help farmers meet their fodder requirements during the off season. A notable percentages (68.33%) of respondents suggested that JMF should develop ‘integrated animal health plan and information system’ to keep track of the health status of their dairy animals and perform timely diagnosis. An appreciable majority (64.44%) demanded that JMF should generate more employment especially among member-producers as per their eligibility and skills. However, sizeable percentages of members also suggested that there should be constant upgradation of infrastructural facilities with time and space which would further enhance the overall productivity and performance of JMF in long run.

4.37 Glimpses of Data Collection

JMF Member-Producers

JMF Member-Producers

Non-member dairy farmers

Non-member dairy farmers

CHAPTER –5

Summary and Conclusions

SUMMARY AND CONCLUSION

India is the world's largest milk producer, accounting for 22% of worldwide production. India produced 187.9 MT of milk, with a per capita availability of 394 g/day, according to the NDDB Report, 2019-20. The dairy sector accounts for 27% of agriculture GDP and 67% of the entire production of the livestock sector, offering employment opportunities for approximately 70 million rural households. The co-operative framework of dairy development initiatives is credited with much of the success of India's "White Revolution." India currently has 172 lakh Dairy farmer members, 1.94 lakh Village Dairy Cooperative Societies, 218 District Milk Cooperative Unions, and 27 State Milk Federations, making it the world's largest dairy cooperative structure. Farmers' membership in dairy cooperatives appears to have resulted in a large rise in milk production and productivity, as well as a reduction in per-unit milk production costs, allowing them to attain higher output prices, lower transaction costs, and better profits, according to previous studies. Even though India is self-sufficient in milk production following Operation Flood Programme; milk production across the country is not fairly distributed, resulting in a large demand and supply gap for milk and milk products in a few states, such as Jharkhand. In terms of both milk output and milk productivity, the state currently ranks 17th among Indian states (GoI, 2019). With a view to give impetus to dairy development in Jharkhand, the State Government formed the Jharkhand State Cooperative Milk Producers' Federation (JMF) in Aug, 2014. JMF at present covers 14 districts out of total 24 districts present throughout the State. Under JMF, the member-producers pour milk directly to the Milk Pooling Point (MPPs) installed at the village level. The milk, after its quality testing, is sent to the Bulk Milk Coolers (BMCs) spread across the district level. Thereafter, the milk is brought to the dairy processing plants of JMF for processing and pasteurization of milk. And then finally, the manufactured milk and milk product is sold to the consumers through the milk booths and retail shops. So far, under JMF 19,910 member-producers have been registered, with 566 MPPs and 90 BMCs functioning within the State. The average milk procured and marketed per day by JMF was 1.14 and 1.09 LLPD, respectively during 2019-20.

Therefore, keeping in view the future prospects of JMF in Jharkhand state, the study was conducted to assess the overall impact of JMF on member-producers and identify various motivational factors influencing cooperative membership, followed by a critical SWOT analysis of JMF at different supply chain levels.

With this backdrop, the present study entitled "Impact Assessment of Jharkhand State Cooperative Milk Producers' Federation on Socio-economic Status of Dairy Farmers" was undertaken with the specific objectives given below:

1. To study the factors that influence farmers' decisions to join Jharkhand State Cooperative Milk Producers' Federation.
2. To assess the impact of Jharkhand State Cooperative Milk Producers' Federation on reproductive, productive and health performance of dairy animals and socio-economic status of dairy farmers.
3. To analyze the problems and prospects of Jharkhand State Cooperative Milk Producers' Federation and their members' perception.

5.1 Research Methodology

The study was conducted in Jharkhand State. Out of, the total 14 districts, covered by JMF, the districts had been first classified into High (More than 1000), Medium (between 500-999) and Low (1-499) categories based on the size of member-producers available in the districts. From each category, one district was purposively selected based on the highest no. of member-producers, BMCs and MPPs available. Therefore, 3 districts *viz.* Ranchi, Latehar and Ramgarh were purposively selected from High, Medium and Low category, respectively. After selecting the districts, one BMC from each district was randomly selected. Thus, a total of three BMCs *viz.* Poriya, Banhardi and Barkakana were selected from Ranchi, Latehar and Ramgarh districts, respectively. From each BMCs randomly selected, 3 MPPs were randomly selected, where from 20 members and 20 non-members were randomly selected from each operational area of respective MPPs. Thus, from Puriyo BMC, three MPPs (Bedo, Kesa Tikratoli, Bharno) were randomly selected, similarly from Banhardi BMC, three MPPs (Rajwar, Tenki, Aragundi) were randomly selected and finally from Barkakana BMC, three MPPs (Barkakana, Manjhla Chumba, Aragadda) were selected randomly. Therefore, a

total of 360 respondents (*i.e.* 180=members and 180=non-members) were finally selected from the study area. The research design espoused for the study was Ex- post facto. For analysis of the Impact Assessment of JMF, Propensity Score Matching was used, whereas for SWOT analysis of JMF, Analytical Hierarchy Process (Saaty, 2008) was used. Further, for Focused Group Discussion (FGD), a total of 20 experts from *viz.* Procurement (5), Processing (5), Marketing (5) and Productivity Enhancement Department (5) were selected for SWOT analysis on JMF. Data collection tools such as Interview schedule, FGDs, Document Analysis and Field observations were used for the study.

5.2 Salient findings of the research

- Majority of the member dairy farmers belonged to young (25.00%) to middle (45.00%) age group categories, whereas most of the non-members belonged to middle (35.00%) to old age (47.22%) group categories.
- Majority of the respondents in both the members (70.00%) and non-members (77.78%) were dominated by male, however, female representation was slightly more in case of members (30.00%) than non-members (22.22%).
- Majority of the members (38.89%) and non-members (28.89%) were found to be educated up to middle school level. However, there were few illiterates (4.44%) among non-members, while there were none in case of members. Further, 8.89 per cent of members and 4.44 per cent of non-members had educational qualification up to graduation and above.
- Exactly, cent per cent of the members were engaged in dairy and animal husbandry as their main or primary occupation followed by agriculture (60.00%), business (13.33%), service (7.78%), labour (10.00%) and others (8.89%) as a subsidiary or secondary occupation. However, majority of the non-members (72.22%) had dairy and animal husbandry as their main or primary occupation, followed by agriculture, business, service, labour and others as both primary as well as secondary occupation.
- Majority of non-members belonged to the category of small (39.44%) to medium (49.44%) family size, whereas majority of members comprised of medium (33.89%) to large (27.22%) family size.

- More than half (56.67%) of members and exactly half (50.00%) of the non-members had medium level of experience (between 8-11 years) in dairy farming. The overall data indicated that members had better experience in dairy farming than the non-members.
- A significant 36.11 per cent of the members were rearing small herd size (*i.e.* <8 nos.), followed by medium (33.33%) and large (30.56%) herd size. Whereas, in case of non-member producers, more than half (55.56%) of the respondents were rearing small herd size followed by medium (25.56%) and large (18.89%) herd size category.
- More than half (54.44%) of the member dairy farmers belonged to medium category (8-15 litres/day) of milk production, followed by low (30.56%) and high (15.00 %) categories. Similarly, in case of non-members, it was observed that majority (45.56%) belonged to medium category (8-15 litres/day) of milk production, followed by low (44.44%) and high (10.00%) milk production categories.
- More than half of the members (52.22%) and a considerable percentage of non-members (46.11%) were consuming milk from 1.25 to 3.20 litres per day, and were categorized under medium milk consumption category.
- Majority of members (49.44%) and non-members (47.78%) were selling 2.60 to 10.82 litres of milk per day and therefore they fell under medium milk selling category.
- More than half of the members (53.33%) and a considerable majority of non-members (47.22%) were having per capita milk availability of 152.64 to 299.7 grams per day and were therefore grouped under medium category of per capita milk availability.
- Non-members sold their milk to their customers at an average selling price of Rs. 37.14 per litre. Whereas, members disposed their milk to JMF with an average procurement price of Rs.33.26 per litre. As per pooled data, the average milk price realized by both members and non-members was Rs. 35.20 per litre.

- A notable percentage (40.56%) of members fell under medium income group, whereas more than half (57.78%) of the non-members belonged to low income group.
- Majority of members and non-members were small (1.1-2.0 ha) to marginal (upto 1 ha) farmers based on their operational land holding. Further, the percentage of landless farmers were more in case of non-members (25.00%) as compared to members (11.11%). Whereas, the large farmers were more in case of members (5.56%) as compared to non-members (1.11%).
- More than half (54.22%) of the members and a considerable majority (67.22%) of non-members had a low level of social participation. Majority of members participated in JMF, followed by Youth Club and SHG, whereas majority of non-members participated in Youth Club, followed by Political organizations and NGOs.
- Majority of both the members (62.78%) and non-members (67.78%) had a medium level of access to information. The major source of information for both members and non-members was newspaper and peer groups.
- More than half (53.33%) of the members had medium level of access to extension services, whereas, among non-members more than half (58.89%) of the respondents had low level of access to extension services. However, unlike non-members, members received additional benefits from JMF apart from the extension services rendered by other field level extension functionary.
- Majority of members (61.67%) and non-members (61.11%) had medium level of provision of veterinary services. Majority of the members accessed veterinary services through JMF, followed by Para Vets and VOs while non-members received veterinary services through NGOs, followed by Para Vets and VOs.
- Majority (48.89%) of the members had high level of access to input supply whereas majority (64.44%) of the non-members had low access to input supply. Majority of the members had access to input supply through JMF, followed by state department and local input dealers, whereas, non-

members had access through local input dealers, followed by state department and NGOs.

- A significant majority of both members (40.00%) and non-members (51.67%) had low level of access to credit facilities. However, on an overall basis, members had better accessibility and availability of credit facilities as compared to non-members.
- The average market distance for members and non-members was 6.64 km and 3.62 km, respectively. However, the average distance of milk pooling point (MPP) from the place of residence in case of members and non-members was 2.00 km and 4.50 km, respectively.
- A significant majority of labour in case of both members (89.19%) and non-members (89.34%) comprised of own family members engaged in dairy farming while rest were the additional labour hired. The animal : man power ratio in members was 4:1 and in non-members was 2:1.
- Major factors influencing farmers' decision to join dairy cooperative using Rank Based Quotient (RBQ) analysis revealed that assured market for milk and milk products (RBQ Score= 76.67), better price realization and competitive advantage in marketplace (75.00), modern infrastructural facilities for procurement, processing and chilling of milk (78.11), skilled managers and staffs with professionalism (75.11) were the major extrinsic motivational factors; whereas voluntary participation and democratic control (78.79), expectation for equal treatment among members (73.64) were the major intrinsic motivational factors. Further, study revealed that lack of cooperation among member producers belonging to different caste, community, tribe etc. (76.67), no revision in the rate chart of milk procurement price by JMF since long time (77.00), irregularity and delay in provision of input services (77.78), lack of representation of member-producers among the board of directors or top level administration etc. (77.94) were major demotivational factors identified in the order of their priority.
- Reproductive performance of crossbred, indigenous and buffalo indicated that age at 1st calving, service per conception, service period was slightly

more in case of non-members, while calving interval was comparatively less in case of members, and were therefore found to be statistically significant at 5% level of significance.

- Productive performance of dairy animals indicated that average daily milk yield, lactation length, average lactation milk yield, peak yield was considerably more in case of members, while dry period interval was comparatively more in case of non-members and were therefore found to be statistically significant at 5% level of significance.
- In the light of health performance; major common diseases/ disorders among cattle were mastitis (15.81%), H.S. (11.16%) and repeat breeding (8.84%) whereas among buffaloes incidences of mastitis (13.55%), H.S. (11.61%), and endo parasitic infestation (9.68%) were quite prominent. However, the occurrences of diseases or disorders in both cattle and buffalo was reported more in case of non-members than members. Further, the average body condition score (BCS) of dairy animals reared by members (BCS range 3.22-3.63) was slightly better in comparison to non-members (BCS range 2.56-2.75). The morbidity and mortality rate in case of non-members was 16.70% and 2.85% respectively, whereas in case of members was 4.64% and 0.87% respectively.
- The estimates of the impact of JMF, as average treatment effect on the treated (ATT), on selected farm performance indicators for different matching algorithms indicated that members of cooperatives were found to have significantly higher milk yield, net dairy income, marketable surplus and per capita milk consumption over the non-members ($p<0.01$). They, however, received lower price compared to the prevalent open market price. Further, Propensity Score Matching between observable covariates across treated and control groups, through covariate balancing test, revealed that Pseudo R^2 had come down significantly from 44% before matching to 4-6% after matching. The likelihood-ratio of the joint significance of all regressors indicated that, systematic differences between the treatment and comparison groups was removed after matching and the two groups became comparable (insignificant p-values after matching). Furthermore, matching process resulted in substantial reduction in bias

(66.89-75.45%) after matching. Finally, the visual inspection of kernel density graph indicated that the groups overlapped to a great extent and were represented as 'treated on support' and 'untreated' respectively. Moreover, the Probit regression followed by goodness-of-fit tests pointed out that selected observable covariates provided good estimates of the conditional JMF membership density since, joint statistical significance of the explanatory variables (LR Chi^2 test statistics) was 116.42 (p-0.000) with pseudo R^2 (0.4368) thus, indicating a good fit of the model.

- The SWOT analysis of Procurement Unit of JMF using AHP indicated that weekly milk payment system and regular payment of bonus, ease of access to milk collection centres etc. were some of the important strengths. Whereas, lack of coordination in the supply chain management, low productivity of animals and high cost of milk production etc. were the major weaknesses. Further, more milk producers willing to join JMF, growing milk demand and expandable market share etc. were the major perceived opportunities. However, farmers losing interest in dairy farming, increasing cost of inputs etc. were some of the potential threats.
- The SWOT analysis of Processing Unit of JMF using AHP indicated that fully computerized system with self-automation facilities, surplus milk handling capacity etc. were some of the important strengths. Whereas, high operational cost for processing liquid milk, more energy consumption etc. were the major weaknesses. Further, development of new product and value addition, in-plant training for the interns, dairy entrepreneurs etc. were the major perceived opportunities. However, high labour cost or shortage of labour, challenge to waste disposal and cleanness etc. were some of the potential threats.
- The SWOT analysis of Productivity Enhancement Unit of JMF using AHP indicated that provision of chelated mineral mixture, bypass protein supplement and compound cattle feed at subsidised price, on call veterinary health care services etc. were some of the important strengths. Whereas, lack of funding from government sources, under-capacity of the feed processing unit to meet the demand of members etc. were the major weaknesses. Further, research and development facilities, development of

feed processing plant with large scale production capacity etc. were the major perceived opportunities. However, supply of expired inputs like medicines and drugs, shortage of labour etc. were some of the potential threats.

- The SWOT analysis of Marketing Unit of JMF using AHP indicated that wide range of quality product, intelligent marketing team executing strategic marketing plan etc. were some of the important strengths. Whereas, absence of strong sales/marketing experience, lack of awareness among prospective customers etc. were the major weaknesses. Further, new markets offering greater potential, investment from external sources etc. were the major perceived opportunities. However, seasonal sales slump, heavy competition from national and local players etc. were some of the potential threats.
- Member producers' perception of SWOT on JMF revealed that, weekly milk payment system and regular payment of bonus provided by the co-operatives, ease of accessibility to milk collection centres etc. were some of the important strengths. Whereas, low productivity of animals and high cost of milk production, low price for milk as compared to other unorganized competitors etc. were the major weaknesses. Further, developing infrastructure like processing equipment, bulk milk coolers, chilling centres and feed manufacturing units, well-equipped quality control laboratory etc. were the major perceived opportunities. However, fluctuations in milk production due to vagaries of climate change, pandemic etc., increasing cost of inputs etc. were some of the potential threats.
- Major constraints perceived by member-producers due to Covid-19 pandemic were no procurement of milk in MPPs due to complete lockdown during the peak period of Covid-19, fall in procurement price of milk due to less demand in the market, limited procurement of milk from the MPPs etc.
- Major suggestions and recommendations perceived by majority of the member-producers indicated that, JMF should give more emphasis on timely provision of extension, veterinary and input services, dynamic milk procurement price policy, provision of short term and long term financial

support at subsidized interest rate etc. for enhancing the overall performance of the JMF.

5.3 Conclusions of the study

Jharkhand State Cooperative Milk Producers' Federation (JMF) plays vital role in procurement, processing and marketing of milk and milk products. Thereby, helping member-producers to earn remunerative prices for their milk produce and further enhances their socio-economic status of living. JMF pools the raw liquid milk from the member-producers daily through Milk Pooling Points (MPPs), which are further channelized to Bulk Milk Coolers (BMCs) and finally disposed to the Dairy Processing Plants, through well-defined milk routes. The performance of JMF is largely dependent on the member-producers' active participation and interest in dairy cooperative. It was observed that members reared large herd size of milch cattle and buffalo and had better experience in dairy farming. Further, comparison indicated that, there was statistical significant difference between members and non-members in terms of selected socio-economic attributes, except for age, herd size, family size and experience in dairy farming. Better education among members enabled them to adopt the improved dairy practices or technologies. Due to presence of large number of high yielding crossbred cattle and buffalo, members reaped higher milk production, higher milk consumption, higher milk sale and per capita milk consumption as compared to non-members. Members also have better access to extension services, veterinary services, and input supplies than their non-member competitors. Furthermore, compared to non-member farmers, most farmer-members had better access to credit through formal sources. This also further indicated that farmers with better access to credit could meet the daily expenses of feed, fodder and mineral mixture for their dairy animal herd. The majority of the members accessed credit facilities through banks and government schemes in the form of short-term loans. Besides this, extension services like training, demonstration and advisory services are provided through different field level extension functionary regarding improved dairy farming practices. This empowered dairy farmers in better decision making and influenced their participation in dairy cooperatives. Provision of regular veterinary services like vaccination, A.I., treatment of chronic diseases etc. by JMF veterinary staff or government veterinary officers created health awareness among dairy farmers to

timely diagnose and treat their animals, thus maintaining proper healthcare of their milch cattle and buffalo. In addition to this, the members are largely benefitted from a wide range of extension and input services offered by JMF. The grassroots extension workers and dedicated staffs employed by JMF offers solutions and caters to various aspects of dairy farming *viz.* breeding, feeding, healthcare, management and extension and advisory needs of the member-producers from time to time. Again, farmers residing farther to market are more inclined to be associated with JMF, as most of the member-producers resided near to the vicinity of the milk pooling points (MPPs), wherefrom JMF regularly procured the milk. It was further observed that several motivational factors (both intrinsic and extrinsic factors) and demotivational factors influenced farmers' participation in JMF which subsequently led to their higher level of participation in dairy cooperative. It was also evident from the study, that dairy animals reared by members showed better reproductive and productive performance since they adopted better dairy management practices. Moreover, in case of health performance; members exhibited higher Body Condition Score (BCS); less occurrences of diseases or disorders and lesser rate of morbidity and mortality in dairy animals. The impact of JMF on socio-economic status of dairy farmers using Propensity Score Matching (PSM) method revealed that farmers' participation in JMF has a positive and statistically significant influence on milk yield, net dairy income and marketable surplus while having no negative impact on household milk consumption. Cooperative pricing, on the other hand, are lower than open market prices as non-members reaped better milk price than the members. Further, SWOT analysis on different supply chain levels using Analytical Hierarchy Process (AHP) prioritized problems and prospects of JMF at different supply chain levels (*viz.* procurement, processing, productivity enhancement and marketing). Further, all the SWOT factors identified were consistent with the AHP criteria and were thus considered for further decision making and formulating strategies to enhance overall efficiency and performance of JMF. These findings have significant implications for Jharkhand's dairy growth. JMF can help boost milk output in the state by improving producers' access to markets. As a result, creating a level playing field for different stakeholders is necessary to attract cooperative investment in dairying. Aside from that, cooperatives must examine milk price policy while taking open market prices into account. Furthermore, updated

technologies must be disseminated to farmers for better efficiency and productivity.

5.4 Implications of the study

- The study will give better insights to the JMF to improve their operational efficiency through proper analysis of the socio-economic impact, problems and prospects of dairy cooperative at different supply chain level.
- The perceived motivational and demotivational factors by member-producers on various aspects of JMF will give better insights on the part of JMF management to critically appraise and influence more dairy farmers to join and participate in JMF.
- Concerted efforts made by JMF will further enhance reproductive, productive and health performance of the dairy animals through timely and better provision of veterinary, input and extension services.
- The SWOT analysis will guide policy makers/ top level management to reduce the weaknesses and threats, and exploit its strengths and opportunities for better performance of JMF at different supply chain levels.
- The study will guide different stakeholders, State Animal Husbandry and Dairying Department, private dairy sector, research institutes etc. to better understand the potential and prospects of dairy processing sector and dairy farming in general for overall dairy development.
- The study will bring awareness among non-members to participate in formal dairy sector like dairy cooperatives instead of non-formal sector and give better exposure of JMF through proper demonstrations, training and capacity building programme.

5.5 Suggestions for future research

- The present study is restricted to performance of single milk cooperative federation *i.e.* JMF and confined to Jharkhand State only. Further, more number of milk federations from different states can be selected for overall assessment of the performance of dairy cooperatives, Also, region-wise or state-wise comparison can be made as per the objective of the study.

- A comparative study can be conducted on dairy cooperatives versus private dairy firm and explore the structural and functional differences between them. Further, SWOT analysis and impact assessment can also be worked out separately.
- A comprehensive study on women members' participation in JMF, highlighting gender related issues in dairy farming, socio-economic impact, livelihood security etc. can be documented in a detailed way.
- To better understand the impact, limits, and expansion of the cooperative dairy sector, periodic cross-sectional and longitudinal studies should be done. Periodic longitudinal field studies employing the difference-in-differences model are a reliable tool for establishing the long-term impact of a technology, programme, or intervention, as it eliminates sample selection bias.
- An overall assessment of level of adoption of improved dairy farming practices, farmers' attitude and knowledge test can be conducted and systematic comparison can be made between beneficiaries and non-beneficiaries of JMF.
- An in-depth analysis of JMF's organizational forms, management efficiency, technical efficiency and production efficiency can also be carried out.

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Appendices

APPENDIX-I

Impact Assessment of Jharkhand State Cooperative Milk Producers' Federation on Socio-Economic Status of Dairy Farmers

INTERVIEW SCHEDULE

Sl. No……

1. Name of the respondent (in full):_____
2. Category: Member/Non-member
3. Village_____ District_____
4. Name/No. of Milk Pooling Point (MPP):_____
5. Name/No. of the Bulk Milk Coolers (BMC):_____
6. Telephone/ Mobile No. of respondent: _____

A. Socio-personal variables

7. **Age of the respondent (in years):**_____
8. **Gender: 1. Male 2. Female** _____
9. **Education**

Sl. No.	Qualification	Score
1	Illiterate	0
2	Functionally Literate	1
3	Primary School	2
4	Middle School	3
5	High School	4
6	High Secondary School	5
7	Graduation or above	6

10. **Occupation**

Sl. No.	Occupation	Main	Subsidiary
1	Agriculture		
2	Dairy and Animal Husbandry		
3	Business		

4	Service		
5	Labour		
6	Others		

11. Family Size

Sl. No.	Category	Total
1	Male	
2	Female	

12. Years of Membership in JMF (for members):_____

13. Experience in Dairy Farming (in years):_____

B. Economic variables

14. Herd size

Sl. No.	Category	In milk	Dry	Calves	Heifer	Bull/Bullock	Total
1	Indigenous cows						
2	Crossbreds						
3	Buffalo						

15. Milk production and sale

Sl. No.	Milch animals	Number	No. of animals in Milk	Milk production (lts/day)	Avg. daily Milk disposed to JMF (lts/day)	Avg. daily Milk sold to customers (lts/day)
1	Indigenous cows					
2	Crossbreds					
3	Buffalo					
	Total					

16. Average daily milk consumption per household (in litres/day):_____

17. Per capita milk availability (in litres/day):_____

18. Price of milk

Sl. No.	Price of Milk	Amount (₹ per day)
1	Procurement price as fixed by JMF	
2	Selling price of milk for customers	

19. Annual Household Income

Sl. No.	Sources of Income	Amount (₹ per annum)
1	Agriculture and allied	
2	Dairy and animal husbandry	
3	Services	
4	Business	
5	Labour	
6	Others	
	Total income per year	
	Total expenditure per year	

20. Net Dairy Income (in ₹/annum):_____

21. Operational land holding

Sl. No.	Category (in ha.)	(✓)
1	Landless (0)	
2	Marginal (upto 1)	
3	Small (1.1-2.0)	
4	Semi-medium(2.1-4.0)	
5	Medium (4.1-10.0)	
6	Large (>10)	

22. Average operational land holding (in ha.):_____

23. Average area under fodder cultivation (in ha.):_____

B. Other variables

24. Social participation

Sl. No.	Organization	Nature of participation		Frequency of participation		
		Member (1)	Office bearer(2)	Regular (3)	Seldom (2)	Never (1)
1	Panchayat					
2	JMF					
3	Youth club					
4	SHG					
5	Religious committee					
6	Political organization					
7	NGO					
11	Any others (specify)					

25. Access to information

Sl. No.	Particulars	Regularly (3)	Seldom (2)	Never (1)
1	Newspapers			
2	Film regarding dairy farming			
3	Radio			
4	Television			
5	Dairy/Agri.Melas			
6	Exhibition			
7	Magazines/Leaflets/Bulletins			
8	Folk media			
9	Internet			
10	Peer group			
11	Any others (specify)			

26. Frequency of extension services accessed

Sl. No.	Particulars	Regularly (3)	Seldom (2)	Never (1)
1	Progressive farmers			
2	VLW/VEO			
3	VO/VLDA			
4	BDO/ADO/DDO			
5	KVKs/ Research Station/ SAU			
6	NGO			
7	Others			
As a member of JMF do you have access to the following services from your cooperative:				
a.	Veterinary health care service			
b.	Supply of mineral mixture/supplements/feed etc. at subsidized price			
c.	A.I. facility			
d.	Training on Ration balancing			
e.	Demonstrations on fodder cultivation			
f.	Training/Workshops/Advisory services on scientific dairy farming			
g	Exposure visits			
h.	Any others (specify)			

27. Provision of veterinary services

Sl. No.	Particulars	Regularly (3)	Seldom (2)	Never (1)
1	JMF			
2	Para Vets			
3	VO/VLDA			
4	Quacks			
5	Local pashu hakim/vaidya			
6	NGO			
7	Any others (specify)			

28. Input Supply

Sl. No.	Particulars	Input Supplied		
		Regularly (3)	Seldom (2)	Never (1)
1	Milk Fed. (JMF)			
2	Local Input Dealers			
3	State Dept.			
4	NGOs			
5	Any others (specify)			

29. What is the distance of milk collection centers from your place of residence/ dairy farm(in km)?_____

30. What is the distance of nearby market from your place of residence/ dairy farm (in km)? _____

31. Access to credit

Sl. No.	Particulars	Access to credit		Credit Availed	Frequency of access		
		Yes (1)	No (0)		Regular (3)	Seldom (2)	Never (1)
1	Private Moneylenders						
2	Cooperative Banks/ Nationalized Banks						
3	Govt. Schemes/Fund						
4	Any others (specify)						

32. Labour profile of member/non-member household

Sl. No.	Particulars	Nos./day
1	Family members engaged in dairy farming	
2	Additional labours hired	
	Total manpower	
	Animal: manpower ratio	

D. Productive, Reproductive and Health performance of dairy animals

I. Productive performance

Sl. No.	Parameters	Crossbred	Indigenous	Buffalo
1	Avg. daily milk yield (l)			
2	Lactation length (days)			
3	Avg. lactation milk yield (l)			
4	Peak yield (l/day)			
5	Dry periods (days)			

II. Reproductive performance

Sl. No.	Parameters	Crossbred	Indigenous	Buffalo
1	Age at 1st calving (months)			

2	Services per conception (in nos.)			
3	Service period (days)			
4	Calving intervals (days)			

III. Health performance

(Occurrences of diseases/disorders in last 2 years)

a. Cattle

Sl. No.	Disease/Disorders	Non-members		Members		Pooled	
		f	%	f	%	f	%
1	Foot & Mouth diseases						
2	Haemorrhagic Septicaemia						
3	Haematuria						
4	Repeat breeding						
5	Urinary problem						
6	Endo parasitic infection						
7	Anoestrus						
8	Emaciation/weakness						
9	Ecto parasitic infestation						
10	Tympaitis/bloat						
11	Warts						
12	Abortion						
13	Diarrhoea/dysentry						
14	Scars						
15	Limb deformity						
16	Mastitis						
17	Milk fever						
	Total						

b. Buffalo

Sl. No.	Disease/Disorders	Non-members		Members		Pooled	
		f	%	f	%	f	%
1	Foot & Mouth diseases						
2	Haemorrhagic Septicaemia						
3	Emaciation/weakness						
4	Endo parasitic infection						
5	Ecto parasitic infestation						
6	Repeat breeding						
7	Anoestrus						
8	Tympaitis/bloat						
9	Abortion						
10	Diarrhoea/dysentry						
11	Mange						
12	Scars						
13	Limb deformity						
14	Mastitis						
15	Milk fever						
	Total						

c. Average Body Condition Score of animals

Sl. No.	Type	Body Condition Score (BCS)				
		1	2	3	4	5
1	Crossbred					
2	Indigenous					
3	Buffalo					

Body Condition Score*

BCS-1=Deep cavity around tail head. Bones of pelvis and short ribs sharp and easily felt. No fatty tissue in pelvic or loin area. Deep depression in loin.

BCS-2=Shallow cavity around tail head with some fatty tissue lining it and covering pin bones. Pelvis easily felt. Ends of short ribs feel rounded and upper surfaces can be felt with slight pressure. Depression visible in loin area.

BCS-3=No cavity around tail head and fatty tissue easily felt over whole area. Pelvis can be felt with slight pressure. Thick layer of tissue covering top of short ribs which can be still be felt with pressure. Slight depression in loin area.

BCS-4=Folds of fatty tissue are seen around tail head with patches of fat covering pin bones. Pelvis can be felt with firm pressure. Short ribs can no longer be felt. No depression in loin area.

BCS-5=Tail head is buried in thick layer of fatty tissue. Pelvic bones cannot be felt even with firm pressure. Short ribs covered with thick of fatty tissue.

d. Morbidity/ Mortality (in last 2 years)

Sl. No.	Particulars	Members	Non-members
1	No. of diseased animal (nos.)		
2	No. of animals died (nos.)		
3	Total herd population (nos.)		
4	Morbidity rate (%) (1/3*100)		
5	Mortality rate (%) (2/3*100)		

E. Member- producers' perception of SWOT on JMF

Please indicate how much you agree or disagree with respect to the following statements related to the JMF

Sl. No.	Statements	Responses				
		SA (5)	A (4)	UD (3)	D (2)	SD (1)
A.	**STRENGTHS**					
1	Weekly milk payment system and regular payment of bonus provided by the co-operatives					
2	Dairy farming is a livelihood occupation of the majority of member-producers					
3	Ease of accessibility to milk collection centers					
4	Good supply chain network					
5	Provision of mobile A.I., concentrate, feed, health services etc.					
6	Provision of training and advisory services					
7	Encouraging women participation in dairy cooperative					

8	Full stake and commitment from the state govt. to ensure long term growth of JMF					
9	Strict sanitary and hygiene practices followed during collection & transportation of milk					
B.	**WEAKNESSES**					
1	Low productivity of animals and high cost of milk production					
2	Lack of structured and clear benefit packages available to keep up the motivation of member farmers					
3	Low price for milk as compared to other unorganized competitors					
4	Lack of support services viz., A.I. service and animal health services and farm inputs like cattle feed or veterinary medicine.					
5	Lack of employment opportunities					
6	Milk collection centers are not well equipped					
C.	**OPPORTUNITIES**					
1	More producers willing to join JMF					
2	Scope for convergence with allied departments and other agencies for funds					
3	Substantial scope for modernization of the unit and new product development					
4	Growing milk demand and expandable market share					

5	Developing infrastructure like processing equipment, bulk milk coolers, chilling centres and feed manufacturing units					
6	Well-equipped quality control laboratory					
D.	**THREATS**					
1	Farmers losing interest in dairy farming					
2	Increasing cost of inputs					
3	Fluctuations in milk production due to vagaries of climate change, pandemic etc.					
4	High incidence of bovine diseases					
5	Distant location of milk collection centres					
6	Lack of appropriate government policy favouring the dairy sector					
7	Decline of grazing lands due to urbanization					

SA=Strongly Agree, A=Agree, UN=Undecided, D=Disagree, SD=Strongly Disagree

F. Factors influencing farmers' decisions to join JMF

a. Motivational factors

Sl. No.	Motivational factors	Rank
A.	**Extrinsic factors**	
	I. Social	
1	Better employment opportunity and job security	
2	Assured market for the milk and milk products	
3	Presence of large size of milking animal herd	
4	Brand name and image of JMF at State level	
5	Growing demand for milk and milk products	

6	Wide coverage of milk shed area with more membership in JMF	
	II. Economic	
1	Increment in income since joining the cooperative	
2	Better price realization and competitive advantage in marketplace	
3	Provision of incentives, insurance etc.	
4	Timely payment of the dividends	
5	Value addition of the milk to widen the market	
6	Provision of credit facilities/bank linkage from the cooperative	
	III. Technical	
1	Better access to improved dairy technology	
2	Timely provision of A.I. service, animal healthcare services and dairy inputs (feed, veterinary medicines etc.)	
3	Modern infrastructural facilities for procurement, processing and chilling of milk	
4	Structured forward and backward linkage	
5	Computerized Data Management System throughout supply chain	
	IV. Administrative	
1	Skilled managers and staffs with professionalism (in terms of planning, monitoring and control of financial & human resources)	
2	Provision of frequent training & extension advisory services from the cooperative	
3	Coordination with other govt. and non-govt. agencies	
4	Swift mechanism for redressal of grievance	
5	Structured channels for timely dissemination of information regarding the latest schemes, subsidies,	

	technology, meetings etc. among the member producers	
B.	**Intrinsic factors**	
1	Expectation for equal treatment among members (without social, gender, cultural and other discrimination).	
2	Better access to social support services during time of crisis	
3	Create forum for experiential and information sharing among members	
4	Voluntary participation and democratic control	
5	Acquired knowledge, attitude& skills in advanced dairy production techniques	
6	Less interferences of State with the cooperative administration and helping in matters such as finance, legislation, investment projects, subsidies etc.	
7	Esprit de corps among members of the cooperatives	
8	Trust in the board members and dedicated staffs with diversified experience and knowledge in the dairy sector	
9	Regularity in conduct of meetings	
10	Good commitment from the State govt. and NDDB to ensure better growth of JMF	
11	Accountability and transparency in usage of member's fund	

b. Demotivational factors

Sl. No.	Demotivational factors	Rank
	I. Social	
1	Communication gap and mutual trust between staff and producer members	
2	Lack of cooperation among member producers belonging to different caste, community, tribe etc.	

3	Remote location of milk collection centre	
4	Prejudiced and biased practices espoused by *Doodh Mitra* at MPP	
5	Rejection of milk due to delay in disposal of milk at scheduled procurement time at MPP	
	II. Economic	
1	Low milk price as compared to other unorganized sector	
2	Low productivity of milk animals	
3	Untimely and irregular distribution of bonuses, incentives, perks etc.	
4	No revision in the rate chart of milk procurement price by JMF since long time	
5	High cost of maintenance of dairy cattle	
	III. Technical	
1	Inadequate and inappropriate animal feeding and health care facilities	
2	Poor basic infrastructural facilities for procurement, transportation, processing of milk and marketing etc.	
3	Defective management and shortage of skilled man power	
4	Irregularity and delay in provision of input services	
5	Frequent malfunctioning of milk testing equipment like stellar, lactometer etc.	
6	Frequent rejection of milk due to less Fat and SNF content in milk sample	
	IV. Administrative	
1	Irregular visit and supervision by JMF officials at the MPP and BMC	
2	Illegitimate policies, bylaws and rules framed by JMF disfavouring dairy farmers	
3	Poor keeping of records/accounts	
4	Existence of corruptive practices or Red tapism	

5	Procedural complications for registration of new members	
6	Lack of representation of member-producers among the board of directors or top level administration	
7	Weak unity of command, unity of direction and scalar chain among line and staff authority in JMF	

G. Additional Information:

1. What were the requirements you had to fulfil to be member of the cooperative?

1. Paying registration fee

2. Paying share

3. Respecting the by-laws of the cooperative

4. Having dairy cows

5. Others (specify) _____

2. What is the minimum and maximum limit of the quantity of milk you can supply to the JMF on daily basis? _____

3. Payment mode-through account/check/cash

4. Payment duration-once a week/fortnight/month

5. Do you want to continue your membership of the cooperative? 1. Yes 2.No

6. Have you read the by-laws of the cooperative when you joined the cooperative? 1. Yes 2. No

7. Initially where did you get information to be member of the cooperative?

1. from friends/ relatives
2. from NGOs working in the area
3. from the executive committees of the dairy cooperative in my place
4. from advertisement, mass media, social media etc.
5. Others (Specify) _____

8. Where did you sell your milk before you become member of the dairy cooperative?

1. There was no culture of selling milk (only using for home consumption)
2. Local markets
3. Directly to consumers
4. Others (specify) _____

9. Any specific suggestions for improving the overall performance of the JMF

Sl. No.	Suggestions
1	
2	
3	
4	

10. Constraints perceived by member-producers of JMF due to Covid-19 pandemic

Sl. No.	Constraints
1	
2	
3	
4	

APPENDIX-II

CONSTRAINTS PERCEIVED BY MEMBER-PRODUCERS OF JMF DUE TO COVID-19 PANDEMIC

Globally, the dairy supply chain has been majorly impacted by the Covid-19 Pandemic and the dairy cooperatives, even more essential than ever, have not gone unscathed. In the context of JMF, both the milk and processed milk product segments were severely impacted by the COVID-19 crisis. As per the survey, the significant challenges encountered by JMF during the pandemic were workforce management, surplus milk collection, decreased demand of milk and milk products, safety and health of animals as well as farmer members from the virus, transportations of milk from MPPs to processing plants and distribution of processed milk and milk products to the consumers.

Table: Constraints perceived by member-producers of JMF due to Covid-19 pandemic (n=180)

Sl. No.	Constraints	Garrett Score	Rank
1	No procurement of milk in MPPs due to complete lockdown during the peak period of Covid-19	75.7	**I**
2	Restriction in the movement due to strict rules imposed by the Govt.	62.95	**IV**
3	Fall in procurement price of milk due to less demand in the market	73.75	**II**
4	Limited procurement of milk from the MPPs	68.10	**III**
5	Decline in farmers' income from dairy farming	60.05	**V**
6	Shifting from dairy to other agri-based activities as an alternative to income generation	48.60	**VIII**
7	Selling of cows and buffaloes to meet the family expenses	57.35	**VI**
8	Increase in price of dry fodder, feed, concentrate etc. due to shortage of supply	53.95	**VII**

Data in the Table highlighted some of the major constraints perceived by member-producers of JMF due to Covid-19 pandemic.During the peak period of first

wave of Covid-19 (2020) pandemic, there was no procurement of milk in MPPs for 15-20 days due to complete lockdown imposed by the government to curb Covid-19. Due to this reason the dairy farmers perceived it to be the foremost constraint since they had to bear heavy financial loss for that time frame. The second major constraint was 'fall in procurement price of milk due to less demand in the market'. Owing to the closure of hotels, cafés, restaurants, and restrictions on public gatherings, the demand for milk and milk products dipped while the procurement of milk increased. The reason for such a situation was that many private players, small enterprises including JMF refused to collect milk or reduced procurement prices, which lead the farmers from different parts of the Jharkhand State to dump the milk on roads in many places or distress sell their milk due to limited procurement at MPPs. Further, it was noticed that restriction in the movement due to strict rules imposed by the Govt. was the major constraint expressed by dairy farmers. The survey found that during the lockdown, the milk supply chain was interrupted by new protocols or standard operating procedures (SOPs) at MPPs, BMCs, dairy plants and state federations. The protocols included maintaining social distancing (by farmers, staff, and officials), washing hands frequently, covering mouth and nose with masks, sanitization of vehicles carrying milk and milk products, etc. Other challenges for the JMF were the availability of manpower as there were restrictions of movement during the lockdown. As a consequence of this, there was drastic decline in farmers' income from dairy farming, since the procurement prices dipped due to less procurement and marketing of milk products. It was noteworthy to mention that due to financial crisis, many dairy farmers were compelled to sell their livestock (cow and buffalo) to meet their family expenses during Covid-19. In addition to this, 'increase in price of dry fodder, feed, concentrate etc. due to shortage of supply' was also an important constraint highlighted by many dairy farmers. The milk producer at the village level during Covid got limited supply of input services such as feed and fodder, artificial insemination, and veterinary services from JMF. However, a notable few members revealed that due to above constraints mentioned, many farmers were shifting from dairy to other agri-based activities as an alternative source for income generation.