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Abbreviations

AI	–	Artificial Insemination
CMP	–	Clean Milk Production
DCS	–	Dairy Cooperative Societies
EIAs	–	End Implementing Agencies
FGDs	–	Focus Group Discussions
HGM	–	High Genetic Merit
ICT	–	Information and Communications Technology
MIS	–	Management Information System
NDDB	–	National Dairy Development Board
NDP I	–	National Dairy Plan Phase I
OBC	–	Other Backward Class
PDO	–	Project Development Objectives
PMU	–	Project Management Unit
SC	–	Scheduled Caste
SOPs	–	Standard Operating Procedures
ST	–	Scheduled Tribe
VBMPS	–	Village Based Milk Procurement System

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This is a report of the research project on "Contribution of The National Dairy Plan I to the Inclusion, Equity and Income of Dairy Farmers" funded by the National Dairy Development Board (NDDB), Anand. It provides and understanding of the equity in distribution of resources, opportunities and livelihood gains generated through the project. The study also provides estimates about the increase in farmers income as a result of the project interventions. Further, it suggests the measures for sustainability of these factors in the long run. We are grateful to the NDDB for providing this opportunity to undertake this study. We are also thankful to the various officials and staff of the selected District Milk Unions and Village Dairy Co-operative Societies for help and cooperation in the conduct of the study.

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Dr. William Joe

Dr. Amarnath Tripathi

Executive Summary

BACKGROUND

The National Dairy Plan Phase I (NDP I) is a Central Sector Scheme for a period of 2012-13 to 2018-19 envisaging a scientifically planned multi-state initiative to strengthen the dairy farmers. Broadly, it has two objectives- first, to increase productivity of milch animals and thereby milk production to meet the rapidly growing demand for milk; and second, to provide rural milk producers with greater access to the organized milk-processing sector. NDP I focuses on 18 major milk producing states viz. Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Telangana, Uttarakhand, Chhattisgarh and Jharkhand, which altogether account for over 90% of the country's milk production. NDP I has three important components: a) productivity enhancement b) Village Based Milk Procurement System (VBMPS) for weighing, testing quality of milk received and making payment to milk producers; and c) project management and learning.

The objectives of the study would lead to more livelihood opportunities for the vulnerable sections of the rural community, viz. women, SC/ST and small holders. It would provide them with more income and employment and build their assets and capacities through trainings and so as to develop, empower and sustain them in the long run. The second social objective of the project is to maintain equitability in the distribution of resources, opportunities and livelihood gains so that social harmony, unity and integrity of the people are promoted. Hence, it is important to understand the contribution of the project to the inclusion, equity and income of the dairy farmers in general and vulnerable classes in particular in the study area.

OBJECTIVES

The specific objectives of the study are-
   a) To understand the inclusion of vulnerable population (viz. women, SC/ST and small holders) in the project interventions.
   b) To analyze the extent of equity in distribution of resources, opportunities and livelihood gains generated through the project.
   c) To estimate the increase in farmer's income as a result of the project interventions.

d) To suggest measures for the sustainability of these factors in the long run.

STUDY DESIGN AND METHODOLOGY

The present study aims to understand the contribution of the NDP I to inclusion, equity and income of the dairy farmers. This study employed a combination of both quantitative and qualitative methods to enhance the quality of results to explain complex relationships in the study area. However, data collected through quantitative methods are designed specifically to ensure objectivity, reliability and generalizing of the findings.

The study adopts a multi-stage sampling strategy to select the survey respondents. Out of the eighteen states where NDP-1 intervention has taken place, nine states were selected for this study. These are as follows: Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu. To provide contrast in the study, four districts were selected from different regions of each state. As a result, 36 districts were chosen for this study. Note that, in the process of the selection of districts, due attention has been given to those districts in the study area where both Rational Balancing Programme (RBP) and Village Based Milk Procurement System (VBMPS) programme was implemented during NDP I phase. From each of these selected districts, two developmental blocks were selected and further 4 villages were chosen from each of them. The selection of control village was based on the basis of non-intervention of NDP-I. Hence, the data was collected from 144 villages from 36 districts of 9 states.

KEY FINDINGS

Dairy cooperatives as important source of knowledge and motivation: Although parents and relatives are the most important source of knowledge and motivation for dairy farming (about 80%) but it is observed that in intervention villages the Dairy Cooperatives have emerged as a second alternative for dissemination of knowledge and has also motivated farmers for adoption of dairy farming.

LRP coverage needs expansion but is effective: The LRPs coverage is currently at 58% and requires further improvement, particularly among the vulnerable populations. The regression analysis indicates that large landholding farmers are more likely to report the LRP visits. However, trainings and interactions on RBP has considerable influence and over 90% of those benefited from such trainings report of practicing the advice received on RBP.

Livestock size is greater in intervention villages: The mean herd size is greater among dairy farmers in intervention villages than compared to control villages. The average number of cows per household

in control and intervention villages is 1.8 and 2.7, respectively. Similarly, the average number of buffaloes per household in control and intervention villages is 1.9 and 3.8, respectively.

Training on RBP is inclusive and beneficial: Training on dairy related activities and receipt of mineral mixture and fodder on subsidized prices are among the important benefits reported by almost one-third of the dairy farmers in intervention villages. While the richer households continue to have greater access to loans and cash bonus but the poor households have greater share in training participation. The logistic regression analysis suggests that the vulnerable populations particularly the SC/ST are 1.6 times more likely than the non-SC/ST households to receive any of these benefits. Small and marginal landholding families are also more likely to benefit from such interventions.

Cost of rearing and milk production is high: Cost of milk production because of higher fodder price and higher labour cost are important constraints identified by the dairy farmers. However, the dairy farmers in intervention villages are less likely to report these challenges than compared to the control villages. In control villages, more than 90% of dairy farmer said that cost of milk production has increased because of higher fodder price which is about 19% higher than intervention villages. In case of labour cost, more than 15% of dairy farmer's complaints about higher labour cost than that of intervention villages for dairy farming. In control villages, complaint about decreasing productivity of milch animal is 8% higher than the intervention villages.

Treatment and medical costs a significant factor: The mean expenditure on treatment of cattles in control and intervention villages is Rs. 1523 and Rs. 1402 per month, respectively. Although, the simple mean difference is not statistically significant but linear regression analysis shows that when adjusted for other socioeconomic variables the treatment expenditure is relatively higher and significant among the control villages.

Quality and quantity of milk produced has improved: Around 30% of the dairy farmers have reported improvement in quality as well as quantity of milk produced after the practice of RBP. The benefits are more or less equally distributed across the population and vulnerable groups. Importantly, every second dairy farmer reported improvement in local purchase of milk after VBMPS.

Poor households satisfied with income gains from RBP and VBMPS interventions: Poor dairy farming households are more likely to report satisfaction with the role of RBP and VBMPS in improving their family income. However, SC/ST households are less likely to report greater income benefits compared to non-SC/ST households. This is partly associated with lower production volume of these households

that does not allow greater income gains. Importantly, the overall level of satisfaction with dairy farming is relatively higher among intervention villages. In fact, dairy farmers in control villages are 40% less likely to report such satisfaction then compared to intervention villages.

Quantity of milk production is higher in intervention villages: The quantity of cow and buffalo milk production is found to be higher among the intervention villages than compared to the control group. The average cow milk production in control and intervention villages is 11.7 and 14.5 litres per day. The average buffalo milk production in control and intervention villages is 6.0 and 9.4 litres per day. The effect across intervention villages is significant even after adjusting for socioeconomic variables in a linear regression model. The propensity score analysis based Average Treatment effect on Treated (ATT) estimates also confirm the significant difference in milk production across control and intervention villages. The ATT based on a sensitivity analysis ranges from 2.6 to 2.9 litres per day for cow milk production and 3.9 to 4.3 litres per day for buffalo milk production.

Income from milk production is higher in intervention villages: The household income from cow and buffalo milk production is found to be higher among the intervention villages than compared to the control group. The average income from cow milk production in control and intervention villages is Rs.310 and Rs.393 per day. The average buffalo milk production in control and intervention villages is Rs.198 and Rs.276 per day. The higher incomes accruing to the intervention villages is found to be significant even after adjusting for socioeconomic variables in a linear regression model. Further, the propensity score analysis based Average Treatment effect on Treated (ATT) estimates also confirm the significant difference in income from milk production across control and intervention villages. The ATT based on a sensitivity analysis ranges from Rs.82 to Rs.99 per day for cow milk production and Rs.48 to Rs.79 per day for buffalo milk production.

Limitations of the study: First, the study is based on a cross-sectional design and it should be interpreted accordingly. Nevertheless, available impact analysis methods for the cross-section design is used to draw analytical inferences. Second, it is often difficult to ascertain income related parameters from household survey with greater accuracy. Similarly, non-monetized income attributable to household consumption of the produced milk products is not taken into account. This may potentially lead to an underestimate of the income level across households. Third, with expansion in communication and transportation as well as development of private sector dairy, the control villages are also likely to have received greater awareness and information on dairy farming. Finally, the study is based on self-reported information on household income from dairy.

- **Strengthening participation and involvement of women**: Given the importance of gender in the rearing of bovine stock, particular attention needs to be paid to meet the credit needs of women farmers. Cooperatives in conjunction with banks may think of putting in place special programs to provide financial services for rural women, such as an agricultural women's bank that would specialize in working with women dairy farmers and catering to their banking needs to start dairy farming. Women play a significant role in dairy farming and undertake critical activities but their control over livestock and its products is very minimal. The income from dairy animals often does not accrue to the women and neither enhance financial autonomy as well as decision making power. There is an urgent need to disseminate technologies which will help all engaged to overcome relatively unpleasing physical exertion and minimise effects on physical and psychological well-being. Women have to be particularly motivated to acquire more scientific knowledge for increasing the livestock production through various extension techniques.

- **Expansion of AI and Extension services**: The quality of animals is critical in determining its milk productivity and hence overall production. Currently, low productivity per animal hinders development of the dairy sector. Cattle and buffalo breeding programmes have been initiated but needs further extensions particularly to overcome the shortage of AI workers or veterinary doctors. More AI technicians should be trained, as well as, livestock development agencies should be strengthened to offer services in animal breeding in the form of procurement, production and distribution of breeding inputs (such as semen and liquid nitrogen), training and promotional activities. There is a need to enhance collaboration between extension service providers and dairy farmers to ensure uptake of improved dairy technologies

- **Strategies to support small-land holding farmers**: Increasing milk production in small-scale dairy farms and enhancing livelihoods of farmers depends mostly on the adoption of appropriate feed technologies. These need to be based on locally available feed resources and improved support services (such as improved feeding systems, appropriate breeding programmes, credit facilities, veterinary health care and marketing systems). Because of their low level of milk production, indigenous cattle are often graded as inefficient when compared with western exotic cattle; however, classification on the basis of milk yield ignores the multipurpose utility of indigenous cattle, their energetic usefulness and adaptation to the local resources and environment. Therefore, efforts need to be made to improve the economic characteristics of indigenous cattle. Concentrates used for fodder include coarse grains, such as maize, sorghum, bajra and other

millets, and other cereal by-products, such as rice bran/polish and various oil meals, including groundnut cake, mustard cake, coconut cake, soybean meal, cotton seed meal and sesame cake. The escalating price of feed ingredients is a major cause for concern. In many states, cooperatives are involved in producing feed concentrate and selling to farmers at subsidized rates. This should be done nation-wide.

- **Access to formal / informal credits**: Lack of access to credit to expand the herd is a critical problem for farmers. There is little access to formal credit through the cooperatives. Informal credit is available from private traders and agents of private companies, but the interest rate is very high. And these loans may or may not be linked to dairy activity. When taking a loan from a trader, the farmer is then tied to selling the milk to that trader, often at a low rate. The low or non-availability of credit as a primary constraint in livestock sector activity, indicating that Public sector lending is abysmally very low. The commercial banks are not favourably disposed to providing credit to livestock farmers and the cooperative credit system is very weak, resulting in excessive dependence of livestock farmers on informal sources and usually at exorbitant interest rates. Efforts should be put on correcting these distortions and ensure timely availability of inputs and services, including credit to livestock farmers. Institutional credit in the dairy production system may be intensified as dairy is one of the remunerative activities where cash flows are fairly positive for farmers. The Pradhan Mantri Jan Dhan Yojana can play a pivotal role in achieving this target.

- **Availability of veterinary doctors in all the villages**: There is lack of veterinary doctors in the rural areas of most of the states. Veterinary doctors are posted at block level only, so the farmers of remote villages do not get services in time. It can be started by providing doctors in a small group of villages. The Government and the private sector are involved in producing medicines and vaccines. However, quality control is a critical issue. There should be an independent agency set up by the government to control the quantity and quality of vaccines so that these are available to each farmer in time and in ample quantity. There is need to provide free veterinary services to the pourer members round the clock thereby reducing the cost of cattle treatment so as to maximize the productivity of cattle and buffaloes stock. This leads to increase in milk production and hence the remunerative price to the dairy farmers from sustainability point of view.

- **Price stabilization of milk based on FAT and SNF level**: Price of milk increases in the lean season and decreases in the peak season. Also, high cost of feeds and fodder discourages dairy farmers. This should be countered by a suitable policy of fodder supply in all season and enforcing price setting of milk based on fat and SNF content to encourage production of cow milk.

- **Capacity-building training**: Placing priority on establishing a permanent vocational and outreach training facilities at the National Dairy Training Centre or state level food technology colleges is very much needed for the purpose of development of dairy farming. The dairy farmers need to have better knowledge of feed management. This can be done by involving milk plants and provincial livestock departments who can provide training and extension services to dairy farmers. There should be scope for increasing dissemination of knowledge learned at trainings to the wider group of dairy farmers who could not attend. With the emergence and likely rapid adoption of biotechnologies, farmers will have to improve their skills so that they can use such technologies effectively. Under these conditions, the role of the extension system would become increasingly important in assisting farmers in the improvement of their managerial skills.

- **School lunch (and milk) programme**: Linking state and district milk producers to the mid-day milk programme in MP with Indore Milk Union has facilitated the dairy sector's revival process while introducing/re-introducing children and their parents to the nutritional benefits of local milk by providing milk in the schools as a part of mid-day meal program. This can be extended to other states also.

- **Livestock insurance scheme**: Progress of the Livestock Insurance Scheme has not been very encouraging. Cattle insurance should be structured more efficiently, involving product and services innovations and effective delivery through dairy cooperatives of farmer organisations.

- **Strengthening cooperative milk procurement and services**: The organizational support for milk producers through the cooperative sector should be streamlined and expanded for primary cooperatives for milk procurement. This should be extended to areas where the local market is unable to absorb the milk production and steps should be taken to reorganize and develop rural market for milk. The societies may ensure necessary input services to all producers in due course of time. Timely provision of input services is not only likely to reduce the cost of milk production by increasing the productivity of individual animals but may also work towards improving the overall genetic stock of such milch animals.

- **Mass media outreach**: Mass media may be utilized to a great extent for transfer of improved dairy practices to the needy farmers/pourer members in enriching their knowledge with respect to various activities of dairy farming.

1 Introduction

1.1. Background

The National Dairy Plan Phase I (NDP I) is a Central Sector Scheme for a period of 2012-13 to 2018-19 envisaging a scientifically planned multi-state initiative with the following Project Development Objectives (PDO):

a) To increase productivity of milch animals and thereby milk production to meet the rapidly growing demand for milk

b) To help provide rural milk producers with greater access to the organized milk-processing sector

These objectives are being pursued through adoption of focused scientific and systematic processes in provision of technical inputs supported by appropriate policy and regulatory measures. NDP I has a focus on 18 major milk producing states: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Telangana, Uttarakhand, Chhattisgarh and Jharkhand, which altogether account for over 90% of the country's milk production.

NDP I has three important components pertaining to: a) productivity enhancement; b) Village Based Milk Procurement System (VBMPS) for weighing, testing quality of milk received and making payment to milk producers; and c) project management and learning. These components are further sub-divided into sub-components (Table 1). In particular, the VBMPS helps to improve market access for milk producers in uncovered villages by establishing new Dairy Cooperative Societies (DCS) and also involves strengthening of existing Dairy Cooperative Societies across villages. The enhanced access to organized market is expected to improve the efficiency of the milk producers as well as other allied sectors and occupations.

The project objectives would lead to more livelihood opportunities for the vulnerable sections of the rural community, viz. women, SC/ST and small holders. It would provide them with more income and employment and build their assets and capacities through trainings and so as to develop, empower and sustain them in the long run.

NDP I: COMPONENTS AND SUB-COMPONENTS

[A] Productivity Enhancement - The various sub-components under this component are as follows:

a) Production of high genetic merit (HGM) cattle and buffalo bulls and import of Jersey/ HF Bulls for semen production
Key strategies:
i) Progeny testing;
ii) Pedigree Selection and
iii) Import of bulls (equivalent embryos)

b) Strengthening existing semen stations / starting new stations for producing high-quality disease-free semen doses
Key strategies:
i) Strengthening existing semen stations - (A & B grade semen stations only); and
ii) New Semen stations

c) Setting up a pilot model for viable doorstep AI delivery services (based on Standard Operating Procedures [SOPs]) through a professional service provider including animal tagging and performance record

d) Improving nutrition of milch animals to produce milk commensurate with their genetic potential and for reducing methane emission

Key strategies:
i) Ration Balancing Program- Extension advice would be provided to dairy farmers through trained Local Resource Persons (LRP) on balanced feeding with local feed resources & area specific mineral mixture; and
ii) Fodder Development- Extension initiatives/interventions for fodder development, including support for improved fodder seed production, fodder production on contract, demonstrations for silage making, and reducing wastage of dry fodder through enrichment & densification

[B] Village based milk procurement systems for weighing, testing quality of milk received and making payment to milk producers - The various sub-components under this component are as follows:

a) Milk weighing, testing and collection
b) Milk cooling
c) Support for creating institutional structure; and d) Training

[C] Project Management and Learning - The various subcomponents under this component are as follows:

a) ICT Based MIS- Support for the operations and management of computerized information systems for collection of data and dissemination of information related to breeding, nutrition and village-based milk procurement systems. The project envisages providing funding support to EIAs for acquiring the relevant hardware and software for each component/ sub-component. In addition, the project would also support funding EIAs for specific application software that will enable transmission of aggregate data/ information required for overall monitoring and reporting.

b) Learning & Evaluation- Support to PMU for appropriate computer hardware and application software to create a centralised database that will store and analyse aggregate data/ information transmitted by EIAs to the PMU on breeding, nutrition, and village-based milk procurement systems. The PMU will engage the services of external agencies for carrying out baseline, mid-term and project completion surveys and other special surveys/studies as may be needed during project implementation.

Facilitate learning and documentation of learning experiences with domestic and overseas exposure visits/ study tours/ training of personnel involved in the implementation of different activities. Hiring of consultants/ experts from both within the country and abroad will be carried out, for providing expert/technical guidance in the implementation of different components/ activities of the project.

Source : https://www.nddb.coop/ndpi/about/components

The second social objective of the project is to maintain equitability in the distribution of resources, opportunities and livelihood gains so that social harmony, unity and integrity of the people are promoted. Continued provision of quality input and output support services is quite relevant to dairy farmers from the perspective of dairy promotion as well as sustainable livelihoods. It is also observed that dairy cooperatives are critical in organizing dairy farmers and promotes inclusive development of several small-scale milk producers in India. However, these social objectives are more meaningful only in the event of monetary gain to the dairy farmers. These objectives / outcomes go a long way in sustaining the benefits of a project to a wide section of the rural community, most particularly the vulnerable and the needy ones. Hence, it is important to understand the contribution of the project to the inclusion, equity and income of the dairy farmers in general and vulnerable classes in particular.

1.2. Objectives

The major objectives of the study are as follows:

1) To understand the inclusion of vulnerable population (viz. women, SC/ST and small holders) in the project interventions.

2) To analyze the extent of equity in distribution of resources, opportunities and livelihood gains generated through the project.

3) To estimate the increase in farmer's income as a result of the project interventions.

4) To suggest measures for the sustainability of these factors in the long run.

In order to analyze the extent of inclusion of vulnerable populations and equity in distribution of resources, opportunities and livelihood gains, we use a range of econometric and statistical tools. The success of any program intervention can be truly assessed only by comparing actual and counterfactual outcomes. However, there may be possibility of selection bias while comparing the treated and control groups. For example, the pre-intervention situation of the control and treated groups may not have been same and therefore the direct comparison may be biased. A successful method to treat selection bias is by considering potential non-participants had they participated in the program. Propensity score matching (PSM) constructs a comparison group based on a model of the probability of participating in the treatment, using observed characteristics. On the basis of this participants are matched with nonparticipant group to estimate the average treatment effect (ATE) or the mean difference in the outcomes across these two groups.

1.3. Dairy Sector in India: An Overview

This section presents the trends and patterns on various aspects of milk related activities at the national level as well as in the nine selected states of Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan and Tamil Nadu. As per the basic animal husbandry statistics, since 1991-92, the milk production in India has increased more than three times from 55.6 million tonnes (1991-92) to 176.3 million tonnes (2017-18). Table 1.1 shows the cattle and buffalo population as well as total livestock population in India since 1951. There is a continuous increase in the population across all the selected categories of livestock.

Table 1.1. Cattle and buffalo population in India (in millions), 1951-2012

Year	Cattle	Buffalo	Cattle and Buffalo	Total Livestock
1951	155.3	43.4	198.7	292.9
1961	175.6	51.2	226.8	336.5
1972	178.3	57.4	235.7	353.2
1982	192.5	69.8	262.2	419.6
1992	204.6	84.2	288.8	470.9
2003	185.2	97.9	283.1	485.0
2012	190.9	108.7	299.6	512.1

Source: Livestock Census, Department of Animal Husbandry, Dairying & Fisheries, Government of India.
Note: Total Livestock= cattle, buffaloes, sheep, goats, horses & ponies, camels, pigs, mules, donkeys and yaks.

Table 1.2 shows that the number of dairy cooperatives in India has increased from 13284 to 185903 during 1980-81 to 2017-18. Gujarat had the highest number of dairies in 1980-81 and accounted for 36 % of total dairy cooperatives in that year. Rajasthan and Tamil Nadu had a share of dairies with 10.8 % and 17.9%, respectively. Number of dairy cooperatives in Bihar has increased in 1980-81 to 2017-18 from 0.9% to 11.8%. Similarly, Table 1.3 informs that the absolute numbers of pouring members across the dairy cooperatives have increased in all states.

Further, Table 1.4 reports the distribution of milk procurement per day in selected states. Table 9 shows milk procurement per day in selected states. At the national level, in 1980-81, milk procurement was 2592 thousand kg/day which is increased to 9702 thousand kg in 1990-91 and to 47563 thousand kg/ day in 2017-18. The highest milk procurement comes from Gujarat with 21135 thousand kg/day in 2017-18. The improvement in the per capita milk production in India is associated with the advancement of artificial insemination for the promotion of high yield breeds, increase in the number of dairy cooperatives and also due to expansion of cold chain infrastructure.

Table 1.2. Number of dairy cooperative societies in the selected states

States	1980-81	1990-91	2000-01	2017-18*
Bihar	118	2060	3525	21945
Gujarat	4798	10056	10679	19044
Karnataka	1267	5621	8516	15817
Madhya Pradesh	441	3865	4877	9263
Maharashtra	718	4535	16724	20647
Odisha	N.A	736	1412	5852
Punjab	490	5726	6823	8018
Rajasthan	1433	4976	5900	14496
Tamil Nadu	2384	6871	8369	10806
India	13284	63415	96206	185903

Source: Annual Report, National Dairy Development Board, 2017-18.
Note: *Provisional figures for 2017-18, N.A= not available.

Table 1.3. Number of producer members (in 000's) in the selected states

State(s)	1980-81	1990-91	2000-01	2017-18*
Bihar	3	100	184	1139
Gujarat	741	1612	2147	3507
Karnataka	195	1013	1528	2539
Madhya Pradesh	24	150	242	336
Maharashtra	87	840	1398	1787
Odisha	N.A	46	111	261
Punjab	26	304	370	410
Rajasthan	80	340	436	806
Tamil Nadu	481	1590	1957	1884
India	1747	7482	10738	16574

Source: Annual Report, National Dairy Development Board, 2017-18.
Note: *Provisional figures for 2017-18, N.A= not available.

Table 1.4. Milk procurement per day in the selected states

States	1980-81		1990-91		2000-01		2017-18*	
	In '000 Kg	%	In '000 Kg	%	In '000 Kg	%	In '000 Kg	%
Bihar	3	0.1	95	1.0	330	2.0	1603	3.4
Gujarat	1344	52.5	3102	32.0	4567	27.7	21135	44.4
Karnataka	261	10.2	917	9.5	1887	11.4	7077	14.9
Madhya Pradesh	68	2.7	256	2.6	319	1.9	1105	2.3
Maharashtra	165	6.4	1872	19.3	2979	18.1	3568	7.5
Odisha	N.A	0.0	41	0.4	94	0.6	508	1.1
Punjab	75	2.9	394	4.1	912	5.5	1758	3.7
Rajasthan	138	5.4	364	3.8	887	5.4	2845	6.0
Tamil Nadu	301	11.7	1106	11.4	1618	9.8	3039	6.4
India	2562	100.0	9702	100.0	16504	100.0	47563	100.0

Source: Annual Report, National Dairy Development Board, 2017-18.
Note: *Provisional figures for 2017-18, N.A= not available.

2 Data and Methodology

2.1. Study Design

The present study aims to understand the contribution of the NDP I to inclusion, equity and income of the dairy farmers. While examining these issues it is important to use a combination of quantitative and qualitative methods to enhance the quality of results and reduce the chance of bias. Data collected through quantitative methods are designed to ensure objectivity, reliability and generalizing of the findings. Quantitative methods provide estimates based on statistical underpinnings and can be useful while deciding upon choices regarding policy and developmental needs.

Although, such data are robust and objectively verifiable but they may not completely capture the factors and perspectives that can be useful for policy. On the other hand, qualitative data is obtained from recordings of interviews, notes of observations, and analysis of documents as well as reflective notes of the researcher. This information have to be organized, summarized, described and interpreted. The key methods involved in qualitative data collection are reviews from direct observations, key informant interviews (KII), focused group discussions (FGD) and participatory rapid appraisal (PRA).

The study adopts a multistage sampling strategy to select the survey respondents. Out of the eighteen states where NDP-1 intervention has taken place, nine states are selected for the present study. These states are: Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu. In particular, two states each were selected from the northern, eastern, western and southern region of India, whereas one state was selected to represent the central region. These states are then classified into regions and agro-climatic zones whereby one district per region was selected for the sampling purposes. For the selection of the districts, we listed those districts from the nine states in which both Rational Balancing Programme (RBP) and Village Based Milk Procurement System (VBMPS) programme was implemented under NDP I. Thus, overall 36 districts are selected for the study.

Table 2.1: List of districts selected for the study

State	Zone	Districts (RBP + VBMPS)
Maharashtra	East	Bhandara
	West	Aurangabad
	South	Kolhapur
	Central West	Ahmednagar
Karnataka	South	Udupi
	East	Kolar
	West	Uttar Kannada
	South West	Rural Bangalore
Punjab	East West	Patiala
	East	SAS Nagar
	South	Bhatinda
	Central	Ludhiana
Odisha	East	Kendrapara
	South East	Puri
	Centre	Cuttack
	North west	Sambalpur
Bihar	Central	Patna
	South	Gaya
	North	Samastipur
	East	Khagaria
Rajasthan	East	Jaipur
	South	Udaipur
	South	Bhilwara
	West	Jodhpur
Madhya Pradesh	West	Ratlam
	West	Ujjain
	Centre	Bhopal
	South	Indore
Tamil Nadu	North	Tiruvallur
	West	Coimbatore
	South	Tirunelveli
	Central	Salem
Gujarat	Central	Anand
	West	Kutch
	North	Banas
	South	Bharuch

Map 2.1: Selected Districts for the Study
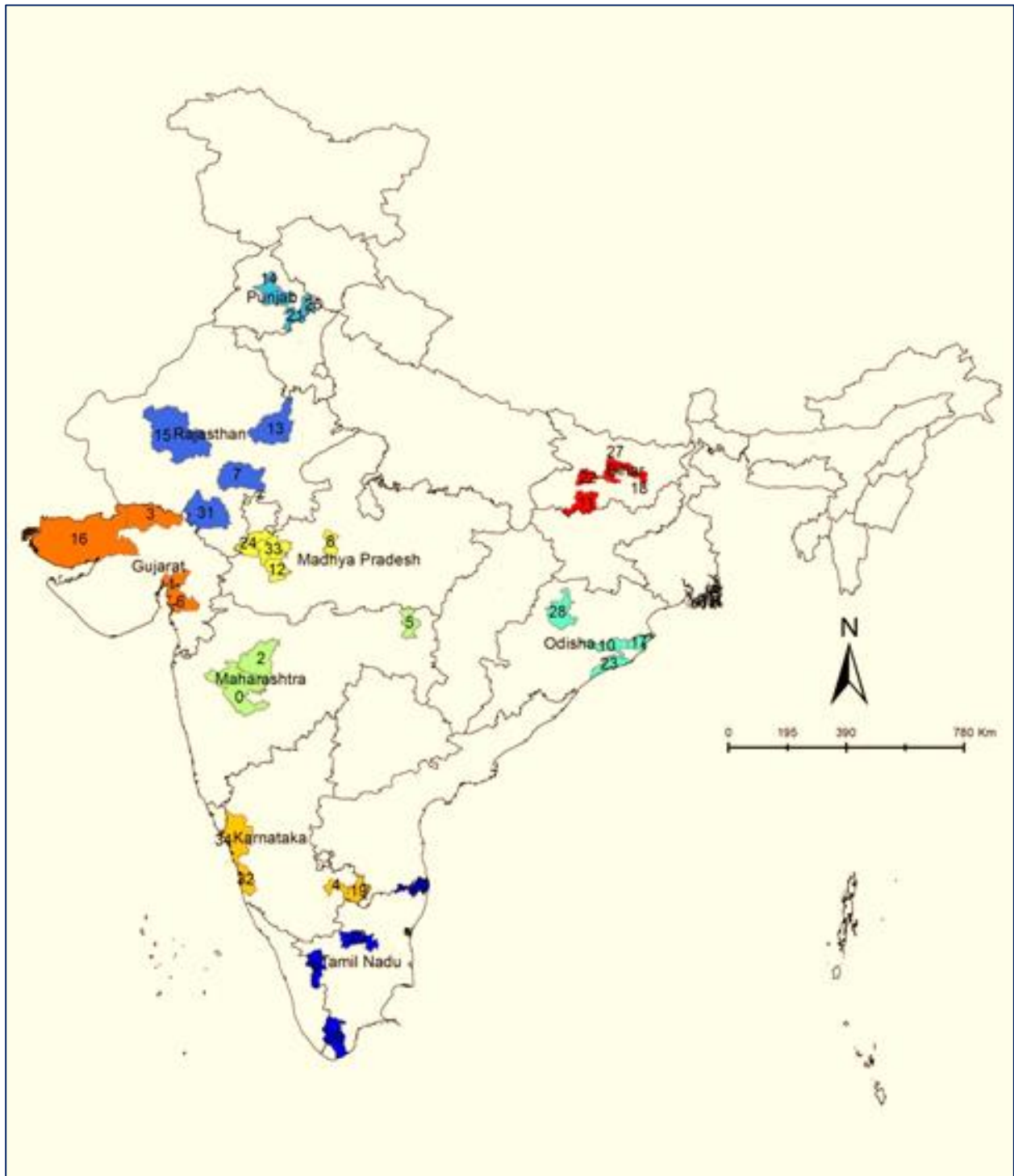
Note: States selected for the study are as follows: Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, and Tamil Nadu.

Table 2.2: List of milk unions selected for the study

State	District	Milk Union
Tamil Nadu	Kancheepuram	Kancheepuram Thriuvallur Milk Union
	Salem	Salem Nammakkal Milk Union
	Coimbatore	Coimbatore Milk Union
	Tirunelveli	Tirunelveli Thuthokudi Milk Union
Rajasthan	Udaipur	Udaipur Zila Dugdha Utpadak Sahkari Sangh Limited
	Bhilwara	Bhilwara Zila Dugdha Utpadak Sahkari Sangh Limited
	Jaipur	Jaipur Zila Dugdha Utpadak Sahkari Sangh Limited
	Jodhpur	Pashchimi Rajasthan Dugdha Utpadak Sangh Limited
	Udaipur	Udaipur Zila Dugdha Utpadak Sahkari Sangh Limited
Gujarat	Anand	Kaira District cooperative Milk Producers Union limited
	Kutch	Kutch District cooperative Milk Producers Union limited
	Bharuch	Bharuch District cooperative Milk Producers Union limited
	Banaskatha	Banaskatha District cooperative Milk Producers Union limited
Maharashtra	Bhandara	Bhandara Zila Dugdha Utpadan Sahkari Sanstha Maryadit
	Aurangabad	Aurangabad Zilla Sahakari Dugdha Utpadak Sangh
	Ahmednagar	Sangamner Taluka Sahakari Dugdha Utpadak & Prakriya Sangh Maryadit
	Kolhapur	Kolhapur Zila Sahakari Dugdha Utpadak Sangh Maryadit
Bihar	Patna	Vaishali Patliputra Dugdha Utpadak Sahkari Sangh limited
	Samastipur	Samastipur Mithila Dugadha Utpadak Sahkari Sangh limited
	Khagaria	Deshratna Dr. Rajendra Prasad Dugadha Utpadak Sahkari Sangh limited
	Gaya	Magadh Dugadha Utpadak Sahkari Sangh limited
Karnataka	Uttar Kannada	Dharwad Milk Union limited
	Rural Bangalore	BAMUL – Bengaluru Rural & Urban and Ramnagar District Cooperative Milk Producer Societies Union limited
	Udupi	Dakshina Kannada Cooperative Milk Producers Union limited
Madhya Pradesh	Bhopal	Bhopal Dugadha Utpadak Sahkari Sangh limited
	Ujjain and Ratlam	Ujjain Dugadha Utpadak Sahkari Sangh limited
	Indore	Indore Dugadha Utpadak Sahkari Sangh limited
Punjab	Patiala	Patiala District Co-operative Milk Producers Union Limited, (Verka Dairy)
	Mohali	Mohali District Co-operative Milk Producers Union Limited, (Verka Dairy)
	Jalandhar	Jalandhar District Co-operative Milk Producers Union Limited, (Verka Dairy)
	Ludhiana	Ludhiana District Co-operative Milk Producers Union Limited, (Verka Dairy)
Odisha	Puri	Puri Co-operative Milk Producers Union Limited, Puri Milk Union, Bhubaneswar
	Cuttack, Kendrapara	Cuttack Co-operative Milk Producers Union Limited, Cuttack Milk Union
	Sambalpur	Samaleswari Regional Co-operative Milk Producers Union Limited

From each of these districts, two development blocks were selected and further 4 villages were chosen from each of them. The selection of intervention village was based on characteristics of DCS i.e. New DCS and Strengthen DCS under NDP-I across four regions of the country for the present study. The selection of districts and villages were made on the RBP and VBMPS programs have been implemented. The selection of control village was based on the basis of non-intervention of NDP-I. Overall, the data was collected from 144 villages from 36 districts of 9 states. In total 28 DCS members as respondents were selected randomly from 144 intervention villages leading to a total of 4032 respondents (inclusive of women, small holders and SC/ST group people). Also, 7 respondents were selected randomly from 144 control villages leading to a total of 1008 respondents.

2.2. Field Implementation

The study team organized training workshops to train the field supervisors as well as personnel at IEG who were engaged in monitoring and supervision of the field survey activities. The main objective of the training was to ensure uniformity in field implementation approach and procedures adopted for data collection in various states and districts. The field supervisors as well as IEG personnel further organized district-level training workshop with the interviewers in all the selected districts. Study coordinators and senior project staff from IEG were the resource persons for the trainings. Data coordinators was trained for editing the questionnaires and for data entry in software (MS Excel).

The fieldwork in each state was carried by interviewers hired by IEG specifically for the conduct of the study. The selection aimed to consider aspects such as local language and conditions. The quantitative questionnaires were translated in local language in selected states. The Milk Unions across various districts was also approached to understand local contexts for the survey. Field testing of study tools team was conducted in Jaipur during March 2018. The field survey was conducted across the various states and districts during June 2018 to February 2019.

2.3. Sample Profile

Table 2.3 shows the percentage distribution of the respondents by selected socio-economic characteristics in both control and intervention villages. Proportion of respondents being males, more than 25 years old and who have completed till primary are higher in both control and intervention villages. The percentage of respondents who belong to OBC (43.8 per cent) is the highest in control and those who belong to General (48.2 per cent) category are highest in intervention village. Proportion of marginal farmers are higher in both control (48.4 per cent) and intervention villages (33.5 per cent). Principal Component Analysis was used to create an asset index. Based on this the households were categorized into two groups Quintile 1 (lower 50% on asset index) and Quintile 2 (higher 50% on asset index).

Table 2.3: Demographic and socioeconomic profile of respondents

	Control	Intervention
Age of Respondent		
Less than equal to 25	2.9	5.4
More than 25 years	97.1	94.7
Education of Respondent		
Below or completed primary	88.9	84.9
More than Primary education	11.1	15.2
Gender of Respondent		
Female	20.4	24.2
Male	79.6	75.9
Caste of Respondent		
General	38.4	48.2
SC/ST	17.8	15.8
OBC	43.8	36.1
Land holding size		
Marginal	48.4	33.5
Small	20.0	22.1
Medium	17.1	20.4
Large	14.5	24.0
Wealth quintile		
Quintile 1	58.7	48.0
Quintile 2	41.3	52.0
Marital Status		
Unmarried	10.8	7.2
Married	89.2	92.8
Total	100.0	100.0

Interaction at diary plant in Kutch, Gujarat

Focus group discussion with dairy farmers, Odisha

Focus group discussion with women dairy farmers, Punjab

3 Key Findings

3.1 Inclusion of Vulnerable groups

3.1.1 Prior Knowledge and Motivation to Start Dairy Farming

Table 3.1 presents the percentage of respondents who have prior knowledge in dairy farming by their social background. Coming to DCS as source of knowledge, there are only 4 % of the respondents in control group belonging to SC/ST while considerably higher (18.8 %) in the intervention group. There is scope to improve knowledge among the SC/STs as compared to other categories as dissemination through this channel is still lower.

Table 3.1: Source of knowledge among respondents who have reported prior knowledge of dairy farming by social group

Control	General	SC/ST	OBC	Total
Family members	80.1	81.2	73.9	77.5
Friends/relatives	15.3	14.9	14.4	14.8
DCS	4.0	4.0	10.9	7.1
Intervention				
Family members	61.4	61.9	59.6	60.9
Friends/relatives	19.1	19.1	16.0	18.1
DCS	21.4	18.8	23.3	21.6
NGO's/SHG's	0.5	0.3	1.1	0.7

The source of motivation among respondents is reported in Table 3.2, the respondents who are encouraged by DCS, are higher in intervention area as compared to control area. It is 5.7% in general category in control area and considerably higher 24% in OBC in the intervention area; SC/ST - 10% in control and 28% in intervention area. Self-motivation by farmers is slightly higher in control area indicating that the intervention could be more successful when coverage is increased. Table 3.3, considering the control group, there are 89.6% of the respondents who possess large cultivated/non-cultivated lands got knowledge of dairy farming from their family members. While this category accounts for 73.8% in intervention group. In the marginal land ownership category and knowledge from family members accounts for 84% in control group and only 49.3% in intervention areas. Under the marginal land ownership and knowledge gained from DCS accounts for only 3% in control area and at huge difference as 29.9% in intervention areas. Table 3.4 shows that for the motivation by DCS, 18%

of the marginal landowners are in control group and 23.8% in intervention group. Coming to the medium sized land owners, 14.3% in control and 30.6% in intervention group are motivated by DCS. The large sized land owners and who got motivation from DCS accounts for 6.3% in control and 21.5% in intervention group.

Table 3.2: Source of motivation among respondents who have reported prior knowledge of dairy farming by social group.

Control	General	SC/ST	OBC	Total
Encouraged by parents/relatives/friends	65.3	50.5	50.9	55.8
Introduced by DCS	5.7	9.9	26.5	16.0
Motivated by Govt/NGO(specify)	0.0	2.0	1.7	1.2
Self-motivated	8.5	18.8	9.1	10.9
Inherited	18.8	18.8	13.9	16.6
Intervention				
Encouraged by parents/relatives/friends	61.6	53.9	46.1	55.4
Introduced by DCS	20.9	27.9	28.8	24.5
Motivated by Govt/NGO(specify)	1.4	1.9	3.0	2.0
Self-motivated	9.4	5.0	10.1	9.0
Inherited	9.7	10.8	11.9	10.6

Table 3.3: Source of knowledge among respondents about Dairy Farming by land holding size

Control	Marginal	Small	Medium	Large	Total
Family members	84.0	66.3	71.4	89.6	79.1
Friends/relatives	13.5	30.1	17.9	6.3	16.8
DCS	3.0	3.6	8.9	0.0	3.6
Intervention					
Family members	49.3	60.8	62.2	73.8	60.7
Friends/relatives	20.0	24.2	22.3	10.5	19.0
DCS	29.9	18.8	18.3	16.9	21.8
NGO's	0.3	0.2	0.0	0.8	0.3
SHG's	0.9	0.4	0.2	0.4	0.5

Table 3.4: Source of motivation among respondents who have reported prior knowledge of dairy farming by land holding size.

Control	Marginal	Small	Medium	Large	Total
Encouraged by parents/relatives/friends	58.5	44.6	55.4	60.4	55.3
Introduced by DCS	18.0	14.5	14.3	6.3	15.3
Motivated by Govt/NGO(specify)	1.5	0.0	1.8	0.0	1.0
Self-motivated	9.0	21.7	17.9	8.3	12.9
Inherited	13.0	24.1	14.3	22.9	16.8
Intervention					
Encouraged by parents/relatives/friends	43.8	61.9	54.4	60.7	54.2
Introduced by DCS	23.8	23.2	30.6	21.5	24.5
Motivated by Govt/NGO(specify)	1.8	2.4	2.4	1.7	2.0
Self-motivated	14.1	7.4	8.3	8.4	10.0
Inherited	16.3	8.7	7.8	9.9	11.3

3.1.2 Ration Balancing

Table 3.5 depicts the percentage of respondents who confirmed local resource person (LRP) visit, advice for balancing feeding, follow up visit by LRP and also who follow instructions provided by LRP by socioeconomic characteristics in the intervention area. Across age cohorts, out of total respondents the LRP visit for milch animals monitoring and measurement under RBP is around 57 percent for old and young age cohort. The LRP advice for balance feeding for young cohort is 94 percent while that of old cohort is 86 percent. The percentage of respondents who confirmed that the LRP follow up on regular basis is 87 percent for young cohort and 82 percent for the old cohort.

Table 3.5: Percentage who confirmed LRP visit, advise for balanced feeding, follow up visits by LRP and who follow instructions provided by LRP by socio economic characteristics, Intervention area

	LRP visit monitoring and measurement	LRP advise for balanced feeding	LRP follow up regular basis	% who follow the instructions and advise by LRP
Age of Respondent				
Less than equal to 25	56.8	91.0	86.8	95.1
More than 25 years	58.3	87.2	79.9	93.0
Education of Respondent				
Below or completed primary	58.2	87.5	79.6	93.8
More than Primary education	57.7	87.1	83.8	89.4
Gender				
Female	70.6	84.2	73.8	94.7
Male	53.6	88.9	83.4	92.4
Caste of Respondent				
General	51.3	87.5	80.7	91.2
SC/ST	56.0	89.0	78.1	94.7
OBC	67.3	86.9	80.6	94.2
Wealth quintile				
Quintile 1	61.2	87.1	81.7	95.4
Quintile 2	55.4	87.8	78.8	90.5
Land				
Marginal	52.3	84.9	81.7	95.4
Small	62.2	89.3	81.0	93.2
Medium	65.1	90.0	75.5	90.2
Large	56.9	96.4	79.0	93.4
Total	58.2	87.5	80.3	93.1

Lastly, the respondents who confirmed the follow the instructions and advice given by LRP is almost 100 percent. Across genders the female confirmation on the LRP visit for the milch animals for monitoring and measurement under RBP is 73 percent while that of male category is 51 percent. As per the LRP advice for balanced feeding is concerned it is 89 percent for male and 81 percent for female

category. The female respondents confirmed the LRP follow up on regular basis is 84 percent for male and 79 percent for female category. Across caste groups those who confirmed the LRP visit for the milch animals are 48 percent for the general category, 57 percent for the ST/SC category and 66 percent for OBC. The LRP visit on balanced feeding is almost 80 percent across caste groups. The LRP follow-up on regular basis is also confirmed by more than 80 percent of the respondents.

Across wealth and land distribution, the pattern is similar. In the lower and upper wealth quintile percentage of respondents who confirmed that the LRP visit for milch animals is almost 57 percent. While those who confirmed the LRP advice for regular balanced feeding is 90 percent in the lower wealth quintile and 83 percent for the upper quintile. Those who confirmed the follow up of LRP on regular basis is 82 percent for lower and upper quintile. Those who confirmed to follow up the instructions and advice given by LRP is 99 percent for both upper and lower wealth quintile groups.

Lastly, across land categories respondents who confirmed the LRP visit for the milch animals their percentage is higher for medium land size and lower for the large land size. Those who confirmed that the LRP visit advised for balanced feeding is close to 90 percent across different land sizes. Those who confirmed the LRP visit follow up on regular basis is higher for small land holders. Lastly, the percentage of respondents confirmed the follow the instruction and advice of LRP is almost same across different land distributions in the intervention area. These results shows that the percentage of respondents who confirmed the LRP visit has improved through different parameters differs across various socioeconomic dimensions.

In the intervention areas the Local Resource person have been assigned the task to visit the households and follow-up with them. In this respect, it has been tested whether there is any discrimination across socio-economic groups. The association between advice received from LRP and follow-up visits under DCS with their socioeconomic correlates is presented in Table 3.6 from a logistic regression. Here dependent variable in Model 1 is binary with 1 indicating that the beneficiary has received advice from LRP about ration balancing; and 0 indicates that no advice was received. In Model 2, 1 indicates that the beneficiary has received follow-up visit from LRP; and 0 indicates that no follow-up visit took place. It is observed that across farmers with different land holding size, the odds that advice was received by medium farmers (OR.32; 95% CI: 0.16,0.63) , small farmers (OR.31; 95% CI: 0.16,0.60) and marginal farmers (OR.30; 95% CI: 0.11,0.38) are lower compared to those who are considered as large farmers. It seems that those who belong to quintile 2 (upper quintile) and are more than 25 years old are less likely to receive a follow –up visit (OR.80; 95% CI: 0.61,1.04) and (OR.44; 95% CI: 0.22,0.89).

	Received LRP advice for balanced feeding		LRP follow up On regular basis	
Age of Respondent Less than equal to 25				
More than 25 years	0.84	[0.37,1.93]	0.44**	[0.22,0.89]
Education Of Respondent				
Below or completed primary				
More than Primary education	0.57**	[0.36,0.91]	1.34	[0.90,1.99]
Gender				
Female				
Male	1.2	[0.82,1.76]	1.95***	[1.49,2.57]
Caste Of Respondent				
General				
SC/ST	1.43	[0.80,2.54]	0.97	[0.65,1.45]
OBC	1.12	[0.77,1.65]	1.11	[0.84,1.47]
Wealth quintile				
Quintile 1				
Quintile 2	1.23	[0.86,1.77]	0.80*	[0.61,1.04]
Land				
Large				
Medium	0.32***	[0.16,0.63]	0.84	[0.58,1.21]
Small	0.31***	[0.16,0.60]	1.17	[0.80,1.71]
Marginal	0.20***	[0.11,0.38]	1.29	[0.90,1.85]

Table 3.7: Percentage who report LRP visit, advise for balanced feeding, follow up visits by LRP and who follow instructions provided by LRP by State, Intervention area

	LRP visit monitoring and measurement	LRP advise for balanced feeding	LRP follow up regular basis	% who follow instructions and advise by LRP
Bihar	68.2	85.6	97.6	99.6
Gujarat	22.7	93.0	95.6	97.6
Karnataka	65.6	100.0	72.6	100.0
Madhya Pradesh	71.0	97.3	87.0	99.4
Maharashtra	66.1	87.4	70.7	98.7
Odisha	24.2	100.0	100.0	100.0
Punjab	0.0			
Rajasthan	73.3	98.1	73.6	100.0
Tamil Nadu	94.2	18.5	79.8	98.5
Total	57.2	86.5	82.6	99.3

Table 3.7 presents the percentage of respondents who conformed LRP visit, advice for balanced feeding, follow up visit by LRP and who follow the instructions provided by states in the intervention area. Percentage of respondents who have confirmed the LRP visit for milch animal monitoring and measurement under RBP is higher for Tamil Nadu followed by Madhya Pradesh and lower in Gujarat

followed by Odisha in the intervention area. The respondent's confirmation on LRP advice for balanced feeding is higher for Karnataka and Odisha and lower for Tamil Nadu (18%). On the LRP follow up on regular basis, the percentage of repondnets who confirmed is higher in Odisha followed by Bihar and lower in Maharashtra. The percentage of respondents who confirmed the follow the instructions and advice given by LRP is higher in Karnataka, Odisha and Rajasthan. In all other states the respondent's confirmation is close to 95 percent in intervention area.

3.1.3 Subsidy

Table 3.8 reflects the percentage of respondents who received subsidy for purchasing breed, infrastructure development, fodder feeding, cultivation of fodder, veterinary services and AI services by States. In the control area out of total respondents, the percentage of respondents who informed that they have received subsidy on purchasing of breed is higher in Karnataka in the control area and Odisha in the intervention area.

Table 3.8: Percentage who received subsidy for purchasing breed, infrastructure development, fodder feeding, cultivation of fodder, veterinary services and ai services by State

	Purchasing on breed	Infrastructure development for cattle	Fodder/feeding intake	Cultivation of fodder	Veterinary	AI services
Control						
Bihar	1.0	0.9	0.9	0.9	0.0	0.0
Gujarat	4.1	5.3	5.2	5.6	34.0	31.0
Karnataka	40.0	0.0	80.0	80.0	40.0	0.0
Madhya Pradesh	0.0	0.0	0.0	0.0	0.0	0.0
Maharashtra	20.0	6.5	20.6	25.3	30.5	6.9
Odisha	0.0	0.0	4.8	0.0	4.8	1.0
Punjab	0.0	0.0	9.1	0.0	9.1	9.1
Rajasthan	0.0	0.0	0.0	0.0	0.0	0.0
Tamil Nadu	0.0	0.0	16.4	0.0	56.4	60.0
Total	4.6	1.9	8.6	6.3	18.1	12.4
Intervention						
Bihar	1.8	10.1	68.3	62.5	67.6	64.9
Gujarat	0.0	0.6	0.6	0.0	19.5	6.3
Karnataka	10.5	27.4	22.0	11.8	42.9	12.5
Madhya Pradesh	0.6	0.6	0.6	1.7	0.6	0.6
Maharashtra	15.3	8.1	21.7	20.8	45.1	4.0
Odisha	18.9	33.9	24.3	6.8	24.6	23.7
Punjab	1.0	1.1	50.0	12.3	48.7	14.9
Rajasthan	14.6	22.6	41.9	31.5	55.0	39.1
Tamil Nadu	15.3	23.9	23.3	16.9	68.4	75.4
Total	10.4	16.2	30.6	21.3	42.7	30.9

On infrastructural development of cattle, the percentage of respondent got subsidy is higher in Maharashtra in the control area and Odisha in the intervention area. Respondents who has got subsidy

on fodder and feeding intake the percentage distribution is higher in Karnataka in the control area and Bihar in intervention area. On cultivation of fodder, the percentage distribution is higher in Karnataka in the control area and Bihar in the intervention area. The percentage of respondents who informed that they have received subsidy on veterinary service is higher in Tamil Nadu both in control and intervention area. Lastly, the respondents informed to get subsidies on AI services is again higher in Tamil Nadu both across control and intervention area.

3.1.4 Herd Size

Table 3.9 shows that male respondents in both the control and intervention areas have reported that they own more animals as compared to the female respondents. Category wise the general category households own a large number of cows (3.12) and buffalos (5.02) in intervention areas as compare to other social groups. Those who belong to higher quintile have more animals in both the regions. Farmers with large land holdings own a large number of animals in intervention areas. Clearly, there are socio-economic inequalities when the distribution of animals is considered and they persist in both control and intervention areas. Notably, the average herd size is bigger in intervention areas.

Table 3.9: Mean herd size by Socio-economic characteristics

	Cow			Buffalo			Herd		
	Control	Int.	t-test	Control	Int.	t-test	Control	Int.	t-test
Age of Respondent									
Less than equal to 25	1.57	3.46	0.00	2.00	2.69	0.36	3.1	5.6	0.04
More than 25 years	1.78	2.62	0.00	1.91	3.96	0.00	3.1	4.6	0.00
Education									
Below or completed primary	1.78	2.55	0.00	2.05	3.69	0.00	3.3	4.6	0.00
More than Primary education	1.79	3.34	0.01	0.94	4.66	0.00	2.1	5.0	0.00
Gender									
Female	1.71	1.69	0.91	1.32	2.42	0.03	2.6	3.6	0.06
Male	1.80	2.96	0.00	1.98	4.24	0.00	3.2	4.9	0.00
Caste of Respondent									
General	1.86	3.12	0.00	2.36	5.02	0.00	3.6	5.0	0.01
SC/ST	2.08	2.00	0.75	2.11	3.02	0.17	3.5	4.1	0.45
OBC	1.63	2.29	0.00	1.53	2.74	0.00	2.7	4.4	0.00
Wealth quintile									
Quintile 1	1.72	1.89	0.15	1.35	2.83	0.00	2.5	4.0	0.00
Quintile 2	1.87	3.22	0.00	2.89	4.26	0.03	4.4	4.7	0.56
Land									
Marginal	1.56	1.88	0.02	1.14	1.75	0.12	1.9	3.1	0.00
Small	2.03	2.16	0.73	1.65	3.30	0.00	2.7	4.6	0.00
Medium	1.90	2.58	0.13	1.70	2.98	0.02	3.2	3.8	0.28
Large	1.68	3.39	0.06	1.79	4.54	0.00	3.3	4.3	0.09
Total	1.8	2.7	0.00	1.9	3.8	0.00	3.1	4.7	0.00

3.2 Equity Considerations

3.2.1 Benefits received by Beneficiaries

Table 3.10 shows that beneficiaries whose age lies below or equal to 25, 21.9 percent of the beneficiaries' respond to get the high benefit on the subsidised fodder which follows 20.8 percent the benefits on the loan/cash bonus. Similarly, the beneficiaries whose age are more than 25 years, 33.6 percent of the beneficiaries respond to get the high benefit received on the free training, it followed 27.1 percent on the subsidized fodder. Beneficiaries who are below or completed primary, 33.8 percent of the respondents respond to get the high benefit on the free training; secondly, 27.4 percent gave the response on the subsidized fodder.

Table 3.10: Benefits received by beneficiaries from DCS by socio-economic characteristics (Interventional area)

	benefits of loan/cash bonus	fodder at subsidized price	Veterinary service at free of cost	free training
Age of Respondent				
Less than equal to 25	20.8	21.9	15.6	16.2
More than 25 years	18.7	27.1	21.4	33.6
Education Of Respondent				
Below or completed primary	18.8	27.4	22.0	33.8
More than Primary	19.8	24.4	16.7	27.4
Gender				
Female	16.5	34.2	25.1	31.9
Male	19.4	24.5	20.0	32.9
Caste Of Respondent				
General	22.2	25.0	18.3	28.5
SC/ST	15.0	32.4	25.4	31.5
OBC	15.9	26.7	23.0	38.6
Wealth quintile				
Quintile 1	19.6	27.2	23.0	30.8
Quintile 2	17.6	26.6	19.7	34.4
Land				
Marginal	19.4	35.8	22.1	37.5
Small	17.1	25.2	22.2	34.5
Medium	17.9	25.8	23.1	35.4
Large	18.0	18.0	14.2	36.4
Total	18.7	26.8	21.1	32.5

Similarly, more than primary educated beneficiaries gave the same response to get the benefit more on the free training services then subsidized fodder. Gender wise, 31.9 percent of the male beneficiaries respond to get high benefit on the training services received from the DCS whereas female beneficiaries respond to get high benefit on the subsidized fodder. Social Category wise, SC/ST beneficiaries respond to get high benefit on the subsidized fodder (32.4 percent) whether they get

low benefit on the cash/loan (15 percent). Similarly, beneficiaries belong to the OBC category respond to get the high benefit on the free training services (38.6 percent) and low on the benefits on loan/cash (15.9 percent).Beneficiaries who belong to the lower quintile, 30.8 percent respond to get the high benefit on the free training. Around 19.6 percent of the beneficiaries get the benefit on loan/cash which is lowest among all the slots.

Among the land holders, marginal land holder's beneficiaries respond to get high benefit they received on the training services (37.5 percent) which they received at the DCS level and low on the veterinary services. Marginal farmers get more benefitted on the subsidized fodder (35.8 percent) they get from the DCS. Small and Medium landholders get the high benefit on the veterinary services at free of cost. Overall the beneficiaries respond to get the high benefits on the services on free training and low on the veterinary services.

Table 3.11 display concentration index estimates regarding distribution of specific benefits under NDP across household's monthly per capita expenditure. Clearly, the positive value of CI for loan benefits under NDP is 0.15 (SE: .013) reflecting higher concentration of benefits among farmers from affluent background. Further, it can be observed from table 3 that benefits related to free veterinary services are significantly concentrated among poorer farmers as the value of CI is -0.024 (SE: 0.021). In addition to this the services related to free training and capacity building is also more agglomerated among farmers from economically vulnerable background,

Table 3.11: Concentration Index Regarding Distribution of NDP Benefits across Household's Monthly Per Capita Expenditure, India

Benefits	CI	SE
Loan or Cash	0.145**	0.013
Fodder at Subsidized Price	0.041**	0.017
Free Veterinary Service	-0.024***	0.021
Free Training	-0.122***	0.015

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

In order to further confirm the idea of equity among socio-economic groups, the association between benefits obtained under DCS with their socioeconomic correlates is presented in table 3.12 below from a simple logistic regression. Here dependent variable is binary with 1 indicating that the beneficiary has receive at least one benefit out of the four benefits which are Loan or Cash, Fodder at Subsidized Price, Free Veterinary Service and Free Training; and 0 indicates that no benefit was received. It is observed that across social groups, the benefits receive by SC/ST farmers (OR1.63; 95% CI: 1.24,2.13) and OBC farmers (OR: 1.47; 95% CI: 1.22,1.78) are higher compared to those from general category. Also, it is

observed that across farmers with different land holding size, the benefits receive by small farmers (OR1.26; 95% CI: 0.98,1.61) and marginal farmers (OR: 1.46; 95% CI: 1.16,1.83) are higher compared to those who are considered as large farmers.

Table 3.12: Logistic Regression results for benefits received by beneficiaries from the interventional area DCS

Age of Respondent		
Less than equal to 25		
More than 25 years	1.19	[0.82,1.71]
Education Of Respondent		
Below or completed primary		
More than Primary education	0.83	[0.66,1.04]
Gender		
Female		
Male	0.98	[0.80,1.21]
Caste Of Respondent		
General		
SC/ST	1.63***	[1.24,2.13]
OBC	1.47***	[1.22,1.78]
Wealth quintile		
Quintile 1		
Quintile 2	0.9	[0.76,1.07]
Land		
Large		
Medium	1.21	[0.95,1.55]
Small	1.26*	[0.98,1.61]
Marginal	1.46***	[1.16,1.83]

Note: Here dependent variable is that the beneficiary has receive at least one benefit out of the four benefits which are Loan or Cash, Fodder at Subsidized Price, Free Veterinary Service and Free Training

Milch animals

Table 3.13 is showing the percentage of respondents reporting that a loan was taken for cow/buffalo and they follow the ration balancing programme by socio-economic characteristics. Comparing the respondents land wise, it can be seen that respondents belonging to marginal lands in the control villages are more taking loan for cow i.e. 13.8% as compared to respondents belonging to small, medium and large lands.

Moving to the intervention villages, it can be seen that out of the total respondents belonging to the intervention villages, there are almost equal number of respondents but with a slight difference who are above and below 25 years old who reported that a loan was taken for cow and buffalo under ration balancing programme. Coming to the education level, there is again almost equal number of respondents having below or completed primary education and more than primary education in the

intervention villages who reported that a loan was taken for cow and buffalo and there is more or less equal distribution of genders among all the respondents.

The data is depicting that the respondents belonging to the intervention villages of all the states are also almost equally divided among all the three categories i.e. General, SC/ST and OBC i.e. 8.4%, 7.7% and 9.9% of the respondents taken loan for cow and 9%, 4.3% and 5% of the respondents taken loan for buffalo. Comparing the respondents land wise, it can be seen that respondents belonging to small lands in the intervention villages are more taking loan for buffalo i.e.11.2percentage as compared to respondents belonging to marginal, medium and large lands. On the other hand, there is almost equal distribution of respondents in intervention villages belonging to marginal, small, medium and large lands who have taken loan for cow.

Table 3.13: Percentage respondents reporting that a loan was taken for cow/ buffalo and they follow the ration balancing programme by socio-economic characteristics

	Intervention			
	Loan taken for cow	Under RBP cow	Loan taken for buffalo	Under RBP buffalo
Age of Respondent				
Upto 25	2.7	9.0	6.4	7.9
More than 25 years	5.1	8.7	6.5	9.2
Education				
Below or completed primary	4.9	8.7	6.3	9.4
More than Primary education	5.3	8.9	8.1	7.9
Gender				
Female	2.9	10.7	7.4	7.0
Male	5.5	7.9	6.2	9.8
Caste of Respondent				
General	6.6	8.4	9.0	9.4
SC/ST	3.8	7.7	4.3	10.9
OBC	3.3	9.9	5.0	8.1
Wealth quintile				
Quintile 1	4.6	10.4	7.3	7.6
Quintile 2	5.0	6.7	6.1	9.9
Land				
Marginal	2.6	8.1	6.7	9.4
Small	5.8	10.3	11.2	6.1
Medium	5.3	7.7	3.8	4.6
Large	4.7	5.0	5.0	5.1

Table 3.14 displays the concentration index values regarding distribution of Ration Balancing Programme beneficiaries across monthly per capita expenditure. It can be observed from table that the RBP beneficiaries for cow is significantly agglomerated among poorer farmers as the CI value for intervention group is -0.032 (SE: 0.014). The CI value for cow or buffalo in the intervention group is -

0.058 (SE: 0.015).   This clearly implies that under intervention group the benefits of RBP is concentrated among poorer farmers.

Table 3.14: Concentration Index regarding Distribution of Ration Balancing Programme beneficiaries in Intervention Groups

	Intervention	
	CI	SE
RBP - Cow	-0.032	0.014
RBP - Buffalo	0.098***	0.026
RBP - Cow or Buffalo	-0.058***	0.015

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level. SE – standard error

Training and Programme

Table 3.15 shows the percentage of respondents who have reported training in the intervention areas in the selected states in India. The reported training for VBMPS, RBP, and Fodder development has been cross tabulated with socioeconomic factors and presented in Table 1. In the present sample under 25 years of age, around 20.6% of them have reported training on VBMPS, 25.6% on ration balancing, and 6.2% on fodder development. In the respondent's category of 25 and above, around 36% have received training on VBMPS, 42.9% on RBP, and 23.7% on Fodder development.

The percentages of respondents who have received training are higher in numberupto primary level education standard. Among respondents in primary education level, around 36.1 % have received training in VBMPS, 42.6% in RBP, and 23.3% on Fodder development. Female respondents are more in numbers who have received training than their male counterparts. The respondents in lower wealth quintile are more in number who has received training in VBMPS, RBP, and Fodder development. In the land ownership categories, highest numbers belong to respondents in the medium category as 45.7% VBMPS, 49.6% RBP, and 25.4% Fodder development.

As a part of the intervention, training has been provided about VBMPS, ration balancing and food procurement. Here, the association between at least one of these training obtained under DCS with their socioeconomic correlates is presented in table 3.16 below from a simple logistic regression. Here dependent variable is binary with 1 indicating that the beneficiary has receive at least one training out of the three; and 0 indicates that no training was received. It is observed that across social groups, the odds of training being received by SC/ST farmers (OR1.42; 95% CI: 1.14,1.77) and OBC farmers (OR: 2.03;

95% CI: 1.72,2.39) are higher compared to those from general category. Also, it is observed that across farmers with different land holding size, the odds of receiving training by medium farmers (OR1.48; 95% CI: 1.20,1.82) and large farmers (OR: 1.36; 95% CI: 1.11,1.66) are higher compared to those who are considered as marginal farmers.

Table 3.15: Percentage reported training in intervention area by socio-economic characteristics

	VBMPS	Ration Balancing	Fodder development
Age of Respondent			
Less than equal to 25	20.6	25.6	6.2
More than 25 years	36.0	42.9	23.7
Education Of Respondent			
Below or completed primary	36.1	42.6	23.3
More than Primary education	29.9	38.6	19.4
Gender			
Female	43.9	53.3	31.0
Male	32.1	38.2	20.0
Caste Of Respondent			
General	31.6	35.2	18.5
SC/ST	40.0	46.8	25.6
OBC	37.4	47.2	25.8
Wealth quintile			
Quintile 1	40.2	49.3	28.9
Quintile 2	31.6	36.3	17.8
Land			
Marginal	33.0	41.7	25.3
Small	38.6	41.9	27.5
Medium	45.7	49.6	25.4
Large	31.6	40.4	12.9
Total	35.4	42.2	22.9

Table 3.17 shows the percentage of respondents who have reported training in the intervention areas in the selected states in India. In the states like Madhya Pradesh and Tamil Nadu around 60% of respondents reported that the trainings for VBMPS and Ration Balancing are taking place. Similarly, around 30% or more of respondents claims the same in the states like Rajasthan, Bihar, Maharashtra and Odisha. On the other hand, below 20 percent of respondents from the states like Gujarat,

Karnataka and Punjab reported that the trainings for VBMPS and Ration are taking place which means that there are no as such trainings are conducting in these states.

For training on fodder development, the data is depicting that Tamil Nadu is the only states where the training on fodder development is taking place as 81% of respondents are reporting the same. On the other hand, only 10-20% of respondents belonging to the states like Karnataka, Madhya Pradesh, Maharashtra and Rajasthan reported training on fodder development is taking place.

Table 3.16: Logistic regression for those who reported to have received at least on training in intervention area

	Training	CI
Age of Respondent		
Less than equal to 25		
More than 25 years	1.81***	[1.28,2.57]
Education Of Respondent		
Below or completed primary		
More than Primary education	0.95	[0.77,1.18]
Gender		
Female		
Male	0.59***	[0.49,0.70]
Caste Of Respondent		
General		
SC/ST	1.42***	[1.14,1.77]
OBC	2.03***	[1.72,2.39]
Wealth quintile		
Quintile 1		
Quintile 2	0.76***	[0.66,0.89]
Land		
Marginal		
Small	1.09	[0.88,1.33]
Medium	1.48***	[1.20,1.82]
Large	1.36***	[1.11,1.66]

Note: Here dependent variable is that the beneficiary has received at least one training out of the three trainings provided which are training on VBMPS, training on ration balancing and training on fodder development

Table 3.17: Percentage who reported training in intervention area by State

	VBMPS	Ration Balancing	Fodder Dev.
Bihar	31.0	48.7	39.8
Gujarat	0.0	0.0	0.0
Karnataka	16.2	19.2	16.0
Madhya Pradesh	60.1	62.2	14.4
Maharashtra	35.4	60.8	19.1
Odisha	44.7	35.1	34.6
Punjab	9.4	14.2	10.4
Rajasthan	51.9	58.2	9.4
Tamil Nadu	61.6	82.6	81.3
Total	35.4	42.2	22.9

Constraints in Dairy Farming

Table 3.18 provide information about the constraints faced by the dairy farmer across the social groups. In control villages, more than 90% of dairy farmer said that cost of milk production has increased because of higher fodder price which is about 19% higher than intervention villages. In case of labour cost, more than 15% of dairy farmer's complaints about higher labour cost than that of intervention villages for dairy farming. In control villages, complaint about decreasing productivity of milch animal is 8% higher than the intervention villages.

Also, complaint about faulty veterinary services and higher mortality and morbidity of animals is ranging from 5 to 10% more than the intervention villages. Dissatisfaction regarding machineries use is reached about 13% higher in control villages than the interventional villages. Same feelings are there for availability of Government services about 13%. Most of the beneficiaries felt about difficulties to enrolment in dairy society due to large documentation and not fulfilment of eligibility criteria. 43% of the beneficiaries belong control group reported that the information about DCS programme details are not easily available whereas 53% of the respondents reported the same belongs to the interventional villages. Approx. only half of the respondents reported that monitoring and evaluation system is up to the mark at ground level, which is more important activities to perform dairy sector to perform in a transparently belongs to the Interventional group.

Table 3.18: Distribution of constraints faced in dairy farming by social groups

	Control				Intervention			
	General	SC/ST	OBC	Total	General	SC/ST	OBC	Total
Increase in cost of production of milk due to high feed/ fodder price	89.6	70.3	80.8	82.0	71.2	72.3	78.1	74.0
Farmers are not getting fair price	72.6	60.2	74.3	71.0	62.5	58.0	65.0	62.8
Labour cost is very high	78.8	75.0	71.4	74.7	63.9	67.8	68.5	66.2
Productivity of animal is coming down over the years	62.1	57.8	63.3	61.8	53.5	53.6	59.6	55.9
Green fodder not available	53.5	65.6	66.6	61.7	55.7	61.3	62.1	59.0
Veterinary services are not satisfactory	61.8	67.2	58.8	61.5	50.0	54.7	51.5	51.3
Morbidity and mortality is high in milch animals	59.6	50.8	47.6	52.4	42.5	50.7	42.3	43.6
Skill training to dairy farmers is not regular	63.9	78.1	64.1	66.7	54.4	62.2	60.6	57.9
Poor Quality of materials / machinery are supplied	57.9	52.0	65.3	60.2	46.9	50.7	46.6	47.3
Government support is inadequate	72.9	78.0	70.8	72.9	60.4	60.9	58.9	59.9
Failure of monitoring and evaluation services	72.8	73.8	70.6	72.0	50.3	58.1	58.4	54.6
Difficult to enrolled in DCS due to documentations and eligibility criteria	65.6	50.8	42.3	52.2	35.8	50.5	50.5	43.6
Difficult to enrolled in any dairy society due to documentations and eligibility criteria.	44.4	50.4	41.9	44.4	35.4	41.9	43.0	39.2
Information about DCS programme details not easily available.	56.3	70.1	51.1	56.5	46.2	48.4	48.0	47.2
Contact details of the department which pay subsidy are not available	58.3	58.7	69.4	63.5	50.4	49.9	55.9	52.4
Nos of documents required for availing subsidy and benefits are too many	58.8	61.1	64.1	61.6	54.7	60.6	58.5	57.0

Table 3.19: Distribution of constraints faced in dairy farming by categories of farmers

	Control					Intervention				
	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
Increase in cost of production of milk due to high feed/ fodder price	89.7	87.0	82.8	72.7	85.6	73.2	69.1	72.4	76.7	73.0
Farmers are not getting fair price	74.1	77.0	77.0	66.7	74.1	62.1	58.9	59.5	68.1	62.4
Labour cost is very high	70.0	77.0	82.8	70.5	73.5	71.1	64.0	67.3	63.5	66.9
Productivity of animal is coming down over the years	60.5	65.0	63.2	55.8	61.1	57.5	53.0	56.8	60.4	57.1
Green fodder not available	65.8	63.0	65.5	50.0	62.9	67.7	51.6	54.2	51.7	57.5
Veterinary services are not satisfactory	58.6	70.0	56.3	65.4	61.4	56.4	45.2	46.9	59.2	52.8
Morbidity and mortality is high in milch animals	54.2	69.0	60.9	52.6	57.9	46.0	43.3	43.7	42.4	44.0
Skill training to dairy farmers is not regular	81.4	74.0	60.9	52.0	72.3	61.7	55.3	52.3	53.9	56.5
Poor Quality of materials / machinery are supplied	67.3	61.2	48.3	59.7	61.9	52.5	38.2	41.3	46.5	45.6
Government support is inadequate	68.1	76.0	78.2	67.5	71.2	61.1	56.3	59.8	59.8	59.5
Failure of monitoring and evaluation services	71.8	70.7	75.9	72.7	72.4	54.5	49.0	54.8	59.7	54.7
Difficult to enrolled in DCS due to documentations and eligibility criteria	56.5	60.6	52.9	53.3	56.2	46.9	41.6	39.0	39.7	42.4
Difficult to enrolled in any dairy society due to documentations and eligibility criteria.	49.1	55.0	44.8	36.4	47.6	42.0	38.7	41.9	38.8	40.5
Information about DCS programme details not easily available.	59.3	69.0	47.1	42.9	56.7	50.4	42.1	43.7	44.2	45.7
Contact details of the department which pay subsidy are not available	66.2	60.6	50.6	52.0	60.5	58.1	46.6	47.4	57.7	53.4
Awareness about the eligibility criteria for availing subsidy is available	60.8	69.7	65.5	59.7	63.1	66.4	54.5	53.9	61.2	60.0
Nos of documents required for availing subsidy and benefits are too many	73.8	55.6	70.1	57.1	67.3	61.3	44.5	53.0	55.9	54.6

Table 3.19 suggest that control villages dairy farmers are facing more constraints when compared to intervention villages. This is uniform in all groups of farmers from marginal to large farmers. Interestingly 58% of the NDP beneficiaries have reported to have difficulty in enrolment in NDP and non-NDP beneficiaries have reported the same constraint to be 44%.

This is quite similar in availability of information about program and contact details of the department. The difference is marginally higher in intervention villages as compared to control villages. When we see the veterinary services both control and intervention villages have reported to have more or less similar scenarios of having non-satisfactory veterinary services. Overall small and marginal farmers are facing more constraints than large and medium farmers.

3.3 Livelihood gains

Quality Parameters of Milk

Table 3.20 indicates that in both control and intervention villages percentage reporting quality of milk is regular is higher among respondent have less than equal age to 25 as compare with more than 25 years. However, reporting quality of milk based on SNF and Fat level is regular is higher among who have more than primary education in both control and intervention village respectively. In addition, percentage of regular reporting quality of milk is higher among large landholder in both control and intervention villages as compare with marginal, small, and medium landholder respondent.

Expenditure on treatment of animals

Table 3.21 below shows that spending on treatment of animals is higher in the age group above twenty-five years as compared to less than 25 years of age among intervention villages. Likewise, expenditure on treatment of animals is higher by who have more than primary education as compare with below or completed primary respondent in control village. Meanwhile, male respondent outlay on treatment of animals is significantly high as compare with female respondent in both control and intervention village. However, table indicates that expenditure on treatment of animals is maximum among OBC respondent in control and intervention village. In the case of both control and intervention village, expenditure incurred by quintile 1 is higher. The average expenditure on treatment of animals is higher among marginal land holder as compare with other categories of land holder in both control and intervention village. T test for difference in mean with null hypothesis that the mean difference is zero was tested. There seems to be significant difference in mean expenditure across control and intervention areas for gender.

Table 3.20: Percentage reporting quality of milk is regular by socio-economic characteristics

| | Control | | Intervention | |
	SNF Regular	Fat Level Regular	SNF Regular	Fat Level Regular
Age of Respondent				
Less than equal to 25	90.9	90.9	98.8	96.8
More than 25 years	62.3	73.9	89.7	89.1
Education Of Respondent				
Below or completed primary	59.1	72.8	89.1	88.8
More than Primary education	82.7	83.7	96.4	93.5
Gender				
Female	71.6	60.6	86.7	86.3
Male	59.7	77.5	91.3	90.6
Caste Of Respondent				
General	55.9	70.4	89.5	90.7
SC/ST	66.1	80.0	90.3	89.5
OBC	67.1	75.5	91.3	88.4
Wealth quintile				
Quintile 1	67.2	74.9	89.5	90.0
Quintile 2	58.8	74.0	90.8	89.1
Land				
Marginal	39.0	53.6	81.0	81.1
Small	52.5	71.6	92.3	90.3
Medium	53.0	70.0	97.0	93.0
Large	83.3	88.5	98.0	97.9
Total	63.0	74.4	90.2	89.6

Table 3.21: Mean expenditure on treatment of animals by Socio-economic characteristics

	Control	Intervention	T-test for Ho: difference =0
Age of Respondent			
Less than equal to 25	1756.1	1249.3	0.340
More than 25 years	1514.9	1416.3	0.351
Education Of Respondent			
Below or completed primary	1504.4	1430.6	0.509
More than Primary education	1665.8	1295.0	0.159
Gender			
Female	991.7	1278.0	0.022
Male	1665.4	1441.5	0.074
Caste Of Respondent			
General	1292.9	1362.9	0.606
SC/ST	1393.0	1158.3	0.189
OBC	1737.8	1544.9	0.284
Wealth quintile			
Quintile 1	1743.1	1653.5	0.579
Quintile 2	1245.2	1215.1	0.799
Land			
Marginal	1790.7	1855.1	0.739
Small	1462.6	1208.0	0.164
Medium	1276.6	1426.3	0.451
Large	1202.6	1234.6	0.867
Total	1523.0	1402.0	0.242

In table 3.22 below, results for simple linear regression model are presented, here the dependent variable is expenditure incurred on treatment of animals. It may be noted that value of expenditure incurred for control group in model is 549.31(95% CI: -91.83,1190.45). Also, the average expenditure is significantly positive for buffalo (coefficient: 294; 95% CI: 209.59,378.41). Interestingly, it was found through adjusted model that the value of expenditure incurred by SC/ST farmers is significantly negative i.e. -735.12(95% CI: [-1443.53,-26.72). Also, it may be noted that the value of coefficient of educated farmers is significantly negative at -277.33(95% CI: [-943.35,388.69) which reflects the importance of education.

Table 3.22: Linear regression model for mean expenditure on treatment of animals

	Mean Expenditure	CI
Age of Respondent		
Less than equal to 25		
More than 25 years	-146.63	[-1365.44,1072.17]
Education Of Respondent		
Below or completed primary		
More than Primary education	-277.33	[-943.35,388.69]
Gender		
Female		
Male	303.51	[-336.98,943.99]
Caste Of Respondent		
General		
SC/ST	-735.12**	[-1443.53,-26.72]
OBC	136.44	[-434.57,707.45]
Wealth quintile		
Quintile 2		
Quintile 1	141.24	[-674.76,392.28]
Land		
Large		
Medium	292.77	[-363.68,949.21]
Small	72.02	[-663.60,807.63]
Marginal	351.01	[-334.05,1036.08]
Intervention area		
Intervention		
Control	549.31*	[-91.83,1190.45]
Cow	-82.35	[-296.62,131.93]
Buffalo	294.00***	[209.59,378.41]
Veterinary Subsidy		
Yes		
No	84.36	[-488.55,657.26]

Training and Programme

Table 3.23 presents the percentage of respondents who have reported benefited from training in intervention areas by socioeconomic characteristics. Training beneficiaries are higher in number in the age category of 25 yearsor less. In this category, 70.1% are benefited from VBMPS, 70.5% from RBP, and 23.4% from training in Fodder development. Respondents who are educated above primary standard, 53.8% are benefited from VBMPS, 63.3% from RBP and 46.5% in Fodder development training which is higher than the respondents who have educated upto primary standard. Results are showing that the percentage of female is higher who have reported benefited from training for VBMPS and RBP and Fodder development. In caste categories, SC/ST population is found to be benefited more under VBMPS and RBP training. Respondents in lower wealth quintile are found to be higher in number who have benefited from the training in intervention areas.

Table 3.23: Percentage who reported benefits from training in intervention area by socio-economic characteristics

	Training for VBMPS	Training on Ration Balancing	Training on fodder development
Age of Respondent			
Less than equal to 25	70.1	70.5	23.4
More than 25 years	48.8	53.4	37.1
Education Of Respondent			
Below or completed primary	49.3	53.0	35.0
More than Primary education	53.8	63.3	46.5
Gender			
Female	57.5	60.0	39.7
Male	46.9	52.3	35.5
Caste Of Respondent			
General	45.0	50.8	32.8
SC/ST	61.2	61.5	44.5
OBC	49.4	55.0	37.0
Wealth quintile			
Quintile 1	53.5	55.9	43.5
Quintile 2	46.1	53.1	29.5
Land			
Marginal	38.8	38.3	32.4
Small	56.6	58.8	48.9
Medium	58.7	68.1	43.0
Large	53.7	68.1	29.0
Total	50.0	54.5	36.7

Table 3.24 present the concentration index estimates regarding distribution of household financial liability across households monthly per capita expenditure for control and intervention group

separately. It can be observed from table that the concentration index value of household debt in both the groups is positive reflecting agglomeration of debt among richer section. More importantly, it may be noted from table 1 that among intervention group, the value of CI for loans regarding cow purchase is -0.177 (SE: 0.041) significantly reflecting agglomeration of cow purchase loan among poorer section. This however implies that the loan facility is more concentrated among beneficiary farmers from poorer section. On the other hand, the value of CI for cow purchase loan among control group was 0.215 (SE: 0.103). Further, the CI values for any loan (cow or buffalo purchase) are significantly different between control and intervention groups (Difference: 0.344; SE: 0.092). While in control group the CI value for any loan is 0.163 (SE: 0.087), it is significantly -0.181 (SE: 0.028) for intervention group. This clearly elicits that in intervention groups, the facility of loan for cow or buffalo purchase is availed mostly by economically vulnerable farmers.

Table 3.24: Concentration Index Regarding Distribution of Household Debt and Loan for Cattle Purchase in Control and Intervention Group, selected States, India

	Intervention		Control		Difference	
	CI	SE	CI	SE	Diff.	SE
Household Debt	0.010***	0.003	0.003	0.007	-0.007***	0.007
Loan Cow Purchase	-0.177***	0.041	0.215	0.103	0.393**	0.111
Loan Buffalo Purchase	0.04	0.092	0.283	0.283	0.242	0.298
Loan – Cow/Buffalo	-0.181***	0.028	0.163	0.087	0.344***	0.092

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

Changes after RBP

Table 3.25 depicts the percentage of respondents who confirmed a positive change after RBP for selected parameters such as improvement in the quality and quantity of milk along with reduction in the cost of feeding intake. Across age cohorts, out of total respondents who confirmed a positive change in the quality of milk after RBP is around 27 percent and 29 percent for old and young age cohort respectively. While percentage of respondents who confirmed the improvement in the quantity of milk is 35.7 percent for the younger cohort and 30.5 percent for the older cohorts in the intervention area. Lastly those confirmed the reduction in the cost of feeding is 19.6percent for older cohort while 8.3 percent for the younger cohort. Across genders the female confirmation who confirmed a positive change in the quality of milk after RBP is 34.9 percent for female and 26.8 percent for male and in terms of quantity it is and 36.8 percent for female 28 percent for male. As per the responders who confirmed the reduction in the cost of feeding after RBP is 17.1 percent for female and 19.8 percent for male category. Across various caste groups those who confirmed a positive change after RBP in the quantity of milk is 36.4 percent for the general category, 23.5 percent for the ST/SC

category and 25.2 percent for the OBC category. While in terms of quantity of milk it is 26.5 percent for General 32.5 percent for ST/ST and 34.2 percent for OBC category. Lastly, in terms of cost reduction in the feeding after RBP is 20.7 percent for general, 9.4 percent for ST/ST and 20.1 percent for OBC.

Table 3.25: Percentage who confirmed positive changes after RBP for selected parameters, Intervention area

	Quality of milk improved	Quantity of milk increased	Both quality and quantity increased and improved	Cost reduction in feeding intake
Age of Respondent				
Less than equal to 25	27.4	35.7	15.5	8.3
More than 25 years	29.4	30.5	21.1	19.6
Education Of Respondent				
Below or completed primary	30.1	31.8	20.0	19.2
More than Primary education	26.2	25.0	24.6	16.5
Gender				
Female	34.9	36.8	19.4	17.1
Male	26.8	28.0	21.4	19.8
Caste Of Respondent				
General	36.4	26.5	17.7	20.7
SC/ST	23.5	32.5	18.8	9.4
OBC	25.2	34.2	23.9	20.1
Wealth quintile				
Quintile 1	29.1	27.2	22.3	17.4
Quintile 2	29.8	34.4	19.0	20.5
Land				
Marginal	28.9	33.1	18.0	22.7
Small	29.6	25.9	23.7	15.1
Medium	24.1	28.0	24.1	14.2
Large	29.4	25.8	18.3	17.5
Total	29.4	30.7	20.7	18.9

Across wealth and land distribution also the pattern is quite different. In the lower and upper wealth quintile percentage of respondents who confirmed that a positive change after RBP in the quality of milk is 29.1 percent and 29.8 percent, while in terms of quantity of milk it is 27.2 percent and 34.4 percent. Those respondents who confirmed a positive change after RBP in terms of reduction in the cost of feeding is 17.4 percent for the lower wealth quintile and 20.5 percent for the upper wealth quintile. Lastly, across land categories respondents who confirmed a positive change after RBP in terms of changes in quality and quantity of milk along with reduction in the cost of feeding is differs across different land sizes. Those respondents who confirmed a positive change after RBP in quality of milk in the intervention area is higher for Small land size category (29.6%) and in terms of quantity it is marginal land holders. Lastly, the percentage of respondents confirmed a positive change after

RBP differs across different land distributions in the intervention area. It is higher for marginal land holders and lower for the medium land holders. These results shows that the percentage of respondents who confirmed a positive change after RBP through changes in the quality and quantity of milk along with reduction in the cost of feeding differs across various socioeconomic dimensions.

Success and Failure of Dairy Farming after enrolment in DCS

Table 3.26 shows the percentage of respondents who feel that the sale, quality and quantity has improved after enrolment in DCS. Around 55% of the respondents above 25 years of age feel that the local sale of milk has improved after enrolment in DCS. Around 54.2% and 51.8% of the respondents feel that the quality and quantity respectively of the milk has improved after enrolment in DCS. Around 36.9% of the respondents have reported that the market has been sustained for milk pooling after introduction of DCS in the selected states in India. Higher proportion of respondents felt that local sale of milk, milk pooling and sustained market, quality and quantity of milk has improved in small and marginal farmers as compared to large and medium farmers.

Table 3.26: Percentage who feels sale, quality and quantity of milk has improved (NDP beneficiaries) by socio-economic characteristics

	Local sale of milk	Sustain market accessibility for milk pooling	Quality of milk improved	Quantity of milk
Age of Respondent				
Less than equal to 25	51.5	31.5	42.7	37.8
More than 25 years	55.1	36.9	54.2	51.8
Education Of Respondent				
Below or completed primary	55.1	36.1	53.6	51.4
More than Primary education	53.6	39.8	53.7	49.5
Gender				
Female	48.6	33.6	56.7	55.0
Male	56.8	37.6	52.7	49.8
Caste Of Respondent				
General	56.5	40.5	57.2	53.9
SC/ST	45.4	30.9	45.7	45.1
OBC	57.2	34.8	52.9	50.1
Wealth quintile				
Quintile 1	56.2	41.0	57.2	54.6
Quintile 2	53.7	32.7	50.3	47.9
Land				
Marginal	68.7	41.2	67.6	64.4
Small	53.6	40.7	52.7	48.6
Medium	43.2	32.3	47.1	43.8
Large	54.4	37.0	48.0	47.7
Total	54.9	36.7	53.7	51.1

Degree of present satisfaction and prospects for future progress

A comprehensive analysis on satisfaction level of dairy households is important for the future prospective of dairy farming. Table 3.27 presents the percentage distribution of respondents who are satisfied with dairy farming, also inform that it improved their standard of living, family income and they are interested to continue dairy farming in future as well. This analysis has done for both the control and intervention area. Further, the analysis has extended over age, education, gender, caste, wealth distribution and land size. It is interesting to note that mostly the intervention area percentage share is larger than that of control area over various socioeconomic characteristics. Across age cohorts in the control area out of total respondents the percentage of respondents inform that their standard of living and family income has improved is 28.6 percent and 19.2 percent, while the old cohort the percentage share is around 33.0 percent and 48.9 percent. Those who interested to continue in dairy farming are 95.2 percent for younger cohort and 86.4 percent for the older cohorts. Compared to this as per intervention is concerned, those informed that their standard of living along with family income has improved is 25 percent and 36.4 percent. Those who are interested to continue in dairy farming are 91.4 percent for younger cohort and 88 percent for the older cohort. Across age groups in the older cohort who are interested to continue the dairy farming is slightly low in the intervention area as compared to the control area.

As per the educational level is concerned, it has divided into below primary level of education and above primary level of education. Across both control and intervention area the analysis has extended. In the control area, as per the level of satisfaction the below primary percentage is 63.2 percent while that of above primary percentage share is 58.0 percent. Those informed the NDP plays and important role in increase the level of standard of living and family income is 33.6 percent and 48.5 percent for below primary category while 25.9 percent and 45.1 percent for the above primary group. Those who are interested to continue the dairy farming are more than 86 percent. Compared to this in the intervention area those informed that the NDP improved their family income and standard of living are 37.3 percent and 49.4 percent for the below primary education level and 40.4 percent and 43 percent for the above primary category. Those who are interested to continue farming are close to 87.8 and 89.8 percent for both the educational categories.

Table 3.27: Percentage distribution of respondents who believe satisfied in dairy farming, income and standard of living improved and would like to continue by socio economic characteristics

	Control				Intervention			
	Degree of satisfaction is highly satisfied	Improved standard of living	DCS increase family income	Like to continue dairy farming	Degree of satisfaction is highly satisfied	Improved standard of living	DCS increase family income	Like to continue dairy farming
Age of Respondent								
Less than equal to 25	59.1	28.6	19.1	95.2	62.0	25.1	36.4	91.4
More than 25 years	62.6	33.0	48.9	86.4	72.0	38.5	49.2	87.9
Education								
Below or completed primary	63.2	33.6	48.5	86.1	72.2	37.3	49.4	87.8
More than Primary education	58.0	25.9	45.1	91.6	67.3	40.4	43.0	89.8
Gender								
Female	70.6	36.8	63.1	87.7	67.6	34.8	46.1	87.3
Male	60.3	31.9	44.2	86.3	72.7	39.0	49.4	88.2
Caste of Respondent								
General	61.1	28.2	41.1	86.0	68.8	37.6	46.0	84.7
SC/ST	51.1	30.8	40.2	79.0	65.4	41.3	51.4	91.3
OBC	67.4	35.8	55.0	89.7	77.6	37.2	50.4	90.6
Wealth quintile								
Quintile 1	59.2	35.1	47.6	88.9	71.7	37.5	48.6	87.2
Quintile 2	67.4	29.6	48.6	83.3	71.2	38.4	48.6	88.5
Land								
Marginal	63.5	37.1	56.5	94.6	76.2	42.5	61.7	84.4
Small	62.0	30.6	42.5	87.2	65.8	37.4	44.9	91.7
Medium	70.8	32.6	43.0	91.0	68.4	33.6	43.4	88.2
Large	45.6	16.5	36.4	86.1	73.1	35.1	41.0	89.0
Total	62.6	32.8	48.0	86.6	71.5	38.0	48.5	88.0

Across genders (male and female) the response towards the satisfaction level and their interest to continue in dairy farming are quite different. The pattern is also differing as per control and intervention area is concerned. In the control area, those improved that the NDP plays important role in increase in standard of living and family income are 36.8 percent and 63.1 percent for female and 31.9 percent and 44.2 percent for male category. Compared to this those who are like to continue in dairy farming both in control and intervention area includes almost 88 percent. The respondents who believed to satisfied with dairy farming also differs across social groups, wealth quintiles and land distributions. Those who likes to continue in dairy farming both in control and intervention area is almost 80 percent. Respondents who believed that the dairy farming has improved their standard of living and family income is 28.2 percent and 41.1 percent for general category in the control area and 37.6 percent and 46 percent in the control area. While for the ST/SC and OBC groups the distribution

quite differs. Across both kind of wealth quintiles, the degree of satisfaction as well as the perception of improving standard of living and family income through dairy farming is slightly different. Those who are interested to be in dairy farming is close to 85 to 88 percent for both the control and intervention area. While, those believed to have dairy farming has improved their standard of living in young cohort is 35.1 percent and 47.6 percent for control area and 37.5 percent and 48.6 percent for the intervention area. As per the different structure of land distribution (marginal, small, medium and large) the perception of respondents, who like to continue in dairy farming is almost more than 85 percent for both the control and intervention area. The response towards dairy faming has improved the standard of living of the respondents is higher for the marginal land holding both across control and intervention area. These results clearly depict the response on the satisfaction level and who believed that the dairy farming has improved the living condition and family income quite differs across various socioeconomic attributes.

Table 3.28 presents the crucial factors for respondents towards continue in dairy farming across major socioeconomic groups both in control and intervention area. These includes, for the expectation for increase income level and profit, for better employment opportunity and for a certainty of regular source of income. As per the level of age is concerned in the younger cohort the major reason for be in dairy farming is higher for the expectation on increase in profit both for control and intervention area. The trend is quite similar as per old cohort is concerned. As per the better employment opportunity perspectives, the younger age cohort percentage share is 25 percent in control area and 31.2 percent in intervention area and 28.2 percent and 23.7 percent across older cohort. Lastly, the dairy farming as for the certainty and regular source of income is higher for older cohorts in the intervention area. As per the level of education, those who are interested to be in dairy farming for better employment opportunities is higher for below primary category for both control and intervention area and lower for the above primary educational category. For other reasons such as for increased profit and certainty and regular source of income structure is quite similar for both the educational categories. Across genders the females much interested in dairy farming as compared to males in both control and intervention area. For other aspects, such as for increase profit and the dairy farm as a regular source of income the pattern also quite differs across genders. Across social categories, the main reason for respondents to continue in dairy farming for increased income opportunities is higher for OBC category both for control and intervention areas. As per better employment opportunities concerned, 45.7 percent of the ST/SC respondents are interested in dairy farming in the control area and 33.9 percent in the intervention area. Lastly, the respondents remark

on dairy farming as a regular source of income is higher (54.4%) for the general category in the intervention area.

Table 3.28: Distribution of main reason for respondents to continue in dairy farming by socio-economic characteristics

	Control			Intervention		
	Increase income /profits	Better employment opportunity	Regular source of income	Increase income /profits	Better employment opportunity	Regular source of income
Age of Respondent						
Less than equal to 25	70.0	25.0	30.0	75.9	31.2	8.8
More than 25 years	52.8	28.2	21.5	52.9	23.7	25.1
Education						
Below primary	53.1	30.2	19.8	53.8	24.4	24.5
More than Primary	51.3	15.8	38.2	56.1	22.1	22.1
Gender						
Female	57.8	30.4	16.3	55.4	25.9	30.6
Male	52.1	27.4	23.3	53.9	23.4	22.0
Caste of Respondent						
General	51.8	24.6	13.2	54.4	23.0	24.8
SC/ST	40.0	45.7	26.7	51.5	33.9	17.6
OBC	57.8	25.4	27.2	55.5	20.5	26.4
Wealth quintile						
Quintile 1	50.4	29.4	20.8	51.9	24.8	24.1
Quintile 2	57.6	26.4	23.2	56.6	23.5	23.8
Land						
Marginal	62.1	22.4	13.6	49.9	23.9	22.1
Small	41.1	35.8	28.4	57.1	21.6	21.8
Medium	43.2	37.0	32.1	56.8	26.2	27.7
Large	38.2	29.4	47.1	60.9	23.6	26.2
Total	53.2	28.2	21.7	54.2	24.0	24.2

As per the wealth quintile is concerned, around 29.4 percent of the respondents are interested in dairy farming in the lower quintile, while 26.4 percent of the respondents in the upper quintiles for better employment opportunities in the control area. Compared to this in the intervention area the percentage distribution is 24.8 percent and 23.5 percent respectively. The respondents remark on be in dairy farming for income and profits is similar both for control and intervention areas. Lastly, across land distribution (marginal, small, medium and large) the main reason for in dairy farming also quite differs. For better employment opportunities the medium land holding share is higher both for control and intervention area. While, on the perspective of increased profit is higher for marginal land holders in control area and large land holders for the intervention area. The respondents remark to be in dairy farming on the certainty and regular source of income the larger land holder's percentage share is higher both for control (47.1%) and intervention area (26.2%).

Farmers with Positive Opinion on NDP's role in Increasing Family Income

Across asset index, the estimates from unadjusted models show that the favourable perception regarding the role of NDP in enhancing income levels of farmers is more likely to come from poor farmers (bottom 50 percent asset holders) compared to richer farmers. These estimates remain consistent when adjusted for other socioeconomic correlates in a multivariate framework. For instance, the value of odds ratio for bottom 50% farmers is 0.77 (95% CI: 0.48; 1.22). This clearly implies that with the launch of NDP, a larger proportion poor farmer feels increase in family income. In order to further confirm the association of farmer's perception with their socioeconomic correlates, table 3.29 present depict the estimates from a simple logistic regression (unadjusted and adjusted) models. It is observed that across social groups, the opinion regarding positive role of NDP in increasing income of dairy farmers is less popular among SC/ST farmers (OR: 0.67; 95% CI: 0.42; 1.65) compared to those from general category. However, the likelihood of this opinion is significantly higher for those belong to Other Backward Class (OR: 1.36; 95 % CI: 0.89; 2.08).

Table 3.29: Logistic Regression Estimates Regarding Association between Farmers with Positive Opinion on NDP's role in Increasing Family Income and Socioeconomic Background

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Social Group				
General®	1.00		1.00	
SC/ST	0.67*	[0.42; 1.05]	0.68*	[0.42; 1.06]
OBC	1.36*	[0.89; 2.08]	1.4*	[0.91; 2.16]
Education				
Below Primary®	1.00		1.00	
Above Primary	1.38	[0.73; 2.59]	1.36	[0.72; 2.50]
Asset Index				
Bottom 50%®	1.00		1.00	
Top 50%	0.37***	[0.24; 0.55]	0.77***	[0.48; 1.22]
Gender				
Female®	1.00		1.00	
Male	0.71	[0.44; 1.10]	0.38	[0.25; 0.57]

Note: Estimates are derived from Simple Linear OLS Regression models. Model 1 – Unadjusted Estimates; Model 2: Model adjusted for Social Group, Farmer's Education and Asset Index. Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

Perception Regarding Standard of Living in Dairy Business

Further, table 3.30 presents the logistic regression estimates regarding econometric association between satisfaction level among farmers with their standard of living and socioeconomic correlates. In both the unadjusted as well as adjusted models, there is significant association between NDP intervention and satisfaction levels. The odds of being fully satisfied with the current standard of living in dairy farming is about half among farmers from control group (OR: 0.59; 95% CI: 0.47; 0.74) compared to those from intervention villages. This observation remained consistent (OR: 0.60; 95% CI: 0.48; 0.76) even after adjusting the model for all socioeconomic correlates. Further, it can be observed from table 8 that the odds of being satisfied is higher for farmers with primary level of education (Or: 1.12; 95% CI: 0.93; 1.35).

Estimates from regression analysis clearly implies that level of satisfaction regarding overall life style is higher among those belong to intervention group displaying a significantly positive and crucial role of NDP. Self-rated satisfaction is one of the most important indicators reflecting an individual's well-being. Therefore the present level of estimates significantly elicit a clear role of NDP in enhancing farmer's standard of living.

Table 3.30: Logistic Regression regarding association between Farmers Satisfied with Standard of living in Dairy Business and Socioeconomic Background

	Model 1		Model 2	
	Coefficient	95% CI	Coefficient	95% CI
NDP				
Intervention®	1.00			
Control	0.59***	[0.47; 0.74]	0.60***	[0.48; 0.76]
Social Group				
General®			1.00	
SC/ST			0.59*	[0.46; 0.77]
OBC			1.05	[0.85; 1.30]
Education				
Below Primary®			1.00	
Above Primary			1.12*	[0.93; 1.35]
Asset Index				
Bottom 50%®			1.00	
Top 50%			1.09	[0.81; 1.46]

Note: Estimates are derived from Simple Linear OLS Regression models. Model 1 – Unadjusted Estimates; Model 2: Model adjusted for Social Group, Farmer's Education and Asset Index. Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

3.4 Income Impact

Milk Production - Cow

In order to identify the difference between the production benefits, table 3.31 presents estimates from simple linear regression models regarding association between production quantity by cow in control and intervention (NDP intervention) areas.

Table 3.31: Linear Regression regrading association between Quantity of Milk Produced (per day in Ltr. By Cow) and NDP/RBP Intervention

Intervention area	Model 1		Model 2	
Control				
Intervention	2.71***	[1.4,4.0]	2.63***	[1.2,4.1]
RBC				
No				
Yes			2.09***	[0.9,3.2]
Age of Respondent				
Less than equal to 25				
More than 25 years			1.99	[-0.6,4.6]
Education Of Respondent				
Below or completed primary				
More than Primary education			1.85**	[0.4,3.3]
Gender				
Female				
Male			1.67**	[0.4,3.0]
Caste Of Respondent				
General				
SC/ST			0.47	[-1.1,2.0]
OBC			2.89***	[1.7,4.0]
Wealth quintile				
Quintile 1				
Quintile 2			-0.01	[-1.1,1.0]
Land				
Marginal				
Small			1.08	[-0.3,2.5]
Medium			2.06***	[0.6,3.5]
Large			1.97***	[0.5,3.4]

Note: Estimates are derived from Simple Linear OLS Regression models. Model 1 – Unadjusted Estimates; Model 2: Model adjusted for Social Group, Farmer's Education and Asset Index. Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

The estimates from Model 1 shows a positive coefficient value for intervention group (Coefficient: -0.19; CI: -2.11; 0.53) reflecting lower quantity production among control groups compared to those with intervention. Further, the estimates from unadjusted model shows that production quantity (cow) for those with Ration Balancing Programme (RBP) is almost 2.09 higher. These estimates were further derived from a regression model adjusted for socioeconomic variables including social groups,

education and household assets. After adjusting for socioeconomic correlates, the finding remain consistent as the value of coefficient for intervention group is 2.63 (95% CI: 1.2,4.1). Similarly, farmers registered under Ration Balancing Programme is 2.09 (95% CI: 0.9,3.2) reflecting higher quantity produced among farmers from intervention group.

Milk Production – Buffalo

Further, to identify the association of NDP intervention with average quantity of milk produced (by buffalo) in a multivariate framework, table 3.32 presents the estimates.

Table 3.32: Linear Regression regarding association between Quantity of Milk Produced (per day in ltr. By Buffalo) and NDP/RBP Intervention

Intervention area	Model 1		Model 2	
Control				
Intervention	3.38***	[1.7,5.0]	3.31***	[1.4,5.2]
RBC				
No				
Yes			3.84***	[2.0,5.7]
Age of Respondent				
Less than equal to 25				
More than 25 years			-1.11	[-3.8,1.6]
Education Of Respondent				
Below or completed primary				
More than Primary education			1.70*	[-0.2,3.6]
Gender				
Female				
Male			1.19	[-0.6,3.0]
Caste Of Respondent				
General				
SC/ST			4.00***	[1.9,6.1]
OBC			4.57***	[3.0,6.2]
Wealth quintile				
Quintile 1				
Quintile 2			-0.81	[-2.3,0.6]
Land				
Marginal				
Small			2.19**	[0.1,4.3]
Medium			2.65**	[0.6,4.7]
Large			4.36***	[2.4,6.3]

Note: Estimates are derived from Simple Linear OLS Regression models. Model 1 – Unadjusted Estimates; Model 2: Model adjusted for Social Group, Farmer's Education and Asset Index. Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

The estimates from Model 1 shows a positive coefficient value for intervention group (Coefficient: 3.17; CI: 1.9,4.5) reflecting lower quantity production among control groups compared to those with

intervention. These estimates were further derived from a regression model adjusted for socioeconomic variables including social groups, education and household assets. After adjusting for socioeconomic correlates, the finding remain consistent as the value of coefficient for intervention group is 2.53 (95% CI: 1.0, 4.0).

Table 3.33: Linear Regression regarding association between Quantity of Milk Produced (per day in ltr. By Buffalo) and NDP/RBP Intervention

	Model 1		Model 2	
Intervention area				
Control				
Intervention	3.17***	[1.9,4.5]	2.53***	[1.0,4.0]
Age of Respondent				
Less than equal to 25				
More than 25 years			0.8	[-1.8,3.3]
Education Of Respondent				
Below or completed primary				
More than Primary education			2.68***	[1.1,4.3]
Gender				
Female				
Male			1.80***	[0.5,3.1]
Caste Of Respondent				
General				
SC/ST			1.38*	[-0.3,3.0]
OBC			3.52***	[2.3,4.7]
Wealth quintile				
Quintile 1				
Quintile 2			0.38	[-0.7,1.5]
Land				
Marginal				
Small			1.77**	[0.3,3.3]
Medium			3.29***	[1.7,4.8]
Large			4.35***	[2.8,5.9]

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

Propensity Score Analysis

In this study the households surveyed in the intervention and control villages were dependent on the NDP I project area identification. Hence, these households are not truly random from a statistical perspective. In such cases, it is likely that the effect of treatment could be affected by bias because of presence of certain confounding factors. Under such conditions, propensity score matching approach can be applied to allow for 'correcting' the estimates of treatment effects by adjusting for the potential influence of the confounding factors. The correction is derived on the logic that the bias could be reduced when the assessment of outcomes is based on the intervention and control group

households who are as similar as possible. Since usually a large number of variables can be used for matching but such comparison is unfeasible for large sample size. In this context, the propensity score matching analysis proposes a single-index variable (or the propensity score) to summarize pre-treatment characteristics of each household and thus allow for matching algorithm for the analysis of treatment effects.

We used Nearest Neighbourhood Matching Method, Kernel Matching Method, and Stratification Matching to estimate the Average Treatment effect on Treated (ATT). The outcome variables were farmer's income (in Rs.) (from cow and buffalo) and quantity produced (per day in Litres). The treatment variable was NDP beneficiary (Yes-1/No-0). The control variables are farmer's age, gender, social category, religion, marital status and asset index (Top 50%-1/Bottom 50%-0).

Table 3.34: Propensity Score Matching Estimates and Average Treatment Effect for Treated (ATT) of NDP on Dairy Farmer's Daily Income (in Rs.), India

Cow					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	1824	395	98.7	21.2	4.7
Kernel Matching Method	1824	397	83.5	17.4	4.8
Stratification Method	1824	441	82.2	18.0	4.6
Arithmetic Mean	2086	472	83.0		
Buffalo					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	801	128	47.9	23.6	2.0
Kernel Matching Method	801	128	74.9	20.5	3.7
Stratification Method	801	130	79.0	22.2	3.6
Arithmetic Mean	883	184	78.0		
Both animals					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	3022	577	90.3	14.7	6.2
Kernel Matching Method	3022	581	90.5	13.0	7.0
Stratification Method	3022	651	92.3	14.0	6.6
Arithmetic Mean	3628	785	88.0		

Table 3.34 shows propensity score matching estimates and average treatment effect on treated (ATT) for impact of NDP on dairy farmer's income. It can be observed that simple difference in the arithmetic average income is Rs. 88. However after applying propensity score analysis and control the estimations for potential bias, it can be observed that the average income of farmers from intervention village is about Rs. 90 higher (Nearest Neighbour Matching Method) compared to those from control group. In order to check the consistency, we also applied Kernel Matching Method and Stratification Method to estimate ATT.

In table 3.35 below, results for simple linear regression model are presented, here the dependent variable is income generated from selling milk of cow, buffalo and from both animals. It may be noted that value of income from cow, buffalo and both animals for intervention group is significantly higher. Also, the income accruing to males is higher. Income accruing to small and medium farmers from selling cow milk is relatively higher. Similarly, the income for marginal farmers from selling milk is higher. This is because on average the number of animals owned by these farmers is relatively higher. On an average there is a difference of 100 in income across control and intervention areas from selling milk of either animal. And, the results are consistent throughout.

Table 3.35: Linear regression model for income from cow and buffalos

	Cow		Buffalo		Herd	
Intervention area						
Control						
Intervention	89.27***	[37.2,141.4]	103.62***	[33.9,173.4]	97.90***	[56.7,139.1]
Age of Respondent						
Less than equal to 25						
More than 25 years	-90.21*	[-187.0,6.6]	-52.75	[-138.3,32.8]	-102.66***	[-172.0,-33.3]
Education Of Respondent						
Below or completed primary						
More than Primary education	-7.48	[-61.9,46.9]	1.71	[-60.7,64.1]	14.37	[-28.5,57.2]
Gender						
Female						
Male	90.10***	[41.5,138.7]	94.28***	[34.9,153.7]	100.94***	[64.5,137.4]
Caste Of Respondent						
General						
SC/ST	-91.74***	[-150.6,-32.8]	-93.93***	[-163.6,-24.2]	-55.23**	[-99.9,-10.6]
OBC	-61.69***	[-105.2,-18.2]	-42.62	[-95.9,10.7]	-5.61	[-38.5,27.3]
Wealth quintile						
Quintile 1						
Quintile 2	-4.4	[-44.7,35.9]	-34.38	[-82.4,13.6]	-10.17	[-40.6,20.3]
Land						
Marginal						
Small	49.54*	[-4.4,103.5]	-74.46*	[-149.5,0.6]	10.97	[-30.0,51.9]
Medium	75.43***	[20.3,130.5]	-53.36	[-125.9,19.1]	48.26**	[6.1,90.4]
Large	-64.98**	[-119.5,-10.5]	-179.43***	[-246.7,-112.1]	-54.97***	[-96.3,-13.6]

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

Table 3.36 reveals the mean herd size, milk production, milk sale and income across intervention and control groups. The average size of herd of cow is 2.7 in intervention area and 1.8 in control area. The average size of herd of buffalos is 3.8 in intervention area and 1.9 in control area. Clearly, the households in intervention areas own a bigger herd of animals as compared to control areas. This also justifies the difference in milk production and sale observed across the two regions. There is a difference of 3 litres per day in milk production and sale across control and intervention areas when milk produced from both the types of animals is considered.

Table 3.36 Mean herd size, milk production, milk sale across intervention and control groups

	Cow			Buffalo			Herd		
Variables	Int.	Control	t-test	Int.	Control	t-test	Int.	Control	t-test
Herd size	2.7	1.8	***	3.8	1.9	0.00	4.7	3.1	***
Total milk production	14.5	11.7	***	9.4	6.0	0.00	14.2	11.0	***
Amount of milk sold	14.2	11.3	***	9.3	5.1	0.00	22.9	13.3	***

Estimations are *significant at 0.10 ** at 0.05 level *** at .01 level.

Table 3.37 displays the propensity score matching estimates and average treatment effect on treated (ATT) for impact of NDP on dairy farmer's average per day milk production.

Table 3.37: Propensity Score Matching Estimates and Average Treatment Effect for Treated (ATT) of NDP on Dairy Farmer's Average Milk Production (per day in Litres), Selected States, India

Cow					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	3022	457	2.9	0.7	4.5
Kernel Matching Method	3022	581	2.6	0.5	4.8
Stratification Method	3022	651	2.7	0.6	4.4
Arithmetic Mean	2687	567	3.2		
Buffalo					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	3022	254	4.3	0.9	4.5
Kernel Matching Method	3022	581	4.2	0.6	7.0
Stratification Method	3022	651	3.9	1.0	3.8
Arithmetic Mean	1356	334	3.4		
Both Animals					
Propensity Score Matching Method	Treatment	Control	ATT	SE	t
Nearest Neighbour Matching Method	3022	577	2.5	0.7	3.7
Kernel Matching Method	3022	581	2.5	0.6	4.1
Stratification Method	3022	651	2.2	0.7	3.4
Arithmetic Mean	3628	785	3.2		

It can be observed from table 3.37 that average milk production (per day) among farmers from intervention group is about 3.2 litres higher than compared to those from control groups. After applying propensity score analysis and controlling for potential bias, nearest neighbourhood matching estimates shows a significant difference of 2.5 litre (per day) (Table – 3.7) difference in production between intervention and control groups. Further, matching estimates from Kernel method shows ATT of about 2.5 litres (t – 4.1) on those who are NDP beneficiary. In addition to this, Stratification method reveals an ATT of about 2.2litres (t – 3.4) on NDP farmers.

Table 3.38: Gini coefficient estimates for income obtained from selling milk from cow, buffalo and both animals

	Control		Intervention		Overall	
	Coefficient	S.E	Coefficient	S.E	Coefficient	S.E
Cow	0.36	0.02	0.53	0.01	0.50	0.01
Buffalo	0.54	0.02	0.57	0.02	0.57	0.01
Both animals	0.40	0.01	0.53	0.01	0.52	0.01

Table 3.38 display Gini coefficient estimates regarding distribution of income from selling milk across control and intervention areas. Clearly, the Gini coefficient is higher across intervention areas as compared to control areas, particularly for income associated with cow milk production. A higher value for income inequalities in intervention areas (0.53) as compared to control areas (0.36) indicates that inequality in richer dairy farmers are deriving greater income benefits in intervention villages and there is further scope to enhance the income of small scale dairy farmers. A low income inequality from milk production suggests that there are relatively fewer large scale dairy farmers in control villages.

Limitations of the Analysis

The study has four important limitations. First, for an analysis of impact of interventions, it is desirable to have a study design based on longitudinal data. An alternative, is to have well-identified randomized control and intervention villages and households. The study is based on a cross-sectional design and it should be interpreted accordingly. Nevertheless, available impact analysis methods for the cross-section design is used to draw analytical inferences. Second, it is often difficult to ascertain income related parameters from household survey with greater accuracy. Similarly, non-monetized income attributable to household consumption of the produced milk products is not taken into account. This may potentially lead to an underestimate of the income level across households. Third, with expansion in communication and transportation as well as development of private sector dairy, the control villages are also likely to have received greater awareness and information on dairy farming. Finally, the study is based on self-reported information on household income from dairy.

4 Qualitative Insights

4.1. Inclusion of Vulnerable Populations

NDP-1 aims to enhance the capability of dairy farmers especially, vulnerable populations, including women and small holders to access the organized dairy cooperatives for improved livelihood and sustained well-being. The key insights are as follows:

- Women are more dependent on dairy farming as compared to men who are predominantly engaged in crop cultivation and allied agricultural activities. In other words, women are less diversified as compared to men. This is because most of the female farmers remained at home or were engaged in unpaid domestic or household activities. Nevertheless, dairy farming has been seen / perceived an important source of livelihood for the majority of women farmers. Men are largely reported as the owners of the whereas in a few cases women are also reported as owners or joint owners. Work participation, however, is also affected by the social status of women. For example, in Bihar, the women belonging to forward castes had low participation in dairy activities than those belonging to lower strata. Certain social customs like purdah system still prevalent in villages restricts active participation in various training programmes and meetings. Lack of time, lack of technical knowledge and sociocultural restrictions are some of the other reasons for non-participation of women.

- It is observed that both men and women dairy farmers need greater awareness and training under ration balancing programme. Lack of RBP knowledge is observed more in female farmers as compared to the male farmers due to less participation of female farmers in the training programmes. Generally, it is observed that most of the women farmers were not completely informed or educated about the RBP and VBMPS efforts of the dairy cooperative.

- Women dairy cooperatives are one of the remarkable examples of a community enterprise working towards economic independence of rural women. The DCS has promoted gender equity by increasing the participation of women in various decision making and social activities and improvement of aspiration level of women. In some villages women are involved in self-help groups for collective and cooperative activities at village levels. For example, in Janakpuri a village in Indore, a self-help group is being run by some of the women members of the DCS from the past

15 years wherein each member contributes an amount of Rs. 200 monthly which could then be used for internal micro loans i.e. to members within the same group.

- Social inclusion is an inclusive development approach wherein no discrimination is made on the basis of caste, class or gender. In general, it observed that the there is no discrimination based on caste in the dairy business as people of all caste and class are allowed to be a part of the DCS. All the DCS members come to the same place to pour milk, stand in the same queue and pour milk in the same can. Villagers from all caste and economic strata are DCS members. Dairy Cooperatives have helped in augmenting income of marginal and small farmers by providing theme access to organized milk market and have been instrumental in bringing about socio economic transformation in rural areas. The Dairy Cooperative societies are formed without any caste and gender considerations.

- In Odisha, women members from the weaker sections especially belonging to the SC/ST community were facilitated by providing training and then enrolled under the project entitled, "Tribal Women Dairy Project", since 2016. Under this, 50 tribal women primary cooperative societies have been created. Although, they did not find any problem to motivate tribal women to associate with the union under this project but there were challenges because of low cattle population in this area.

- While there is no barrier / discrimination from DCS according to caste, class, or gender but lower participation of SC/ST households in dairying is attributable to their landlessness, lack of household experience in dairy or their poor economic status. Although, there are certain policies and provisions for these social groups to avail subsidies for cattle purchase but not much uptake is reported. Nevertheless, many of the marginal farmers have started dairying with the help of SHGs, Unions, and some of the schemes provided by government. DCS also is helpful in reaching out to farmers to broaden its base through welfare measures but landlessness remains an important concern for dairy uptake.

4.2. Awareness and Impact of Selected Programs

4.2.1. Ration Balancing Programme (RBP)

- The program was rolled out to educate milk producers on feeding balanced ration to their animals so that the nutrients required by their individual milch animals is fulfilled in an optimum manner, thereby improving milk production efficiency and the economic return. It is envisaged under the project that each animal covered under RBP would be uniquely identified with an ear tag so as to

enable monitoring of its productivity as well as efficiency of RBP through data to be fed into a performance recording system. Local Resource Persons (LRPs) were appointed in society at a modest monthly remuneration on a tapering basis for about two years.

- It is observed that animal diet, mineral and milk hygiene was better practiced by those who have participated in RBP trainings. Prior to introduction of RBP, farmers were not providing mineral mixture to their animals but now the farmers themselves demand mineral mixture from DCS/Union. RBP has created awareness amongst the milk producers on optimization of animal feeding by efficient utilization of locally available feed resources at the possible least cost. Therefore, under RBP proper use of locally available feed resources to balance the ration of animals at lower costs is ensured. This has helped to increase milk production with more fat and SNF.

- In Odisha, a respondent said, "*I have taken training on clean milk production and on balanced diet for cattle in the year 2016, which is organized by the officials of Sambalpur Milk Union in our village. I am very much thankful to the union. I learnt hygienic milk production and adequate quantity of daily feeding (perfect combination of green fodder, cattle fed, mineral mixture and oral calcium) to the cows. This has helped in the production of quality milk having more Fat and SNF content. As a result, I am getting Rs. 27 per litre for cow milk from the last one year (2017-18) as compared to Rs. 23.50/- per litre previously*" (Village: Charpali, Block: Dhankada, District: Samabalpur, Odisha).

- Knowledge among farmers about RBP at DCS levels varied according to the usage of RBP. The one who have already adopted RBP were more knowledgeable than the one who just heard about it. Further, it is observed that income has improved after adopting RBP as there was cut in feeding cost as opined by many in the FGDs. Generally, 10% cost has been reduced through RBP as farmer were made aware of using cattle feed, mineral mix with green and dry fodder.

- Nevertheless, several issues were noticed with the program. The remuneration to LRPs was not high enough to attract or hold them in the job. The job also requires certain education level and technical skills, which leads to shortage of suitable candidates. Besides, poor Internet connectivity adversely affects the job performance. The DCSs also do not encourage this practice as the full cost is borne the societies themselves. While discussing the RBP with DCS members, it was found that DCS members expect financial assistance (subsidy) to adopt the RBP with its full potential. However, it does not suggest that RBP is total failure; rather it is gaining momentum with slow pace. The obvious reason for this slow pace is low level of education, traditional way of conducting dairy farming, lack of awareness and unavailability of required fodder for RBP.

4.2.2. Village Based Milk Procurement Systems (VBMPS)

- VBMPS aims to increase milk production through key scientific and technical considerations involving genetic enhancements (Breeding) and scientific nutrition programmes for milch animals would need to be supported by providing milk producers greater opportunities for sale of surplus milk to the organized sector. This would require: a) strengthening of procurement systems of the existing dairy cooperatives and b) promoting producer companies where cooperatives have low presence and procurement. The Milk unions determine the milk procurement price based on the fat content /SNF level and Corrected Lactometer Reading (CLR). The buffalo milk fetches more price than cow milk which has lower fat content.

- VBMPS is achieving its objectives of setting-up a sustaining procurement system based on fairness and transparency. It ensures the quality milk that is being collected by setting up of AMCUs at the DCS level to not just check for Fat and SNF but also check for adulteration. Another major objective was to bring in maximum milk producers under organized sector which seems to have hit the bull's eye across several states. Under the VBMPS a number of old DCS were strengthened by providing infrastructure like funds for constructing a building for the DCS, installing Bulk Milk Coolers (BMC), Chilling Centers (CC) and Cold storages to increase the time span of milk pouring and a number of new village level institutional structures or DCS were created following cooperative principles and safeguarding the interests of small farmers. This has helped provide the rural milk producers access to organized market and thereby enhance their income.

- VBMPS has fostered trust between pouring members and DCS. Most of the participants told that the quality of milk in terms of increment in FAT and SNF level is realized. The collection and procurement at village level further facilitate their activities; else farmers had to put in more time on dairy activities. As one of the participants put, "Before installation of BMC, there were some occasions, our milk was rejected in case of there were less quality. But from last one year, we see no rejection of our milk from union. Our time is saved, transparency as well as quality is tremendously improved" (M 40 Nimon, Ahmednagar Maharashtra).

4.3. Impact of Dairy on Household Income

- Dairying has emerged as an important source of livelihood in rural areas. The formation of Dairy Cooperative Societies (DCS) has helped in providing an institutional platform for rural people for marketing their milk produces and get remunerative prices for their produce. It has helped people to diversify their income sources. In several households, dairy was found to be equally contributing to the household income along with agriculture or daily wage labour. Those who were included in

dairy business, acknowledged the role of dairy / union in maintaining sustained living and in some part, achieved better economic status by gainful employment. There were several participants who informed how dairying has supported house construction or in child education. In general, there has been considerable change in the economic status of dairy farmer. Many farmers' children are pursuing higher studies and dairy farmers are witnessing social and economic advancement.

- It is observed that the surveyed household basically has two sources of income, one income from crop, second from dairy farming. Of which dairy farming is considered to be the continual source of income. As opined by a participant, "agriculture is depended upon rainfall in our region, nobody knows the future of crop whatever you take. No one can sure about the returns from agriculture. In comparison to that dairy gives you income by every ten day that is usually used for household consumption" (F 24, Bhalgaon Aurangabad). Similarly, one of the participants told, "it was otherwise difficult to educate our children if there had not been a dairy. We look at it with great hope that there is something at our hand which won't let us down in difficulty. Because of this dairy, we can raise money also from other source; else you cannot get help on farming most of the time" (M29, Hanamatwadi Kolhapur)

4.4. Major Concerns

- Finance is a major obstacle for marginal farmers who want to adopt this business. They can't get easily loan from Government bank. If the loans process is facilitated, then more and more marginal farmer of the village will be connected to the dairy business. Cattle insurance is also a problem for all categories like SC, OBC and marginal farmers.

- There is lack of regular training in dairy farming or dairy business. There is limited information dissemination on maintenance of animal, their feeding, and treatment from illnesses and general hygiene. Also, there is a need to give more training to women on these topics.

- Since dairy cooperatives do not have capacity to hire young high skilled professionals, the only way is to upgrade the skill set of existing manpower by giving them extensive training and education on technical and modern management practices and processes in Madhya Pradesh. Training programmes should be conducted keeping in mind certain factors like duration, time (season), place, month and interval of training based upon judicious assessment and analysis of needs of the dairy farmers.

- To increase the participation of people in cooperative sector, certain incentives or reward for hard work and support services in the form of free and timely veterinary services, input supply and selling their milk at reasonable cost should be provided to the members' of DCS. Efforts should

also be made to empower women by organizing training programmes for women dairy members and promoting women extension workers as they can train and disseminate technologies to women dairy farmers better.

- There is a need to reduce the cost of rearing of milch animals by providing subsidized cattle feed and free of cost veterinary services. To further strengthen and attract more farmers to adopt dairy farming, there are suggestions for provision of free seeds for the cultivation of appropriate fodder crops, cheap loan facility to purchase cow and for the construction of cattle shed. The average cost of rearing of single cow per day is Rs. 140-150, this has to be reduced for the betterment of milk pourers.

- It is noted that private players are present in every district though their market share is comparatively less than that of Milk unions. The price of milk too fluctuates because of private players in market. Generally, the private dairy pays Rs. 1 more than milk union however this is not permanent. Private players also reduce their prices whenever there is a large supply of milk. Majority of participants however, were suspicious about the quality of milk collected by private players since there is no regulatory mechanism to check the quality in private sector.

4.4.1. Key Issues

The following issues are relevant to enable small holders, especially from the weaker sections, women farmers, to improve and engage in dairy farming are as follows:

- Better credit facilities in terms of short- and long-term loans by organized financial institutions.
- To provide more subsidy on cattle feed and mineral mixture and purchase of milch animals.
- Good network expansion to inform about scientific dairy and veterinary healthcare in time.
- It is important to create more awareness through training programmes about nutrition base so that small holders participate effectively in organized cooperatives.
- Need for educating the farmers particularly those with a low level of education to reduce the health and economic impact of zoonotic diseases (that transfers to humans from animals such as like Plaque, Brucellosis, Rabies, etc.).
- There is need to strengthen RBP program in village level in most of the states.
- Under VBMPS, there is need to strengthen infrastructure facilities in terms of BMC having 2000 litres capacity at DCS level especially where surplus milk is procured.
- There is need to provide remunerative price to the milk pourers of their milk production at DCS level on sustainable basis so that majority of the farmers voluntarily adopt dairy farming from the livelihood point of view.

4.5. Case Studies

Ujala Vyas, President, DCS Nayakhedi village, Ujjain Milk Union

At Nayakhedi DCS of Ujjain, all the members of the DCS are women, including the president, secretary and the LRP. President of DCS is Mrs Ujala Vyas. Nayakhedi DCS is an *Adarsh* DCS too. Mrs Ujala Vyas mentioned that the main occupation of the villagers is agriculture which is dependent on rain. So she tries to encourage women of the villages to do dairy farming for additional income. Only two cultivation is possible in Nayakhedi village. Soyabean and peanut are the main crops. Ms Ujala Vyas mentioned that earlier her family was having only 2 cows but once she started earning good income from dairy business, she purchased more cows. Now she is having 9 cows. She used to sell milk products too. The money, which she is earning from dairy farming, is kept with her only either in her own home locker or the bank. She does not share that with her husband. She mentioned that all the activity of dairy farming is carried out with her and her daughters-in-law. Ms. Vyas mentioned that money empowers her and gives her strength to take decisions too. A19 year old girl is the secretary of the DCS.

Rattan Kumar

Dairy farmer, Kudana village of Indore Milk Union.

Kudana village DCS is one of the most effective DCS in terms of quality of infrastructure, bulk milk procurement and strong revenues. In the last few years, the Kudana DCS has been awarded the best by Indore Milk Union. In 2018, Kudana DCS has been awarded with a prize money of Rs 6 Lakhs for their excellent functioning. Mr. Ratan Kumar is a farmer and his main occupation is agriculture. Later on he started dairy farming and with its profit he purchased 20 HF cows. On his farm, milking is done by electronic milking machine. His whole family is involved in dairy farming. He is having 4 sons and 4 daughters. Two sons and 2 daughters are married. Mr. Ratan mentioned that he treats his cattle as his family. He has made permanent structure for cattle shade and cattle sheets made up of rubber for cattle are used to keep them in good hygienic condition. He kept dairy animals in a clean area with proper lighting, good ventilation and drainage system. Mr. Ratan is growing green fodder in his agriculture farm and sells it to other farmers too. Being very close to Indore (Sanchi) Milk Union, he is having very good relationships with the union officials.

Ramesh Kumar

Dairy Farmer, Gopalpur village, Patna Milk Union

Ramesh Kumar is a graduate and a small dairy farmer of Hazipur village of Patna district. His village is having scarcity of harvesting water. Most of the villagers depends on rain water for cultivation. Earlier, Mr Ramesh worked for some time in Patna, but he was unable to save even a single rupee from his earnings. After that he returned back to his village and came in contact with Patna milk union people for starting milk society in his village. He took training in milk union and started encouraging his own village people to give milk to the society. Initially it was very difficult for him to convince people as everybody told him that cattle are their family members so they will not sell milk. He tried to convince them to give less amount even so that he could be able to run DCS. At present there are only 20 members in DCS who supply milk regularly. Ramesh is a Science subject graduate, so he himself does the AI for villagers with very nominal charge of Rs. 60. Hazipur village is very remote village and people have poor transport facilities and usually during emergency veterinary cases they face huge difficulties. Purchasing of cattle is another problem for the villagers as they did not get loan without proper bill of purchasing and if they buy it from open market then the cost of cattle is much higher as the sellers knew that the farmer is securing loan from bank. Ramesh encouraged farmers to buy cattle from their relatives or known persons, so that they pay less and get the cattle.

Vimala Singh

Secretary, DCS(BMC) Mahila, Karauta village, Patna Milk Union

Vimala Singh, 52 years old, is Secretary of DCS, which is also a BMC. This DCS is women owned and operated DCS. Her husband is a school teacher. She was having 4 cows with her when she started dairy business. Her village is famous for banana cultivation and for that farmers need cow dung and urine as natural fertilizer. She is having agriculture land near by her house where she used to keep her cattle. Later on that land became very much fertile with cow dung and urine. So, she started cultivating banana too. This increased her family income. Gradual increase in the family income and improvement in the living standard motivated her to encourage other women of the village. The village is situated on the Patna – Vaishali highway so milk transportation is not a major problem. Her husband also joined dairy farming after his retirement and started helping his wife. Vimala Singh encouraged her sister-in-law (Sangeeta) to take the training of AI and do it for the villagers. Earlier she faced rejections from the villagers as it was the mindset of the villagers that AI worker should be a male and not a female. But later on, AI done by Sangeeta received 99% success rate, so she got acceptance from the villagers.

Ms Ujala Vyas, President of DCS Nayakhedi village, Ujjain Milk Union

Mr. Rattan Kumar, Dairy farmer, Kudana village, Indore Milk Union

Mrs. Vimala Singh, Secratery, DCS(BMC), Karauta village, Patna Milk Union

Mr. Ramesh Kumar, Dairy farmer, Gopalpur village, Patna Milk Union

5 Conclusions and Recommendations

5.1. Key Conclusions

- **Dairy cooperatives as important source of knowledge and motivation**: Although parents and relatives are the most important source of knowledge and motivation for dairy farming (about 80%) but it is observed that in intervention villages the Dairy Cooperatives have emerged as a second alternative for dissemination of knowledge and has also motivated farmers for adoption of dairy farming.

- **LRP coverage needs expansion but is effective**: The LRPs coverage is currently at 58% and requires further improvement, particularly among the vulnerable populations. The regression analysis indicates that large landholding farmers are more likely to report the LRP visits. However, trainings and interactions on RBP has considerable influence and over 90% of those benefited from such trainings report of practicing the advice received on RBP.

- **Livestock size is greater in intervention villages**: The mean herd size is greater among dairy farmers in intervention villages than compared to control villages. The average number of cows per household in control and intervention villages is 1.8 and 2.7, respectively. Similarly, the average number of buffaloes per household in control and intervention villages is 1.9 and 3.8, respectively.

- **Training on RBP is inclusive and beneficial**: Training on dairy related activities and receipt of mineral mixture and fodder on subsidized prices are among the important benefits reported by almost one-third of the dairy farmers in intervention villages. While the richer households continue to have greater access to loans and cash bonus but the poor households have greater share in training participation. The logistic regression analysis suggests that the vulnerable populations particularly the SC/ST are 1.6 times more likely than the non-SC/ST households to receive any of these benefits. Small and marginal landholding families are also more likely to benefit from such interventions.

- **Cost of rearing and milk production is high:** Cost of milk production because of higher fodder price and higher labour cost are important constraints identified by the dairy farmers. However, the

dairy farmers in intervention villages are less likely to report these challenges than compared to the control villages. In control villages, more than 90% of dairy farmer said that cost of milk production has increased because of higher fodder price which is about 19% higher than intervention villages. In case of labour cost, more than 15% of dairy farmer's complaints about higher labour cost than that of intervention villages for dairy farming. In control villages, complaint about decreasing productivity of milch animal is 8% higher than the intervention villages.

- **Treatment and medical costs a significant factor**: The mean expenditure on treatment of cattles in control and intervention villages is Rs. 1523 and Rs. 1402 per month, respectively. Although, the simple mean difference is not statistically significant but linear regression analysis shows that when adjusted for other socioeconomic variables the treatment expenditure is relatively higher and significant among the control villages.

- **Quality and quantity of milk produced has improved**: Around 30% of the dairy farmers have reported improvement in quality as well as quantity of milk produced after the practice of RBP. The benefits are more or less equally distributed across the population and vulnerable groups. Importantly, every second dairy farmer reported improvement in local purchase of milk after VBMPS.

- **Poor households satisfied with income gains from RBP and VBMPS interventions**: Poor dairy farming households are more likely to report satisfaction with the role of RBP and VBMPS in improving their family income. However, SC/ST households are less likely to report greater income benefits compared to non-SC/ST households. This is partly associated with lower production volume of these households that does not allow greater income gains. Importantly, the overall level of satisfaction with dairy farming is relatively higher among intervention villages. In fact, dairy farmers in control villages are 40% less likely to report such satisfaction then compared to intervention villages.

- **Quantity of milk production is higher in intervention villages**: The quantity of cow and buffalo milk production is found to be higher among the intervention villages than compared to the control group. The average cow milk production in control and intervention villages is 11.7 and 14.5 litres per day. The average buffalo milk production in control and intervention villages is 6.0 and 9.4 litres per day. The effect across intervention villages is significant even after adjusting for socioeconomic variables in a linear regression model. The propensity score analysis based Average Treatment effect on Treated (ATT) estimates also confirm the significant difference in milk

production across control and intervention villages. The ATT based on a sensitivity analysis ranges from 2.6 to 2.9 litres per day for cow milk production and 3.9 to 4.3 litres per day for buffalo milk production.

- **Income from milk production is higher in intervention villages**: The household income from cow and buffalo milk production is found to be higher among the intervention villages than compared to the control group. The average income from cow milk production in control and intervention villages is Rs.310 and Rs.393 per day. The average buffalo milk production in control and intervention villages is Rs.198 and Rs.276 per day. The higher incomes accruing to the intervention villages is found to be significant even after adjusting for socioeconomic variables in a linear regression model. Further, the propensity score analysis based Average Treatment effect on Treated (ATT) estimates also confirm the significant difference in income from milk production across control and intervention villages. The ATT based on a sensitivity analysis ranges from Rs.82 to Rs.99 per day for cow milk production and Rs.48 to Rs.79 per day for buffalo milk production.

5.2. Major Recommendations

The main recommendations to further strengthen the dairy farmers (or milk pourer members) in general and smallholders in particular, with a focus to achieve the objective of inclusive development, thereby improving their livelihood and sustainability prospects:

- **Strengthening participation and involvement of women**: Given the importance of gender in the rearing of bovine stock, particular attention needs to be paid to meet the credit needs of women farmers. Cooperatives in conjunction with banks may think of putting in place special programs to provide financial services for rural women, such as an agricultural women's bank that would specialize in working with women dairy farmers and catering to their banking needs to start dairy farming. Women play a significant role in dairy farming and undertake critical activities but their control over livestock and its products is very minimal. The income from dairy animals often does not accrue to the women and neither enhance financial autonomy as well as decision making power. There is an urgent need to disseminate technologies which will help all engaged to overcome relatively unpleasing physical exertion and minimise effects on physical and psychological well-being. Women have to be particularly motivated to acquire more scientific knowledge for increasing the livestock production through various extension techniques.

- **Expansion of AI and Extension services**: The quality of animals is critical in determining its milk productivity and hence overall production. Currently, low productivity per animal hinders

development of the dairy sector. Cattle and buffalo breeding programmes have been initiated but needs further extensions particularly to overcome the shortage of AI workers or veterinary doctors. More AI technicians should be trained, as well as, livestock development agencies should be strengthened to offer services in animal breeding in the form of procurement, production and distribution of breeding inputs (such as semen and liquid nitrogen), training and promotional activities. There is a need to enhance collaboration between extension service providers and dairy farmers to ensure uptake of improved dairy technologies

- **Strategies to support small-land holding farmers**: Increasing milk production in small-scale dairy farms and enhancing livelihoods of farmers depends mostly on the adoption of appropriate feed technologies. These need to be based on locally available feed resources and improved support services (such as improved feeding systems, appropriate breeding programmes, credit facilities, veterinary health care and marketing systems). Because of their low level of milk production, indigenous cattle are often graded as inefficient when compared with western exotic cattle; however, classification on the basis of milk yield ignores the multipurpose utility of indigenous cattle, their energetic usefulness and adaptation to the local resources and environment. Therefore, efforts need to be made to improve the economic characteristics of indigenous cattle. Concentrates used for fodder include coarse grains, such as maize, sorghum, bajra and other millets, and other cereal by-products, such as rice bran/polish and various oil meals, including groundnut cake, mustard cake, coconut cake, soybean meal, cotton seed meal and sesame cake. The escalating price of feed ingredients is a major cause for concern. In many states, cooperatives are involved in producing feed concentrate and selling to farmers at subsidized rates. This should be done nation-wide.

- **Access to formal / informal credits**: Lack of access to credit to expand the herd is a critical problem for farmers. There is little access to formal credit through the cooperatives. Informal credit is available from private traders and agents of private companies, but the interest rate is very high. And these loans may or may not be linked to dairy activity. When taking a loan from a trader, the farmer is then tied to selling the milk to that trader, often at a low rate. The low or non-availability of credit as a primary constraint in livestock sector activity, indicating that Public sector lending is abysmally very low. The commercial banks are not favourably disposed to providing credit to livestock farmers and the cooperative credit system is very weak, resulting in excessive dependence of livestock farmers on informal sources and usually at exorbitant interest rates. Efforts should be put on correcting these distortions and ensure timely availability of inputs and services, including credit to livestock farmers. Institutional credit in the dairy production system

may be intensified as dairy is one of the remunerative activities where cash flows are fairly positive for farmers. The Pradhan Mantri Jan Dhan Yojana can play a pivotal role in achieving this target.

- **Availability of veterinary doctors in all the villages**: There is lack of veterinary doctors in the rural areas of most of the states. Veterinary doctors are posted at block level only, so the farmers of remote villages do not get services in time. It can be started by providing doctors in a small group of villages. The Government and the private sector are involved in producing medicines and vaccines. However, quality control is a critical issue. There should be an independent agency set up by the government to control the quantity and quality of vaccines so that these are available to each farmer in time and in ample quantity. There is need to provide free veterinary services to the pourer members round the clock thereby reducing the cost of cattle treatment so as to maximize the productivity of cattle and buffaloes stock. This leads to increase in milk production and hence the remunerative price to the dairy farmers from sustainability point of view.

- **Price stabilization of milk based on FAT and SNF level**: Price of milk increases in the lean season and decreases in the peak season followed by high cost of feeds and fodder, which sometimes discourages dairy farmers. This should be countered by a suitable policy of fodder supply in all season and enforcing price setting of milk based on fat and SNF content to encourage production of cow milk.

- **Capacity-building training**: Placing priority on establishing a permanent vocational and outreach training facilities at the National Dairy Training Centre or state level food technology colleges is very much needed for the purpose of development of dairy farming. The dairy farmers need to have better knowledge of feed management. This can be done by involving milk plants and provincial livestock departments who can provide training and extension services to dairy farmers. There should be scope for increasing dissemination of knowledge learned at trainings to the wider group of dairy farmers who could not attend. With the emergence and likely rapid adoption of biotechnologies, farmers will have to improve their skills so that they can use such technologies effectively. Under these conditions, the role of the extension system would become increasingly important in assisting farmers in the improvement of their managerial skills.

- **School lunch (and milk) programme**: Linking state and district milk producers to the mid-day milk programme in MP with Indore Milk Union has facilitated the dairy sector's revival process while introducing/re-introducing children and their parents to the nutritional benefits of local milk by providing milk in the schools as a part of mid-day meal program. This can be extended to other states also.

- **Livestock insurance scheme**: Progress of the Livestock Insurance Scheme has not been very encouraging. Cattle insurance should be structured more efficiently, involving product and services innovations and effective delivery through dairy cooperatives of farmer organisations.

- **Agriculture and fodder development**: It may be recommended that the agricultural development must be considered as a primary condition for improving cattle or buffaloes of any region in India. Primary efforts may be made to improve the farming conditions with adequate provision for fodder crops. To achieve this, additional public investment in fodder technology may be needed to enhance the production of fodder crops (such as berseem, lucerne, cowpea, oats, sorghum, etc.), which in turn leads to increase in overall welfare of dairy farmers by reducing the cost of rearing of cattle and buffaloes. There is need to provide training to dairy farmers on silage making, hay making and on the conservation of crop residues so as to enhance livestock productivity by ensuring adequate fodder supply, especially during the lean season. Eventually, it will ensure milk production round the year and generate income on sustainable basis to improve the livelihood of dairy farmers. The changing cropping pattern should aim to produce sufficient green and dry fodder to livestock population in the village and encourage the farmer to take up fodder cultivation on a commercial basis. Attempts should also be made to improve the quality of manufactured feed in the cooperative sector so that quality feed can be supplied at reasonable prices.

- **Strengthening cooperative milk procurement and services**: The organizational support for milk producers through the cooperative sector should be streamlined and expanded for primary cooperatives for milk procurement. This should be extended to areas where the local market is unable to absorb the milk production and steps should be taken to reorganize and develop rural market for milk. The societies may ensure necessary input services to all producers in due course of time. Timely provision of input services is not only likely to reduce the cost of milk production by increasing the productivity of individual animals but may also work towards improving the overall genetic stock of such milch animals.

- **Mass media outreach**: Mass media may be utilized to a great extent for transfer of improved dairy practices to the needy farmers/pourer members in enriching their knowledge with respect to various activities of dairy farming.

Annexure

Literature Review

Introduction

NDP 1 is a central sector scheme being implemented by the NDDB through End Implementing Agencies (EIA) for a period of 2011-12 to 2018-19. NDP 1 is a scientifically planned multi-state initiative with the core objectives to help increase productivity of milch animals and milk production with broader access to the organized milk-processing sector to rural producers (NDDB, Websites). The project components of the NDP-I are increasing productivity through scientific breeding and feeding; increasing production of high-quality disease-free semen; nutrition and ration balancing programme; fodder development; computerized information systems for enhancing productivity; promoting and strengthening village-based milk procurement systems; project management and learning; and capacity building (NDDB, 2012).

Income and Employment generation

Due to lack of employment opportunities and shrinking of agricultural land, livestock rearing becomes more proportionate in rural areas. It has a positive impact on income and employment generation, and poverty alleviation (Ali 2007). This fact was unquestionably accepted that under livestock, dairy is more profitable work. Likewise, in a study of the Kolar districts of India, Nagaraja et al, established that if dairy is included with other entities, its reward is more encouraging. This combination not only does increase agricultural income, but the resources available with it also to be used in a better manner. It helps to generate flow of cash to the farmers round the year by way of disposal of milk, meat, poultry eggs, silk cocoons, etc. Dairying is also playing a very important role in the development of women's. Women engaged in domestic work can actively participate in this sector. In this way, they can not only contribute the share in family income but also they can change her status in the house as a non-earning to earning member of the family (Patel and Mitra, 2015).

Though, there is no studies have been found which was done directly by pointing to the impact of NDP 1. Further, literature related to the impact of the main component VBMPS and RBP of NDP I on the marginalized section of the society is also not available. Although, some studies have reflected that in India, Dairy farming has emerged as a vital source of livelihood, and also describes as small

industry which provides gainful employment opportunities particularly on small holder households in rural and semi urban areas (Singh and Joshi, 2008; Dhanabalan, 2009; Singh et al., 2012; Kumar, A and S J Staal, 2010). Nedelea et al (2009) stated in a study of Bangladesh that if we keep in mind the input cost of any work, then there is more income and revenue in the dairying than other works in both rural and urban areas. He also detected that dairy wastage could be used as fertilizer in agricultural land and or fireworks in rural areas. It was observed that due to technology progress and growth in dairy product consumption stimulate the dairy income (Dong 2006). As the participation of people will increase, and by this there will be an increase in the income of the people, the inequality of income distribution will also decrease which is a major problem of ours society. But it is extremely important for the dairy to be adopted as a main business and to promote it. Most importantly, the farmers involved should be well trained. Experience, investment in human capital, managerial skill and size of investment also affect it primarily (Chang et al 2008).

Trade and Marketing

Marketing of dairy products represents an imperative component of dairy development. An efficient marketing is that in which marketing costs are the lowest and productive benefits are highest. In this way, in many studies it has been found that if raw milk is traded and marketed directly without any intermediary, then it is most beneficial for the producers (Rangasamy and Dhaka, 2008; Staal, 2010).

However, Birthal et al (2009) opinion is contrary to them and he told that compromise trading in milk business is more profitable than independent business. He found that small producers have to bear the excess of the exchange. So if they do business through institutions then they can greatly reduce their costs. It will also reduce supply risks to the processors. Likewise, Thirunavukkarasu and Sudeep Kumar (2005) shows in a study of Tamil Nadu that it was stated that due to the irregularities in payment by the vendors in the subsequent years, prevention of procurement and weakening of the mutual relations of farmers and sellers, the farmers had left the vendors and turned to the co-operative societies. It is well established that the co-operative system was indisputably accepted, due to which millions of farmers were benefitted from joining. Simultaneously, an unexpected increase in milk production and farmers' income was recorded. This has resulted in unprecedented improvement in the quality of life of the farmers (Although Harold (1987). But when private investment was accepted in the cooperative sector, there was a decrease in its performance. After this the farmer turned his attention towards a new marketing system called integrated contract system. Whereas in an another study executed by the Rangasamy and Dhaka (2008) of the same State found that the marketing efficiency of cooperative dairy plant for all dairy products has been observed

relatively less than that of private dairy plant. All the dairy products earn more marketing margins in the private sector than in co-operative dairy plant.

Since, there are several changes in NDDB leadership. Nevertheless, despite all the storms, the co-operative model under NDDB has been given the highest attention, and dairying becomes an alluring sector with passes time. It has also been observed that while the elite groups played an important role in the past, now the people living on the margins are also interested in it and are performing well. Further women allocation contributes to more desirable results (Shylendra 2011, Kishore et al 2016).

Production and Breed of animal

The growth in milk production has been uneven in the world in different regions of the world in general and India in particular. Per capita availability of milk in India is 355 grams/day is much better as compared to the average world per capita availability of 229 grams/day. The per capita availability of milk is highest in the northern region with 1075 grams in Punjab and 930 grams in Haryana. In the western states like Gujarat and Rajasthan, the per capita availability of milk is the second highest, viz. 563 grams and 3785 grams, respectively. In southern states like Andhra Pradesh and Karnataka, the per capita availability of milk is 522 grams and 291 grams, respectively as against the national average of 355 grams/capita/day (NDDB Website).

There are several studies which reveal that milk availability is based on the productivity of milk in any specific place or regions and it is almost depends on the milk production. Whereas a study done by Paul and Chandel (2010) also suggested that need to be more focus to achieve through a herd composition such as adaptation of crossbreed animals in dairy. Likewise, higher proportions of the farmers have positive attitude about the importance of crossbred cattles, and they replaced indigenous cattle by crossbred cows or buffalos (Gangasagare and Karanjkar 2009, Shankari 1989, Harold 1987). In a research it was found that the farmers with large herd size; preferred crossbred cows against the local cows or buffaloes, while farmers with small herd size preferred otherwise. It was also noticed that improved scientific dairy farming practices and increase in proportion of crossbred cows in the total miltch animals, led to increase in average daily milk production. Per litre cost of production was substantially low of crossbred cows than local cows and buffaloes. To a great extent, the herd size, season and type of animals caused significant effect on average daily milk contribution by dairy farmers to DCS milk pool (Singh et al 2012.). Urbanization has a profound positive influence on dairy development, which is mainly driven by the smallholders. On the supply side, factors

like farm mechanization, improved access to groundwater irrigation and crop diversification away from cereals, are associated with a shift in the bovine economy from draught to dairying (Kishore et al 2016).

Constraints

Several hurdles in dairying are founds in many studies in different segments of the industry. Fodder and livestock development are the key challenges in the sector. Lack of the suitable plans is another major reason for the backwardness. Keeping in the view of this problem, fodder development was one of the main activities of the planning of NDDB. This emerged as a mile stone in the development of dairying. Involvements of the institutional agencies can play a heroic role with regard to all these (Shylendra 2011). Prime factors affecting the milk yields are the technological and socio-economic constraints. Awareness about de-worming and vaccination in the farming community is also very low in India. These problems could be addressed by adopting improved management, better feeding, controlling of diseases and improvement of the socio-economic conditions of the farmers (Paula and Chandel, 2010; Aden et al, 2008). Lesser use of mobile phones in dairying is another big constraint; there is a need to encourage this among the farmers. But this will only be meaningful when information related to animal husbandry and milk production is carried to farmers through mobile phones (Rathod et al, 2016).

As it has been said above, it is also a big problem in the milk production as the cooperatives are unable to work properly. Shah (1997), while underlining this problem, said that such problems were also being held in the cooperative societies in Maharashtra. He advised, for the smooth functioning of the milk co-operatives, it is not enough to offer remunerative prices to the producers, but the co-operatives themselves should take over the onerous task of ensuring necessary inputs so as to improve productivity and overall genetic stock of milk animals. Inequality in the ownership of land and barriers imposed by the caste system are the most formidable obstacles to participation of poor households in the dairy cooperatives. Illiteracy among SC/ST and women's another substantial barrier to democratizing the functioning of the cooperatives (Rawal 2001). Further, deregulation and liberalization of the dairy industry alone cannot solve the problems economic efficiency and low productivity (Singh et al 2008). While Sirohi, Kumar and Staal (2009) found that the created infrastructure was either largely defunct or grossly under-utilized. In a major step for the improvement of the management functions (Mehta et al 2004), undertook an action research study focusing on staff function and re-laid improvements that can influence policy related to decision making.

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Table A1: Percentage distribution of age of the respondents by State and gender

	Control		Intervention	
	Less than equal to 25	More than 25 years	Less than equal to 25	More than 25 years
Male				
Bihar	8.7	91.3	1.7	98.3
Gujarat	1.6	98.5	5.0	95.0
Karnataka	5.5	94.6	7.3	92.7
Madhya Pradesh	6.0	94.0	7.0	93.0
Maharashtra	3.3	96.7	3.8	96.3
Odisha	0.0	100.0	0.4	99.6
Punjab	0.0	100.0	4.7	95.3
Rajasthan	4.2	95.8	14.9	85.1
Tamil Nadu	0.0	100.0	1.7	98.3
Total	3.0	97.0	5.0	95.0
Female				
Bihar	0.0	100.0	6.5	93.6
Gujarat	14.3	85.7	8.3	91.7
Karnataka	14.3	85.7	1.5	98.5
Madhya Pradesh	5.6	94.4	5.3	94.7
Maharashtra	0.0	100.0	9.2	90.8
Odisha	0.0	100.0	1.6	98.4
Punjab			0.0	100.0
Rajasthan	25.0	75.0	16.0	84.0
Tamil Nadu	0.0	100.0	1.0	99.0
Total	3.6	96.4	7.8	92.2

Table A2: Percentage distribution of respondents by gender, age and marital status

	Control			Intervention		
	Female	Male	Total	Female	Male	Total
Age Of Respondent	Unmarried			Unmarried		
Less than equal to 25	42.9	57.1	100.0	14.0	86.1	100.0
More than 25 years	34.4	65.6	100.0	35.3	64.8	100.0
Total	35.3	64.7	100.0	30.2	69.8	100.0
	Female	Male	Total	Female	Male	Total
	Married			Married		
Less than equal to 25	15.4	84.6	100.0	41.0	59.0	100.0
More than 25 years	20.4	79.6	100.0	23.5	76.5	100.0
Total	20.3	79.7	100.0	24.3	75.7	100.0

Figure A1: Possession of Bank account, Aadhar, Job under MNREGA and Kisan Credit Card by gender of the respondent in Control Areas
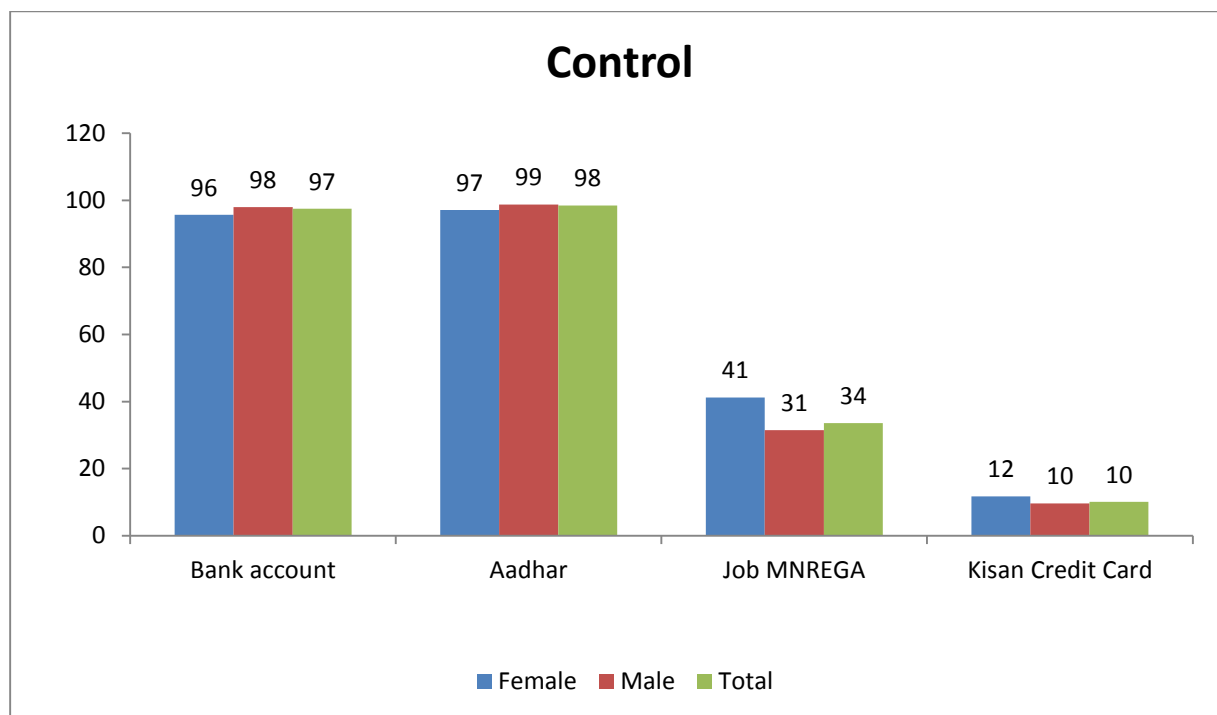
Figure A2: Possession of Bank account, Aadhar, Job under MNREGA and Kisan Credit Card by gender of the respondent in Intervention Areas
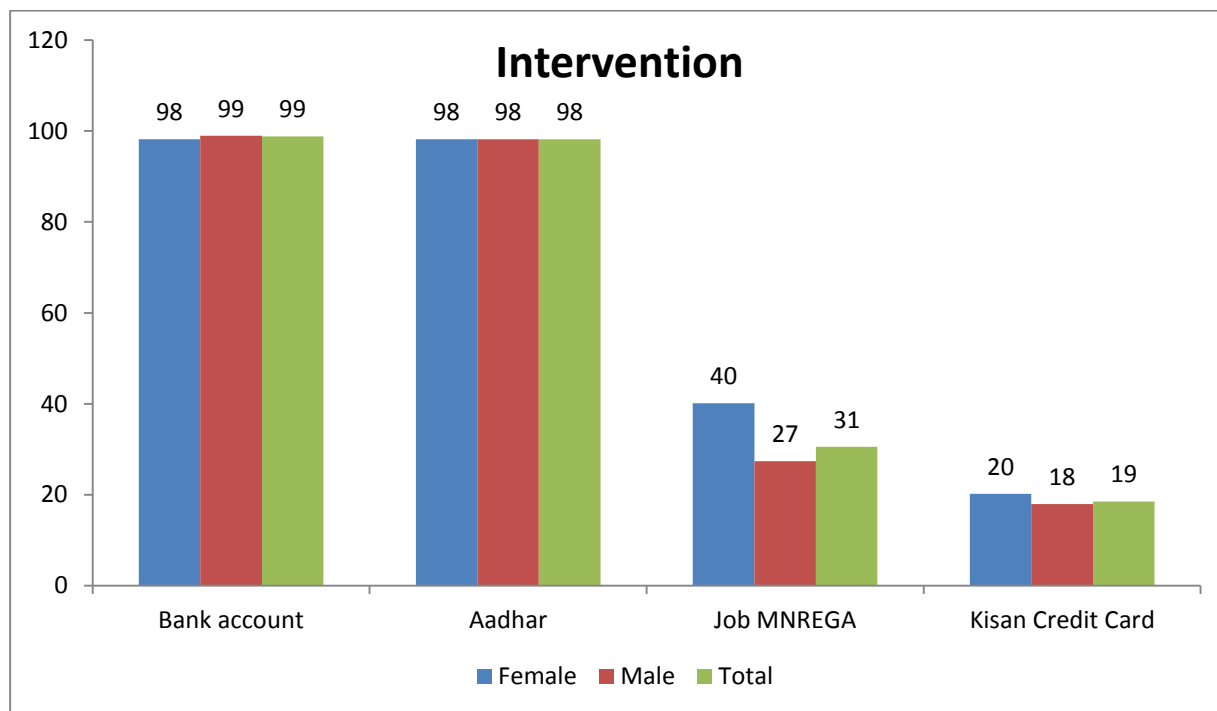
Table A3: Possession of Bank account, Aadhar, Job under MNREGA and Kisan Credit Card by State

	Control				Intervention			
	Bank account	Aadhar	Job MNREGA	Kisan Credit Card	Bank account	Aadhar	Job MNREGA	Kisan Credit Card
Bihar	98.0	94.0	26.0	20.5	99.2	99.0	11.7	7.7
Gujarat	98.6	96.4	1.6	2.4	99.4	96.4	0.3	0.0
Karnataka	98.4	100.0	25.4	0.0	100.0	99.7	32.0	18.6
Madhya Pradesh	97.1	99.0	24.3	14.7	95.5	96.5	26.1	32.3
Maharashtra	95.3	100.0	25.0	7.8	97.6	98.8	31.4	16.9
Odisha	97.6	100.0	82.1	26.2	100.0	98.8	44.6	17.6
Punjab	100.0	100.0	50.0	0.0	99.4	96.7	19.7	20.9
Rajasthan	96.4	96.4	75.0	14.3	99.2	98.9	66.1	30.4
Tamil Nadu	95.8	100.0	43.2	3.2	99.6	98.2	40.8	23.2
Total	97.3	98.4	33.4	10.0	98.8	98.2	30.6	18.6

Table A4: Mean expenditure across different States

	Control	Intervention
Bihar	10211	5912
Gujarat	8391	11164
Karnataka	5536	4088
Madhya Pradesh	4529	4808
Maharashtra	5823	5654
Odisha	5456	4977
Punjab	6700	7234
Rajasthan	1467	4140
Tamil Nadu	5331	3669
Total	6202	5573

Table A5: Mean expenditure on different items

Control							
State	Food	Clothing	Entertainment	Bathing	Transport	Rent	Fuel
Bihar	5662	1978	758	488	934	174	739
Gujarat	6146	896	410	495	796	344	902
Karnataka	2296	1696	114	398	441	95	780
Madhya Pradesh	1856	549	408	424	1051	58	580
Maharashtra	2795	708	160	610	970	25	595
Odisha	3563	600	222	146	466	0	462
Punjab	2125	1413	643	600	900	0	1100
Rajasthan	798	200	14	101	64	38	250
Tamil Nadu	2632	460	429	606	965	59	485
Total	3567	804	339	438	806	83	600
Intervention							
Bihar	3435	725	319	253	644	45	603
Gujarat	7012	1412	710	573	1353	566	1083
Karnataka	1721	973	245	374	487	92	688
Madhya Pradesh	1809	577	189	402	1122	42	740
Maharashtra	2642	820	202	556	775	54	762
Odisha	2907	641	198	151	585	50	522
Punjab	1911	1284	773	761	1452	250	1147
Rajasthan	2099	656	379	442	479	473	488
Tamil Nadu	1468	650	292	333	495	1469	537
Total	2792	809	317	399	788	171	692

Figure A3: Mean expenditure by social groups

Figure A3: Mean expenditure by social groups
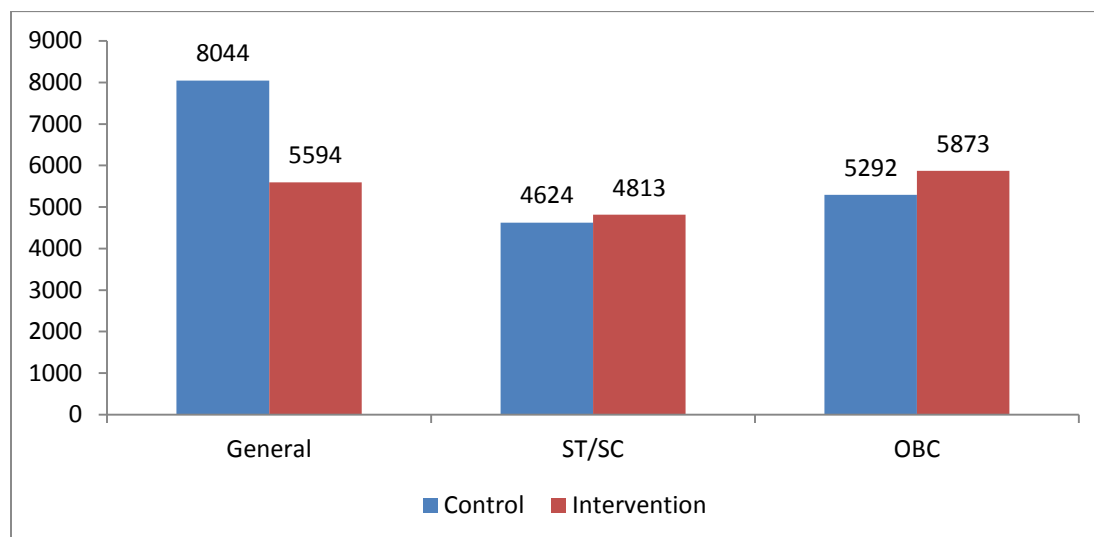
Table A6: Percentage of respondents who have taken a loan from bank in control and intervention areas by socio-economic characteristics

	Control	Intervention
Age of Respondent		
Less than equal to 25	0.0	29.0
More than 25 years	20.7	28.4
Education Of Respondent		
Below or completed primary	20.1	28.9
More than Primary education	16.3	24.5
Gender		
Female	34.8	26.6
Male	15.4	29.1
Caste Of Respondent		
General	25.1	31.3
SC/ST	15.2	33.6
OBC	16.8	23.7
Wealth quintile		
Quintile 1	19.3	34.0
Quintile 2	20.9	23.8
Land		
Marginal	21.0	28.4
Small	26.5	35.8
Medium	11.1	27.0
Large	22.9	25.8
Total	20.0	28.5

Table A7: Percentage of respondents who have taken a loan from bank in control and intervention areas by State

	Control	Intervention
Bihar	37.8	40.4
Gujarat	0.0	2.9
Karnataka	11.8	53.6
Madhya Pradesh	10.0	14.6
Maharashtra	43.9	57.6
Odisha	41.5	18.2
Punjab	0.0	14.4
Rajasthan	0.0	8.3
Tamil Nadu	0.0	35.9
Total	20.0	28.5

Table A8: Percentage of respondents who report that their household have hired male and female labour by socio-economic characteristics

	Control		Intervention	
	Male hired	Female hired	Male hired	Female hired
Age of Respondent				
Less than equal to 25	5.0	0.0	9.6	10.2
More than 25 years	3.4	1.0	7.9	6.5
Education Of Respondent				
Below or completed primary	3.7	0.9	8.4	7.0
More than Primary education	1.6	1.6	5.4	4.9
Gender				
Female	2.9	2.9	8.5	10.4
Male	3.6	0.4	7.9	5.5
Caste Of Respondent				
General	0.4	0.0	5.5	2.4
SC/ST	9.8	2.7	11.0	6.5
OBC	2.3	0.8	9.7	11.6
Wealth quintile				
Quintile 1	2.9	0.9	9.0	7.4
Quintile 2	4.0	1.0	7.5	6.1
Land				
Marginal	2.3	2.3	7.5	7.9
Small	3.1	0.0	6.2	9.2
Medium	0.0	0.0	9.4	4.6
Large	1.6	0.0	10.6	8.6
Total	3.4	0.9	8.2	6.7

Table A9: Percentage of respondents who report that their household have hired male and female labour by State

	Control		Intervention	
	Male hired	Female hired	Male hired	Female hired
Bihar	3.9	3.9	14.4	13.6
Gujarat	10.4	0.7	0.3	0.3
Karnataka	6.4	4.8	12.1	3.9
Madhya Pradesh	0.0	0.0	16.3	15.3
Maharashtra	1.6	0.0	2.1	2.4
Odisha	0.0	0.0	0.0	9.8
Punjab	0.0	0.0	11.1	7.8
Rajasthan	0.0	0.0	3.9	1.9
Tamil Nadu	0.0	0.0	13.6	3.2
Total	3.4	0.9	8.2	6.7

Table A10: Source of knowledge among respondents who have reported prior knowledge of dairy farming

	Family members	Friends/relatives	NDP/DCS	NGO's	SHG's
Control					
Bihar	71.4	28.6	0.0	0.0	0.0
Gujarat	83.8	14.1	1.0	0.0	0.0
Karnataka	94.0	6.0	0.0	0.0	0.0
Madhya Pradesh	84.8	10.2	1.7	0.0	0.0
Maharashtra	64.3	32.1	1.8	0.0	0.0
Odisha	75.9	24.1	0.0	0.0	0.0
Punjab	83.3	0.0	16.7	0.0	0.0
Rajasthan	72.7	27.3	0.0	0.0	0.0
Tamil Nadu	64.5	6.6	3.3	0.0	0.0
Total	77.3	15.9	6.1	0.0	0.0
Intervention					
Bihar	54.4	28.6	12.1	1.1	1.7
Gujarat	92.5	4.4	3.1	0.0	0.0
Karnataka	61.2	37.3	20.2	0.0	0.0
Madhya Pradesh	74.2	14.2	16.6	1.0	1.0
Maharashtra	56.7	28.5	13.1	0.3	0.0
Odisha	8.7	23.9	66.5	0.0	0.5
Punjab	86.0	09.3	4.7	0.0	0.0
Rajasthan	58.0	16.0	24.5	0.0	0.0
Tamil Nadu	43.1	8.0	48.5	0.0	1.7
Total	58.4	19.8	23.8	0.3	0.5

Table A11: Benefits received by beneficiaries from the interventional area DCS/NDP by State

	benefits of loan/cash	fodder at subsidized price	veterinary service at free of cost	free training
Bihar	8.2	45.0	35.5	44.2
Gujarat	36.7	26.0	12.7	5.0
Karnataka	7.6	17.1	4.8	23.6
Madhya Pradesh	12.5	12.0	9.0	61.2
Maharashtra	45.4	5.6	26.8	13.0
Odisha	31.0	34.8	4.2	47.0
Punjab	1.3	7.2	2.0	11.1
Rajasthan	24.7	26.1	19.5	32.1
Tamil Nadu	2.9	67.9	55.7	19.3
Total	20.0	27.2	19.3	30.7

Table A12: Benefits received by non-beneficiaries from the control area by State

	benefits of loan/cash	fodder at subsidized price	veterinary service at free of cost	free training
Bihar	41.2	0.0	0.0	0.0
Gujarat	14.6	0.0	0.0	0.0
Karnataka	1.6	4.8	0.0	0.0
Madhya Pradesh	0.0	27.2	0.0	0.0
Maharashtra	1.6	1.6	9.4	0.0
Odisha	16.7	11.9	0.0	0.0
Punjab	0.0	0.0	0.0	0.0
Rajasthan	0.0	0.0	0.0	0.0
Tamil Nadu	7.2	16.5	9.3	1.0
Total	10.1	9.0	2.3	0.2

Table A13: Benefits received by beneficiaries from DCS/NDP by socio-economic characteristics (Interventional area)

	benefits of loan/cash	fodder at subsidized price	Veterinary service at free of cost	free training
Age of Respondent				
Less than equal to 25	22.2	23.4	15.6	14.4
More than 25 years	19.9	27.5	19.5	31.9
Education Of Respondent				
Below or completed primary	19.9	27.6	20.3	31.7
More than Primary education	21.3	24.6	12.3	25.4
Gender				
Female	17.7	32.7	22.3	26.3
Male	20.7	25.4	18.4	32.4
Caste Of Respondent				
General	24.0	26.8	15.6	28.1
SC/ST	16.5	31.4	23.6	25.3
OBC	17.1	25.9	21.7	36.2
Wealth quintile				
Quintile 1	20.3	25.4	19.8	29.4
Quintile 2	19.4	29.1	19.0	32.4
Land				
Marginal	19.6	38.0	22.7	35.3
Small	17.8	22.8	17.8	32.3
Medium	20.7	25.1	21.1	31.7
Large	19.9	16.5	10.1	36.3
Total	20.0	27.2	19.3	30.7

Table A14: Benefits received by non-beneficiaries in control area by socio-economic characteristics

	benefits of loan/cash	fodder at subsidized price	Veterinary service at free of cost	free training
Age of Respondent				
Less than equal to 25	15.0	20.0	0.0	0.0
More than 25 years	10.0	8.7	2.4	0.2
Education Of Respondent				
Below or completed primary	10.6	7.1	2.7	0.2
More than Primary education	7.9	28.6	0.0	0.0
Gender				
Female	2.9	10.7	2.1	0.0
Male	12.3	8.7	2.4	0.2
Caste Of Respondent				
General	10.4	5.6	0.0	0.0
SC/ST	12.5	0.9	0.0	0.0
OBC	9.4	16.2	5.6	0.4
Wealth quintile				
Quintile 1	12.2	7.6	2.0	0.3
Quintile 2	7.7	10.7	2.7	0.0
Land				
Marginal	19.4	10.2	4.6	0.5
Small	4.2	14.6	1.0	0.0
Medium	0.0	15.1	0.0	0.0
Large	0.0	14.5	6.5	0.0
Total	10.1	9.0	2.3	0.2

Table A15: Percentage respondents reporting that a loan was taken for cow/ buffalo and they follow the ration balancing programme by State

	Control				Intervention			
	Loan taken for cow	Under RBP cow	Loan taken for buffalo	Under RBP buffalo	Loan taken for cow	Under RBP cow	Loan taken for buffalo	Under RBP buffalo
Bihar	0.0	2.0	7.8	0.0	21.6	28.8	4.9	5.7
Gujarat	3.5	21.5	16.7	3.5	10.1	26.0	15.1	7.1
Karnataka	0.0	0.0	0.0	0.0	3.7	26.1	0.0	0.8
Madhya Pradesh	0.0	1.0	0.0	1.0	0.5	42.6	0.3	15.0
Maharashtra	6.3	1.6	0.0	0.0	15.3	50.7	4.7	18.3
Odisha	9.5	26.2	0.0	0.0	1.2	19.6	0.0	0.0
Punjab	0.0	25.0	37.5	0.0	0.0	3.3	58.8	0.0
Rajasthan	0.0	0.0	0.0	0.0	1.1	22.5	1.7	37.1
Tamil Nadu	24.7	0.0	0.0	0.0	6.1	70.4	0.7	0.0
Total	6.4	9.0	4.8	0.9	7.1	33.3	6.3	10.4

Table A16: Percentage who report LRP visit, advise for balanced feeding, follow up visits by LRP and who follow instructions provided by LRP by State, Intervention area

	LRP visit monitoring and measurement	LRP advise for balanced feeding	LRP follow up regular basis	% who follow instructions and advise by LRP
Bihar	68.2	85.6	97.6	99.6
Gujarat	22.7	93.0	95.6	97.6
Karnataka	65.6	100.0	72.6	100.0
Madhya Pradesh	71.0	97.3	87.0	99.4
Maharashtra	66.1	87.4	70.7	98.7
Odisha	24.2	100.0	100.0	100.0
Punjab	0.0			
Rajasthan	73.3	98.1	73.6	100.0
Tamil Nadu	94.2	18.5	79.8	98.5
Total	57.2	86.5	82.6	99.3

Table A17: Percentage reporting agency to be DCS and corporate society by State

	SNF		Fat Level	
Control	DCS	Corporate Society	DCS	Corporate Society
Bihar	100.0	0.0	100.0	0.0
Gujarat	100.0	0.0	55.6	0.0
Karnataka	100.0	0.0	100.0	0.0
Madhya Pradesh	79.6	4.3	100.0	0.0
Maharashtra	31.8	9.5	30.7	9.7
Odisha	19.1	14.3	16.7	16.7
Punjab			100.0	0.0
Rajasthan	100.0	0.0	0.0	100.0
Tamil Nadu	90.0	10.0	80.0	20.0
Total	62.2	6.9	48.6	14.8
Intervention				
Bihar	99.7	0.3	99.5	0.5
Gujarat	70.7	29.4	98.4	1.7
Karnataka	83.5	16.5	83.3	16.3
Madhya Pradesh	99.0	0.7	99.0	0.7
Maharashtra	100.0	0.0	100.0	0.0
Odisha	100.0	0.0	100.0	0.0
Punjab	100.0	0.0	100.0	0.0
Rajasthan	96.9	3.2	94.9	5.1
Tamil Nadu	40.7	57.6	42.1	54.6
Total	91.0	8.8	95.0	4.8

Table A18: Percentage reporting agency to be DCS and corporate society by socio-economic characteristics

	Control				Intervention			
	SNF		Fat		SNF		Fat	
	DCS	Corp Society	DCS	Corp Society	DCS	Corp Society	DCS	Corp Society
Age of Respondent								
Less than equal to 25	90.9	0.0	72.7	18.2	96.5	3.5	96.5	3.5
More than 25 years	61.2	7.1	47.8	14.7	91.0	8.9	94.8	5.0
Education Of Respondent								
Below or completed primary	58.8	7.3	45.0	15.6	90.0	9.8	94.5	5.2
More than Primary education	81.0	4.8	75.0	10.0	99.1	0.9	97.4	2.6
Gender								
Female	69.6	4.4	47.5	11.5	88.8	11.0	92.1	7.7
Male	59.2	7.8	48.5	15.7	92.0	7.8	95.8	4.0
Caste Of Respondent								
General	53.9	10.4	52.2	10.9	89.2	10.8	94.0	5.9
SC/ST	56.5	2.2	11.9	41.8	95.3	4.7	92.6	7.4
OBC	70.1	5.1	64.3	4.8	91.3	8.3	96.8	2.8
Wealth quintile								
Quintile 1	63.6	5.6	46.7	22.7	91.5	8.3	95.5	4.3
Quintile 2	61.0	8.0	50.3	8.3	90.5	9.3	94.3	5.4
Land								
Marginal	39.1	11.4	33.3	20.6	92.3	7.6	93.4	6.4
Small	55.6	3.7	42.7	25.0	92.7	7.1	96.1	3.5
Medium	37.3	9.8	41.7	20.8	88.9	10.6	92.2	7.3
Large	78.0	8.0	84.4	2.2	96.7	3.3	98.7	1.4
Total	62.2	6.9	48.6	14.8	91.0	8.8	95.0	4.8

Table A19: Percentage reporting quality of milk is regular by socio-economic characteristics

	Control		Intervention	
	SNF	Fat Level	SNF	Fat Level
	Regular	Regular	Regular	Regular
Age of Respondent				
Less than equal to 25	90.9	90.9	98.6	96.5
More than 25 years	59.4	72.2	87.6	87.7
Education Of Respondent				
Below or completed primary	56.0	70.9	87.1	87.6
More than Primary education	84.1	85.0	95.6	92.2
Gender				
Female	72.7	60.7	84.1	83.7
Male	55.4	75.4	89.6	89.6
Caste Of Respondent				
General	49.7	65.7	86.9	88.6
SC/ST	57.5	76.1	87.7	86.8
OBC	69.3	78.7	90.2	88.6
Wealth quintile				
Quintile 1	63.6	70.4	89.9	90.5
Quintile 2	57.3	74.9	86.5	86.0
Land				
Marginal	35.1	50.0	77.9	79.8
Small	49.1	71.6	90.4	88.6
Medium	47.9	68.9	96.4	91.5
Large	81.1	87.5	97.6	97.4
Total	60.4	72.8	88.3	88.3

Table A20: Percentage reporting quality of milk is regular by State

	Control		Intervention	
	SNF	Fat Level	SNF	Fat Level
Bihar	100.0	100.0	97.1	98.4
Gujarat	60.9	100.0	77.6	96.7
Karnataka	100.0	100.0	94.2	63.6
Madhya Pradesh	76.3	100.0	99.0	99.3
Maharashtra	48.3	54.4	99.4	99.6
Odisha	14.3	23.8	59.6	63.8
Punjab	100.0	100.0	100.0	94.7
Rajasthan		100.0	100.0	96.5
Tamil Nadu	97.3	100.0	57.2	64.4
Total	60.4	72.8	88.3	88.3

Table A21: Distribution of Animal disease by State

	Mouth disease	Feet disease	Stomach disease	Galgoatt/gurra disease	Thanela /mastitis	Other	Not specified
Control							
Bihar	5.9	17.7	19.6	0.0	0.0	0.0	0.0
Gujarat	0.7	1.4	0.7	0.0	0.0	0.0	0.0
Karnataka	0.0	0.0	0.0	0.0	0.0	0.0	17.5
Madhya Pradesh	21.4	17.5	10.7	11.7	8.7	14.6	0.0
Maharashtra	32.8	32.8	20.3	7.8	6.3	3.1	0.0
Odisha	78.6	33.3	7.1	16.7	7.1	4.8	4.8
Punjab	25.0	37.5	12.5	12.5	0.0	0.0	0.0
Rajasthan	0.0	0.0	0.0	0.0	3.6	0.0	0.0
Tamil Nadu	7.2	2.1	1.0	1.0	1.0	0.0	0.0
Total	19.0	12.9	6.7	5.1	3.3	3.3	2.3
Intervention							
Bihar	15.4	16.2	35.0	0.8	3.1	2.3	0.0
Gujarat	28.7	15.1	11.8	2.4	1.5	2.4	2.7
Karnataka	9.8	5.9	0.0	0.0	0.0	0.8	9.3
Madhya Pradesh	38.1	37.8	31.6	20.1	31.1	25.8	0.0
Maharashtra	32.5	28.9	11.5	6.2	5.9	2.1	9.7
Odisha	9.5	29.8	12.2	0.0	5.4	20.2	0.0
Punjab	28.8	21.6	6.5	20.3	20.9	0.0	0.0
Rajasthan	45.1	12.4	0.8	1.1	0.3	0.0	0.0
Tamil Nadu	19.6	44.6	21.4	0.0	1.4	0.0	0.0
Total	25.4	23.3	15.4	5.0	7.3	6.7	2.5

Table A22: Distribution of Animal disease by Social group

Control	General	SC/ST	OBC	Total
Mouth disease	21.6	15.2	19.2	19.4
Feet disease	14.8	11.6	12.4	13.2
Stomach disease	4.0	8.0	9.0	6.9
Galgoatt/gurra disease	5.2	1.8	6.8	5.3
Thanela /mastitis	3.2	1.8	4.1	3.3
Other	3.2	1.8	4.1	3.3
Not specified	0.8	3.6	3.4	2.4
Intervention				
Mouth disease	20.1	31.6	29.0	25.4
Feet disease	20.2	22.3	27.3	23.4
Stomach disease	13.3	10.2	20.0	15.5
Galgoatt/gurra disease	5.8	2.8	4.9	5.0
Thanela /mastitis	6.9	4.1	9.2	7.4
Other	5.8	3.3	9.3	6.7
Not specified	3.1	3.9	1.4	2.6

Table A23: Distribution of Animal disease by landholding size

Control	Marginal	Small	Medium	Large	Total
Mouth disease	31.0	20.8	20.6	21.0	25.7
Feet disease	16.2	20.8	17.8	12.9	17.0
Stomach disease	8.3	9.4	12.3	6.5	9.0
Galgoatt/gurra disease	6.9	9.4	5.5	1.6	6.5
Thanela /mastitis	3.7	5.2	5.5	6.5	4.7
Other	3.2	4.2	8.2	4.8	4.5
Not specified	2.3	6.3	2.7	1.6	3.1
Intervention					
Mouth disease	15.1	28.6	28.5	38.4	26.3
Feet disease	27.2	19.1	23.1	24.1	23.9
Stomach disease	19.3	13.8	14.3	18.1	16.9
Galgoatt/gurra disease	2.6	2.8	4.6	12.4	5.4
Thanela /mastitis	6.2	5.8	7.6	13.4	8.1
Other	6.4	7.1	5.8	11.2	7.6
Not specified	2.4	3.0	3.8	2.8	2.9

Table A24: Distribution of Vet service provider by State

	NDP/DCS	Corporate society	Total
Control			
Bihar	0.0	4.6	100.0
Gujarat			
Karnataka			
Madhya Pradesh	0.0	100.0	100.0
Maharashtra	4.1	95.9	100.0
Odisha	0.0	100.0	100.0
Punjab	0.0	100.0	100.0
Rajasthan	0.0	100.0	100.0
Tamil Nadu	6.0	40.0	100.0
Total	3.0	84.3	100.0
Intervention			
Bihar	72.4	27.6	100.0
Gujarat	0.0	100.0	100.0
Karnataka	41.1	58.9	100.0
Madhya Pradesh	0.7	99.3	100.0
Maharashtra	33.0	67.0	100.0
Odisha	11.3	88.7	100.0
Punjab	7.5	92.5	100.0
Rajasthan	43.6	56.4	100.0
Tamil Nadu	74.4	23.3	100.0
Total	37.8	61.9	100.0

Table A25: Distribution of Vet service provider by Social group

	NDP/DCS	Corporate society	Total
Control			
General	0.0	95.1	100.0
SC/ST	3.3	70.0	100.0
OBC	7.4	75.9	100.0
Total	3.0	84.3	100.0
Intervention			
General	38.1	61.9	100.0
SC/ST	30.8	69.2	100.0
OBC	39.9	59.4	100.0
Total	37.9	61.8	100.0

Table A26: Distribution of Vet service provider by landholding size

	NDP/DCS	Corporate society	Total
Control			
Marginal	2.1	77.9	100.0
Small	3.0	90.9	100.0
Medium	4.6	95.5	100.0
Large	0.0	100.0	100.0
Total	2.5	84.6	100.0
Intervention			
Marginal	45.1	54.7	100.0
Small	39.8	59.7	100.0
Medium	35.4	63.7	100.0
Large	24.9	75.1	100.0
Total	37.7	62.0	100.0

Table A27: Percentage reporting training in intervention area by socio-economic characteristics

	Training for VBMPS	Training on Ration Balancing	Training on fodder development
Age of Respondent			
Less than equal to 25	20.3	25.0	6.1
More than 25 years	34.6	39.9	20.6
Education Of Respondent			
Below or completed primary	34.5	39.6	20.3
More than Primary education	28.0	35.8	15.6
Gender			
Female	39.3	50.0	24.1
Male	31.7	35.4	18.2
Caste Of Respondent			
General	29.6	30.1	15.3
SC/ST	37.3	44.6	19.5
OBC	36.7	45.8	24.0
Wealth quintile			
Quintile 1	38.3	44.9	24.5
Quintile 2	30.4	34.5	15.6
Land			
Marginal	32.5	41.1	24.1
Small	36.9	38.9	24.0
Medium	44.3	44.7	18.7
Large	31.5	37.6	10.0
Total	33.9	39.2	19.8

Table A28: Percentage who reported training in intervention area by State

Intervention	Training for VBMPS	Training on Ration Balancing	Training on fodder development
Bihar	31.0	48.7	39.8
Gujarat	0.0	0.0	0.0
Karnataka	5.2	10.4	10.3
Madhya Pradesh	60.1	62.2	14.4
Maharashtra	34.8	53.9	15.7
Odisha	30.7	17.9	17.6
Punjab	2.0	0.0	0.0
Rajasthan	57.8	60.5	10.6
Tamil Nadu	57.1	82.6	81.3
Total	33.9	39.2	19.8

Table A29: Percentage who are aware about grievance cell and have registered complain by State

Control	% Aware about Public grievance cell	% have registered complain	% reported that department took corrective action to resolve that issue	Intervention	% Aware about Public grievance cell	% have registered complain	% reported that department took corrective action to resolve that issue
Bihar	4.4	0.0		Bihar	10.2	3.1	50.0
Gujarat	51.2	4.1		Gujarat	37.9	1.1	100.0
Karnataka	0.0	0.0		Karnataka	32.7	94.4	100.0
Madhya Pradesh	9.3	0.0		Madhya Pradesh	32.7	0.6	100.0
Maharashtra	48.4	1.6	100.0	Maharashtra	56.3	5.1	50.0
Odisha	31.0	0.0		Odisha	57.7	25.1	100.0
Punjab	12.5	0.0		Punjab	25.5	7.5	50.0
Rajasthan	100.0	0.0		Rajasthan	27.1	22.5	38.0
Tamil Nadu				Tamil Nadu			
Total	39.0	1.2	100.0	Total	36.0	10.1	74.9

Table A30: Percentage distribution of constraints faced in dairy farming by wealth quintile

	Control			Intervention		
	Q1	Q2	Total	Q1	Q2	Total
Increase in cost of production of milk due to high feed/ fodder price	90.2	72.3	81.5	73.9	74.1	74.0
Farmers are not getting fair price	77.1	65.7	71.6	65.9	64.5	65.2
Labour cost is very high	76.1	74.6	75.4	68.3	63.8	66.0
Productivity of animal is coming down over the years	60.0	63.4	61.7	60.9	56.3	58.5
Green fodder not available	69.5	50.4	60.2	58.3	62.4	60.4
Veterinary services are not satisfactory	54.4	64.9	59.5	59.0	48.8	53.7
Morbidity and mortality is high in milch animals	53.7	50.0	51.9	46.0	40.8	43.3
Skill training to dairy farmers is not regular	66.9	67.4	67.2	59.6	59.9	59.8
Poor Quality of materials / machinery are supplied	61.3	68.4	64.8	51.3	48.1	49.6
Government support is inadequate	73.5	77.2	75.3	60.5	61.3	60.9
Failure of monitoring and evaluation services	74.0	74.5	74.3	58.1	53.6	55.8
Difficult to enrolled in DCS/NDP due to documentations and eligibility criteria	58.9	54.7	56.9	44.7	50.8	47.8
Difficult to enrolled in any dairy society due to documentations and eligibility criteria.	56.9	38.1	47.7	45.1	42.2	43.6
Information about DCS/NDP programme details not easily available.	56.7	59.2	57.9	52.5	52.2	52.3
Contact details of the department which pay subsidy are not available	67.5	58.4	63.1	57.4	53.1	55.2
Awareness about the eligibility criteria for availing subsidy is available?	66.9	57.1	62.2	61.9	53.4	57.5
Nos of documents required for availing subsidy and benefits are too many	76.4	71.9	74.2	56.3	64.4	60.5

Table A31: Percentage distribution of constraints related with milk price, labour cost and productivity of animals by State

Control	Increase in cost of production due to high feed/ fodder price	Farmers are not getting fair price	Labour cost is very high	Productivity of animal is coming down over the years
Bihar	80.4	74.5	76.5	33.3
Gujarat	68.1	58.9	81.4	62.0
Karnataka	9.1	18.2	18.2	54.6
Madhya Pradesh	67.3	63.4	65.4	52.5
Maharashtra	81.0	68.8	78.1	67.2
Odisha	100.0	81.0	88.1	85.7
Punjab	87.5	87.5	75.0	87.5
Rajasthan	100.0	75.0	78.6	75.0
Tamil Nadu	100.0	91.4	71.0	55.9
Total	81.5	71.6	75.4	61.7
Intervention				
Bihar	82.2	55.7	55.3	48.8
Gujarat	89.4	81.0	63.8	66.5
Karnataka	14.9	0.9	15.0	1.4
Madhya Pradesh	72.9	62.2	56.5	44.7
Maharashtra	75.8	75.2	83.8	82.3
Odisha	92.6	80.7	93.5	66.4
Punjab	76.3	73.0	82.9	76.3
Rajasthan	71.9	79.0	75.5	71.4
Tamil Nadu	66.4	57.0	55.5	63.5
Total	74.0	65.1	65.9	58.6

Table A32: Percentage distribution of constraints related with availability of fodder, veterinary services and morbidity of animals by State

Control	Green fodder not available	Vet. services are not satisfactory	High Morbidity mortality milch animals
Bihar	70.6	70.6	51.0
Gujarat	54.0	63.7	19.5
Karnataka	54.6	45.5	45.5
Madhya Pradesh	62.4	53.5	47.5
Maharashtra	35.9	59.4	67.2
Odisha	19.1	64.3	83.3
Punjab	100.0	75.0	87.5
Rajasthan	96.4	82.1	96.4
Tamil Nadu	100.0	44.1	41.9
Total	60.2	59.5	51.9
Intervention			
Bihar	75.2	66.0	42.5
Gujarat	55.3	72.5	53.6
Karnataka	14.9	1.4	2.8
Madhya Pradesh	55.0	45.2	33.3
Maharashtra	45.4	52.2	61.1
Odisha	90.0	73.5	50.9
Punjab	82.9	71.1	67.1
Rajasthan	60.1	58.1	50.1
Tamil Nadu	61.8	22.1	22.4
Total	60.5	53.8	43.6

Table A33: Percentage distribution of constraints related with government support, difficulty to avail services and knowledge about subsidy by State

Control	Government support inadequate	Failure of monitoring and evaluation	Difficult to enrolled in DCS/NDP	Difficult to enrolled in any dairy society	Information about DCS/NDP programme details not available	Contact details of the department which pay subsidy are not available	Nos of documents required for availing subsidy and benefits are too many
Bihar	76.5	86.3	94.0	80.4	84.3	78.4	78.4
Gujarat	81.1	59.3	33.3	36.9	66.1	62.7	50.9
Karnataka	45.5	45.5	45.5	18.2	60.0	45.5	27.3
Madhya Pradesh	69.3	65.4	47.5	33.7	38.6	53.5	67.3
Maharashtra	73.4	73.4	89.1	71.9	71.9	64.1	64.1
Odisha	88.1	85.7	92.9	45.2	71.4	45.2	100.0
Punjab	100.0	87.5	75.0	37.5	87.5	87.5	85.7
Rajasthan	78.6	85.7	32.1	57.1	71.4	57.1	57.1
Tamil Nadu	64.5	83.9	26.9	45.2	25.8	82.8	100.0
Total	75.3	74.3	56.9	47.7	57.9	63.1	74.2
Intervention							
Bihar	56.1	50.4	43.7	36.2	68.0	62.4	41.0
Gujarat	63.5	61.3	50.0	37.0	65.3	75.0	56.4
Karnataka	2.4	14.0	15.4	2.4	2.4	2.4	2.7
Madhya Pradesh	65.3	43.7	46.2	25.6	47.2	48.1	65.2
Maharashtra	84.4	80.2	52.2	65.5	62.0	59.0	77.2
Odisha	76.8	64.9	48.8	49.7	39.3	75.6	89.9
Punjab	67.1	80.3	62.5	61.8	73.0	75.0	72.3
Rajasthan	62.0	54.0	57.9	61.2	51.0	42.7	68.9
Tamil Nadu	48.8	56.6	52.0	55.7	59.7	47.4	48.0
Total	61.1	56.0	47.9	43.6	52.6	55.3	60.7

Table A34: Percentage who confirmed positive changes after RBP, Intervention area

	Quality of milk improved	Quantity of milk increased	Both quality and quantity increased and improved	Cost reduction in feeding intake
Age of Respondent				
Less than equal to 25	28.4	36.5	13.5	9.5
More than 25 years	28.3	31.8	16.6	22.5
Education Of Respondent				
Below or completed primary	28.7	33.2	15.9	21.8
More than Primary education	27.3	25.0	19.3	20.5
Gender				
Female	36.0	40.1	12.5	18.0
Male	24.5	27.8	18.5	23.6
Caste Of Respondent				
General	34.6	26.1	13.7	28.9
SC/ST	20.8	35.9	14.1	7.8
OBC	26.5	35.3	19.0	20.3
Wealth quintile				
Quintile 1	27.8	24.2	18.3	16.6
Quintile 2	29.2	39.6	14.4	26.7
Land				
Marginal	27.3	31.9	15.1	27.3
Small	28.5	26.1	19.0	17.6
Medium	20.8	30.4	20.4	13.5
Large	29.8	27.3	11.3	18.9
Total	28.5	31.9	16.3	21.7

Table A35: Percentage who confirmed positive changes after RBP, Intervention area

	Quality of milk improved	Quantity of milk increased	Both quality and quantity increased and improved	Cost reduction in feeding intake
Bihar	22.3	23.5	23.1	23.1
Gujarat	34.0	29.8	10.6	4.3
Karnataka	14.5	12.1	25.0	45.2
Madhya Pradesh	22.8	12.5	16.3	15.8
Maharashtra	33.3	33.3	13.5	14.9
Odisha	50.0	25.0	12.5	16.3
Punjab				
Rajasthan	13.4	48.6	12.7	0.0
Tamil Nadu	67.7	64.6	11.5	68.5
Total	28.5	31.9	16.3	21.7

Table A36: Percentage who feels availability and collection of fodder and cultivation of green fodder has much improved (NDP beneficiaries) by socio-economic characteristics

	Availability and collection of fodder at local market	Green fodder cultivation
Age of Respondent		
Less than equal to 25	24.3	29.2
More than 25 years	41.3	34.4
Education Of Respondent		
Below or completed primary	39.5	33.2
More than Primary education	44.7	40.0
Gender		
Female	30.0	30.8
Male	43.6	35.1
Caste Of Respondent		
General	44.2	33.0
SC/ST	41.5	35.8
OBC	35.9	34.2
Wealth quintile		
Quintile 1	42.9	34.1
Quintile 2	37.6	34.0
Land		
Marginal	50.9	37.7
Small	34.0	39.0
Medium	32.4	30.8
Large	36.6	32.3
Total	40.2	34.0

Table A37: Percentage who feels added income and value added products from milk has improved by socio-economic characteristics

	Added income source from cattle manure	Value added products from milk
Age of Respondent		
Less than equal to 25	35.0	31.3
More than 25 years	40.4	44.1
Education Of Respondent		
Below or completed primary	38.9	42.3
More than Primary education	47.6	50.2
Gender		
Female	37.0	40.4
Male	41.1	44.4
Caste Of Respondent		
General	38.4	38.5
SC/ST	39.0	48.0
OBC	42.2	47.0
Wealth quintile		
Quintile 1	43.1	45.9
Quintile 2	37.1	41.1
Land		
Marginal	42.4	52.7
Small	41.3	47.0
Medium	39.9	40.8
Large	39.0	39.4
Total	40.1	43.5

Table A38: Percentage who feel a positive impact of dairy farming on economic status by socio-economic characteristics

	Control		Intervention	
	Households economic status	Economic status of women	Households economic status	Economic status of women
Age of Respondent				
Less than equal to 25	87.5	75.0	87.4	75.9
More than 25 years	84.8	80.7	89.2	82.3
Education Of Respondent				
Below or completed primary	83.3	80.7	89.0	82.0
More than Primary education	98.3	80.4	89.7	81.3
Gender				
Female	93.2	88.7	95.0	82.7
Male	82.2	77.9	87.2	81.9
Caste Of Respondent				
General	85.1	79.5	89.2	81.9
SC/ST	77.7	76.7	89.2	88.6
OBC	87.0	82.0	89.2	79.5
Wealth quintile				
Quintile 1	92.3	87.8	88.8	78.9
Quintile 2	77.2	73.1	89.7	84.6
Land				
Marginal	90.2	91.2	91.0	87.4
Small	91.8	85.7	89.7	77.1
Medium	90.5	82.5	88.1	80.3
Large	85.7	76.8	87.4	79.1
Total	84.95	80.61	89.08	81.82

Table A39: Percentage who feel a positive impact of dairy farming on economic status by State

	Households economic status	Economic status of women
Control		
Bihar	100.0	92.2
Gujarat	61.3	53.2
Karnataka	79.0	79.0
Madhya Pradesh	95.1	75.5
Maharashtra	82.8	84.4
Odisha	78.6	85.7
Punjab	62.5	87.5
Rajasthan	100.0	100.0
Tamil Nadu	100.0	100.0
Total	85.0	80.6
Intervention		
Bihar	89.7	78.6
Gujarat	77.6	61.3
Karnataka	97.2	98.5
Madhya Pradesh	94.5	83.2
Maharashtra	85.3	86.7
Odisha	90.5	81.3
Punjab	71.7	71.7
Rajasthan	93.7	84.9
Tamil Nadu	91.2	85.9
Total	89.1	81.8

Table A40: Percentage who feel a positive impact of dairy farming on social and cultural status; and motivation of youth by socio-economic characteristics

	Control			Intervention		
	Households social status	Women's Social - cultural status	Motivation of rural youth towards dairy farming	Households social status	Women's Social - cultural status	Motivation of rural youth towards dairy farming
Age of Respondent						
Less than equal to 25	93.8	87.5	75.0	71.1	66.9	70.9
More than 25 years	79.2	62.1	73.6	77.5	71.5	75.5
Education Of Respondent						
Below or completed primary	78.1	61.7	72.5	77.0	71.0	74.8
More than Primary education	91.2	73.7	80.4	78.7	72.8	77.8
Gender						
Female	87.2	59.4	91.7	79.9	73.0	75.8
Male	77.3	64.0	67.9	76.4	70.7	75.0
Caste Of Respondent						
General	80.6	51.3	74.4	74.8	77.2	78.0
SC/ST	70.9	70.9	66.0	82.4	70.4	73.0
OBC	81.3	67.1	74.7	77.7	64.8	73.5
Wealth quintile						
Quintile 1	83.3	72.8	79.9	74.7	73.5	72.5
Quintile 2	75.7	52.4	67.3	80.0	69.5	78.2
Land						
Marginal	83.6	70.1	76.8	77.0	76.1	72.1
Small	84.7	75.3	83.5	77.5	74.2	74.1
Medium	88.9	54.0	63.5	81.2	69.8	74.4
Large	82.1	64.3	71.4	78.3	76.4	84.3
Total	79.61	62.9	73.64	77.07	71.15	75.14

Table A41: Percentage who feel a positive impact of dairy farming on social and cultural status; and motivation of youth by State

	Households social status	Social and cultural status of women	Motivation of rural youth towards dairy farming
Control			
Bihar	94.1	54.9	52.9
Gujarat	57.1	44.6	53.6
Karnataka	79.0	83.3	79.0
Madhya Pradesh	77.5	53.9	65.7
Maharashtra	84.4	75.0	70.2
Odisha	73.8	35.7	88.1
Punjab	75.0	87.5	100.0
Rajasthan	92.9	100.0	89.3
Tamil Nadu	100.0	98.9	98.9
Total	79.6	62.9	73.6
Intervention			
Bihar	81.4	54.0	77.8
Gujarat	51.7	50.8	54.0
Karnataka	97.5	89.4	85.4
Madhya Pradesh	85.5	52.9	91.0
Maharashtra	81.4	84.7	76.3
Odisha	46.1	84.8	61.3
Punjab	79.0	77.6	87.5
Rajasthan	83.8	73.3	71.9
Tamil Nadu	88.0	85.1	74.6
Total	77.1	71.2	75.1

Table A42: Percentage distribution of respondents who believe satisfied in dairy farming, income and standard of living improved and would like to continue by State

	Degree of satisfaction is highly satisfied	Improved standard of living	NDP/DCS increase family income	Like to continue dairy farming
Control				
Bihar	33.3	27.5	5.9	72.6
Gujarat	63.7	46.4	54.0	64.3
Karnataka	80.0	36.6	31.5	92.6
Madhya Pradesh	74.5	26.5	35.1	88.2
Maharashtra	70.3	20.3	34.4	96.9
Odisha	83.3	21.4	81.0	100.0
Punjab	87.5	12.5	37.5	75.0
Rajasthan	60.7	39.3	28.6	67.9
Tamil Nadu	97.9	60.2	97.9	98.9
Total	73.3	35.5	52.0	85.9
Intervention				
Bihar	83.7	48.1	63.8	88.4
Gujarat	86.6	30.5	24.9	93.4
Karnataka	85.0	62.8	45.9	93.5
Madhya Pradesh	80.2	41.9	55.5	95.0
Maharashtra	75.2	34.2	32.9	83.5
Odisha	83.9	16.7	73.2	66.3
Punjab	84.9	45.4	49.3	83.6
Rajasthan	75.7	25.3	36.5	91.7
Tamil Nadu	88.7	44.5	66.2	91.5
Total	82.3	38.2	49.7	87.7

Table A43: Distribution of main reason for respondents to continue in dairy farming by State

	increased in income /profits	Better employment opportunity	Certainty and regular source of income	increased in income /profits	Better employment opportunity	Certainty and regular source of income
Control				Intervention		
Bihar	51.4	24.3	16.2	70.6	18.1	20.3
Gujarat	58.3	11.1	25.0	72.4	10.8	10.1
Karnataka	68.0	14.0	2.0	70.7	19.3	21.0
Madhya Pradesh	73.3	16.7	42.2	78.7	17.6	22.6
Maharashtra	9.7	59.7	30.7	15.6	53.0	30.4
Odisha	57.1	35.7	7.1	52.7	5.5	16.8
Punjab	66.7	16.7	0.0	46.5	30.7	11.0
Rajasthan	15.8	84.2	0.0	77.4	17.2	10.5
Tamil Nadu	72.8	27.2	0.0	14.1	54.2	43.8
Total	56.5	28.9	17.2	58.3	24.2	20.9

Table A44: Percentage of Farmers with Positive Opinion for NDP's role in Increasing Family Income across Socioeconomic Background, India

Socioeconomic Background	Percentage
Social Group	
General	95.70
SC/ST	93.80
OBC	96.80
Education	
Below Primary	95.70
Above Primary	96.80
Asset Index	
Bottom 50%	97.70
Top 50%	94.00
Gender	
Male	96.80
Female	95.50

Figure A4: Percentage of Farmers with Positive Opinion on Role for NDP's in Increasing Family Income, Selected States, India

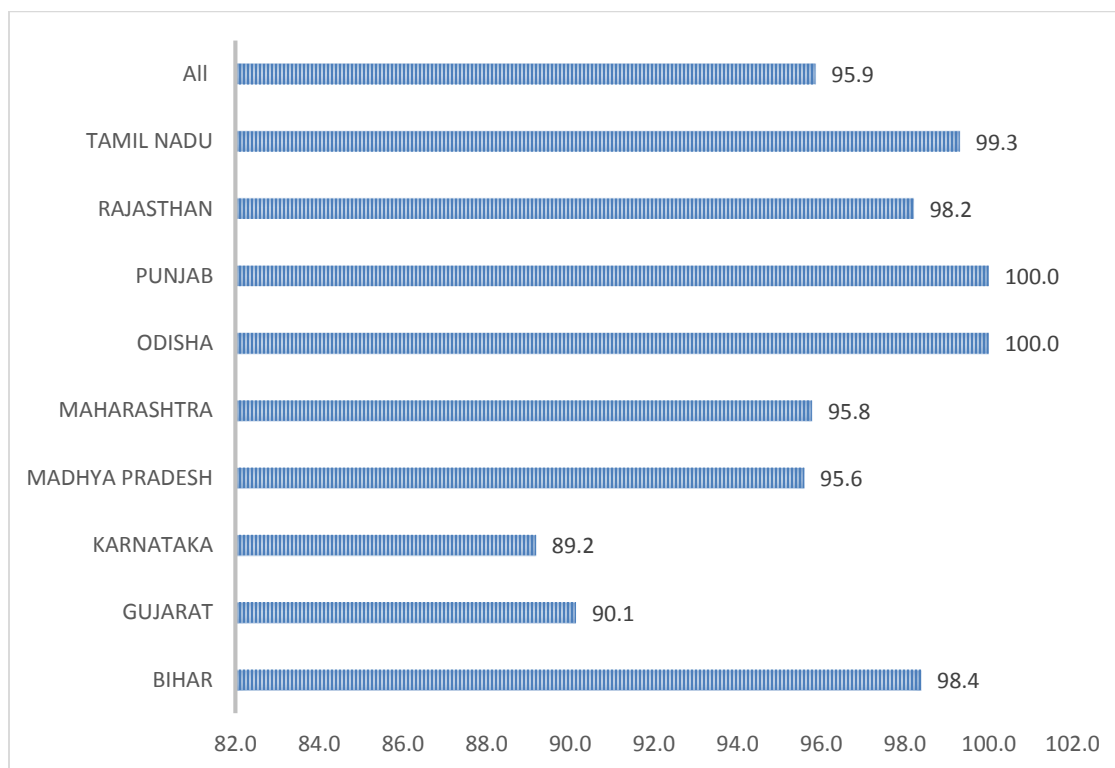| State	Percentage
All	95.9
TAMIL NADU	99.3
RAJASTHAN	98.2
PUNJAB	100.0
ODISHA	100.0
MAHARASHTRA	95.8
MADHYA PRADESH	95.6
KARNATAKA	89.2
GUJARAT	90.1
BIHAR	98.4

Table A45: Percentage who feels knowledge and awareness and animal health and veterinary services has much improved by socio-economic characteristics

	Knowledge and awareness about dairy farming	Animal health and veterinary services
Age of Respondent		
Less than equal to 25	32.1	31.9
More than 25 years	35.6	33.2
Education Of Respondent		
Below or completed primary	34.9	31.1
More than Primary education	38.7	46.0
Gender		
Female	32.2	28.2
Male	36.4	34.6
Caste Of Respondent		
General	33.9	27.5
SC/ST	37.4	34.3
OBC	36.2	38.5
Wealth quintile		
Quintile 1	33.7	35.0
Quintile 2	37.0	31.3
Land		
Marginal	38.1	36.3
Small	31.5	34.9
Medium	26.5	26.3
Large	38.4	38.7
Total	35.4	33.2

Table A46: Percentage who feels sale, quality and quantity of milk has improved (NDP beneficiaries) by State

	Local sale of milk	Sustain market accessibility for milk pooling	Quality of milk improved	Quantity of milk
Bihar	69.0	38.7	69.6	72.2
Gujarat	49.3	24.9	36.1	35.8
Karnataka	81.4	64.8	79.3	57.9
Madhya Pradesh	68.0	30.5	38.4	41.8
Maharashtra	38.1	31.3	38.6	35.1
Odisha	87.2	67.0	90.8	87.8
Punjab	22.4	4.0	27.6	40.8
Rajasthan	35.8	33.3	35.1	24.6
Tamil Nadu	38.7	39.0	62.6	61.5
Total	57.2	38.8	54.3	51.8