PUNJAB ECONOMIC OPPORTUNITIES PROGRAM

Household and Community Surveys

Phase -1 Baseline Report for Livestock

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EXECUTIVE SUMMARY

The Punjab Economic Opportunities Program (PEOP) is a flagship program of the Government of Punjab being implemented in partnership with the Department for International Development, Government of UK (DfID). PEOP aims to alleviate poverty and create inclusive growth in the province's high poverty districts – Bahawalpur, Bahawalnagar, Lodhran and Muzaffargarh – by increasing the employability and earnings of poor and vulnerable families. The Government of Punjab, DfID, LDDD and PSDF entered into a collaborative arrangement with the Center of Economic Research in Pakistan (CERP) to calibrate and evaluate PEOP interventions and provide evidence-based input on design.

This report summarizes the design-relevant findings of the initial sample of 1,955 households in first 130 rural PSUs surveyed, out of a total of 193 rural and urban PSUs surveyed under Phase 1. In relation to the sample as a whole, there will be 861 PSUs to be surveyed under Phases 1 and 2. The results provide initial findings that have important implications for program design in five main areas: (1) demographics of the region; (2) current state of livestock ownership and levels of productivity as defined by milk produced per animal, by animal type; (3) key constraints in terms of input and service use in livestock sector; (4) demand for livestock and agriculture related skills; and (5) market linkage opportunities from building supply side links between farmer producers and purchasers of milk, covering both formal and informal purchasers of livestock products. The contribution of the report is ultimately in prioritizing between a set of possible interventions (i.e., arguing there is more support for some versus others) and in providing details that can help design specific program features for these livestock related interventions.

Current State of the Market for Livestock

Understanding the livestock market is important for the design of effective and grounded interventions. We find that:

- Livestock ownership is not universal: in rural areas around one third of households own no livestock, *suggesting a need for asset transfer programs*. These transfer programs need to be based on the appropriate targeting criteria, and later in the report we highlight how lack of livestock ownership correlates to other measures of well-being, a household's economic circumstances, and knowledge - or potential to learn - about livestock rearing.
- There is enormous variation in milk yields per animal – a measure of productivity in the livestock sector, with the 25% most productive households having productivity levels more than double those of the least 25% productive households. These productivity differences remain even after accounting for some basic differences across the two types of households such as the number and composition of livestock owned, livestock breed, and characteristics of the household head. The practices and inputs used towards livestock differ across these

groups, *suggesting a need for interventions that provide information on best practices and make available basic inputs and veterinary services*.

- A significant fraction of households that produce milk do not sell any to the market, *suggesting any interventions that raise productivity might have large impacts on household incomes*. At the same time, farmers need to perceive (and obtain) a fair and transparent return on their produce from purchasers, and many of them feel this is currently not the case.

- The provision of government services are *highly regarded* in terms of perceptions of quality, satisfaction with services delivered and overall levels of trust. These perceptions do not differ much between government and private sector providers. The key constraint in why farmers do not access them is because they are *too far away*. Potential interventions such as the provision of Mobile Veterinary Services, or using mobile telecommunications to inform farmers of market prices and other relevant information, might have large impacts based on these findings from Phase 1.

- *Market linkages* – to veterinary services, chillers and milk processors need to be strengthened, perhaps using more intermediaries, such as dodhis to transport milk. The primary reason households give for not accessing such services is *distance*, not cost or service quality. The issue remains that the collective bargaining power needs to be established so that their milk can command higher prices. Although dodhis are often seen to be taking value from farmers, they are an institutional feature of the milk supply chain, so policies need to be devised taking into account the prominent role they play and will continue to do so.

Skills Training

There are two main findings from the Phase 1 data regarding the market for livestock related skills that should inform program design:

- There is demand for livestock related skills among men and women. Men and women are divided into separate roles in the sector with men specializing in agriculture, and women specializing in livestock production. Both genders feel their current skills are in these domains, and they *express a desire to acquire more skills in these spheres*. This suggests households will be receptive to training programs, and livestock productivity might especially benefit from programs *targeted specifically towards each gender*.

- Neither gender expresses a desire to be trained in animal health services. There is a great need for such services in the PEOP districts and these will need to be provided by providers from both the public and private sector. If not, then many farmers will remain reliant on informal vets that might be offering low quality services.

Overall Implications

On the whole, these findings suggest that four broad types of interventions could have immediate impact:

1. **Asset Transfers:** One class of interventions could be designed to provide livestock to households that own no such animals. This would correspond to around 33% of households in rural areas, and a non-significant fraction of households in urban areas might also benefit from such programs. This is found to be generally more effective than targeting new livestock to existing livestock holders. For example, there is little increase in milk yields found between households with one or two livestock. The key complement of any asset transfer program is the associated package of skills training that will allow households to take full advantage of such a transfer.
2. **Livestock Practices and Information:** Programs such as the Farmer Days intervention that provide farmers with intense one-day training on basic skills and practices can be a cost effective intervention that should be sanctioned under the PEOP program. The use of mobile phone communication technologies can also be explored to provide farmers up to date information on livestock relevant prices, and the availability of other government services.
3. **Animal Health Inputs:** A key missing input is veterinary services. These can be provided through mobile veterinary dispensaries (MVD) or in the longer term, through the training and placement of lady livestock workers or community animal health workers for example.
4. **Building Market Linkages:** There is a need to better link farmers to markets through the placement of key infrastructure, such as chillers, and the engagement of middlemen such as dodhis.

In addition to providing support both for the above classes of interventions and specifics on how best to design them, the report also examined a range of other interventions that were initially proposed as potentially important given the experience in other environments. However, based on the initial evidence from the survey, there is currently limited support for interventions that are based solely on either solving individuals' credit constraints or providing them linkages to cattle markets, although they may form components of the above-mentioned interventions.

Table of Contents

TABLES

FIGURES

1 Introduction

1.1 Background on PEOP

The Punjab Economic Opportunities Program (PEOP) is a flagship program of the Government of Punjab being implemented in partnership with the Department for International Development, Government of UK (DfID). The aim of the program is to create inclusive growth and alleviate poverty in the province's high poverty districts. The Program is being launched in the Southern Punjab districts of Bahawalpur, Bahawalnagar, Lodhran and Muzaffargarh. PEOP's two main components include: (i) increasing employability and earnings of low income, poor and vulnerable families by augmenting their skills-base through vocational training and (ii) increasing the access and returns to livestock income for the poor.

The livestock component of PEOP is being implemented by the Project Implementation Team (PIT) and the Punjab Livestock and Dairy Development Department (LDDD) in collaboration with DfID. PIT has been created to increase the access of low income, poor and vulnerable members of society to livestock income and skills with an aim to achieve the following outcomes at the ***household level***:

- Providing high quality information regarding livestock practices to households
- Improving the process and quality of livestock inputs
- Strengthening market linkages across the livestock value chain
- Increase livestock ownership to provide a means of income to poor households

In order to attain these outcomes, PIT aims to intervene at various stages of the livestock value chain starting with inputs into the household, including animal ownership and health, and linkages to intermediate and final markets, such as milk processing and urban consumers. PIT and LDDD are aware that successful program design will need to account for the distinct needs and interests of households, supply side providers and intermediate markets.

1.2 Collaboration with the Center for Economic Research in Pakistan (CERP)

The Center of Economic Research in Pakistan (CERP) has entered into collaboration with the Government of Punjab, DfID and PIT to provide technical assistance on evidence-based design and program calibration based on baseline surveys, and to conduct rigorous scientific impact evaluation of the portfolio of interventions. This collaboration is recognition of the fact that cost effective impact requires interventions that are grounded in and informed by solid evidence and that address issues faced *across* the livestock value chain. The key components of this collaboration include:

- Evidence-based and empirically grounded design of an integrated program of interventions in the market for livestock
- Continuous monitoring and evaluation of the impact of interventions to enable recalibration for effective delivery

1.3 Report

The current report has been prepared by CERP to provide evidence-based input into program design. It is important to mention that the current report represents the findings from 11% of the households from the baseline survey. The small size of the current sample needs to be kept in mind while interpreting the results. While this sample is too small to identify statistically meaningful *differences across districts*, it provides sufficient precision to identify the broad characteristics of the four PEOP districts on a range of dimensions and to provide valuable input into program design.

The report makes several contributions to that end. It uses empirical data to provide the regional context in which interventions are going to be implemented and highlights the challenges posed for intervention design by the characteristics of households in the program districts. The next section provides information on the survey and the sample used for this report.

Section 3 examines the basic demographics of the target region in terms of age, education, economic welfare and the nature of skills acquisition. Here the report describes the challenges faced by the male and female citizens and households belonging to different consumption brackets (quartiles).

Section 4 discusses the current state of livestock ownership. It provides information on how many households would benefit from an asset transfer program targeted towards households that currently have no livestock and rely solely on their wage labor. It makes clear how patterns of livestock differ between rural and urban PSUs included in the Phase 1 CERP-PEOP baseline.

Section 5 documents milk productivity in the PEOP districts, discusses the enormous variation in milk yields among farmers and suggests the underlying reasons for this (and also highlights which factors *cannot* explain these productivity differences across farmers). It also discusses egg production and seasonal price variation in the PEOP districts. We document in detail livestock related skills and skills demand by gender, within the livestock and agricultural sectors.

Section 6 documents the use of and constraints on other inputs by farmers including animal health care, feed and fodder, natural insemination techniques, artificial insemination techniques and credit availability and usage.

Section 7 presents evidence on linkages farmers have to markets through dodhis and chillers. **Section 8 discusses the related linkages farmers have to cattle markets** and examines how integrated these markets are. **Section 9 brings all the information together to discuss prices and outputs in the livestock sector.** These are the core sections from which we can evaluate whether and how market linkages might best be established in the livestock sector.

Section 10 presents an overview of the livestock supply side surveys that we will conduct, and explains how they will further inform the design of PEOP policy interventions.

Section 11 concludes with a summary of the implications for PEOP livestock sector interventions from the Phase 1 baseline survey findings. Additional material is provided in the Appendix.

2 Methods

Beginning in October 2011, CERP initiated a large-scale household survey in the four PEOP districts in order to provide information along two key dimensions. First, the survey provides baseline tehsil-level measurements of economic outcomes against which PEOP's impact can be measured. These measures will also facilitate evidence-based adjustments of specific PEOP components in years two and three of the program. Second, the survey provides estimates on a range of factors relevant to designing effective programs in livestock, including: the ownership of livestock, practices towards livestock rearing, the use of inputs relevant for livestock, milk and egg production, and income expectations related to milk production and livestock rearing.

The baseline household survey is divided into three phases.

1. Phase 1A is intended to provide input into the design of the initial PEOP interventions and includes respondents in 1,955 households that were surveyed in the first 97 PSUs (short for Primary Sampling Units i.e. randomly selected 'sample areas'). These 97 PSUs were selected randomly from the overall tehsil-representative sample of 861 PSUs and are geographically spread over all four program districts.
2. Phase 1B provides the larger sample required to provide sufficient evidence to revise the survey and cover the initial set of evaluation communities planned for the first skills and livestock interventions. Phase 1B, which is now completed, covered an additional 96 PSUs.
3. Phase 2 will provide sufficient precision to estimate tehsil-level changes deriving from PEOP programming. Phase 2 covers the remaining 667 PSUs.

This report is based on Phase 1A and Phase 1B data[1]. This represents approximately 22% of the households that will eventually be sampled in the baseline survey.

2.1 Sample Details

Of these 193 PSUs completed in Phase 1, 33% were urban and 67% were rural. Overall, 23% of the total urban PSUs haven been covered in Phase 1, and 22.2% of the total rural PSUs have been completed.

Table 1 Phase 1 Sample

	Rural	Urban	Total
No. of PSUs[2]	129	64	193
No. of Tehsils included	17	15	--
No. of Districts included	4	4	4

[1] We do not report any district-level estimates in this report as we await sampling weights from FBS which would allow us to make the data district-representative. However, we do not expect the overall results to vary substantially as a result of the re-weighting.

[2] A PSU is a revenue village in rural areas and a sampling block in urban areas

In Bahawalpur, 25.9% of the total PSUs have been completed. This figure is 20.7%, 21.7% and 21.3% for Bahawalnagar, Lodhran and Muzaffargarh respectively. The fraction of completed PSUs within urban-rural areas of each district is given in Table 2 below:

Table 2 Percentage of PSUs in Each District by Rural/Urban

District	As a % of total urban PSUs in each district	As a % of total rural PSUs in each district
Bahawalpur	22.22	20.00
Bahawalnagar	25.61	26.01
Lodhran	22.92	20.83
Muzaffargarh	20.00	21.79
Total (Out of 861)	22.86	22.38

4,598 unique households were *visited* in the Phase-1, out of which 4,082 were from the original sample and 516 were from the random replacement sample. The replacement households were used only if households in the original sample refused to answer, or could not be surveyed for any other reason such as non-availability of the household head or an adult female respondent. Out of the total attempted households, 3,947 were completed, meaning that the completion rate for Phase-1 households was 85.8%.

3 Demographics

This section provides information on aspects of household-level demographic attributes and on the nature of skills acquisition in the program districts. The evidence presented in this section will be helpful in designing PEOP livestock interventions.

The baseline survey collected basic demographic information on all residents in our respondent households. Surveys were fielded to both male and female heads of the household. In the vast majority of households, both such respondents did answer the survey questions. In this section we report basic statistics for the entire sample and selectively for the urban and rural areas.

The main findings of this section are the following:

- **The population in the program districts is quite young.**
- **The level of educational attainment in this population is low in general and especially low among women.**
- **The levels of poverty and vulnerability among households in the program districts are high, with approximately half the population falling in these categories.**

Detailed findings are given in the sub-sections below.

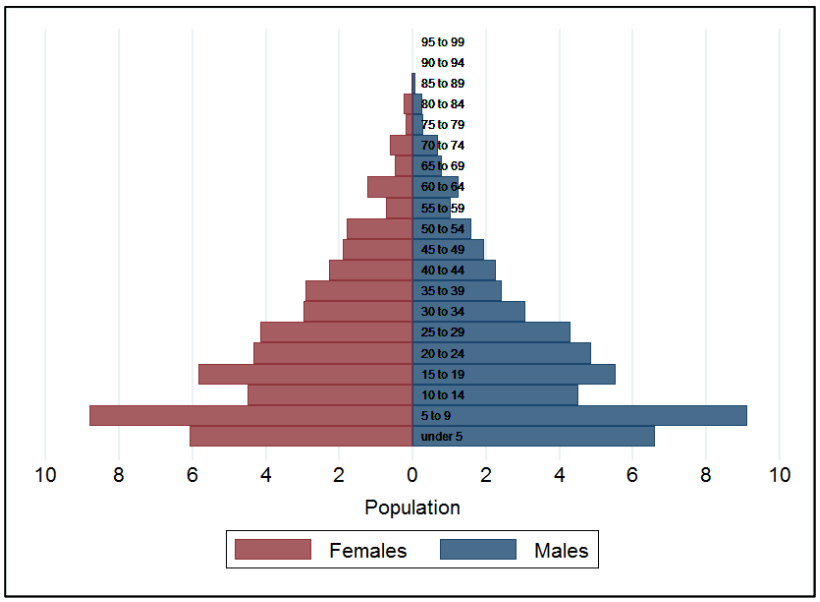
3.1 Age

Not surprisingly, the age distribution in these districts is heavily skewed towards the young. Roughly 50% of the working age population in the sample is under the age of 30 and a large fraction of this population is beyond the school going age. Figure 1 provides a summary of the age distribution in the program districts.

The horizontal axis gives the total percentage of the population that falls under each age-wise category (given on the vertical axis). We can see that the bars are longer at the bottom of the pyramid for both males and females, which suggests that, as expected, a large fraction of the population in our PEOP sample is young. The age distribution in the urban sample is also in line with the age distribution in the overall sample (see Figure 2).

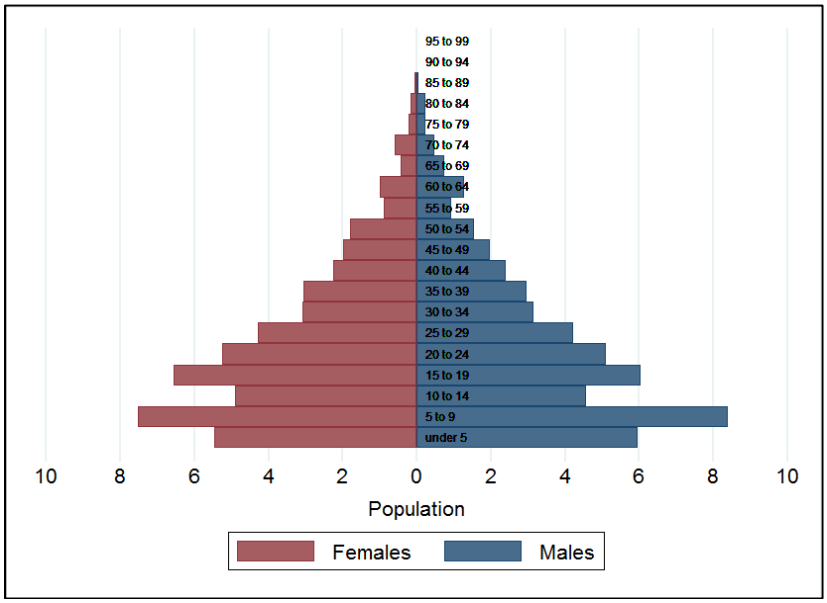
The fact that the population in program districts is young implies an opportunity to have a long-term impact on the welfare of households in the program districts by augmenting their human capital and livestock related skills and knowledge.

Figure 1 Age Distribution of Population



Note: The graph above shows the percentage of total population on the x-axis (for males on the right-hand side and for females on the left-hand side of zero)

Figure 2 Age Distribution of Urban Population

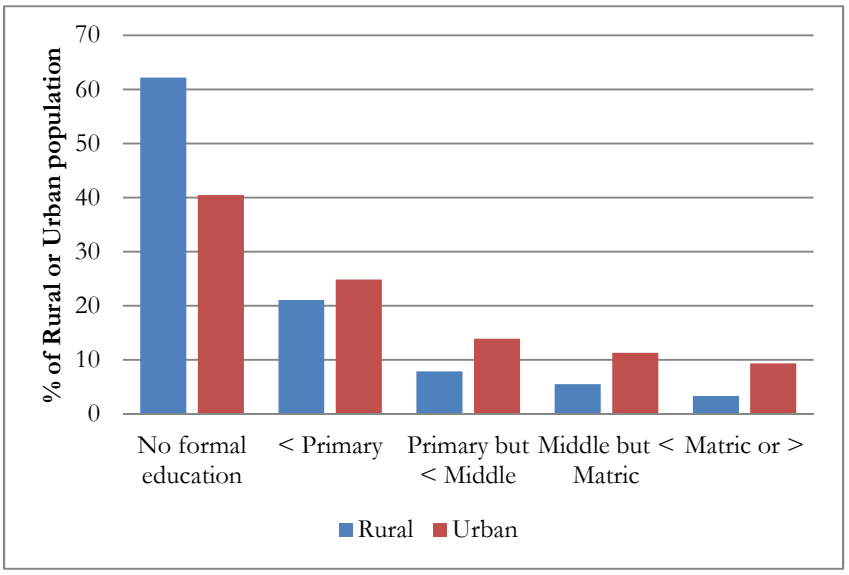


Note: The graph above shows the percentage of total urban population on the x-axis (for males on the right-hand side and for females on the left-hand side of zero)

3.2 Education

Figure 3 presents data on the education levels in the population. It shows the percentage of rural or urban population in our sample that has obtained a particular level of education. It can be seen that more than half of the rural population and approximately one-third of the urban population have no formal schooling and another 10% of the population has an educational attainment of less than primary. Overall, we can see that **the population in the PEOP districts, significantly more so in the rural areas, is largely uneducated with a very small percentage receiving education above primary levels.**

Figure 3 Education Attainments by Rural-Urban



Furthermore, the educational attainment deficit is much more acute among women in both rural and urban areas. Figure 4 shows the same story as above but splits the population by gender in urban areas. Figure 5 does the same for rural areas. We can immediately see a few trends from the graphs below. First, **there is divergence in the education levels of females relative to males**, regardless of whether we look at urbal or rural poplation. Second, **the difference is more stark in rural areas where the education levels are also considerably lower**. Finally **the deficit in educational attainment is much more acute in rural areas.**

Figure 4 Educational Attainment by Gender in Urban Areas

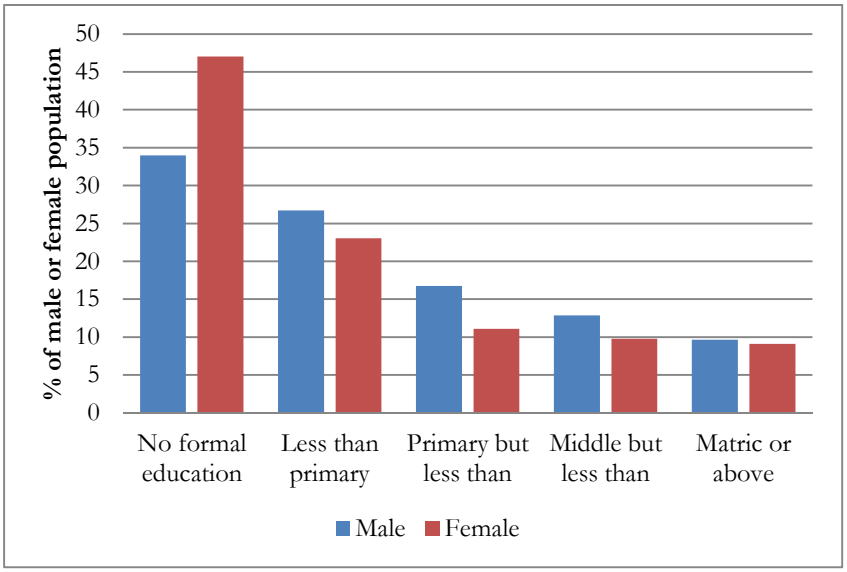
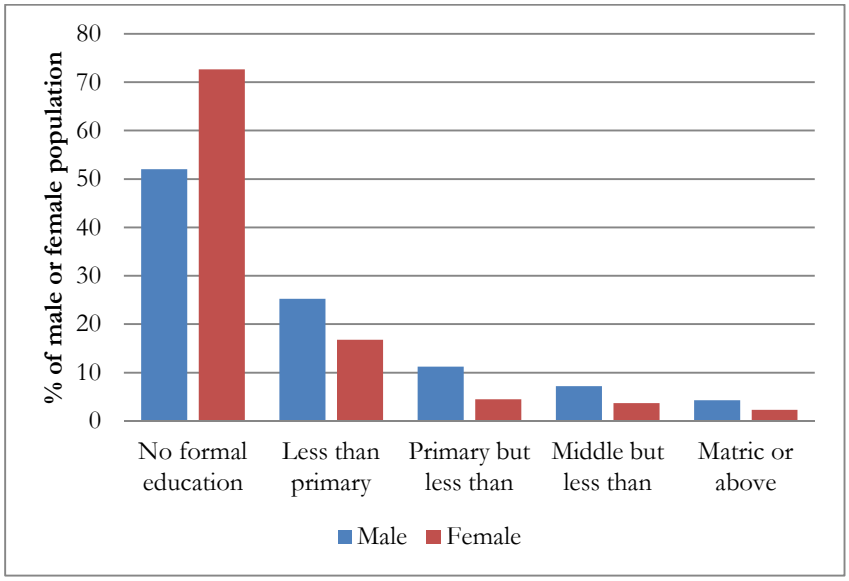


Figure 5 Educational Attainment by Gender in Rural Areas



The educational deficit in this young population, a large proportion of which is beyond the school going age, reinforces the importance of livestock related skills training as a way to build human capital. Since women form a large part of the marginalized group, it would also help them if livestock related skills, that are specifically beneficial for women, are introduced.

3.3 Economic Well-Being, Poverty and Vulnerability

Consistent with the literature for developing countries, we use a consumption based measure of household welfare rather than an income based indicator. As argued by Deaton and Zaidi (2002) there are several reasons for doing so. First, current consumption is less volatile to negative income shocks and hence is less variable over time. This is so especially in settings which are highly dependent on agriculture, where the households' stream of income fluctuates considerably over seasons and years. Second, there is a risk involved in measuring the income for households whose occupations are self-employment based. Often, these incomes (which are self-reported) are either underreported or reported with significant error. In such cases using income as a measure for poverty will seriously bias our results.

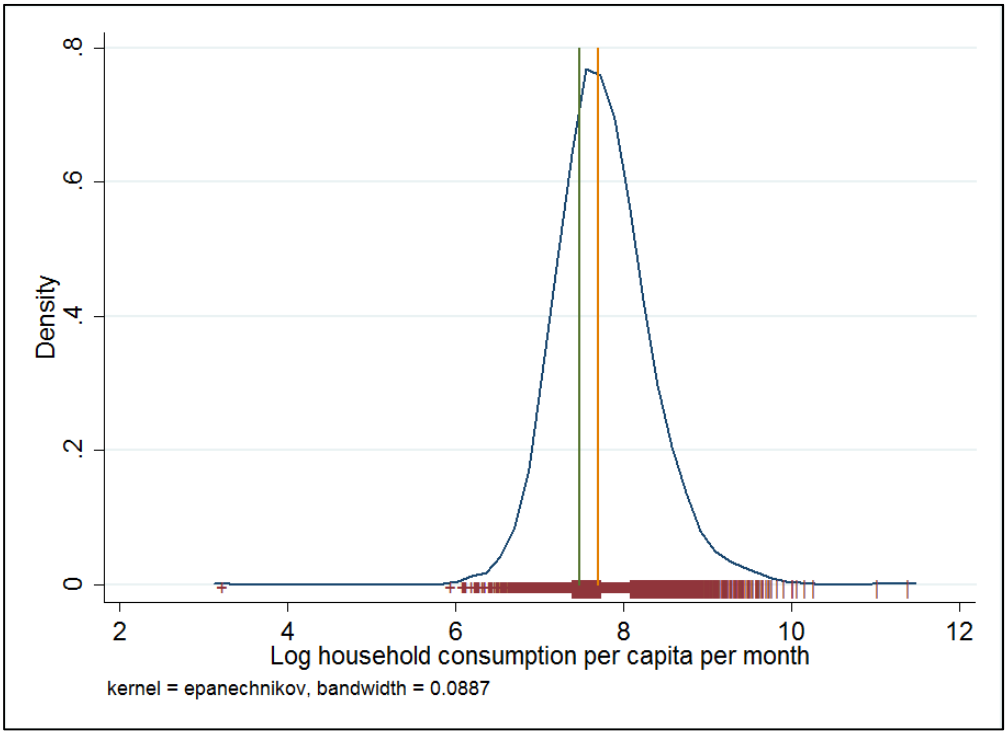
Section 3 of the household survey (female) asked respondents about the household's spending on food and other items during the reference period (last month or year). For the consumption measure, the monthly per capita expense for each household was determined. Among the non-food items, as per convention, purchase of durable goods such as clothing, furniture and utensils was valued at its user cost and expenses on items like dowry were excluded from the consumption aggregate as the latter can be viewed as a bequest or inter-generational transfer of wealth rather than consumption spending.

We present results on economic well-being by dividing households into four consumption brackets or quartiles based on the above measure. If we were to rank all households on the basis of consumption per capita, which gives us a measure of their income levels, the households that fall in the bottom 25% of this group, that is, the households with the lowest consumption levels, will fall in the first consumption quartile. Similarly, the households that are in the top 25%, that is, those households that consume the most, are in the fourth consumption quartile.

In order to test whether consumption is an accurate measure of the relative poverty of the household, we conduct the following exercise. The relationship of these consumption quartiles against the national poverty line for the year 2011 can be seen in Figure 6. In addition, we use the methodology of the Economic Survey 2007-08 to determine those households located just above but within 25% of the poverty line as vulnerable to poverty. Figure 6 gives us the number of households that lie at a particular household consumption level (shown on the horizontal axis). The highest point on this graph indicates that the highest number of households have the corresponding household consumption level. This figure shows that approximately half of the population is poor and vulnerable as the yellow line, which represents the consumption level which is just above the national poverty line but still in the 'vulnerable' population group.

As noted earlier, we follow the classification used in the Economic Survey (2007-08) in defining the poor and vulnerable population. We use an inflation-adjusted official poverty line to classify the poor. The vulnerable population is that population of the non-poor whose per capita household consumption expenditures lies within a threshold (25% higher) of the poverty line leaving them susceptible to being driven into poverty by adverse shocks.

Figure 6 Poor and Vulnerable Population



Note: Green line represents the national poverty line set at Rs. 1,767 per capita per month. The orange line denotes the vulnerability threshold set at Rs. 2,209 per capita per month. The individual consumption values are denoted by the markers below the graph ('+' denoting the first and third quartile and '|' denoting the other two quartiles.

The average household expenditure per capita of the top consumption 25% households is more than four times that of the bottom 25% of households (Table 3). The table also shows that the mean household expenditure of the households lying in the 25%-50% bracket is not much higher than the expenditure of the bottom 25% households. This suggests that the average discrepancy in consumption is quite stark between the poorest and the most well-off households in the PEOP districts.

Table 3 Mean Household Expenditure per Capita, by Consumption Quartiles

Consumption Quartile	Mean	Standard Deviation	Min	Max
1	1,246	265	25	1,627
2	1,931	178	1,628	2,254
3	2,696	281	2,255	3,250
4	5,423	4,223	3,251	87,352

3.4 Economic Well-Being and Educational Attainment

Not only is educational attainment low in the program districts, there is a positive correlation between per capita household consumption expenditure and educational attainment. Approximately eighty percent of the population in the first consumption bracket has less than five years of education with half of this population never having been to school.

This is shown in Table 4 below, which lists education levels by the consumption quartiles discussed in the previous sub-section. We can see that the poorest households also have the fewest years of schooling on average. Thus 43.55 in every 100 households in the lowest 25% group have never been to school while the corresponding figure for the highest 25% group is only 32.3, suggesting a divergence in educational attainment between the richest and the poorest households.

Table 4 Education by Consumption Quartile

Education categories	Consumption Quartiles (Column %)				
	1	2	3	4	Total
Never been to school	43.55	39.8	35.99	32.3	38.99
Basic literacy (or hafiz) without formal schooling	4.96	5.71	4.87	4.72	5.12
Less than 5 years of schooling	28.9	26.02	25.52	22.64	26.32
5<= Education <8	11.16	12.82	12.53	11.19	11.94
8<= Education <10	5.75	6.83	8.94	8.9	7.27
Education >=10	5.69	8.81	12.15	20.27	10.37
Total	100	100	100	100	100

The correlation between consumption expenditure and educational attainment is stronger in the female population as roughly half of the female population in the first and second consumption quartiles has never been to school. Table 5 shows this in detail. We can see that the percentage of females that never went to school is as high as 56.78 in every 100 household in the poorest 25% of the households.

Table 5 Education by Consumption Quartiles, Females Only

Females only					
Education categories	**Consumption Quartile (Column %)**				
	1	**2**	**3**	**4**	**Total**
Never been to school	56.78	51.09	46.98	40.95	50.19
Basic literacy (or hafiz) without formal schooling	4.06	5.63	4.73	5.07	4.84
Less than 5 years of schooling	23.41	22.67	22.95	20.94	22.66
5<= Education <8	8.31	9.56	10.23	9.77	9.34
8<= Education <10	3.43	4.25	5.23	6.05	4.53
Education >=10	4.01	6.8	9.88	17.22	8.45
Total	100	100	100	100	100

These numbers are extremely stark and suggest the need to be extremely careful while designing the content and pedagogy of livestock related skills training: in particular the educational attainment required by any training programs.

While the lack of schooling in the population may at first seem to be a severe challenge for PEOP, we believe it also represents an opportunity. Households in the region expect substantial returns from obtaining even the most basic livestock related skills. As we will show later, there are strong reasons to think that programs providing livestock related skills will be enthusiastically received in the region. Fortunately, several of the most salient barriers to skills acquisition are things that PEOP can readily address (e.g. lack of information about best practices or provision of services). In turn, this implies there are great opportunities for successfully enhancing skills acquisition.

4 Livestock Ownership

This section discusses the status of livestock ownership in the PEOP districts. It is important to have knowledge of this because existing government data sets, such as MICS 2007-08, are dated and do not provide us with a detailed understanding of livestock-specific statistics that we need to inform deliberations on intervention design, specifically, informing us of the percentage of households that are potential beneficiaries of our interventions and the key constraints they face in raising incomes from livestock.

Table 6 shows livestock ownership, split by rural-urban location. The results show that in the full sample of 193 Phase 1 PSUs, 50.6% of households do not own any livestock. In rural PSUs this drops to 39.1% as expected while in urban PSUs the evidence suggests that over 83% of households have no livestock.

Among those households with at least one animal, the average herd size is 5.52 in the full sample of PSUs. The average herd size is slightly lower in rural PSUs – at 5.50 animals, and slightly higher in urban areas at 5.72 animals. This difference is not driven by a different composition of animal herd in rural and urban locations. The final row shows the mean herd size for the largest animals: cattle and buffaloes combined. Among such animals, the mean herd size is 3.62 in the full sample, 3.63 in the rural sample and actually slightly lower – at 3.53 – in the urban sample.

Table 6 Livestock Ownership

	Full Sample	Rural Only	Urban Only
Non-owner HHs	50.6%	39.1%	83.1%
HHs owning at least one animal	49.4%	60.9%	16.9%
Mean of HHs with animal, conditional on ≥1	5.52	5.50	5.72
Mean of Cattle + Buffaloes, conditional on ≥1	3.62	3.63	3.53

Figure 7 below then shows how ownership by animal type varies. The figure shows the percentage of households that own a certain number of animals out of the total households that own that animal type. This reveals that herd sizes are smaller for larger animals as expected. Moreover there are very few households that report having camels in the PEOP districts.

Figure 7 Percentage of Ownership of Animal Type by Stock

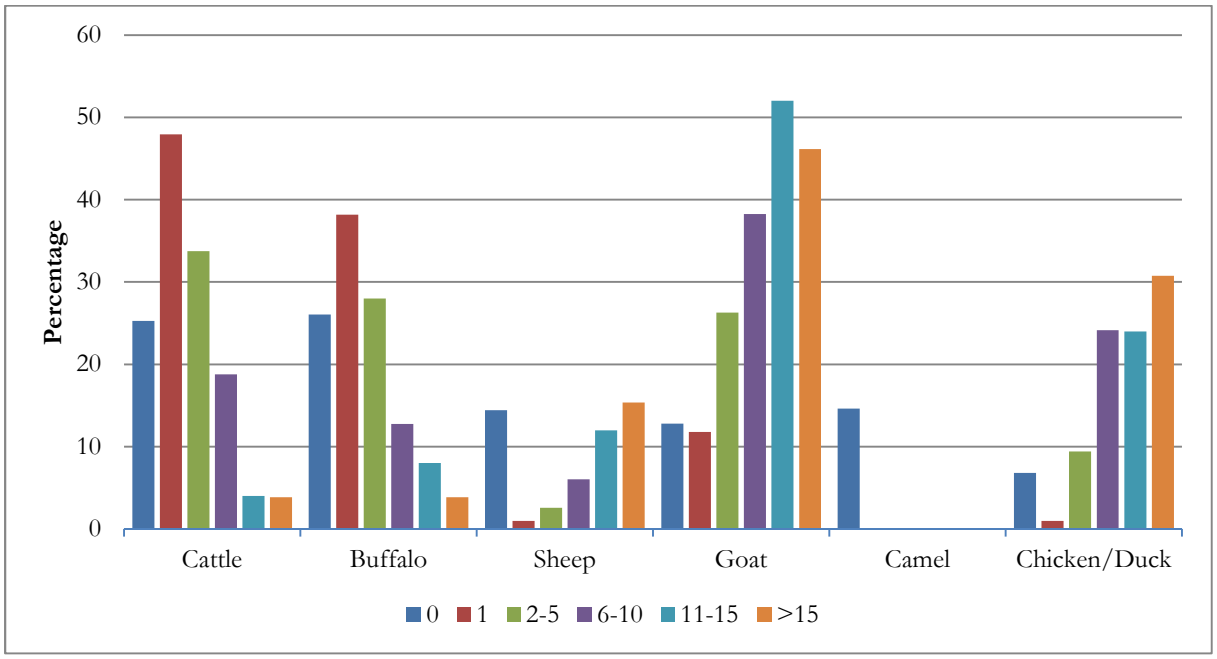


Figure 8 gives the ownership statistics by animal type. We can see that the most common type of animals owned across households, regardless of herd size, are cattle and buffalo followed by smaller animals like sheep and goats.

Figure 8 Percentage of Household Ownership by Animal Type

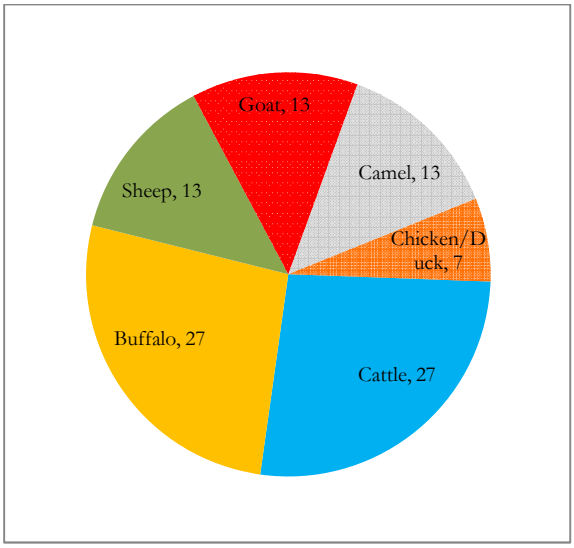


Table 6 highlights a number of factors that are relevant for livestock related PEOP program. First, **for asset transfer programs that are targeted towards those households without livestock, the set of potential beneficiaries, corresponds to 51% of all households, and 39% of all rural households**. As we document the key constraints on livestock productivity later in this report, it will

become clear that any asset transfer program must also be accompanied with targeted skills training so that households can best take advantage of any new livestock transferred to them.

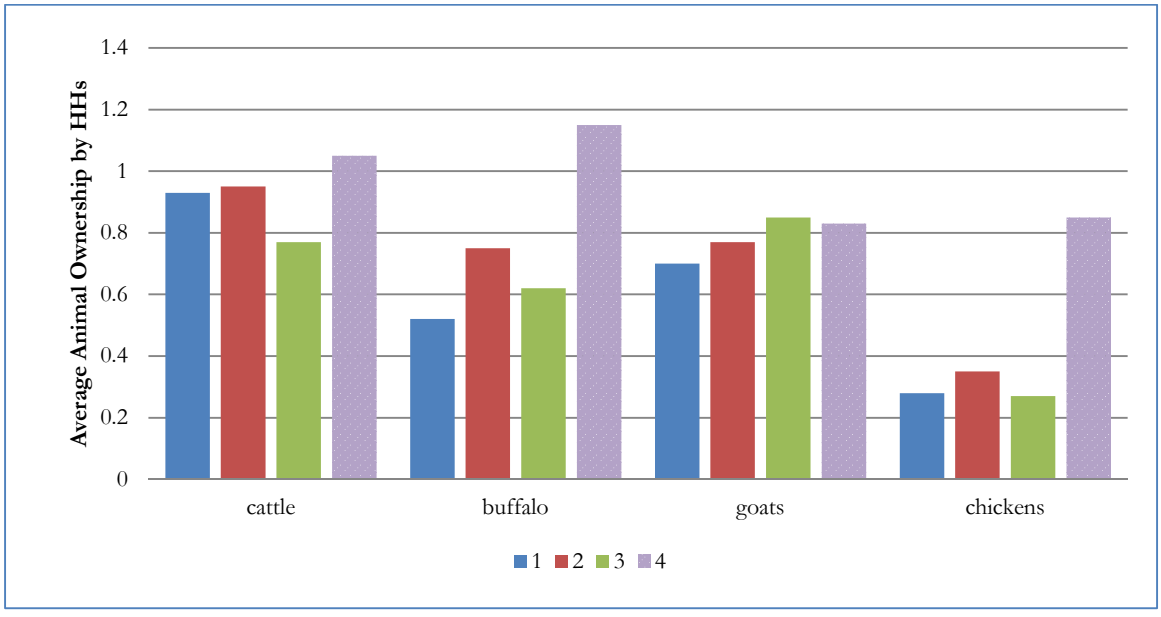
Second, **PEOP programs that emphasize improvements in knowledge or practices related to livestock, and are targeted towards those households that currently have livestock, have a scope of influencing the productivity of a large number of beneficiaries** - 49% of all households and 61% of all rural households.

Third, **PEOP programs that emphasize building market linkages between farmer-producers and purchasers of livestock products will directly benefit at least 49% of all households**, rising to 61% of all rural households. This is a lower bound figure because there are other groups of households that might also indirectly benefit from such interventions. For example, there might be households that do not themselves own livestock but that are engaged on the livestock supply side – such as those supplying *wanda,* feed and drugs, that are also positively affected by market linkages which increase the scale of livestock production in the village.

The fourth and final key insight from this table is that **there exists a highly selected group of livestock households in urban areas**. These households also need to be considered and brought within PEOP interventions. For example, interventions linking farmers to consumer markets might be especially relevant and more cost effective for farmers located in the urban areas.

Figure 9 then shows how livestock ownership varies by consumption quartile. Our figure reveals that for a number of livestock types: cattle, buffalo and chickens, higher consumption quartile households own more livestock although the gradient for this is not very steep. Hence, the PEOP interventions targeted towards the poorest households will be received by those that have low levels of livestock - households in consumption quartile one average less than one animal (as it includes a mixture of households with no animals and those with very few).

Figure 9 Mean Number of Animals Owned, by Consumption Quartile



The final set of tables relate to incomes from livestock. Table 7 shows among those occupations in the livestock sector, monthly earnings (both in cash and in-kind).

Table 7 Monthly Earnings from Livestock Occupations

ISCO's occupation Code	Mean earnings per Month (Rs.)
Crop farm labourers	5,765
Dairy-products makers	5,133
Livestock and dairy producers	4,204
Livestock farm labourers	4,694
Poultry producers	4,409
Subsistence crop farmers	7,039

The next table breaks down incomes by livestock occupation and productivity quartile in milk production, as described earlier, so that the most productive households in terms of milk per animal are ranked in the fourth quartile:

Table 8 Monthly Earnings from Livestock Occupations by Productivity Quartiles

ISCO's occupation Code	Productivity quartiles			
	1	2	3	4
Crop farm labourers	6,164	6,561	3,563	4,398
Livestock and dairy producers	5,286	3,364	7,108	3,123
Livestock farm labourers	4,396	1,000	0	0
Poultry producers	0	2,083	0	0
Subsistence crop farmers	6,091	6,472	5,257	10,396

Surprisingly, there is not a clear relationship between productivity and incomes - more productive households (in the fourth quartile) do not, for example, have higher earnings as livestock and dairy producers. This might reflect the fact that higher productivity households do not sell their produce to the market.

5 Milk Yields, Practices, Egg Production and Skills

This section summarizes data on milk productivity in the PEOP districts, variation in milk yields between households, production and seasonal variation in egg prices, and demand of livestock related skills by gender. The discussion below will help us in establishing the productivity levels in and dispersion between households which will feed into discussions on possible intervention designs relating to livestock practices.

The first table below, Table 9 shows milk production per animal by type and time of milking (morning or evening). Each figure is calculated on a per animal basis. It shows that the average morning milking for cattle is 2.33 litres while the corresponding figure for evening milking is 2.05 litres. We see that slightly more milk is produced in morning milkings for each animal type. The table also shows the standard deviation in milk produced per milking, and there is slightly more variation in morning milkings.

Table 9 Average Milk Production per animal by Type and Time of Day

Animal Type	Morning (litres)	S.D.	Evening (litres)	S.D.
Cow	2.33	1.24	2.05	1.08
Buffalo	3.11	1.35	2.75	1.23
Goat	0.79	0.42	0.75	0.40

Table 10 Average Milk Production per Breed by Time of Day

Breed	Morning (litres)	S.D.	Evening (litres)	S.D.
Cow Breeds				
Sahiwal	2.63	1.34	2.36	1.22
Cholistani	2.37	1.35	2.02	0.99
Dhanni	2.04	0.87	1.94	0.70
Dajjal	2.53	1.12	2.29	1.09
Cross breed	2.26	0.93	1.98	0.83
Others	2.10	1.18	1.82	1.06
Buffalo Breeds				
Nili/Ravi	3.19	1.42	2.89	1.28
Kundi	3.05	1.28	2.69	1.17
Others	3.08	1.25	2.54	1.14

This last table breaks down the previous figures for each breed of cow and buffalo. We see that **there are some breeds that are on average more productive than others, but that these differences are not large compared to the variation in productivity within each breed.** This is informative for thinking through precisely which types of breed might be supplied in any asset transfer program.

The next table explores the productivity of livestock. This is measured as the total number of litres produced per animal, summed over morning and evening milkings.

Table 11 Milk Yield Distributions by Animal Type

Animal	Mean	25th Percentile	Median	75th Percentile
Cow	2.18	1.5	2	2.5
Buffalo	2.92	2	3	3.5

Table 11 shows that over a typical day, the average amount of milk produced by a cow is about 2 litres, and for a buffalo, this figure rises to around 3 litres. Note that the totals reported here are not the sum of the morning and evening yields because not all animals will be milked twice in the same day.

The table also shows more evidence on the dispersion of productivity. If we order all households based on their milk productivity by animal type, we can develop an understanding of the difference between the higher and lower productivity households. The median yield (for the household at the middle of the productivity ranking) for cows is 2, lower than the mean and suggesting a long left tail of low yields. Indeed, the other statistics on the top row above confirm this: the yield for the lowest 25 percent of households is 1.5 litres. Remarkably, the yield at 75th percentile for the upper 25 percent of the yield distribution is 67% higher, at 2.5 litres per animal per day.

This heterogeneity in milk yields is replicated for buffaloes. Again, we see that in our sample we have the top 25 percent of households (those above the 75th percentile) having productivity that is 75% higher than the lowest 25% of households in the sample (those below the 25th percentile).

This highlights the huge variation in observed productivities in the livestock sector. Before drawing any conclusions from this, we adjust for two types of factors.

First, these productivity differences might be caused by farmers owning different animals, different types of animals, different breeds within an animal type, or having different characteristics themselves: for example, education levels, household sizes or demographic compositions of the household. To check for the impact of these we, therefore, regressed productivity on these characteristics and examined the remaining unexplained portion of productivity. We find that while such factors do explain productivity differences to some extent, a significant amount of variation still remains to be explained.

To quantify this, we note that moving from the 25th percentile to the 75th percentile of the residuals of the first stage regression described above (that is our measure of the unobserved ability of farmers) increases productivity by over 54% of the mean value.

A second extension of this method is to see how much of the productivity variation is driven by the location of PSUs. To examine this we repeat the regression analysis above and additionally control for PSU fixed effects. These control for all factors that are common to each PSU – for example distances to local roads, markets and service accessibility. Conducting this analysis and therefore comparing very similar farmers in the same location, we find that a large portion of productivity in milk yields remains unexplained. Indeed, it remains the case that moving from the 25th percentile to the 75th of the residuals of the first stage regression described above (that is our measure of the unobserved ability of farmers) increases productivity by over 54% of the mean value.

In conclusion, these results suggest that there is *enormous variation* in farmer yields, even after taking into account the basic characteristics of farmers, their livestock (including breed), and the location in which they reside. To be clear, with the complete data we will also be able to check whether these differences persist once land quality, and the availability and use of other types of inputs such as *wanda* are also controlled for. However, it is unlikely that such factors can help explain the productivity gap, given that more prominent factors such as breed and livestock ownership patterns are already being controlled for.

If these differences are driven by differences in knowledge and practices then there is enormous scope for interventions based on improving knowledge and basic practices to increase productivity in the PEOP-livestock districts.

As such an intervention such as the 'farmer days program' is a relatively low cost means by which to transmit basic information to farmers. Given the evidence from the baseline survey, we might expect this type of intervention to have a large impact on milk yields for both cows and buffalo.

5.1 Basic Livestock Practices

One way to confirm the importance of practices is to compare differences in household behavior. We do so by comparing self-reported practices among farmers in the first and fourth quartiles[3] of the productivity distribution. These comparisons are shown in Table 12 and reveal the following facts (recall that in each of the tables below, N refers to the sample size among first and fourth quartile respondents):

First, high and low productivity households are equally likely to feed their calves colostrum, and the households are also similar in terms of keeping their animals tied up. Second, low productivity households are significantly more likely to report feeding their animals twice a day, with high productivity households feeding their animals three times per day. Higher productivity households are also more likely to report giving their animals water three times per day – presumably given the low cost with which water is available, this reflects a knowledge difference between households. This knowledge gap can potentially be altered using low cost investments such as farmer days.

[3]The first quartile contains all values that are below 25 percent of data.

Table 12 Livestock Practices by Productivity Quartile

Colostrum	Productivity quartile		Total	N
	Bottom 25%	Top 25%		
No	0.95	2.72	1.68	6
Yes	99.05	97.28	98.32	352

Are animals tied	Productivity quartile		Total	N
	Bottom 25%	Top 25%		
Always tied up	75.32	80.23	77.4	315
Tied for part of the day	23.4	19.77	21.87	89

How many times are animals fed	Productivity quartile		Total	N
	Bottom 25%	Top 25%		
Twice	74.89	57.56	67.57	275
Three times	20.43	37.79	27.76	113

How many times is water given	Productivity quartile		Total	N
	Bottom 25%	Top 25%		
Once	1.28	2.91	1.97	8
Twice	77.87	65.7	72.73	296
Thrice	20.85	30.23	24.82	101

Table 13 shows that the worst productivity is experienced most by the poorest households; about 39% of households in the lowest productivity bracket fall in the lowest consumption bracket while, only 19% of such households fall in the highest consumption band. About 70 percent of households in the lowest productivity quartile also fall in the lowest two quartiles by consumption, while households are spread more evenly across consumption quartiles for the highest productivity quartiles. PEOP interventions, discussed below, can potentially tackle this problem and reduce poverty substantially in the PEOP districts.

Table 13 Productivity by Consumption Quartiles

Consumption Quartile	Productivity Quartile			
	1	2	3	4
1	39.20	33.17	8.04	19.60
2	38.00	34.50	6.00	21.50
3	26.79	36.90	11.90	24.40
4	21.43	34.29	11.43	32.86

Note: Cell values represent percentages

5.2 Egg Production

Another important output from livestock is the production of eggs. The table below shows the number of eggs produced per chicken. The table shows considerable variation in egg production by area - rural area production is twice as much as that in urban areas.

Table 14 Egg Production per Number of Chickens

Area type	Number of Eggs per Number of Chickens			
	Mean	Bottom 25% HHs	50% HH	Top 25% HHs
Rural	0.48	0.29	0.43	0.57
Urban	0.27	0.14	0.23	0.43

The next table shows the proportion of eggs that are used for own consumption. In rural areas, this proportion is very high, showing that more than 90% of eggs produced are consumed by households themselves, and this might well contribute to the nutritional status of the household. However, in urban areas, even though the mean number of eggs per chicken is lower than rural areas, 33% of the eggs produced are sold.

Table 15 Proportion of Eggs Consumed and Sold, by Area

Area	Eggs Produced per Week	Proportion Consumed	Proportion Sold	Proportion Given
Rural	14.10	0.92	0.07	0.01
Urban	18.67	0.67	0.33	0.00
Total	14.31	0.91	0.09	0.01

Lastly, we look at the mean price that farmer's receive from selling eggs in different seasons. The table below shows that the price received during winter is higher than the price in summer, with median price in winter being twice as high as the median price in summer.

Table 16 Seasonal Price Variation (Rs.)

Season	Mean	Bottom 25%	50% HH (Median)	Top 25%
Winter	9.5	10	10	10
Summer	6.75	5	5	9

The results above show low productivity even in egg production. This might be because of the domination of the desi breed. Replacing this breed with improved breeds, as well as tackling diseases such as Newcastle Disease, should contribute to improved productivity.

Egg production is low and most of the eggs produced are consumed within the household. One reason for this could also be the seasonal variation in egg prices, which acts as a disincentive for the farmers to sell eggs in the market. Any intervention that can smooth the farmers' earnings from eggs will act as an incentive for them to produce more eggs.

5.3 Livestock Skills

The notion that providing farmers with information can change their behavior is premised on the assumption that farmers have unmet demand for such information, and will be receptive to new ideas. This can be verified from our baseline survey. To do so, we first asked farmers what they *currently perceive* as the tasks their skills are most suited for. The results are shown, by gender of the respondent and district, in Table 17 and Table 18 below, where N refers to the total number of observations from Phase 1 on which this is based.

Table 17 Skills Most Suited For: Males

What tasks are your skills most suited for?	District Code				Total
	BHN	BHW	LDH	MZG	
Farm Maintenance	41.75	8.84	2.26	2.44	14.07
Farming	47.17	40.14	30.77	42.05	41.04
Animal Breeding	1.89	46.12	66.52	39.36	37.12
Animal Health Care	8.25	3.70	0.00	3.42	4.23
Poultry	0.94	0.96	0.45	2.44	1.22
Veterinary	0.00	0.24	0.00	10.27	2.33
N	424	837	221	409	1891

Table 18 Skills Most Suited For: Females

What tasks are your skills most suited for?	District Code				Total
	BHN	BHW	LDH	MZG	
Farm Maintenance	50.00	6.76	2.08	2.72	4.73
Farming	50.00	18.92	2.08	5.44	9.45
Animal Breeding	0.00	55.41	95.83	89.12	79.27
Animal Health Care	0.00	17.57	0.00	0.00	4.73
Poultry	0.00	0.00	0.00	1.36	0.73
Veterinary	0.00	1.35	0.00	1.36	1.09
N	6	74	48	147	275

This shows that **males currently have skills mostly related to farming**. **Females have skills mostly related to animal breeding** (detecting whether an animal is on heat and natural insemination methods). There is considerable segregation of skills across gender, as expected.

The next two tables, Table 19 and Table 20, show the skills that are *most desired*, by gender of the respondent and district, below, where N refers to the total number of observations from Phase 1 on which this is based. Three factors are revealed that are important for the design of future PEOP-livestock interventions.

Table 19 Skills Most Like to Acquire: Male

What skill would you like to acquire?	District Code				Total
	BHN	BHW	LDH	MZG	
Farm Maintenance	46	9	3	1	14
Farming	43	36	31	41	38
Animal Breeding	2	47	66	40	39
Animal Health Care	8	6	0	4	5
Fish Farms	0	0	0	0	0
Poultry	1	1	0	2	1
Veterinary	0	0	0	11	2
N	392	830	223	406	1851

Table 20 Skills Most Like to Acquire: Females

What skill would you like to acquire?	District Code				Total
	BHN	BHW	LDH	MZG	
Farm Maintenance	33	4	0	4	4
Farming	67	19	0	5	9
Animal Breeding	0	60	98	87	80
Animal Health Care	0	16	0	1	5
Fish Farms	0	0	2	0	0
Poultry	0	0	0	1	1
Veterinary	0	0	0	1	1
N	6	73	49	150	278

First, both genders demand more skills in tasks in which they are already currently most skilled. Males demand more skills related to farming, as well as animal breeding, and females demand most skills related to animal breeding only. Hence, we can expect gender segregation by tasks in agriculture and livestock to continue.

Second, there is no desire by either gender to diversify their skills set in agriculture and livestock. Hence, knowledge and practice related programs should factor this in[4].

Third, there are few respondents that have current skills related to animal health care. Nor is there a desire expressed to acquire such skills. Hence the interventions related to animal health should focus on providing such services to farmers rather than training farmers to provide those services to each other.

[4] These are subset of findings on the skills side, the bulk of which are shared in the companion skills report from CERP.

5.4 Engagement in Milk Production

The results so far in this section have been based on those animals that are actually used for milk production. Table 21 focuses on what percentage of owned livestock are engaged in milk production.

Table 21 Percentage of Animals in Active Milk Production by Animal Type and Time of Day

Animal Type	Total Animal Stock	Percentage used for milk production	N	Morning		Evening	
				Percentage used	N	Percentage used	N
Cattle	3040	66.94%	2035	34.38%	1045	32.57%	990
Buffalo	2668	72.75%	1941	37.44%	999	35.31%	942
Goat	2580	10.70%	276	5.78%	149	4.92%	127

The following points are of note for the design of PEOP interventions. First, **there is a considerable percentage of animals that are not used for milk production** – in neither morning nor afternoon milking. For example, among cattle we see that 67% of them are used for milk production at some point in the day. Among buffalo, this figure is higher at 73%. The vast majority of goats are not used for milking.

Some **animals might not be used for milking because of ill health or age**. Nevertheless, the baseline survey indicates that some animals might be underutilized for milk production. Again, simple low cost interventions might be able to shift such behavior.

In terms of what happens to milk produced, we note that the lowest productivity households consume **all** their milk and do not sell any to the market. Hence **there might be considerable gains to be had from having milk yields raised by targeting those households for practice programs**.

6 Input Usage

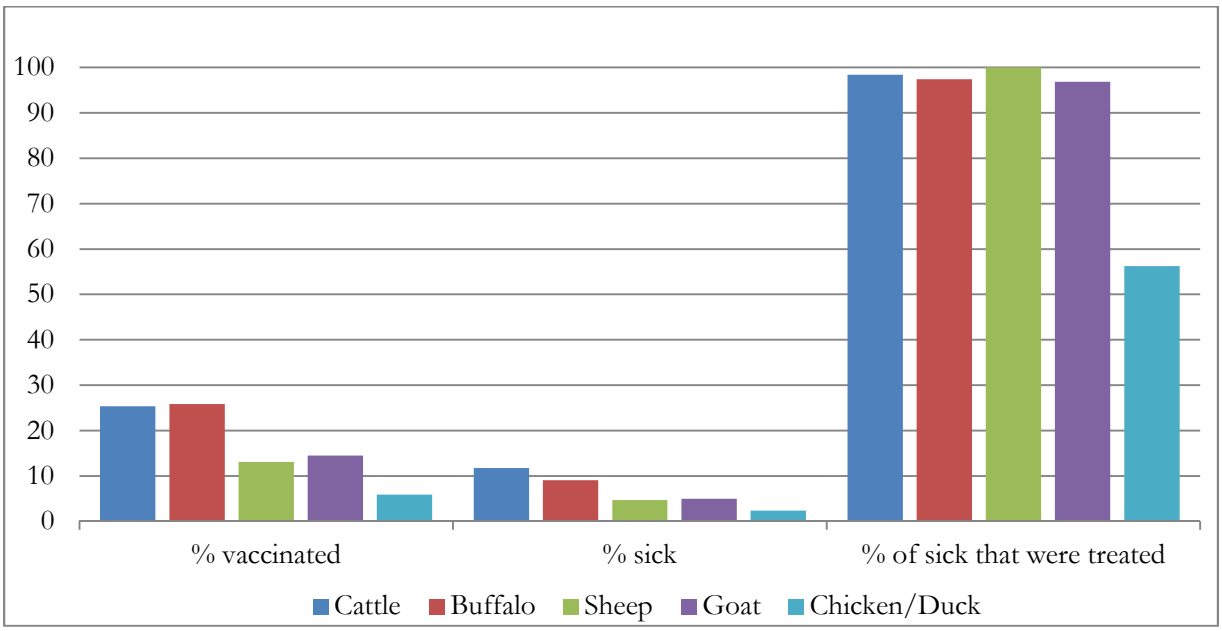
This section details how households use livestock related inputs, paying special attention to animal health care, feed and fodder, natural and artificial insemination techniques. It analyses the constraints that farmers face in the usage of some of these inputs while also looking at the availability and usage of credit. The discussion in this section motivates findings relating to access to inputs, and concludes that while credit is not a major issue, services need to be brought closer to farmers and households.

6.1 Animal Health

Figure 10 provides information on the health of animals in the PEOP districts. We have already seen the relatively low productivity yields among some livestock-owning households. It is therefore unsurprising that we see that **only a small percentage of livestock are vaccinated.** The large animals – cows and buffaloes – are both more likely to be sick and more likely to have been vaccinated, relative to other animal types.

In the short term, PEOP interventions that increase such vaccinations – through either short informational campaigns such as farmer days, or the provision of veterinary services to rural households – via mobile veterinary services – **will both help to alleviate this concern.** Another possible intervention could be the provision of incentives to farmers to visit veterinary facilities located at central places. The provision of such monetary incentives have shown to be effective in increasing access and use of medical health services, and should increase awareness among farmers regarding livestock related services as well. In the longer term, only when large parts of districts are declared disease free zones, can the preconditions for animal exports be established and the livestock sector undergo a transformation to become more export oriented.

Figure 10 Livestock Health Status by Animal Type

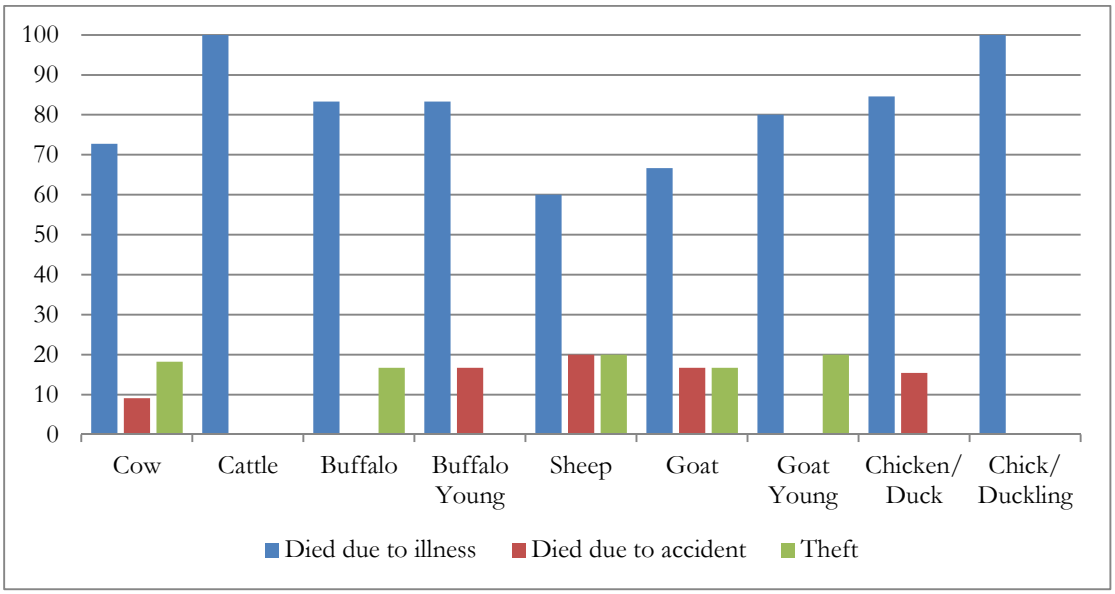


On a more positive note, **of the animals that are sick, the majority of them are treated in some way.** The concern will be however that the majority of these will be treated by informal vets that might lack knowledge. This is thought to be the case because, as reported later, farmers report having little contact with formal veterinary services, and there are individuals in the PSUs who report having animal related skills as their main skill, despite not owning livestock themselves. As discussed in Section 10 on the livestock supply side surveys, the CERP team will be engaging in a data collection exercise from these supply side providers to understand their role, and all the services provided.

Figure 11 highlights the main causes of loss of animals, by animal type. Two factors are striking for the design of interventions. First, **the majority of animals that are lost are due to illness**. The need for the provision of animal health facilities is therefore of first order.

Second, **the next most common reason for animal loss is theft.** This is especially the case for cows, buffaloes and young goats. The prevalence of theft increases the returns to any PEOP intervention that introduces an effective tagging system to the districts. If properly designed, such tags can increase property rights over animals and then raise incentives to invest into the animals.

Figure 11 Cause of Animal loss by Animal Type



6.2 Use of Government Animal Treatment Facilities

Table 22 reports on usage of government animal treatment facilities, broken down by PEOP district. Again, N refers to the number of male respondents to this question and shows the evidence is based on reasonable sized samples from Phase 1.

Table 22 Percentage of Households that Use Government Treatment Facilities, by District

District	% of Livestock owning HHs that availed govt. services	Total Govt. Vet facilities (Source: LDDD)	Reason for not availing as %age of Livestock owning HHs that did not avail facility		
			Too far	Poor Response	Too Expensive
Bahawalnagar	36.89	184	84.09	14.29	1.62
Bahawalpur	46.25	173	88.25	9.21	2.54
Lodhran	19.34	37	71.04	23.53	5.43
Muzaffargarh	39.10	132	81.48	16.36	2.16
N		526	958	178	32

A number of important policy lessons are derived from this. First, **in all four districts the majority of households are not using government services.** In Lodhran only 19.3% households are using government facilities. This is very unlikely to be because animals in Lodhran are far healthier than the other districts.

The percentage of households using such service is related to the number of such facilities. The percentage of households that avail government services is low, and the number of such facilities is also far lower than in the other districts: Lodhran has only 37 of these facilities (as reported by the LDDD up until December 14th). The fact that Lodhran has the fewest number of facilities is in line with it being the smallest PEOP district. Whether this alone accounts for the number of service providers there being so far below that in other districts remains to be analyzed.

What these figures suggest is that if more services were available, more services would be used. We have clearly seen above that there is a need for households to be able to access such animal treatment facilities given the prevalence of illness among animals in these PEOP districts. This conclusion is further supported by the reasons households give for not using such services. **The vast majority of households report not using the government services because they are too far away.** This is a far more common explanation for not using the services than because the services offered are too expensive (in theory they should be free, and in practice only a few percent of respondents say the service is too expensive).

The second most important reason why households are not using government facilities is that the service is poor. However this explanation of not availing the service is nowhere near as important as the distance to the facility. However, there is some variation in this reason. Some

districts such as Lodhran and Muzaffargarh have around one in five farmers reporting such services are inadequate.

The key policy lesson is the need to bring such services closer to farmers – farmers currently cannot travel to access such services, especially in the presence of sick animals. This means that interventions such as the provision of mobile veterinary services should be prioritized within the PEOP-livestock program. Another possible intervention is to give some small incentive to households owning livestock to come to the veterinary service located at the centre of a group of villages, rather than paying the veterinarians to travel from village to village.

Table 23 examines whether farmer perceptions differ between government and private sector animal health providers. We do so along two dimensions: perceptions of quality and satisfaction among users of those services (to avoid the results being biased from those that have no direct experience of the services offered).

The important finding from this comparison is that there are relatively minor differences in perceptions of quality and actual satisfaction from dealings, between government and private facilities. Around 70% of the respondents answered that their perception of quality was either neutral or satisfactory, for both government as well as private facilities. This figure rises up to around 80% for the level of satisfaction with government and private facilities. This reinforces the notion that the main reason such services are not being availed is primarily down to their lack of availability, and not other reasons.

Table 23 Perceptions of Quality and Satisfaction, by Facility Provider

	Perception of quality		Satisfaction with outcome of dealing with animal health service provider	
	Private	**Govt.**	**Private**	**Govt.**
Very Unsatisfactory	5.69	3.80	5.80	4.87
Unsatisfactory	9.60	21.99	10.17	21.32
Neutral	32.33	35.23	31.54	33.80
Satisfactory	49.54	36.22	49.76	37.30
Very Satisfactory	2.84	2.76	2.73	2.70

Note: Cell values represent column percentages

Table 24 then details the precise reasons given for why facilities are not used, again split by provider. Two points are of note. First, **the main reason given for not using the service is that it was not available in the area.** This reinforces the findings above. Second, **the other prominent reasons given are that "people like me cannot use that service" and "other" reasons.** The former might hint at the possibility at some farmers lacking knowledge or being excluded from such service providers. These constraints can be challenged by PEOP-interventions. Interventions such as the farmer days can target exactly these types of concern, by emphasizing to farmers that services are available to all, and not some select minority. Finally, we note that the reasons for not using facilities remain remarkably similar between both government and private providers.

Table 24 Reason for Not Using Facility, by Facility Provider

Reasons for not using	Private (%)	Govt (%)
It Was Too Expensive Or I Couldn't Afford	3.90	2.00
It Wasn't Available In My Area	28.55	33.81
People Like Me Cannot Use That Service	30.64	23.07
Cannot Access Due To Distance	2.66	5.28
Prefer To Avoid A Queue/Long Wait	0.51	0.44
The Relevant Staff Is Absent	1.47	2.48
Staff Is Incompetent	1.75	4.61
Inadequate Quality Of Provision Medicine	1.87	3.68
Service Hours Are Inconvenient	1.24	1.11
Other (specify)	9.95	8.03
N	1769	2254

6.3 Feed and Fodder

Figure 12 shows the percentage of households using various types of feed. **Nearly all use fodder, although other forms of feed are widely available across the PEOP districts.** This is not surprising given that fodder is typically self-produced on farm. However, the relatively low use of some feeds - such as wheat bran, sarson oil and dried bread might explain some of the low milk yields documented.

Figure 12 Percentage of Households Using Feed

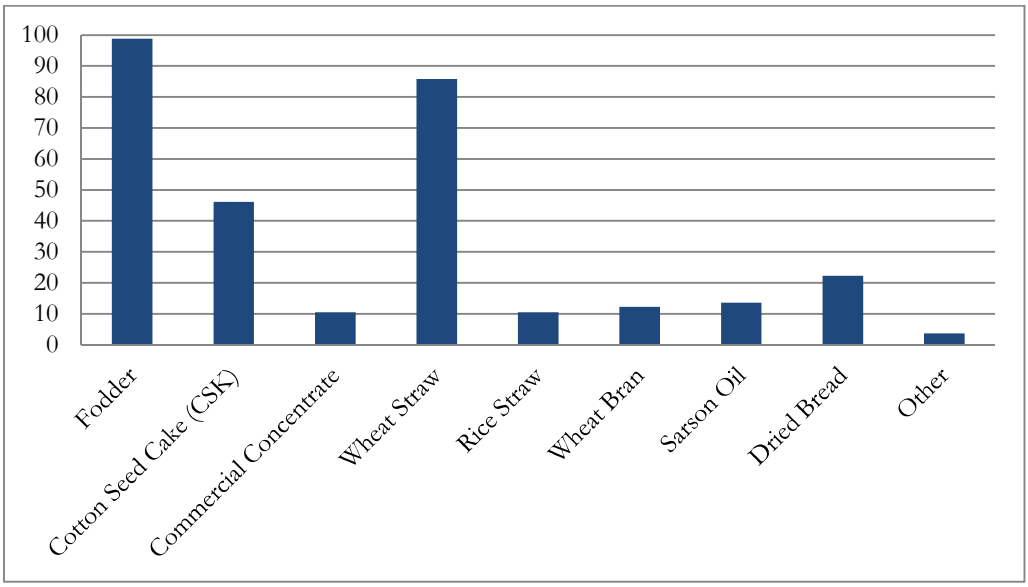


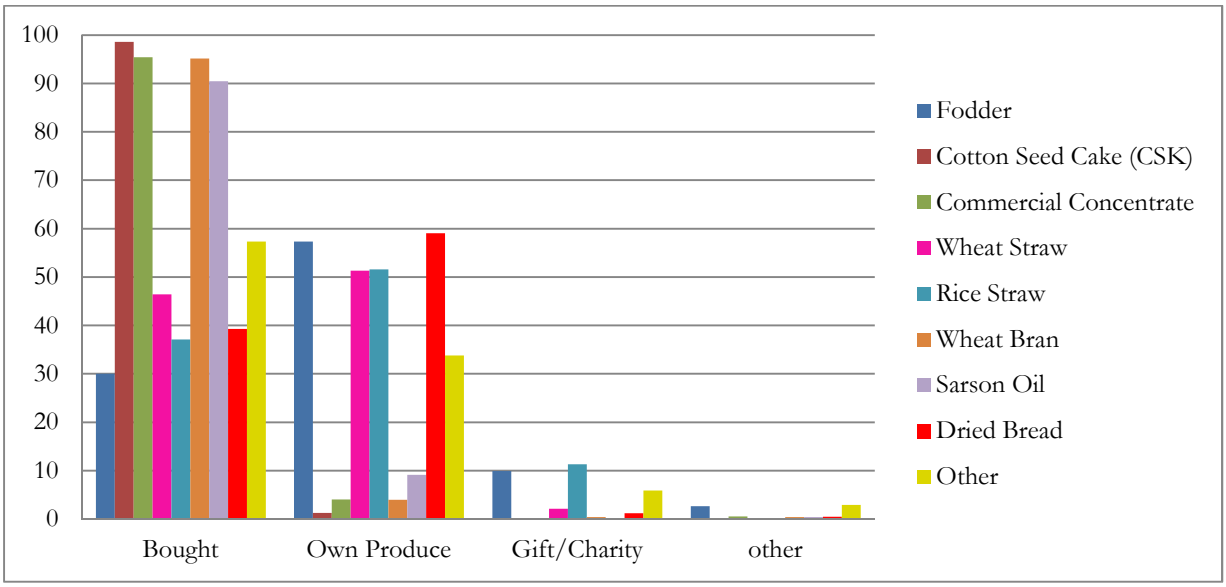
Table 25 shows more detailed information on usage for each type of feed, for each animal per week. We see that **households spend a considerable amount on feed: as a point of comparison the average consumption per week is 2,239 Rs.**

Table 25 Feed Usage

Feed type	%HHs that use	Mean use per week per animal (kg)	Mean total value last week (Rs.)
Fodder	98.88	183.41	1,302
Cotton Seed Cake (CSK)	46.12	12.28	626
Commercial concentrate	10.52	18.71	542
Wheat straw	85.76	98.96	664
Rice straw	10.52	80.52	356
Wheat bran	12.27	15.06	466
Sarson oil cake	13.6	1.36	266
Dried bread	22.26	8.33	187
Other	3.72	36.45	303

Figure 13 shows how the household acquired the feed, for each type of feed. **In the majority of cases feed was bought, although there are considerable amounts of own production for some feed types.** This highlights that interventions on the supply side could be effective in raising feed usage and variety of feed used.

Figure 13 Source of Feed and Fodder



It is again useful to try to explain the variation in feed usage observed by taking account of household characteristics, herd characteristics and the PSU in which farmers reside. We do so using a very similar set of techniques as described for deriving the residual distribution of milk yields. The results are summarized below in Table 26.

This highlights that **there is huge variation in feed usage left unexplained by household and PSU characteristics.** This unexplained variation is larger than for milk production *per se*. If this heterogeneity across farmers reflects knowledge and practices, then such input variation can be reduced. This might have a subsequent impact on milk yields.

Table 26 Unexplained Component of Feed Usage

Feed usage and value per week	($75^{th} - 25^{th}$) in residual distribution		(75^{th}-25^{th})/Mean	
	No FE	FE	No FE	FE
Feed used per week (kg)	212.9	220.4	0.69	0.72
Feed per week value (Rs.)	568.4	571.0	0.67	0.67

6.4 Natural Insemination

We now consider the use of natural insemination techniques. Table 27 below shows the prices that households pay for such services, and the final column shows the sample number of respondents on which this price information is based.

A significant fraction of households do not pay for natural insemination. This suggests the households are engaged in these activities themselves. Among those that do pay, the mean

price paid is over 300 Rs per natural insemination. Moreover, there is wide variation in the amounts paid, by animal type. For both cows and buffaloes we see that the 75th percentile of prices is double that at the 25th percentile. The maximum values reported in the penultimate column might well reflect an extreme event and are not close to the typical experience of most farmers.

Table 27 Cost of Natural Insemination by Animal Type

Animal	% who don't pay for NI	From people who do pay for NI					
		Mean	25th percentile	Median	75th percentile	Max	N
Cow	36.34	338.08	200	300	400	2,000	239
Buffalo	33.37	385.25	200	300	400	4,000	295

Table 28 below relates prices paid by households to the availability of government facilities (that should not charge for such services). What is striking is that **as there are more government facilities per 1,000 of the district population so that the service provision network has more coverage, the prices paid for natural insemination (outside of government facilities) drops**. Lodhran, that has the highest coverage, has the second lowest prices for natural insemination. Similarly, Muzaffargarh, that has the second highest coverage, has the lowest prices for natural insemination.

For PEOP policy interventions this is one example where greater supply side competition can reduce prices farmers pay. One way to see this is to check whether the use of NI techniques, that are explicitly not provided through LDDD veterinary facilities is related to the provision of LDDD services. This is shown in the table below. We see that **the greater the provision of government facilities, the less likely it might be that farmers resort to using informal providers of natural insemination altogether. This is another reason why the greater provision of government facilities will improve the quality of livestock.**

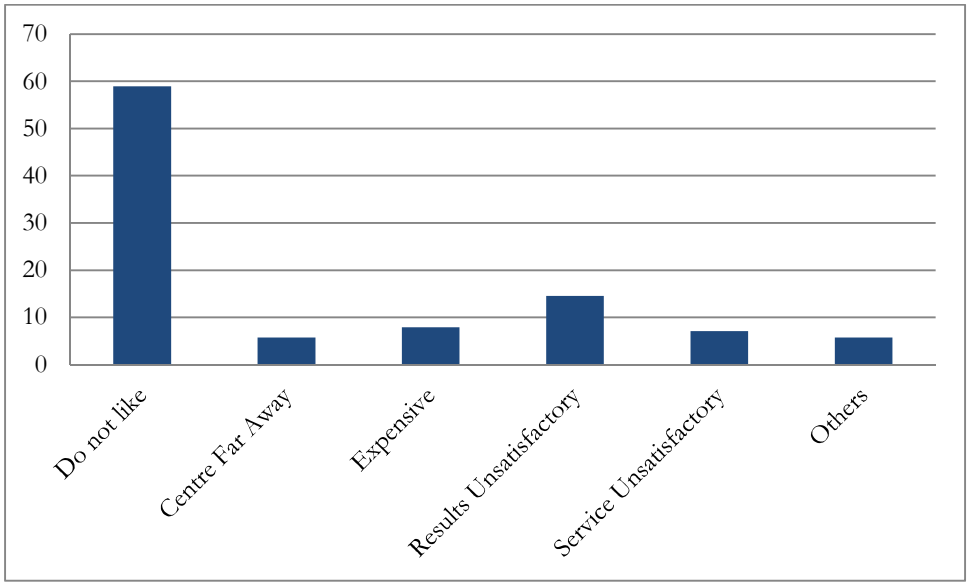
Table 28 Cost of Natural Insemination at Government Facilities

	No. of Private & Public Veterinary facilities (Source: LDDD)	1998 Population (in 000's)	Normalised Number of Vet Facility (No. of veterinary facilities/ Population)	% Who Do Not Pay for NI	Mean Price (Rs.)
Bahawalpur	50	2433	0.02	46.29	449
Bahawalnagar	84	2061	0.04	33.62	421
Muzaffargarh	180	2636	0.07	7.64	323
Lodhran	203	1172	0.17	12.45	417

6.5 Artificial Insemination

A final aspect of input usage we explored in the baseline survey analysis relates to the use of artificial insemination techniques. The histogram below shows the main reason households report for not using such services.

Figure 14 Reasons for Not Using Artificial Insemination



The primary reason for not using AI – given by the majority of farmers – is that they do not like the services. This is somewhat difficult to interpret and based on these baseline surveys, we will now be revising the questionnaire to fine tune potential responses and break this category up into, 'for religious reasons', 'because of own past bad experience', 'because of the bad experiences of others', 'low success rate of AI' or 'lack of awareness of AI usage'.

For policy design, the evidence suggests a potentially large number of farmers could be convinced to use AI techniques through information campaigns. Interventions like Farmer Days provide information on benefits from using artificial insemination techniques. These types of intervention need to be followed up by the provision of access to high quality AI services through the existing network of LDDD facilities.

6.6 Credit

Our baseline survey allows us to examine the provision and uses of credit. Figure 15 below shows the actual use that farmers put credit to. This highlights that **only a small percentage of loans are currently used for livestock purposes – around 1%.** Further, including agricultural purchases of seeds, this rises by another 8%. Hence, few credit loans are used for purposes related to PEOP-livestock program.

Figure 15 Purpose of Loan

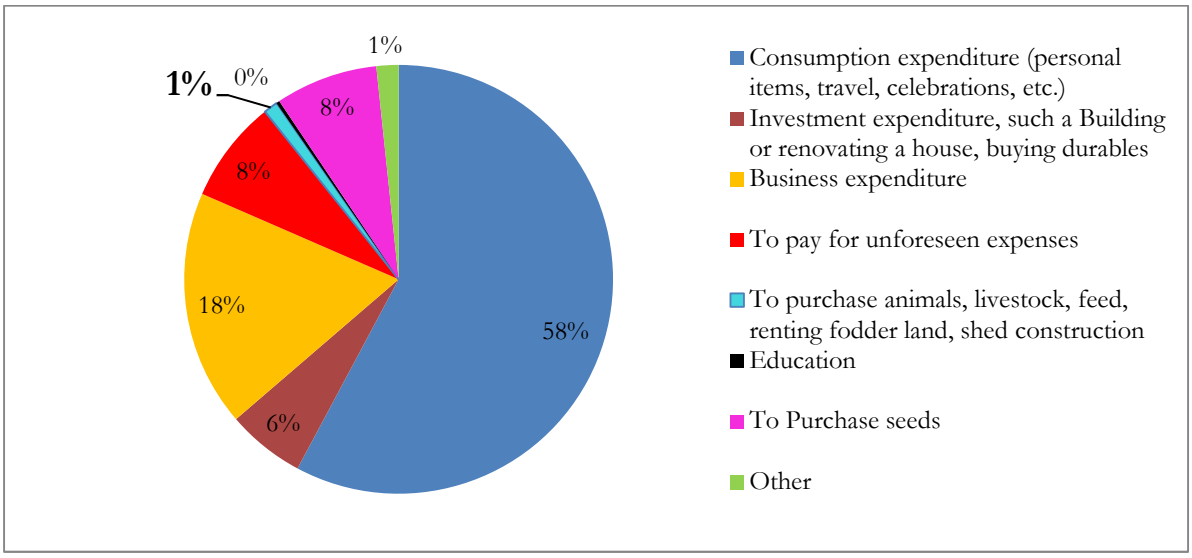
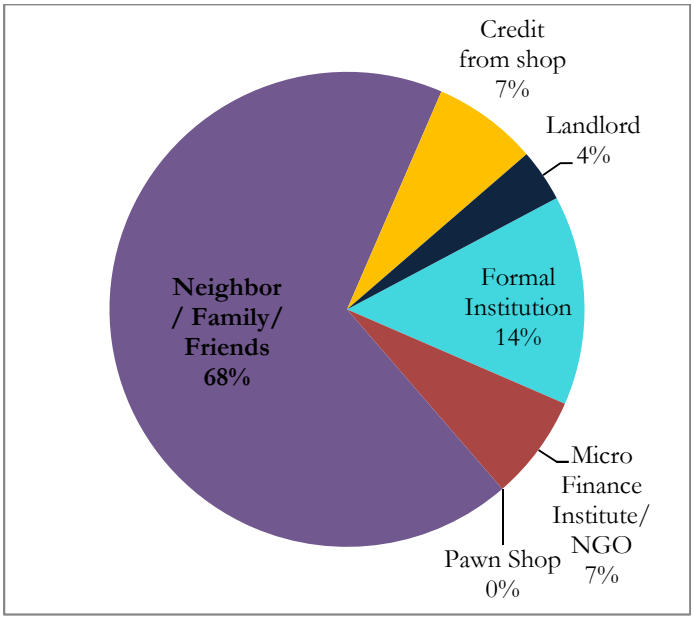


Figure 16 below shows the various sources of finance available – as expected the most important source is family and friends. There are other informal lenders, and a complete absence of formal providers.

Figure 16 Livestock Loan Sources



The **policy implications** from this are not straightforward. On the one hand, **a revealed preference argument suggests that credit is not a key constraint to farmers** because not many of them are currently choosing to spend credit on livestock. At the same time, this might relate to their **low levels of aspiration related to their possibilities to expand the scale and productivity of their livestock operations**.

7 Market Linkages: Chillers and *Dodhis*

We next present evidence on linkages farmers have to milk markets through *dodhis* and chillers. By analyzing evidence relating to prices of milk paid at different stages of the supply chain in Section 9, we will analyze the degree of integration of these markets and suggest policy interventions that can improve welfare of the farmers.

In this section, we focus more on the key linkage in the milk supply chain: chillers, which are formal supply side purchasers of milk and *dodhis* who are sometimes informal middlemen that collect milk from farmers and supply them to either chillers or consumers or hotels for example, directly.

Figure 17 describes the availability of chillers. As expected, **the majority of farmers do not report a chiller being located within their village.**

Figure 17 Is There Any Chiller Installed in Your Village (or Nearby)?

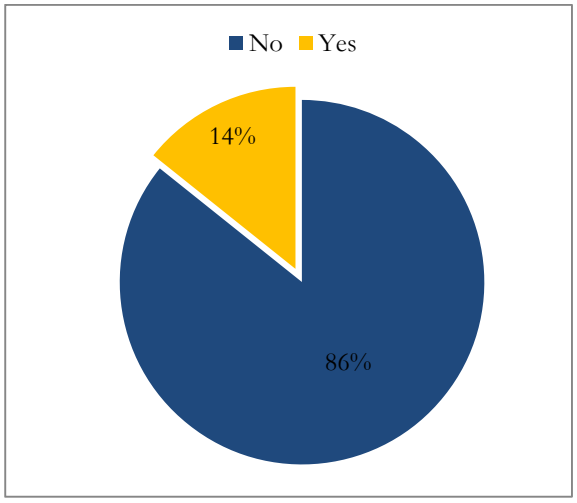
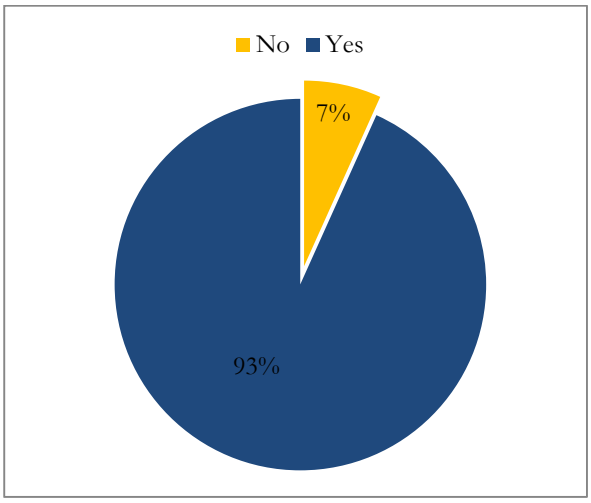


Figure 18 shows that **for chillers that are within the village or nearby, majority of the chillers are operational.** Hence, the concern that chillers that once supplied services soon become inoperable is not borne out by the data.

Figure 18 If Yes, is it Operational?



The third piece of evidence related to accessibility of chillers relates to travel times to chillers. These are shown in Figure 19 below by district. These travel times vary between 18 minutes on average in MZG to nearly 12 minutes walking time to the nearest chiller in BHW.

Figure 19 If Chiller in Village (Or Nearby), Average Walking Distance in Minutes

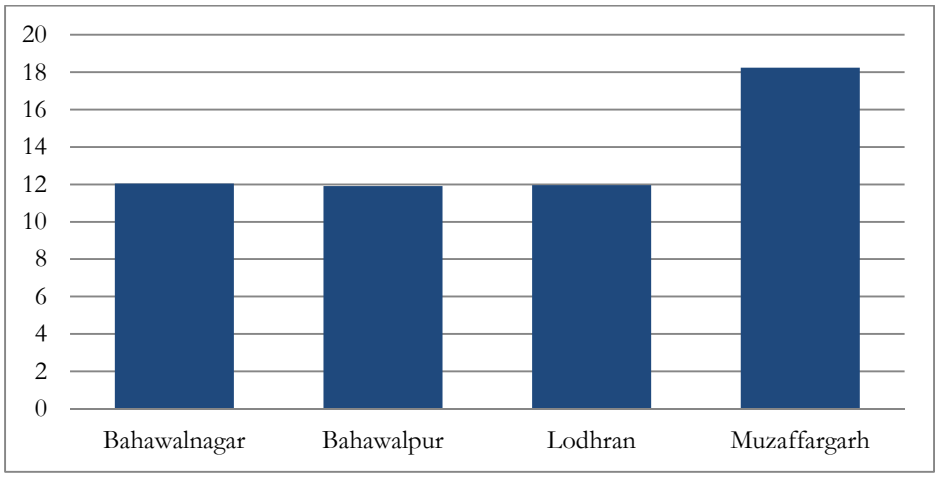
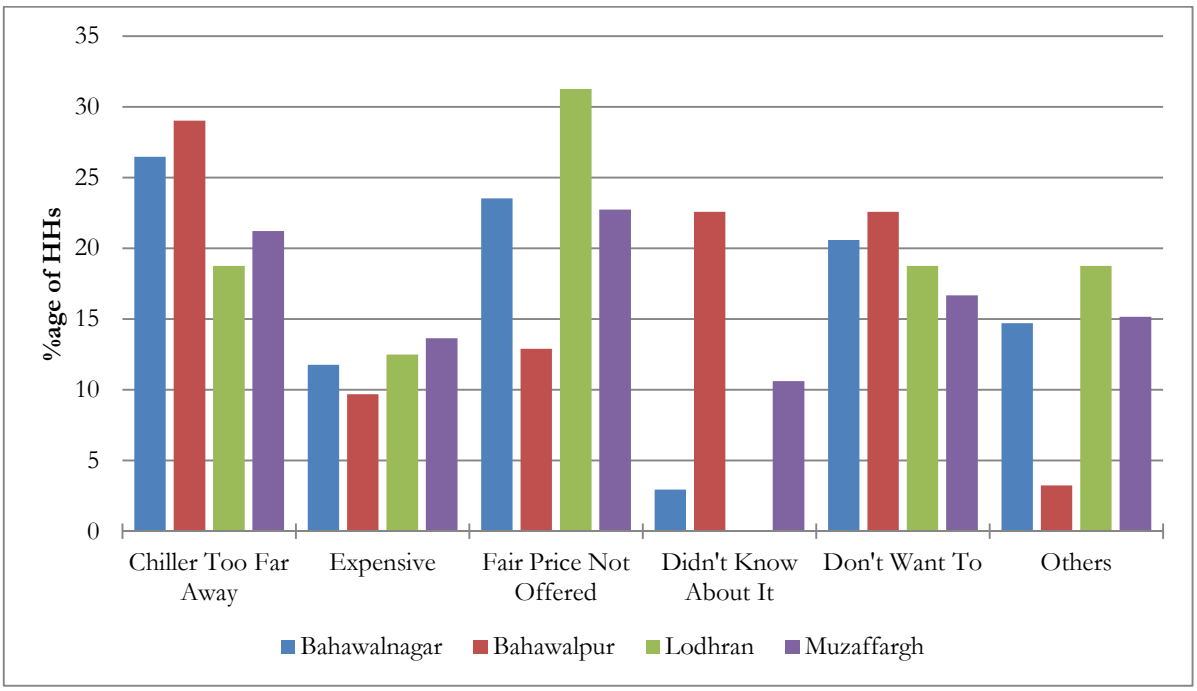


Figure 20 asks farmers why they are not using chillers. The most prominent reason across districts is that the chillers are too far away. The second most prominent reason is that the chillers do not provide a fair price for milk. This is particularly a problem in Lodhran, as this district shows the highest number of people reporting this problem. The third most common reason in most of the districts is that farmers do not want to provide milk to the chillers.

It follows from the above discussion that in order to improve market linkages with the chillers, services need to be provided to the farmers as farmers face significant constraints to travel to the services. **Providing these services at convenient locations - or through existing middlemen such as *dodhis* - should reduce travel times and improve prices for households.**

Some of the issues related to how chillers are operating will be addressed in the livestock supply side surveys. These are described in a later section. Note that there is no corresponding data for government provided chillers because there are only two such chillers in our sample PSUs.

Figure 20 Reasons Why Not Using Private Chillers, by District



8 Market Linkages: Cattle Markets

Another important market linkage to consider relates to the sale and purchase of animals. We turn now to analyze the links of farmers to cattle markets and consider the degree to which this market is integrated. As in the section above, using the discussion in this section, we will analyze price data in Section 9, suggesting policy interventions that can possibly improve the welfare of farmers.

Figure 21 shows the number of purchase transactions respectively reported in our Baseline Phase 1 survey by animal type and location. **There is considerable diversification of animal purchase in terms of location of purchase.** For cows, for which the number of transactions reported is highest, most households purchased from their village, followed by outside the village. This preference is consistent across most animal types where a significant number of transactions were recorded, and signifies that **households do not necessarily rely on cattle markets and purchase from multiple sources, often mostly from nearby.**

Figure 21 Number of Purchase Transactions Reported, by Animal Type

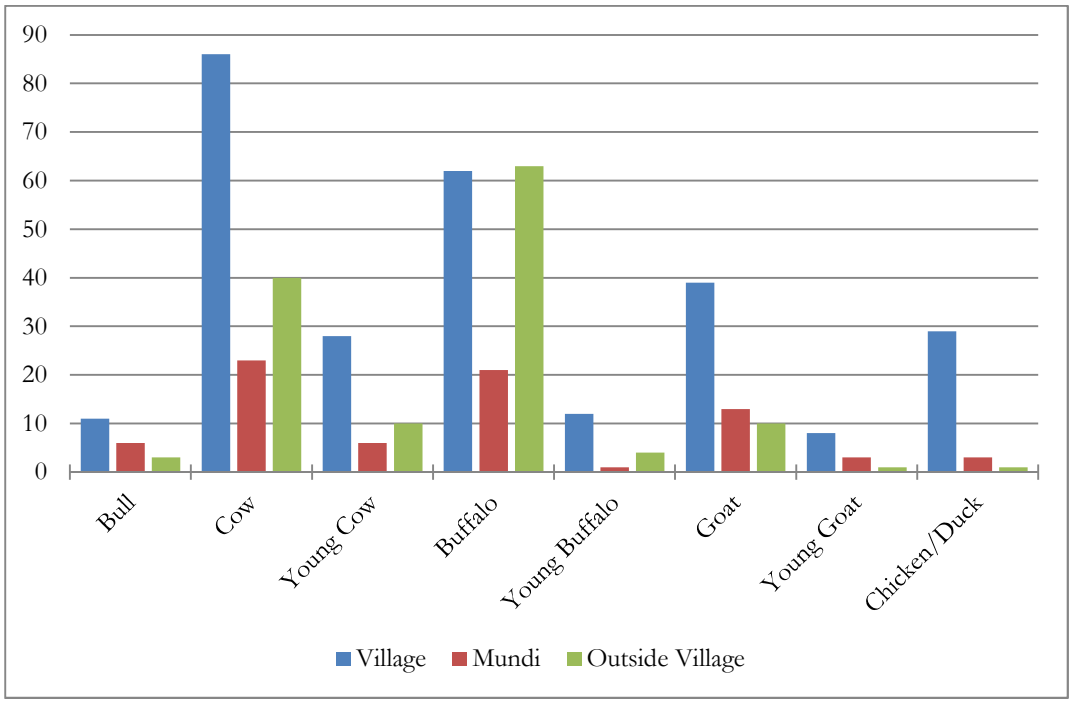
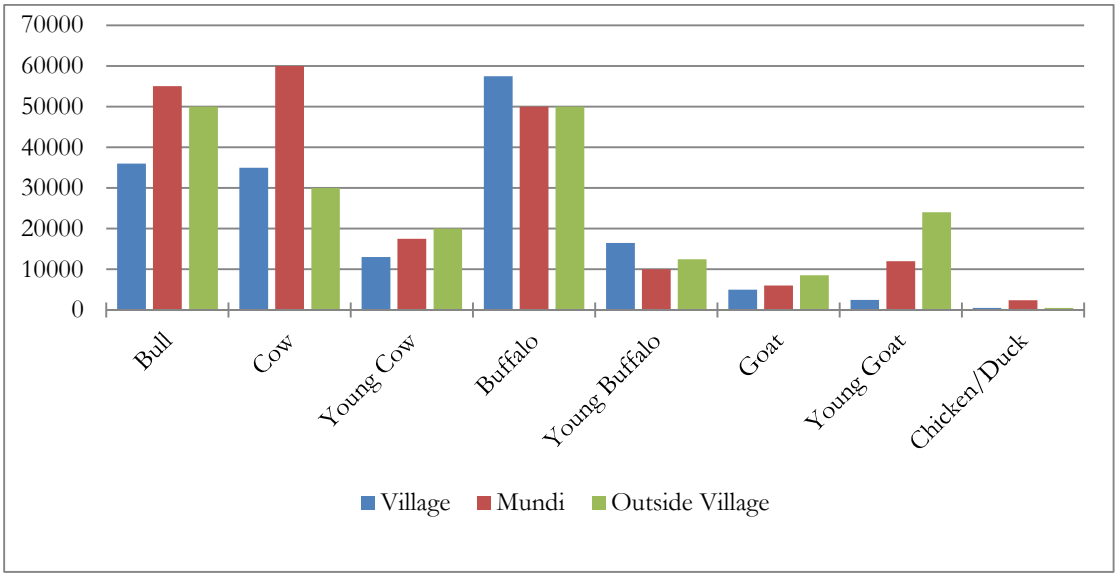


Figure 22 reports the median price of the above transactions for each animal type. By reading figures for transactions and prices together, it is possible to develop a sense of the level of integration of the cattle markets. **The general trend, with notable exceptions for transactions indicates that the prices paid do not vary tremendously.** Prices for cows are significantly different from this general case where prices being asked at *Mundis* (cattle markets) are considerably higher, perhaps because of which the number of transactions reported there are low. One reason for this could have to do with the specific kinds of cows sold at cattle markets and is not a general trend. Additionally, high number of transactions reported in nearby locations indicates that livestock middlemen and other households offer enough animals to meet the demand. If this were not the case, we would have

expected prices at *Mundis* to be lower than those asked at nearby locations. In any case, we expect to capture more information on this through the livestock supply side surveys.

Figure 22 Median Price by Location of Purchase (Rs.)



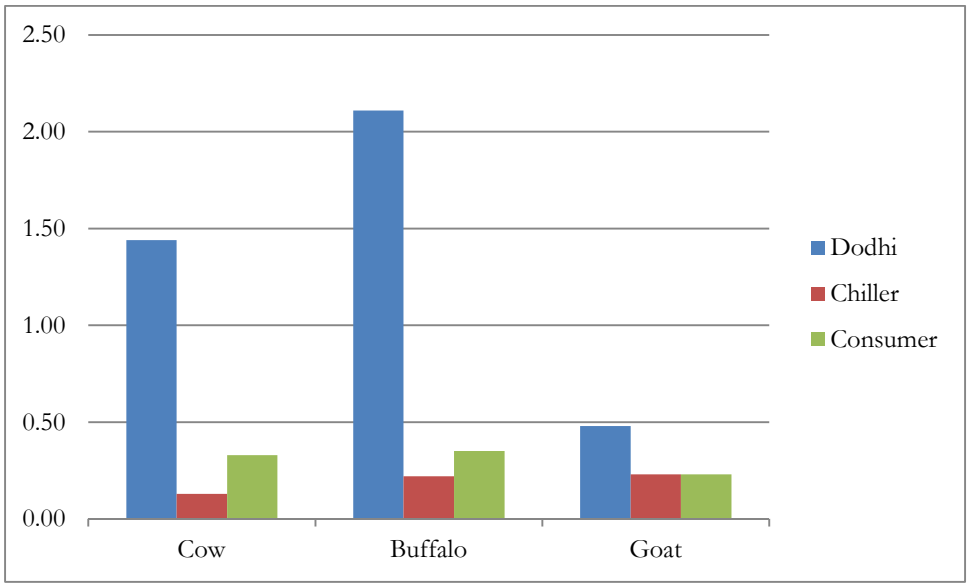
In terms of policy lessons, there exists less evidence of the need for households to obtain access to cattle markets. In fact, price integration, and number of nearby transactions reported, suggests that markets are considerably well integrated for livestock purchase. There exists no strong evidence on the need to establish central cattle markets that are too far from most households and it is perhaps prudent to focus more on establishing localized service provision and delivery.

9 Outputs: Milk Sale and Purchase

This section concludes the discussion in the above two sections and introduces prices and outputs to linkages in milk and animal sale and purchase markets. It is important to consider prices in these two markets because they enable an understanding of the degree to which the supply chain of animals and milk is integrated. If markets are highly integrated, as suggested by a low degree of price dispersion at various stages, we can surmise that farmers are relatively well off because they receive a price that is close to what they will receive selling directly to the final consumer. If the markets are not well integrated, there is scope to improve farmer welfare by reducing the disparity of prices through the supply chain.

We start by looking at the average amount of milk sold daily, by animal type. The figure below shows that *dodhis* are the main buyers for Buffalo and Cow milk. Out of the three animals, cow and buffalo milk is a preferred sale item than goat milk.

Figure 23 Average Amount of Milk Sold Daily (liters)



We next turn to consider the prices farmers receive per liter of cow and buffalo milk. Our baseline survey allows us to present this by animal, by time of sale (morning or evening) and by purchaser: a *dodhi*, direct to a chiller, to an urban consumer or milk shop, or a rural consumer or milk shop. Table 29 shows the milk price distribution for cows and buffaloes, while
Figure 24 shows prices for cows by buyer type, and Figure 25 does so for buffalo milk.

Table 29 Milk Price Distribution

Animal	Mean	25th Percentile	Median	75th Percentile	Max	N
Cow	33.32	30	32	35	80	203
Buffalo	36.59	33.5	37	40	50	260

The following important implications for policy follow. First, PEOP programs that enable farmers to start selling their produce will cause a large rise in incomes. As previously seen, there are a large number of households that are consuming all their produce. With increased productivity, they might be able to sell some of their surplus, which will raise their incomes.

Second, there is not much variation between price paid by *dodhis* and chillers. At face value, this suggests farmers would benefit from being linked to either. However, given the need to make profits, it is also somewhat surprising that both types of buyers pay similar prices. This raises the concern that *dodhis* might be engaged in adulteration practices.

Third, there is a gap between the prices paid by consumers or milk shops – in both rural and urban sectors – and the amounts paid by *dodhis* and chillers. This price difference in part reflects the rents accruing to middlemen. Increased supply side competition – say through granting farmers access to more than one chiller, or increasing the number of *dodhis* in an area, would help place upward pressure on prices. The importance of a middleman is highlighted in the results above; hence, we will obtain more information on informal and formal networks of milk collection in our supply side surveys.

Fourth, these conclusions are unchanged considering the time of day milk is purchased – morning or evening – or the type of animal milk considered – cow or buffalo.

Figure 24 Average Cow Milk Price by Type of Buyer and Time

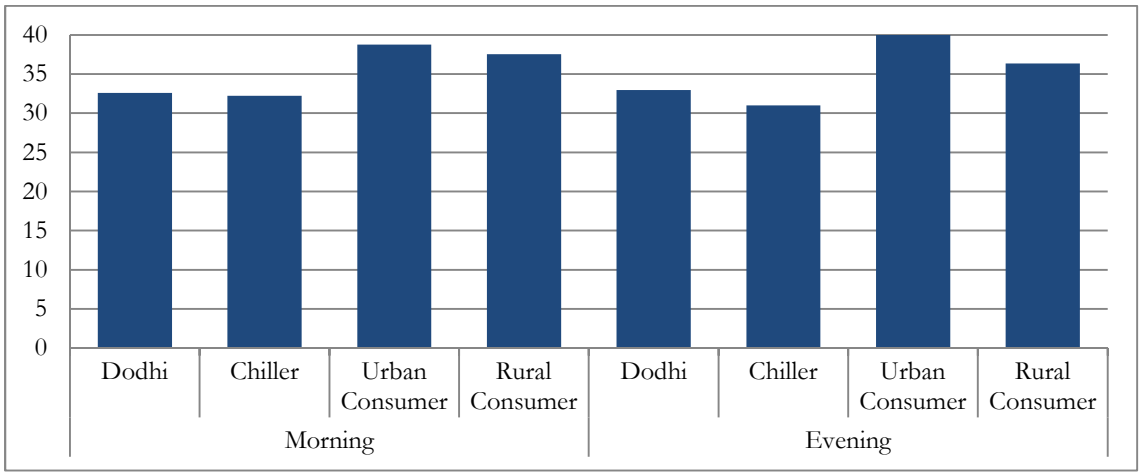
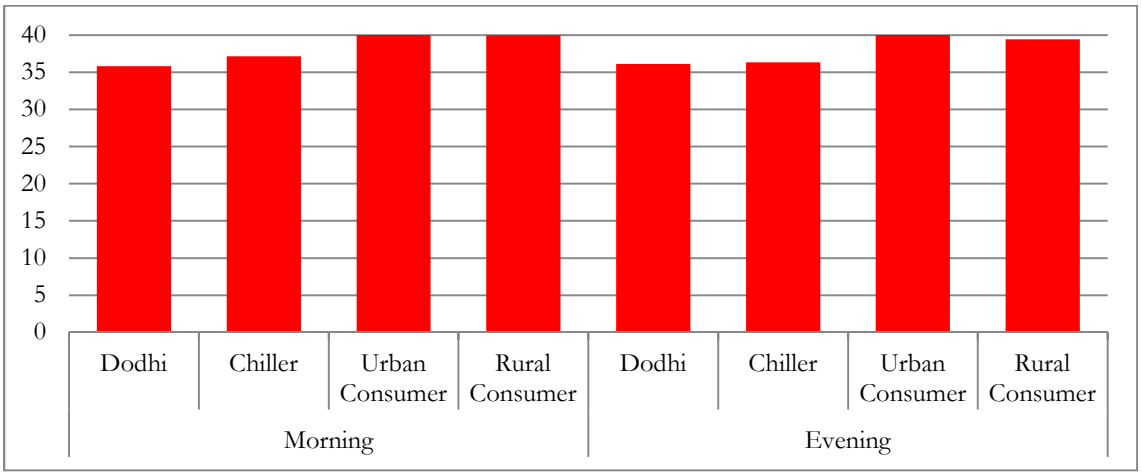


Figure 25 Average Buffalo Milk Price by Type of Buyer and Time



We next look at the seasonal price variation for *dodhis* by animal type. **Table 30 shows some evidence of seasonal variation in prices, and points towards another source of risk and uncertainty in the market for milk.**

Table 30 Seasonal Milk Prices for *Dodhis*

Animal Type	Winter (Rs.)	N	Summer (Rs.)	N
Morning				
Cattle	32.37	147	32.84	147
Buffalo	35.27	193	37.21	193
Evening				
Cattle	32.63	63	33.97	63
Buffalo	35.56	91	38.11	91
Combined				
Cattle	32.38	154	32.88	154
Buffalo	35.20	204	37.14	204

This uncertainty provides a potential role for microfinance to help consumption smoothing, but since livestock ownership in PEOP regions is low, market reform and creation of market linkages will have a relatively larger role to play for livestock interventions. Another way to reduce such seasonal price variation is through improved feeding such as silage feeding and better livestock management practices to reduce heat stress of animals.

10 Livestock Supply Side Surveys

This section presents an overview of the livestock supply side surveys that we will conduct, and explains how they will further inform the design of PEOP policy interventions. These supply side surveys will be helpful not just to design PEOP interventions, but will also provide livestock related data for the LDDD. Current datasets are outdated and it is the aim of these surveys to provide the department with a source of updated and comprehensive information on the livestock supply side providers. It has been logistically difficult to collect data on the informal segment of the market, i.e. informal money lenders, quacks and *dodhis*, however, CERP is in a unique position to collect this micro-level information - we are already conducting village level surveys including Village Household Surveys and Village Mapping Surveys, where our level of penetration in the four districts will enable us to get detailed information on the supply side providers.

The Livestock Department can develop a thorough understanding of the supply side of the livestock market through these surveys. This sort of exercise has, to the best of the CERP team's knowledge, not been undertaken so far in Pakistan or in other countries. This novel survey will provide information on a side of the livestock market that is missing, yet constitutes essential information for policy making that is cognizant of more linkages between different segments of the livestock market.

To build a comprehensive picture of the supply side of the livestock sector in the PEOP districts, we plan to conduct an extensive survey for each of the following types of firms engaged on the supply side:

1. Private Vets
2. Veterinary Institutes
3. Milk Collection Centres and Chillers
4. Cattle Markets and Slaughterhouses
5. Microfinance Institutions
6. Informal Moneylenders
7. Informal Vets (quacks)
8. *Dodhis* and Milk Traders

The first five of these supply side providers are formal institutions. We are coordinating with the LDDD to establish a complete list of all such providers in the PEOP districts. This will serve as the sampling frame for the supply side surveys. This will be the first time this information is being collated. It will be useful to the LDDD in planning its service provision, in understanding how the demand and supply sides of the livestock market operate and interact with LDDD operations, in designing targeted interventions for more effective provision of livestock services and for increased productivity and incomes for households, and finally in estimating the full impact of these interventions on the households and the service providers

The last three types of supply side players all operate in the informal sector. As such, it will be impossible to establish the entire population of all such supply side providers operating in the PEOP districts. Our approach is therefore to use the village household surveys and village mapping surveys to be conducted in the 861 PSUs to establish the most relevant of these supply side providers in the PEOP-CERP PSUs. In this way, the analysis and advice can take into account how policy responses might vary according to the characteristics of these informal providers.

We have already found 190 supply siders in our Phase 1 villages.

Table 31 Supply-side Providers in Phase 1 Sample

Livestock related skill	Own Livestock		Total
	No	Yes	
Animal Breeding	20	98	118
Animal Health Care	8	55	63
Poultry	5	1	6
Veterinary	1	2	3
Total	34	156	190

Table 32 shows the total number of people/entities that are engaged in livestock activities. Cattle market refers to the officially gazetted place of sale and purchase of animals. LDDD issues contracts for the management of these markets. Milk collection centers and chillers primarily are privately owned with government ownership in the exceptional case. These are an important source of market linkage for milk producers, who can also receive one-stop services on animal health at these locations. Veterinary facilities can be privately or publicly owned and consist of hospitals, artificial insemination centers, sub-centers, dispensaries etc. These are places where farmers go to for animal health issues. Private veterinary workers are those people who provide door-to-door veterinary services or have small informal operations in villages. MFI or Microfinance institutions are institutions that lend for the purposes of livestock in the PEOP districts.

Table 32 Total Number of Livestock Suppliers

Livestock Suppliers	Total No. (Data from LDDD)
Cattle Markets	34
Milk Collection Centers and Chillers	282
Veterinary Facility	436
Private Vets	517
MFI	68
Total	1337

The supply side surveys have been designed to cover many of the same core topics. These include the following: Section X - Identifying Information, which includes date, location, respondent ID and consent confirmation from the respondent. The section on Basic Demographics includes information about current/prior business address, age and work hours. Section 2 obtains information about the legal status of business. Ownership details are covered in section 3, and covers employee details, SES characteristics and time-use details. Section 4 obtains information about the type, location and duration of business, as well as quantity/quality and price of the

product. The payment received and revenue generated from the business is also covered in this section. We ask about reasons for change in customers in section 5. Section 6 covers details on pricing strategy, including ranked price determinants and price discrimination. Information about catchment area, transport use, competitors, and costs incurred is covered in section 7. Groups Served. Client demographics, including livestock ownership, SES, and reasons to buy or not buy a particular product are covered in section 8. Section 9 captures upward/downward linkages in supply chain, as well as more extensive details about networks with other businesses. This section will also cover details about the basis, type, frequency of interaction, transaction history and credit sharing with other businesses. Information about any constraints that the business might face is covered extensively in section 10. Section 11 obtains details on the management practices, including problem solving, targets and incentives. Registration details of the business, including history and reasons for (de)registration, are covered in section 12. Finally, information about the source of income of the business owner is covered in section 13.

Of course, while each supply side survey will focus on the core activity of the service provider, we have included sections in each survey to understand the full range of services provided. For example, many of these supply side providers might be important sources of credit for farmers.

In addition, a number of supply side surveys will help shed light on the nature of bargaining over price and quality that farmers engage in with supply side providers. The lack of numeracy and literacy among farmers can leave them vulnerable to such negotiations, or make them reluctant to engage in such market exchange in the first place.

These supply side surveys will help pinpoint the geographical locations where the most significant supply side gaps exist, for each provider and market linkage. This will inform policy interventions – that might need to work in collaboration with private sector firms or NGOs in determining the optimal locations to place new services. These supply side surveys will also help inform us whether there are some groups that are being excluded from the use of such services.

11 Summary: Proposals for Livestock Interventions

The discussion in previous sections gives us direction for thinking further about potential interventions in the livestock sector. Using evidence gathered from the CERP Phase 1 survey, the report has been able to establish some facts about the four PEOP districts. Below is a synthesis of what has been reported in earlier sections.

11.1 Potential Interventions Suggested by Evidence from Phase 1-A Survey

There is a need to increase the number of small livestock-owning households. An asset transfer program targeting the most productive breeds towards those households with no livestock can benefit around one third of households in rural areas. It is important to note that there exist households who possess livestock skills but do not currently own any animals. An asset transfer program should aim to give animals to these households with greater priority. At the same time, a delicate balance needs to be maintained between providing livestock to those households with the lowest well-being, and those that have the skills or desire to learn the skills, for livestock rearing.

A second set of policy recommendations relate to the access of households to livestock and dairy practices. From our survey, it is evident that there exists demand for improved livestock related skills training among both men and women. The largest gains from these will accrue to households that have the lowest productivity of milk production and are mostly the poorest households, defined by consumption. It is these households that consume all of their milk and do not sell any in the market. **If PEOP is able to bring services and skills training to the farmers, through interventions like mobile veterinary services and farmer days, evidence suggests that we are likely to see significant improvements in household welfare in the PEOP districts.** There exists scope for further discussion on the relative benefits of Mobile Veterinary services and Lady Livestock Workers and Village Animal Health Workers. An alternative intervention involves offering small incentives for households owning livestock to come to the veterinary service located at the centre of a group of villages for accessing livestock services, rather than paying the providers of livestock services to travel from village to village.

Finally, livestock interventions in PEOP should aim to improve the functioning of livestock markets and linkages. There is scope for increasing access in the milk supply chain where PEOP can consider interventions that improve linkages by increasing access through *dodhis* and chillers.

11.2 Interventions for Which Current Evidence is Less Supportive

There exists less compelling evidence that lack of credit is a major impediment for achievement of PEOP goals in livestock. For instance, data suggests that farmers that do not use existing services because of access related issues and not because the services being offered are very expensive. On the contrary, farmers currently *are* able to take out credit loans, and they do not use them for livestock related purposes. The supply side surveys will bolster the information on the sources of credit available to livestock farmers.

Evidence is also lacking for the need to improve access to cattle markets for sale and purchase of animals. Our analysis reveals that prices across various markets, within and outside of villages, are well-integrated, suggesting little need for increasing access to central cattle markets. Instead, the focus of PEOP interventions should be on more localized service provision and delivery.

Appendix A: Survey Status Report

Table A Number of PSUs completed in Phase 1 with rural-urban distribution

District	Urban	Rural	Total	% of Total PSUs
Bahawalpur	21	45	66	25.9%
Bahawalnagar	20	36	56	20.7%
Lodhran	11	15	26	21.7%
Muzaffargarh	12	33	45	20.8%
Total	64	130	193	22.4%

Table B Percentage of PSUs completed in Phase 1 with rural-urban distribution

District	As a % of total urban PSUs in each district	As a % of total rural PSUs in each district
Bahawalpur	25.6%	26.0%
Bahawalnagar	22.2%	20.0%
Lodhran	22.9%	20.8%
Muzaffargarh	20.0%	21.2%
Total (Out of 861)	22.9%	22.2%

Appendix B: Survey Status Map

Figure A PEOP Household Survey: 193 PSUs of Phase 1