Role of Indian Dairy Cooperatives in Empowering Women and Improving Gender Parity

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Abstract

Propensity score matching method was adopted to study the impact of National Dairy Plan- I[5] (NDP) on various dimensions of Women Empowerment. The econometric results indicate that NDP had a positive impact on women's participation in decisions related to selling milk. However, the program did not significantly influence women's participation in the use of dairy income as compared to women located in non-NDP areas. The most significant change was observed in the area of leadership. The program village women were found to be five per cent more likely to participate in village level infrastructure discussions. A typical woman in a NDP household is six per cent more likely to demand fair wages for public works and protest misbehavior by authorities and elected representatives. It is interesting to note that the program has the potential to indirectly influence the efficacy of rights based programs such as MGNREGS. These results are in line with the targets of Goal 5 of Gender Equality of 2030 Agenda for Sustainable Development, which were adopted by world leaders at the United Nations Sustainable Development Summit in 2015. This program through cooperatives ensures women improved and effective participation and equal opportunities for leadership at various levels of decision making in political, economics and public life.

1. Introduction

India is one of the fastest growing economies in the world. Recent estimates show that it is the third largest economy, after US and China, in purchasing power parity terms[6]. Despite commendable macroeconomic growth over the last decade, gender inequality indicators continue to raise concerns. According to the 2014 Gender Inequality Index (GII) of the United Nations Development Program, India ranked at 127 out of 146 countries[7]. India's persistently dismal performance lags behind that of other countries in the region, including countries with lower per capita gross domestic product (GDP) like Sri Lanka. Gender equality is important for sustainable economic development and empowering rural women is vital to food security and poverty reduction.

Dairying has always been regarded as one of the activities that could contribute to poverty alleviation and employment generation, especially in drought-prone and rain-fed areas. Compared to other sectors, gender equity is more pronounced in livestock and animal husbandry sector where women constitute about 69 per cent of the workforce.

The Indian dairy sector has registered significant growth during the last four decades. Today, the country accounts for more than 15 per cent of world's total milk production. Approximately 70 million of 147 million rural households are engaged in dairying for their livelihoods. Unorganized sector handles around 70 per cent of the national milk volume. Of the remaining 30 per cent, dairy cooperative handle 16 per cent and large private processors handle 14 per cent milk volume. Apart from being world's largest milk producer, India is also the largest consumer base of dairy products in the world, consuming almost all of its own milk production. While the annual milk production is growing at 3.3 per cent, consumption is growing at 5 per cent leaving a gap between demand and supply[8]. This demand supply gap is due to the changing consumption habits, dynamic demographic patterns, and rapid urbanization of rural India. Emerging trends indicate that milk demand is likely to reach 155 MT by 2016-17 and between 200-210 MT by 2021-22. The absolute volume growth in milk production in 2014-15 over the previous year is in excess of six million tones.

In order to address the mounting challenges in the dairy sector along with improving gender inequality, a central sector scheme of National Dairy Plan-I was launched for a period of 2011-12 to 2018-19. NDP-I is being implemented with a total investment of about 2242 crore, where the Government of India is partnering with several organizations including International Development Association (IDA) as credit partner, End Implementing Agencies (EIAs) and National Dairy Development Board (NDDB) and its subsidiaries. It is designed as scientifically planned multi-state initiatives to increase milk production by increasing productivity through a focused approach to breeding and feeding.Two primary development objectives of this scheme is to help increase productivity of milch animals and thereby increase milk production to meet the rapidly growing demand for milk, and to help provide rural milk producers with greater access to the organized milk sector. The details of the program are more elaborately discussed in Annexure I.

NDP-I program interventions are anticipated to reduce poverty and empower women in a number of ways. The 18 states participating in the program include a number of economically lagging states such as Uttar Pradesh, Orissa and Rajasthan. Under NDP, specific focus has been given to gender integration at all the three levels, i.e. farmer's level, functionary level and institutional level. The following steps were being taken for ensuring better inclusion of women: (i) Promoting formation of new Women Dairy Cooperative Societies, (ii) Improving enrolment of women members in existing and new Dairy Cooperative Societies, (iii) Improving involvement of women in leadership roles as members of management committees and on boards of milk unions, (iv)Inclusion of more women as field functionaries and gender integration in all the training and capacity building programs, (v) ensuring participation of women in capacity building programs, and (vi) providing advisory services directly to women beneficiaries.

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[8]http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Dairy%20and%20Products%20Annual_New%20Delhi_India_10-15-2014.pdf

In this paper we provide an account of mid-term performance of NDP-I-I on empowering women in terms of increasing women's participation and their role in decision making in dairying through cooperatives. Data from six states U.P., Punjab, Rajasthan, Gujarat, Karnataka, and Odisha are analyzed. Household level survey data was spread across 2423 households covering a total of 4846 respondents (two adult members from each household, one male and the other female).

2. Research Methodology

A multi-stage purposive sampling plan was followed for the household survey. NDP-I is implemented in 18 major states with potential to enhance milk production. These states together contribute about 90 per cent of total milk production in India. A weighted average index was developed to identify six states for data collection using the criteria which is discussed in Annexure II.

The sampling unit was household, which was selected using the following three criteria: (i) five or less number of milch animals, (ii) presence of adult male-female members at the time of data collection, and (iii) household actively selling milk. Data from 24 such households in each of the selected villages were collected. Table 1 provides an overview of the selected States, EIAs, districts, villages and households.

Table 1: Overview of Selected States, Implementing Agencies, Districts, Villages and Households

Selected States	Selected Implementing Agencies	Selected Districts	Selected Villages	Selected Households
Gujarat	Banas	Banaskantha	10	240
	Mahi Producer Cooperative	Bhavnagar	10	240
Rajasthan	Bhilwara	Bhilwara	10	240
	Paayas Producer Cooperative	Jaipur	10	240
Punjab	Ropar	Ropar	10	240
	Ludhiana	Ludhiana	10	240
Uttar Pradesh	Lucknow	Lucknow	10	240
Odisha	Cuttack	Jagatsinghpur	10	240
Karnataka	Kolar	Kolar	10	240
	Mandya	Mandya	10	240

In all, data from 2423 households (4846 adult male-female respondents) residing in 100 villages in 10 districts of 10 Implementing agencies across six states were collected.

We have used a quasi-experimental technique to quantitatively analyze and report the impact of NDP-I interventions. This design consisted of constructing a comparison group using matching technique. Matching involves identifying non–program participants comparable in essential characteristics to program participants. Both groups were matched on the basis of either a few observed characteristics or a number of them that are known or believed to influence program outcomes so that both groups

are not systematically different from each other. Both, average program effects and heterogeneous effects were estimated to identify variations in the impact of the Plan across various sub-categories in the target population. This quantitative analysis is expected to elucidate the program designand its impact on women empowerment.

Women Empowerment in Dairy Index

For our study, we developed a Women's Empowerment in Dairy Index (WEDI) in line with the Alkire et al (2013) Women's Empowerment in Agriculture Index (WEAI). It is a survey-based index comprising two sub-indices, to measure the empowerment, agency, and inclusion of women in the agricultural sector. This was developed as a tool to reflect women's empowerment and to assess the empowerment and gender parity in agriculture.

It is composed of two sub-indices: one measures the five domains of empowerment for women, and the other measures gender parity in empowerment within the household. It is based on individual-level data on men and women within the same households. The following five domains of empowerment (5DE) measure women's empowerment in dairy: production, resources, income, leadership, and work leisure. Scores on these domains reflect the extent to which women are empowered in these domains. Difference between man's and woman's score shows gender gap in the household. A brief description of these indicators is shown in table 2. An elaborate discussion is provided in the Annexure II.

Table 2: List of Women Empowerment Indicators

Key Areas	Indicators
Production Related Decision Making	Participation in decisions related to selling milk
	Participation in decisions related to vaccination and veterinary services
	Participation in decisions related to cultivation of animal field
	Participation in decisions related to buying of animal
	Participation in decisions related to Artificial Insemination of milch animal
Resource Related Decision Making	Ownership of milch animals and milk produced
	Participation in decision related to selling milch animals and milk produced
	Participation in decision related purchasing of milch animals and milk produced
	Access to credit facilities during last 12 months
	Participation in borrowing decision making
	Participation in decisions related to the allocation of borrowed money
	Regularity in the use of veterinary services in past 12 months
	Regularity in the use of artificial insemination service in past 12 months
	Regularity in the use of animal feed and nutrition advisory service in past 12 months
Income Related Decisions	Participation in decisions related to the use of income generated from the sale of milk
	Participation in decisions related to the use of income generated from the sale of milch animal
Group Membership	Membership in agriculture/livestock/milk producers or marketing group
	Membership in water user's group

Key Areas	Indicators
	Membership in forest user's group
	Membership in credit/ micro-finance group
	Membership in panchayat
	Membership in other groups
Speaking up in public	Comfort in speaking up in public on infrastructure
	Comfort in speaking up in public on wages
	Comfort in speaking up in public on misbehaviour of the authorities
	Comfort in speaking up in public against malpractices of local 'Dudhia'/ cooperative dairy
Work/ Leisure Indicators	Number of hours spend on dairy activities
	Satisfaction derived from leisure activity

The Gender Parity Index (GPI) is a relative inequality measure that reflects the inequality in 5DE between the primary adult male and female in each household. Households are considered to lack parity if the female is not empowered and her censored inadequacy is higher than the censored inadequacy score of her male counterpart. Put differently, a household enjoys parity if the woman is empowered; or if she is not empowered, her adequacy score is greater than or equal to that of the male in the household. The GPI score can thus be improved by the percentage of women who have gender parity or, for those women who are less empowered than the men, by reducing their empowerment gap between the male and female of the same household (Alkire et al. 2012).

3. The Impact of the NDP-I

Conceptual Framework

We have approached the evaluation of the Plan through Potential outcomes framework (Rubin, 1974). According to Morgan and Winship (2015), the core of potential outcomes model of causal inference is quite simple. The key assumption of the potential outcomes model is that each unit in the population of interest has a potential outcome under each state of existence, even though each unit can be observed in only one treatment state at any point in time. In other words, the objective of program evaluation is to determine how the intervention influenced desired outcome(s). This is achieved by comparing the treatment effect against a counterfactual. The treatment effect of the program intervention on an individual i can be expressed as:

$\alpha_i = y_{i1} - y_{i0}$

where y_{i1} is outcome for an individual who participates and y_{i0} if she does not participate.

However it is not possible to observe causal effect of the program on an individual who participates and does not participate at the same time. Therefore program evaluation is a missing data problem (Khandker et al). In relation to the program, the most challenging aspect of program evaluation is to estimate empowerment related outcomes for women participants if they had not participated in the NDP-I. The parameters of interests are Average Treatment Effect (ATE) and Average Treatment Effect on Treated (ATT). ATE measures the effect of the program on both participants and non-participants. ATE on a participating woman, given a vector of characteristics **x**, can be expressed as:

$ATE = E[y_1 | \mathbf{x}] - E[y_0 | \mathbf{x}]$

ATT is the expected value of the outcome for those who participated in the program, conditional on the individual characteristics that influence program participation.

$$ATT = E[y_1 \mid \mathbf{x}, NDP = 1] – E[y_0 \mid \mathbf{x}, NDP = 1]$$

We have already mentioned that $E[y_0 \mid \mathbf{x}, NDP = 1]$ is the expected empowerment level of program women if did not participate in the Plan, and hence it cannot be directly observed. However we can observe $E[y_0 \mid \mathbf{x}, NDP = 0]$, that is, expected outcome of untreated, given that they did not receive the program. Under the absence of selection bias, we can assume that those who participated in the program would have equal outcomes to those who did not, in the absence of the program. In other words:

$$E[y_0 \mid \mathbf{x}, NDP = 1] - E[y_0 \mid \mathbf{x}, NDP = 0] = 0$$

However it would not be possible to safely assume zero selection bias in the absence of randomized allocation of eligible individuals to treatment and control groups. NDP-I is a demand driven program and hence households exposed to the treatment will be systematically different from those who did not choose to participate in the program. In that case, it is quite likely that the differences in outcomes are due to pre-program differences. If these differences are not taken care of then it would distort impact estimates.

In addition to selection bias, there could also be program placement bias. Therefore the chosen evaluation methodology should be able to account for possible sources of endogeneity in program selection, spill-over effects, and heterogeneity of program impacts.

In the presence of selection/program placement bias (endogeneity), the control group households would be systematically different from treatment group. For instance, in this study these differences were observed in relation to household characteristics, primary source of income, land allocation to agricultural activities, religion, caste, participation in other government and NGO programs, etc. In addition to observed, there are several unobserved characteristics that may get correlated with program participation and empowerment related outcomes. As already noted, NDP-I was not rolled out using RCT, hence we had to use one of the non-experimental techniques or some combination of them. For our study, we finally zeroed on matching methods, specifically Propensity Score Matching (PSM) Method for estimating the counterfactual group that can be made appreciable free from selection bias problem. We were able to address the program placement bias by utilizing the pipeline method for selecting control villages.

Matching Propensity Based Methods

The social scientists who adopt a counterfactual perspective, matching methods are fast becoming an indispensable technique for addressing causal effects of development programs on socially desirable outcomes. PSM consists of choosing the comparison group according to the probability of being selected for the program, given the set of observable characteristics that do not themselves get determined by program intervention but in turn influence program participation and outcomes.

Our data set contains both types of households, that enrolled and that did not enroll in the program. The program did not have any clear assignment rule that why some households enrolled and others did not. Given this background, PSM will enable us to identify a set of control group households that look very similar to the treatment group households, based on the characteristics for which the study team has collected the data. In essence matching uses statistical algorithms to construct an artificial comparison group we use to estimate the counterfactual, that is, E [y_0| **x**,NDP = 1]

Estimation of the Selection Model and Propensity Scores

The first step is to estimate the propensity scores (that is, probability for participation and non-participation): Prob [NDP=1|**x**]. We have used the End Implementing Agency(EIA) fixed effects logistic regression for specifying the selection model. The representative model has been presented below:

$$log \frac{p(NDP = 1)}{1 - p\,(NDP = 1)}$$

$$= \beta_0 + \beta_1 religion_i + \beta_2 caste_i + \beta_3 fem\_educ_i + \beta_4 fem\_bankacc_i + \beta_5 hh\_own_i$$
$$+ \beta_6 hh\_type_i + \beta_7 land\_size_i + \beta_8 income\_source_i + \beta_9 group\_member_i + u_i$$

Table 3: Program Participation Model

Selection Factors	Prob (NDP=1 | x)	Standard Error
Muslim	0.43	0.09**
SC	-0.08	0.045
OBC	0.083	0.03*
Water Use	0.09	0.02**
Wasteland	0.013	0.005*
Agri_main_income	-0.08	0.03*
Non_Aglab_main_income	-0.21	0.07*
Group_Member	0.15	0.02**

* Significant at 5%; ** Significant at 1%

The above table presents a partial list of variables that were used to construct the participation model and estimate propensity scores. The propensity score is estimated using various socio-demographic characteristics of dairy households: education, age, religion, caste, income and assets, etc. Looking at the standard errors, we can assert that participation is related to religion, and that Muslim households have a higher probability of participating (43%), although based on t-statistics, the effect of SC households on participation appears not to be significant. Furthermore, availability of water for non-

drinking purposes at the doorstep, size of wasteland, and membership in other village-level groups positively affect the propensity score, while households whose primary source of income is either agriculture or non-agricultural labor, are less likely to participate in NDP-I. Households having salaried members, or who have a micro-enterprise do not seem to explain participation.

Estimation of Average Program Impacts on Women Empowerment

For the purpose of micro-econometric impact assessment, we would be utilizing components of five broad empowerment dimensions, the gender parity score, and some general empowerment indicators.

Average Treatment Effect on Treated

The parameter that we are interested in is the Average Treatment Effect on Treated (ATT). We have used three types of matching algorithms to perform robustness checks of the impact estimates. These are caliper, radius, and kernel matching. It is essential to note that by this stage we have got a group of households from the treatment and control areas that have similar observed characteristics. Therefore the estimated ATT would indicate the impact of the program on various dimensions of women empowerment

Production Dimension

The production dimension is concerned with the role of women in the dairy production activities. The production decisions that were included in the study were related to sale of milk, vaccination & veterinary services, cultivation / purchase of animal feed, and artificial insemination of the milch animals.

The summary statistics from the treatment and control areas are presented below:

Table 4: Descriptive Statistics on Production Indicators

Production Indicators	NDP	Non-NDP	t-value
Participation in decisions related to selling milk	0.82 (.38)!	0.77 (.42)	-3.04**
Participation in decisions related to vaccination and veterinary services	0.79 (.40)	0.79 (.40)	0.05
Participation in decisions related to cultivation of animal field	0.80 (.39)	0.81 (.38)	0.77
Participation in decisions related to buying of animal	0.73 (.44)	0.75 (.43)	0.944
Participation in decisions related to Artificial Insemination of milch animal	0.52 (.49)	0.55 (.49)	1.56

* Significant at 5%; ** significant at 1%

! Figures in parenthesis are standard errors of the estimates

The treatment effect of NDP on women's participation in above mentioned production decisions are presented in table 5 below:

Table 5: Impact Estimates: Production Dimension

Do female participate in following production decisions?	Caliper	Radius	Kernel
Selling Milk	0.047**	0.03*	0.04**
Vet Services	-0.018	-0.02	-0.017
Cultivate Feed	-0.02	-0.04**	-0.03
Buy Feed	-0.024	-0.04**	-0.03
AI Services	-0.011	-0.05**	-0.032

* Significant at 10%; ** significant at 5%, *** significant at 1%

As mentioned above, three matching algorithms have been used to perform robustness checks of impact estimates. For reporting of the impact, we would be consistently using the results associated with kernel matching. Table 5 indicates that NDP had a positive impact on women's participation in decisions related selling milk. In fact women in program villages are 4% more likely to influence selling decisions. The results in table did not indicate significant and robust impact of the NDP on other aspects of production activities.

Income and Leadership Dimension

The income dimension focused on understanding the role of women in the deciding the use of dairy income. A 5 point Likert scale was used to elicit the extent to which women can determine the use of household's dairy income. The leadership dimension investigated whether women are comfortable to speak in public on issues related with village level infrastructure requirements, fair wages, misbehavior and malpractices of local 'Dudhia' / DCS / other milk buyers in the village. The NDPand non-NDP women were also enquired if they held leadership position (president, secretary, treasurer, etc.) in a village-level organization such as panchayat, credit groups, milk producer/marketing groups, etc.

The summary statistics from the NDP and Non-NDP areas are presented below:

Table 5: Descriptive Statistics on Income and Leadership Indicators

Income & Leadership Indicators	NDP	Non-NDP	t-value

Income & Leadership Indicators	NDP	Non-NDP	t-value
Participation in decisions related to the use of income generated from the sale of milk	0.93 (0.24)	0.93 (0.23)	0.27
Participation in decisions related to the use of income generated from the sale of milk	0.93 (0.24)	0.93 (0.24)	0.19
Membership in agriculture/livestock/milk producers or marketing group	0.16 (0.36)	0.12 (0.33)	-2.40*
Leadership position in agriculture/livestock/milk producers or marketing group	.017 (0.13)	0.01 (0.13)	0.43
Membership in water user's group	0.0008 (0.028)	0	-1.00
Membership in forest user's group	0.0008 (0.028)	0	-1.00
Membership in credit/micro-finance group	0.004 (0.06)	0.02 (0.15)	4.03**
Leadership position in credit/ micro-finance group	0.001 (0.04)	0.008 (0.09)	2.30*
Membership in Panchayat	0.10 (0.30)	0.08 (0.27)	-1.58
Leadership position in Panchayat	0.01 (0.10)	0.003 (0.05)	-2.20*
Comfort in speaking up in public on infrastructure	0.32 (0.46)	0.29 (0.45)	-1.55
Comfort in speaking up in public on wages	0.29 (0.45)	0.26 (0.44)	-1.87
Comfort in speaking up in public on misbehaviour of the authorities	0.29 (0.45)	0.26 (0.44)	-1.69
Comfort in speaking up in public against malpractices of local 'Dudhia/ cooperative dairy	0.34 (0.47)	0.33 (0.47)	-0.

* Significant at 5%; ** significant at 1%
Figures in parenthesis are standard errors of the estimates

The treatment effect of NDP on the use of income and leadership are presented in table 6below:

Table 6: Impact Estimates: Income and Leadership Dimension

Outcomes	Caliper	Radius	Kernel
Use of Milk Income	0.006	0.006	-0.002
Infrastructure Discussion	0.03	0.045**	0.05**
Fair Wages	0.053**	0.054**	0.06**

Outcomes	Caliper	Radius	Kernel
Protest Misbehavior	0.06**	0.047**	0.045**
Protest Malpractice	0.01	0.03	0.02
Panchayat Leader	0.008*	0.006*	0.007*
Credit Group Leader	-0.005	-0.01***	-0.009**

* Significant at 10%; ** significant at 5%, *** significant at 1%

The ATT estimates presented in table 3.6 indicate that the Plan did not significantly improve women's participation in the use of dairy income; however the program did result into a positive and statistically significant impact on various dimensions of leadership. Average women in program villages were found to be 5% more likely to participate in village-level infrastructure discussion, while they are 6% more likely to demand fair wages for public works as compared to average women in non-Program villages. Hence the program may indirectly enhance the efficacy of rights based programs such as MGNREGS. The probability that a female would publically protest misbehavior of authorities and elected officials has appreciated by 4.5%. The last two impacts in a sense are likely to reinforce each other.

Resource Dimension

The resource dimension was constructed to investigate the role of women in decisions pertaining to sale and purchase of productive capital, and in accessing dairy extension services, such as, veterinary services, artificial insemination services, and animal feed and nutrition advisory services. The summary statistics from the treatment and control areas are presented below:

Table 7: Descriptive Statistics on Resource Indicators

Resource Indicators	NDP	Non- NDP	t-value
Participation in decision related to selling milch animals	0.67 (0.46)	0.62 (0.48)	-2.40*
Participation in decision related to selling milk produced	0.70 (0.45)	0.67 (0.46)	-1.81
Participation in decision related purchasing of milch animals	0.65 (0.47)	0.62 (0.48)	-1.56
Participation in decision related purchasing of milk produced	0.697 (0.45)	0.66 (0.47)	-1.76
Regularity in the use of veterinary services in past 12 months	1.72 (1.72)	1.74 (1.81)	0.34

Regularity in the use of artificial insemination service in past 12 months	1.16 (1.36)	1.149 (1.65)	-0.29
Regularity in the use of animal feed and nutrition advisory service in past 12 months	2.63 (7.11)	3.66 (8.27)	3.28**

* Significant at 10%; ** significant at 5%, *** significant at 1%

Figures in parenthesis are standard errors of the estimates.

The treatment effects of the program on women's participation in above mentioned resource based decisions are presented in table 8below:

Table 8: Impact Estimates: Resource Dimension

Outcomes	Caliper	Radius	Kernel
Cattle Sale	0.04**	0.08**	0.08**
Buy Cattle	0.05	0.066	0.064
Milk Sale	0.011	0.05	0.06
Used Extension Service	0.04**	0.04**	0.05***
Vet Service Count	-0.065	-0.04	-0.04
AI Service Count	-0.009	-0.02	0.003
Nutrition Service Count	-1.16**	-1.03**	-0.95**

* Significant at 10%; ** significant at 5%, *** significant at 1%

The impact estimates presented in table 8 indicate that the probability that males located in the NDP villages would unilaterally take the decision to sell cattle is 8% less as compared to non-NDP villages. Results also indicate that the program has been successful in inducing women to use extension services. The NDP has increased the opportunities of accessing at least one of three types of extension services by 5%.

Impact of NDP on Gender Parity

Research methodology section has discussed the computation of Gender Parity Index (GPI). The matched households (based on kernel matching algorithm) were used to assess the effect on GPI. The GPI score is comprised on male and female score. We took the difference of female and male score. Therefore when GPI=0, both males and females are considered to be equally empowered at the households level, when GPI>0, females are more empowered than their male counterparts.

The table below presents the regression results of impact estimates

Table 9: Impact on Gender Parity

Variables	Coefficient	Std. Err.	t-value
Plan	-0.008	0.009	-0.67
Plan*VBMPS	0.038***	0.011	3.36
Plan*RBP	0.058***	0.011	5.29
Group Member	0.035***	0.0066	5.25
Plan * Fem_Educated	0.0064**	0.0028	2.28
Female Bank Account	0.022***	0.0058	3.86
Plan*bpl	-0.034***	0.009	-3.63
Plan*Fem_Vill_Head	-0.002	0.011	-0.20

* Significant at 10%; ** significant at 5%, *** significant at 1%

The regression results indicate that both Village Based Milk Procurement System (VBMPS) and RBP villages contributed to the GPI, however RBP effect is more pronounced than the VBMPS[9]. As expected, women who participate in other village level groups and have their own bank account, have a higher GPI, irrespective of whether they are located in the program or control villages. The education effect was further magnified in the program villages.

4. Conclusion

This study provides an account of mid-term performance of the NDP-I on empowering women in terms of increasing women's participation and their role in decision making in dairying. Dairying has emerged as an important source of income for women, though it is still considered as a secondary source. In the cases, where a family doesn't own land and is dependent on labor work for its subsistence, dairying has become primary source of income for them. Women also see dairying as their responsibility as well as an opportunity for them. It has been observed that women are independent in taking day-to-day decisions regarding dairying.The econometric results indicate that NDP had a positive impact on women's

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[9] RBP effect may be greater that VBMPS on account of WEDI construction. Majority of the index parameters give score on dairy related decisions, for instance decisions related to feeding milch cattle, sale of milk, etc. These variables are likely to be influenced more by RBP subcomponent as compared to VBMPS.

participation in decisions related to selling milk. However, the program did not significantly influence women's participation in the use of dairy income as compared to women located in control village's areas. The most significant change was observed in the area of leadership. The program village women were found to be five per cent more likely to participate in village level infrastructure discussions. A typical woman in a program household is six per cent more likely to demand fair wages for public works and protest misbehavior by authorities and elected representatives. It is interesting to note that the program has the potential to indirectly influence the efficacy of rights based programs such as MGNREGS.

The program has helped women gain access to at least one of the three extension services (AI, veterinary, and nutrition service). To be precise, the NDP women are eight per cent more likely to access one or the other extension services. Results indicate that the program has significantly improved the breadth of coverage of extension services; however, the frequency of use of the extensions services by women members remains an area of improvement.

The study also investigated the impact on gender parity at the household level. Impact estimates indicate that both VBMPS and RBP sub-components positively contributed to gender parity. Households with educated females, individual bank accounts were the largest beneficiaries, while Below Poverty Line (BPL) households are still lagging behind on various dimensions of women empowerment. The program has positively influenced the public speaking opportunities for women. They are more likely to use extension services, devote additional time to improve quality of poured milk, and participate in milk selling decisions.

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Annexure I

National Dairy Plan-I
National Dairy Plan – I, a central sector scheme, is designed as scientifically planned multi-state initiatives to increase milk production by increasing productivity through a focused approach to breeding and feeding. Two primary development objectives of this scheme are:
(1) To help increase productivity of milch animals and thereby increase milk production to meet the rapidly growing demand for milk.
(2) To help provide rural milk producers with greater access to the organized milk sector.

Women empowerment, though not explicitly stated objective under NDP-I, NDDB has always emphasized Gender Inclusion and Women Empowerment in all its development objectives.
Since the Operation Flood period and subsequent to that, NDDB has been following a pro- active policy to enroll more women as members of dairy cooperatives, ensure representation of women in Management Committees of the DCS, Board of Directors of Milk Unions and State Federations. NDDB has also pursued formation of exclusive Women managed Milk Unions and Producer Companies. The Women Cooperative Leadership Program (WCLDP), implemented during Operation Flood III, was a special project implemented by NDDB, acknowledging the important role that our women play in dairy related matters and therefore they needed to be given fair representation in the decision making in the institutions that they use for their livelihood support.

 NDP-I is being implemented with a total investment of about Rs. 2242 crore, where the Government of India is partnering with several organizations including International Development Association (IDA) as credit partner, End Implementing Agencies (EIAs) and National Dairy Development Board (NDDB) and its subsidiaries. End Implementing Agencies include State Cooperative Dairy Federations, District Cooperative Milk Producer Unions, Producer Companies, Registered Societies/ Trusts, State Livestock Boards, Bull Production Farms and Semen Production Institutions. NDP-I focuses on 18 major milk producing states namely Andhra Pradesh, Bihar, Gujarat, Haryana,

Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Telangana, Uttarakhand, Jharkhand and Chhattisgarh which together account for over 90% of the total milk production in India. Benefits of NDP-I will accrue to the country as a whole. The project components and sub-components under NDP-I are:

Table 1.1: NDP-I Components

Component A: Productivity Enhancement
- Artificial Insemination (AI)   - Progeny Testing (PT)   - Pedigree Selection (PS)   - Strengthening of Semen Station (SSS)   - Ration Balancing Program (RBP)   - Fodder Development (FD)
Component B: Milk Collection and Bulking
- Expansion of existing and formation of new Dairy Cooperative Societies (DCS)   - Promotion of new milk producer Institutions / New Generation Cooperatives   - Village level infrastructure development (milk cans, coolers, weighting/testing machine)   - Training & capacity building of milk producers & other functionaries
Component C: Project Management and Learning
- ICT Based MIS   - Learning and Evaluation

Annexure II

Women Empowerment Index in Dairy

These 5 domains of empowerment and calculation of scores on them are elaborated below.

Production: This dimension concerns decisions about dairy production and refers to input in decision-making about selling milk, cultivation of fodder crops, buying of animal feed, availing vaccination and veterinary services, and decision whether to adopt artificial insemination technology. The answerscale for the questions regarding input in decision-making was 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high. For each activity, an individual was considered adequate, if the respondent makes the decision, or if the respondent feels that he or she could participate in the decision making to the *low* extent. All sub-indicators were then aggregated to form the indicator "input in productive decisions". The respondent was considered adequate on input in productive decisions, if he or she was considered adequate in at least two of the sub-indicators. In other words, the individual was considered adequate if there were at least two types of production related decisions in which he or she had at least *low* input in decision making.

Resources: This dimension concerns ownership of, access to and decision-making power over *s*elling and buying of productive resources such as milk, milch animal, credit and dairy extension services. Access to credit included sourceslike NGO's, formal and informal money lender, and friends and relatives. Under dairy extension services, respondents were asked about the use of veterinary, artificial insemination and nutrition advisory services in past 12 months. The ownership indicator examined whether an individual had sole or joint ownership of milch animals and milk produced. A

person was considered adequate in this area, if he or she reported having sole or joint ownership. For access to credit and dairy extension services, respondent was considered adequate, if he or she had accessed any one of the services in last 12 months.

Income: This dimension captures say over the use of income generated from sale of milk and of milch cattle. If an individual had participated in the activity, how much say did the individual have in decisions related to the use of income generated from the sale of milk and milch cattle. The answer scale for the question regarding input in decisions was: 1 = none, 2 = low, 3 = moderate, 4 = high, and 5 = full. The individual was considered adequate on input in decisions about the use of income, if he or she had at least some input into decisions related to that activity.

Leadership: This dimension concerns leadership in the community measured by membership in economic or social groups, and comfort in speaking in public. Recognizing the value of social capital as a resource, this shows whether the person is an active member of at least one group, including (a) agriculture/ livestock/ milk producers' or marketing groups, (b) water users' groups, (c) forest users' groups, (d) credit or microfinance groups, (e) Panchayat, or (f) any other specific group. Group membership was not restricted to formal agriculture-related groups because other types of civic or social groups provide important sources of networks and social capital that are empowering in themselves and may also be an important source of dairy information or inputs. The indicator of whether the person was comfortable speaking in public was constructed based on responses to questions regarding the person's ease in speaking in public for the following: (a) decision with regard to infrastructure development such as small wells, roads, (b) ensuring appropriate payment of wages for public work or other similar programs, (c) raising voice against delinquency of authorities or elected officials, and (d) speaking against the malpractices of local 'Dudhia'/cooperative dairy or other milk buyers in the village. The respondent was considered adequate in speaking in public, if he or she was comfortable expressing opinions in public for at least one of the four reasons listed above.

Work/ Leisure: The time allocation domain includes two indicators: workload and leisure. The first refers to the allocation of time to everyday dairying tasks; the second captures the individual's satisfaction with the time available for leisure activities. The definition of work-related tasks includes cleaning cattle shed, cleaning/caring of animals, collect/prepare fodder, feeding animals, milking animals, pouring milk, grazing cattle, fetching water for cattle, and cleaning of milk vessels. The individual is defined as adequate on workload if the number of hours he or she worked per day was between eight to 12 hours. Respondents were asked to rank their level of satisfaction with the time available for leisure activities such as visiting neighbors, watching TV, listening to radio, watching movies, or participating in sports from 1 = not satisfied to 6 = very satisfied. The indicator "leisure time" considered the respondent adequate if he or she ranked his or her level of satisfaction equal to or higher than 3, which meant he or she was either satisfied with or indifferent to the time available for leisure.

Figure *Error! No text of specified style in document.***.1: Components of 5DE**
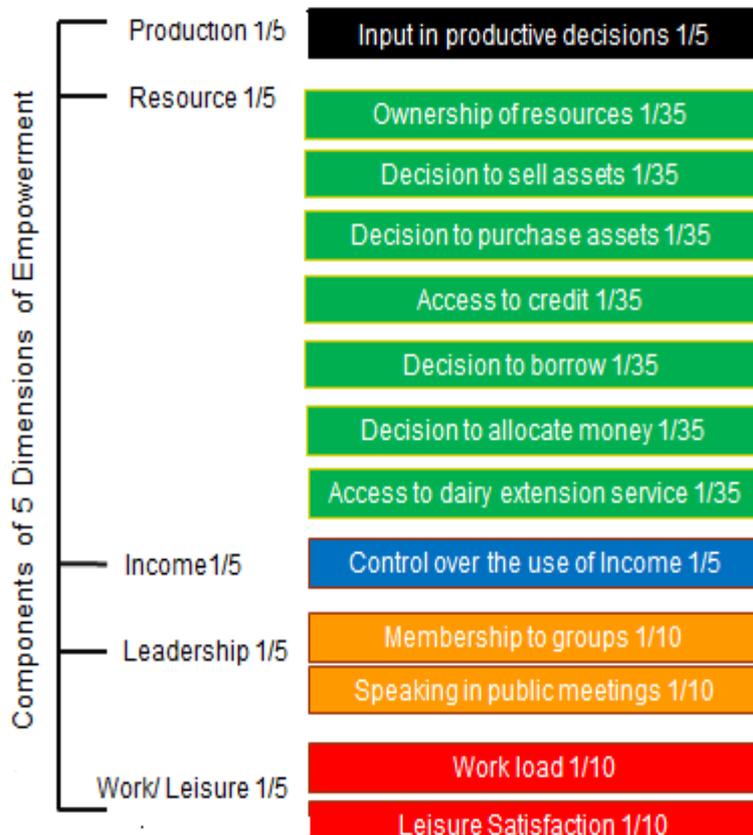
The sub-index 5DE is calculated as follows:

$$5DE = H_e + H_n (A_a)$$

H_e = percentage of women who are empowered

H_n = percentage of women who are not empowered $(1-H_e)$

A_a= adequate empowerment percentage of non-empowered women.

For the women who are disempowered, A_a shows the percentage of domains in which they meet the required threshold and thus experience sufficiency or adequacy.

The advantage of this construction is that it allows us to identify the critical indicators of the five domains that must be addressed to increase empowerment. This enables decision makers to focus on the situation of disempowered.

In this study, the disempowerment cut-off of 20 per cent has been contemplated, similar to what is considered in the Alkire et al (2013) WEAI construction. An individual is disempowered if his or her inadequacy score is greater than 20 per cent. This is similar to saying that an individual is identified as empowered on 5DE, if he or she has adequate achievements in four of the five domains, enjoys adequacy in some combination of the weighted indicators that sum up to 80 per cent or more, or has an adequacy score of 80 or greater.

The 5DE score can thus be improved by increasing the percentage of empowered women, or for those women who are not yet empowered, by increasing their adequacy scores.

The Gender Parity Index

The Gender Parity Index (GPI) is a relative inequality measure that reflects the inequality in 5DE between the primary adult male and female in each household. Households are considered to lack parity if the female is not empowered and her censored inadequacy is higher than the censored inadequacy score of her male counterpart. Put differently, a household enjoys parity if the woman is

empowered; or if she is not empowered, her adequacy score is greater than or equal to that of the male in the household.

GPI = 1- H_w (R_p)
H_p = percentage of women with gender parity
H_w = percentage of women without gender parity
R_p = the average empowerment gap between women compared to the men in their Household
The GPI score can thus be improved by increasing the percentage of women who have gender parity (reducing H_w), or for those women who are less empowered than men, by reducing the empowerment gap between the male and female of the same household (reducing R_p).

Annexure III

These states together contribute about 90 per cent of total milk production in India. A weighted average index was developed to identify six states for data collection using the a criteria which is discussed in Annexure II
1. The first criterion was state's share in total milk production in India. The states were sub-divided in three categories – high, medium and low – based on their share in total milk production in India. States with less than 4 per cent share were ranked low, 5 to 7 per cent of share were ranked medium, and greater than 8 per cent were ranked high. This indicator was given 33 per cent weigh in the index.
2. The second criterion was number of EIAs with Village Based Milk Procurement System (VBMPS) projects for each state. This criterion was informed by the theory of change. Village Based Milk Procurement System intervention is expected to contribute most significantly to women empowerment as it will enable women's participation in production and sale of milk via DCS/Producer companies. This criterion was assigned 33 percent weight.
3. Finally, Gender Empowerment Measure (GEM 2006) scores were used for each state and assigned 34 percent weight. Gender Empowerment Measure is a measure of inequalities between men's and women's opportunities in a country. It combines inequalities in three areas: political participation and decision making, economic participation and decision making, and power over economic resources.

The final ranking of the states was based on the index score. These states were then categorized into four geographical zones: North, South, East and West. One state was selected from each South and West zones and two states each from North and West zones. The states with no VBMPS project initiated in 2012-13 were not selected in the final list because it would take more than a year for the empowerment impacts to become visible and measurable at the household level. Gujarat was purposively selected after preparing this index from the west zone because of its importance in the cooperative dairy movement and existence of a milk producers' company Maahi. Between Uttar Pradesh and Bihar, the former was selected because of its highest share (18 per cent) in the national milk production. The final list of the six states was: Gujarat, Rajasthan, Punjab, Uttar Pradesh, Odisha and Karnataka. Please refer to Annexure 1 for an overview of the sampling process and Annexure 2 for state selection scores and details.

The next stage in the sampling process was EIA selection from the six states. For each state, implementing agencies having approved VBMPS projects since 2012-13 were identified. However, exception was made for the producer companies where VBMPS projects were approved in 2013-14. In Karnataka where more than two implementing agencies met the criteria, final selection was done on the basis of the number of proposed women DCS. Two implementing agencies, Banas and Kolar Milk Unions, were selected to give better representation to sub projects other than VBMPS.

The next stage of the multi-stage purposive sampling process was village selection. A total of 100 villages, 10 per implementing agencies were randomly selected from the list made available by NDDB. Of the 10 villages per implementing agencie, five villages were randomly selected as *program villages* where VBMPS had already been rolled out and the remaining five villages were randomly selected as *control villages* where VBMPS program will be rolled out during 2015-17. The final list of program and control villages was discussed and verified with the implementing agencies.