Annexure - IIa
List of NDP I Project Districts

Number of Districts with Different Interventions by State																					
Sl No	States	Districts	RBP Vill-TDC	RBP Vill-NGC	PT-Ongoing	PT- New	PS-Ongoing	PT- New	Bulking -Existing-TDC	Bulking -New-TDC	Bulking -NGC	AI -NGC	Fodder-Biomass bunkers/silos	Fodder-Fodder seed production & marketing support	Fodder-Mower demo	Fodder-Mower with Auto pickup / rakes	Fodder-Mower with manual pickup	Fodder-Revegetation of common grazing lands	Fodder-Seed processing plant	Fodder-Silage demo	Fodder-Straw Enrichment & Densification Plant
1	Andhra Pradesh	9	6	2	0	3	0	0	1	1	2	2	0	2	0	0	0	1	1	0	0
2	Bihar	5	5	0	0	0	0	0	3	0	0	0	4	0	0	4	4	0	1	4	0
3	Gujarat	20	10	7	7	0	2	4	0	0	7	7	3	9	0	8	8	8	0	8	0
4	Haryana	13	7	0	0	6	0	3	6	0	0	0	0	0	0	4	3	0	0	4	0
5	Karnataka	15	10	0	2	0	0	0	5	4	0	0	7	12	0	7	9	3	9	0	0
6	Kerala	10	6	0	0	0	0	0	10	10	0	0	1	0	1	0	0	1	0	1	0
7	Madhya Pradesh	10	5	0	0	0	0	0	5	0	0	0	0	5	5	0	0	5	0	5	0
8	Orissa	12	5	0	0	0	0	0	11	0	0	0	0	2	2	0	0	2	0	2	0
9	Punjab	15	5	9	0	9	0	2	5	0	9	9	0	6	0	0	0	0	1	5	0
10	Rajasthan	21	6	15	0	0	3	2	6	0	15	15	1	6	1	0	0	5	1	1	1
11	Tamil Nadu	13	8	0	4	5	0	0	3	3	0	0	3	1	3	0	0	3	1	3	1
12	Uttar Pradesh	31	9	22	4	0	0	0	0	0	22	22	7	8	0	6	8	3	1	11	0
13	West Bengal	7	4	0	0	0	0	0	4	0	0	0	3	3	3	0	0	0	0	3	0
14	Maharashtra	8	5	0	0	3	0	1	6	0	0	0	5	5	0	5	5	5	0	5	0
Total		**189**	**91**	**55**	**17**	**26**	**5**	**12**	**65**	**18**	**55**	**55**	**34**	**59**	**15**	**34**	**37**	**36**	**15**	**52**	**2**

Annexure - IIb
Sample Size Determination

Sample Size Determination

Sample Size Determination for Household

The indicators to be estimated are in the form of changes in ratios and proportions of various parameters such as milk production, 'in-milk' female animals, milk sold to organized sector etc. There are several criteria for determining the sample sizes. We first describe a widely adopted criterion for determining the initial sample size for estimating mean/total of a specific characteristic in case of sampling from a finite population for simple random sampling. This criterion determines the sample size for a given margin of tolerable error in the estimates and a specified confidence level.

Formula for estimating the sample sizes is

$$n_0 = \left(\frac{t.CV}{r}\right)^2$$

where t is the t-value for (1-α) level of significance (here α is taken as 0.05 and we are taking 95 percent confidence level for which t= 1.96; r is the margin of error to be tolerated (r=0.01 implies that we are prepared to tolerate a margin of error in the estimates up to 1%) and CV is the coefficient of variation for the study variable in the population. The above formula provides an approximate value for the sample size for very large populations. However, if we incorporate the adjustments for finite population correction, with population size N, then the formula for sample size takes the following form:

$$n = \frac{n_0}{\left(1 + \frac{n_0}{N}\right)}$$

Although, these formulae are oriented towards estimation of total/mean of a population, they provide a basis for sample sizes for ratios as well as proportions. In fact, relative changes can also be measured as ratios. For example, let average milk production at two points of time is Y1 and Y2, the percent change in the average milk production is

$$\%\ Change = \frac{Y_2 - Y_1}{Y_1}.100 = \left(\frac{Y_2}{Y_1} - 1\right).100$$

If we determine the sample sizes for estimating the ratio , it amounts to working out the sample size for measuring the change. It may be noted that the sample size depends on CVs which measures the variability inherent in the population. The variability in the ratio of average yields is likely to be comparatively much smaller.

Using the above formula, the estimated sample size required for r= 0.01 and confidence levels of 95 percent and an assumed CV of 50 percent is 9604. This is the minimum sample size required for estimating the parameter. These calculations are based on the assumption of simple random sampling. Considering the need to provide for additional sample size to accommodate design effect, need for bifurcating total sample between treatment and control sample, and the sample size for the entire

project has been fixed at 15,120 households. An equal sample size of 1080 households has been proposed for the 14 project states.

It may be noted that, these sample sizes are likely to provide reliable estimates at the project level, if 1 percent margin of error are targeted. A much larger sample size would be required for state level estimates at 1 percent margin of error. The proposed sample size of 1080 for a state, however, would be adequate to get reliable estimate at 3 percent margin of error.

An alternative approach for sample size determination was also attempted, in which the broad approach is to estimate the sample size by specifying the expected change in the output indicators at two points of time, estimated variability and pre-decided level of the two types of errors. The derived sample sizes are almost of similar order and therefore the proposed sample sizes seem to be in order.

Annexure - IIc
Estimation Procedure

Estimation Procedure

PDO indicators have been estimated using appropriate sample weights. The estimation procedure for estimating the PDO indicators, which are invariably in the form of totals and ratios, along with procedures for calculating corresponding standard errors are presented here. The procedures for calculating sample weights are also described here.

Sample Weights:

Sampling weights are needed for developing the estimates for various parameters. If we are interested in estimating parameters like population total or mean, the estimates for such parameters are also linear in nature with sample observations suitably weighted with appropriate sampling weights. The ultimate units of selection in the project are the households having adult cows/buffaloes. In general, the weighting procedures are essentially based on following three types of weights:

1) Base weights
2) Non-response adjustments
3) Post-stratification adjustments

In the present estimation procedure, we consider only the base weights. However, the aspects of non-response and post-stratification adjustments may be incorporated whenever required.

Base Weights:

Base weights are the inverse of selection probabilities for individual households having cows//buffaloes, which are the units of selection.

In three-stage sampling, the overall selection probability of a Third Stage Sampling unit (TSU) is the product of:

(1) Selection probability of corresponding First Stage Unit (FSU)
(2) The conditional selection probability of Second Stage Unit (SSU) for the given FSU
(3) The conditional selection probability of the TSU for the given FSU and SSU.

In the present case, talukas are FSUs which are selected with pps systematic sampling, villages are the SSUs which are also selected with PPS systematic sampling, households having animals are the TSUs which are selected with equal probability sampling following systematic sampling.

In order to understand the formulae used for weight calculation, the notations for a specific state are defined as below:

i: the sub-script i stands for i^{th} selected taluk,
j: the sub-script j stands for j^{th} selected village,
k: the sub-script k stands for k^{th} selected household,
N: number of taluks in the specific state,
n: number of taluks selected in a state (proposed number =30),
m: number of villages selected in each taluk (proposed number =3),
Z_i : size measure used for selecting ith FSU (taluk/mandal),

$$p_i = Z_i / Z$$

; it is the selection probability for i^{th} taluk.

Z_{ij} = size measure used for selecting j^{th} SSU (village) in i^{th} FSU.

; it is the selection probability for j^{th} village in the i^{th} selected ..... taluk.

H_{ij} = Number of listed households to be used as a frame for selection in the $(ij)^{th}$ village,

h = number of households selected in $(ij)^{th}$ selected village (proposed number =12),

y, x = observed value of y, x under estimation

= estimate of population total Y, X for the characteristics y, x.

The overall selection probability for k^{th} household in j^{th} village within i^{th} taluk is

$$\pi_{ijk} = (nmhZ_{ij}) \Big/ (H_{ij}Z)$$

The base weights for selected households are the inverse of their selection probabilities. Therefore**, the Base weights for each household in the j^{th} selected village in the i^{th} selected taluk is**

$$w_{ijk} = (H_{ij}Z) \Big/ (nmhZ_{ij})$$

It may be remarked that the notations have been used here corresponding to a specific state (say, s^{th} state). The subscript "s" will be further introduced for s^{th} state when pooling of results over different states will be done. As the samples of talukas are selected independently in each of the 14 States, each state may be considered as a stratum and estimation procedures are presented at stratum level. Strata estimates are then pooled appropriately for country level estimates.

Parameters to be Estimated:

Most of the parameters of interest in the PDO indicators are in the form of totals or ratios. Let us consider a PDO indicator in the form of a ratio R as

$$R = \frac{Y}{X}$$

Where Y and X are defined as aggregated parameters, relevant to the corresponding PDO indicator. The notations used for country level parameters are R,Y and X, whereas for state-level parameters, we use

Rs, Ys and Xs. It is also noted that and; .

The numerator (Y) and denominator (X) for different PDO indicators in the form of ratio (R) are as follows:

PDO Indicator 1: Milk Production per In-Milk Animal

Y: Total milk production
X: Number of in milk animals

PDO Indicator 2: In-Milk to Adult Female Ratio

Y: Number of in milk animals
X: Number of adult female animals

PDO Indicator 3: Proportion of Total Milk Sold to Total Production

Y: Total milk sold

X: Total milk produced

PDO Indicator 4: Share of Milk Sold to the Organized Sector

Y: Milk sold to organized sector

X: Total milk sold

Estimation of Totals:

An estimator for the Population total Y_s for s^{th} state is given by

$$\hat{Y}_s = \sum_i \sum_j \sum_k w_{sijk} y_{sijk}$$

where and is the y-value for (sijk) th household. The corresponding population total for the character x i.e. X_s is estimated as

The project level estimates pooled over all the states for Y and X are given as

$$\hat{Y} = \sum_s \hat{Y}_s$$

$$\hat{X} = \sum_s \hat{X}_s$$

Estimation of Ratios:

Ratio for s^{th} state is estimated as

$$\hat{R}_s = \hat{Y}_s / \hat{X}_s$$

and project level PDO indicators (in the form of ratios), pooled over all the states are estimated as

$$\hat{R} = \hat{Y} / \hat{X}$$

Estimation of Standard Errors:

For estimating the sampling variances, the procedure of random group method is followed here. The ideal situation is to independently select random groups to form independent estimates for the same parameter, which may be used for estimating variances. However, in the present context, the main sample is randomly divided in two sub-groups which are further used to estimate sampling variances. In each state, sample of 30 talukas, is randomly divided into two sub-groups of 15 talukas each.

At the state level for s^{th} state, two sub-group estimates for Y_s, X_s and R_s are for d^{th} sub-group, d= 1 and 2.

It may be noted that

$$\hat{Y}_s = \frac{1}{2}(\hat{Y}_{s1} + \hat{Y}_{s2})$$

$$\hat{X}_s = \frac{1}{2}(\hat{X}_{s1} + \hat{X}_{s2})$$

$$\hat{X} = \sum_s \hat{X}_s$$

$$\hat{R} = \hat{Y}/\hat{X}$$

The estimated variances for above estimates will be as follows:

For Aggregate :

Estimated variance of is

$$\hat{V}(\hat{Y}) = \sum_s \hat{V}(\hat{Y}_s)$$

$$\hat{V}(\hat{Y}_s) = \frac{1}{4}(\hat{Y}_{s1} - \hat{Y}_{s2})^2 ;$$

and are state level estimates for sub-sample 1 and sub-sample 2 respectively. Corresponding estimates for and is defined accordingly.

For Ratio:

Estimates for ratios are normally biased estimates. Therefore, suitable measures for sampling variances are Mean Square Errors (MSE). However, to the first order of approximation MSEs and Variances are same. Therefore, we use the term Variance in place of MSE.

$$\hat{V}(\hat{R}) = \frac{1}{4\hat{X}^2}\sum_s \left[(\hat{Y}_{s1} - \hat{Y}_{s2})^2 + \hat{R}^2(\hat{X}_{s1} - \hat{X}_{s2})^2 - 2\hat{R}(\hat{Y}_{s1} - \hat{Y}_{s2})(\hat{X}_{s1} - \hat{X}_{s2})\right]$$

Standard Errors (SE) and Relative Standard Errors (RSE) (%) are estimated as follows:

$$\widehat{SE}(\hat{Y}) = \sqrt{\hat{V}(\hat{Y})}$$

$$\widehat{RSE}(\hat{Y}) = \frac{\widehat{SE}(\hat{Y})}{\hat{Y}} \text{x} 100$$

$$\widehat{SE}(\hat{R}) = \sqrt{\hat{V}(\hat{R})}$$

$$\widehat{RSE}(\hat{R}) = \frac{\widehat{SE}(\hat{R})}{\hat{R}} \text{x} 100$$

Percent RSE is also called percent coefficient of variation (% CV) of the estimate.

Annexure - IId
List of Weighted Data

Weighted Data

Following are the lists of Weighted Data:

Chapter-III

1. Distribution of MAH by Number of Adult Female Bovine Animals.
2. Distribution of MAH by Social Group.
3. Distribution of MAH by Economic Group.
4. Distribution of MAH by Land Holding Class.
5. Average Land Holding by Land Holding Class (In Ha).

Chapter-IV

1. Composition of Milch Animals.
2. In-Milk to Adult Female Ratio.

Chapter-V

1. Milk Production by Animal Category
2. Milk Yield by Animal Category.
3. Milk Yield by Social Group.
4. Milk Yield by Milch Animal Holding Size.
5. Milk Yield by Lactation Completed.
6. Milk yield by Economic Group.
7. Milk Yield by Land Holding Size.
8. Milk Production per Household by Social Group.
9. Milk Production per Household by Economic Group.

Chapter-VI

1. Liquid Milk Sold as percent of Milk Production.
2. Share of Different Channels in Total Milk Sold.
3. Per Capita Milk Consumption in MAH Consuming Milk by Social Group.
4. Per Capita Milk Consumption in MAH Consuming Milk by Milch Animal Holding Size.

5. Per Capita Milk Consumption in MAH Consuming Milk by Economic Group.
6. Per Capita Milk Consumption in MAH Consuming Milk by Land Holding Size.
7. Per MAH Milk Consumption in Milk Consuming MAH by Social Group.
8. Per MAH Milk Consumption in Milk Consuming MAH by Milch Animal Holding Size.
9. Per MAH Milk Consumption in Milk Consuming MAH by Economic Group.
10. Per MAH Milk Consumption in Milk Consuming MAH by Land Holding Class.
11. Milk Production and Milk Consumption per MAH.
12. Per Capita Milk Availaibility and Per Capita Milk Consumption.