GENDER, LIVESTOCK AND LIVELIHOOD INDICATORS

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1 Introduction

1.1 Background

This guide is a reference point for some of the important indicators that ILRI can use to monitor the changing role of livestock in livelihoods in different production systems and the impact of livestock-related interventions. While this list of indicators is not comprehensive in covering all the areas in which ILRI works, it provides a starting point for the common objectives which most of our projects, be they in markets, biotechnology or the environment, hope to achieve. Some of these indicators are already commonly used in different surveys but their application has not always been consistent or comparable. With time, we expect to develop further common indicators around other areas of research in ILRI. This document should therefore be considered as a living document to which we will add core indicators around the thematic areas covered by ILRI's research including such areas as partnerships, capacity building and the key thematic areas of markets, biotechnology and environment.

This document should be used to guide your data collection within projects. These may include baseline data, evaluation (both internal and external), impact assessments, project appraisals and any other data collection within the projects and programmes across the institute, including surveys conducted by students where possible. Currently, the indicators are designed for data collection at household level and for integration into household surveys. Project teams should ask for assistance in adapting these indicators for use in other types of surveys such as community surveys, focus group discussions, market agent surveys and key informant interviews.

Livestock play multiple roles in livelihoods. In deriving these indicators, we have used both the sustainable livelihoods framework, placing livestock within an assets and capital framework, and as a pathway out of poverty. The latter recognizes that for livestock to translate into poverty reduction the necessary conditions i.e. technologies and services to generate productive, sustainable and profitable markets are a pre-requisite.

1.2 A definition of concepts

Gender refers to the socially constructed roles and status of women and men, girls and boys. It is a set of culturally specific characteristics defining the social behavior of women and men, and the relationship between them. Gender roles, status and relations vary according to place (countries, regions, and villages), groups (class, ethnic, religious, caste), generations and stages of the lifecycle of individuals. Gender is, thus, not about women but about the relationship between women and men.

A **household** is a group of people living in the same dwelling space usually, but not exclusively kin related who eat meals together and pool some of their resources (such as land, livestock etc) together. The household definition can vary across contexts and therefore this definition should be adapted for different contexts.

Asset ownership is the ultimate and exclusive right conferred by a lawful claim or title, and subject to certain restrictions to enjoy, occupy, possess, rent, sell, use, give away, or even destroy an item of property. For non titled assets, it is the claim to ownership through purchase or other means of acquisition as well as the rights to dispose of the assets.

1.3 Organization of the document

Section 2 of this document identifies 6 categories of indicators and gives a rationale for each of the indicators and how to measure them covering both the tools for data collection on the indicators and their calculation. Section 3 provides the initial basic survey data to capture in ILRI surveys, Section 4 focuses on study meta-data to document and Section 5 on household sampling.

2 Indicators: Rationale, data and calculation

2.1 Indicator 1: Livestock ownership and the importance of livestock as assets

Calculated variables under this indicator include:

- Total livestock holding (by species and Tropical Livestock Units)
- Livestock ownership by women
- Household non-land asset index
- Gender asset disparity
- Livestock contribution to household asset base
- Livestock contribution to women's asset base

2.1.1 Rationale

The number and type of animals owned by a household and by the individuals within that household is essential information for characterizing the household, and for calculating other indicators such as productivity and income. Livestock ownership is also an important welfare measure because in many regions livestock are an important asset through which households are able to store their wealth. Ownership of assets is considered a better measure of welfare than income since it reflects a household's long term capacity to manage risk and meet its consumption requirements. The importance of livestock as a store of wealth can be estimated by measuring the portion of total assets accounted for by livestock, either as a fraction of total value or of an asset index.

Gender disaggregation of assets helps to track reductions in gender asset disparities. The meaning of the concept of "ownership" should be explored and understood before asking these questions in order to adapt the actual questions asked to such meaning. Ownership of assets by women has been associated with positive development outcomes such as health and education as it increases women's bargaining power within households (Quisumbing, 2004). The relative contribution of certain groups of assets e.g. livestock can be assessed through analysis of their contribution to the total household asset index. Similarly, women's asset ownership can be assessed as a proportion of total household assets.

2.1.2 Data

The assets are disaggregated into land assets, domestic and farm assets, housing, and animal assets with a weight assigned to each asset. Adjustment for age of the asset is made. For comparison purposes, a core group of assets is included but projects can track additional assets that may be of particular relevance to the project or the local context.

2.1.2.1 Land assets

Parcel* ID	Parcel Description / Name	Size of this parcel	Unit of land (Code)	Tenure system (Code)	If parcel **is *owned,*** who owns (Code)
1					
2					
3					
4					

UNIT OF LAND	**TENURE SYSTEM**	**If owned, name on title/certificate:**
1= acre 2= ha 3= sqm2 4= other, specify conversion in metric system	1= Title deed 2= Owned but not titled 3= public land 4= Rented-in/ sharecropped 5=Other (specify)	1= Male 2= Female 3= Joint 4=Other relative 5= Other

**parcel is one contiguous plot of land. One parcel can contain more than one plot.*

2.1.2.2 Farm and domestic assets

Name of Asset	Total Number owned	Relative / average age (number in this age group)*								
		Owned by men			Owned by women			Owned jointly		
		< 3 yrs	3-7 yrs	> 7 yrs	< 3 yrs	3-7 yrs	> 7 yrs	< 3 yrs	3-7 yrs	> 7 yrs
Domestic										
Cooker/ Gas Stove										
Refrigerator										
Radio										
Television										
DVD Player										
Mobile phone										
Sofa set										
Sewing Machine										
Mosquito nets										
Transport										
Car/Truck										
Motorcycle										
Bicycle										
Cart (animal drawn)										
Farm										
Hoes										
Spades/shovel										
Ploughs										
Sprayer pump										
Water pump										
Other - locally specific assets (e.g. jewellery)										
Other										
Other										

* ***For countries where ownership of assets is either 'only by men' or 'all jointly' then delete the irrelevant columns***

2.1.2.3 Housing

Home ownership	Number of rooms	Floor material (Code)	Wall material (code)	Roofing material (code)
		FLOOR MATERIAL	**WALL MATERIAL**	**ROOFING MATERIAL**
1= Owned 2=Rented 3=Borrowed 4=Other (specify)		1= earth 2= cement 3= tiles 4= other, specify	1= earth/ mud 2= wood/ bamboo/ iron sheets 3= cement/ bricks 4= other, specify	1= grass 2= iron sheets/ asbestos 3= tiles 4= other, specify

2.1.2.4 Livestock

Does your household have any livestock (0 = No, 1 = Yes)? ☐

If yes, **indicate** the **numbers of animals** for the different species kept on the farm

Livestock Species			Number owned by male	Number owned by female	Number owned jointly	**Number owned by the household (total)**
Cattle	Local	Bull				
		Cow				
		Immature males / Heifers				
		Calves				
	Cross/ exotic*	Bull				
		Cow				
		Immature males / Heifers				
		Calves				
Goats	Local					
	Cross/ exotic					
Sheep	Local					
	Cross/ exotic					
Poultry	Local					
	Cross/ exotic					
Pig	Local					
	Cross/ exotic					
Donkeys/Horses						
Rabbits						
Other, specify						

**** "Cross" refers to a cross-bred animal which is part-exotic. Alternative name for this in some countries / systems may be "improved". "Exotic" refers to a pure-exotic animal.***

Breakdown by age is included in the above for cattle because of the large changes in TLU value. In addition, this table may be adapted depending on the level of precision required for TLU calculations for other species, specific breeds and by sex.

2.1.3 Calculation

Household domestic asset index

The asset index analysis is adapted from analyses recommended for all Bill and Melinda Gates funded projects (BMGF, 2010). The asset index is calculated for all movable assets including livestock. Each of the assets is assigned a weight (w) and then adjusted for age.

Asset *(g)*	**Number owned**	**Weight of asset (w_g)**	**Age (adjustment for age shown in cell) (a)**		
			< 3 yrs old	**3 – 7 yrs old**	**> 7 yrs old**
Animal			Calves	Immature male / Heifer	Bull / Cow
Cattle		10	× 0.4	× 0.8	× 1
Horses		10	no adjustment		
Sheep/goats		3			
Poultry		1			
Pigs		2			
Domestic assets			**< 3 yrs old**	**3 – 7 yrs old**	**> 7 yrs old**
Cooker		2	× 1	× 0.8	× 0.5
Kitchen cupboard		2			
Refrigerator		4			
Radio		2			
Television		4			
DVD player		4			
Cell phone		3			
Chairs		1			
Mosquito nets		1			
Gas stove		2			
Transport			**< 3 yrs old**	**3 – 7 yrs old**	**> 7 yrs old**
Car/truck		160	× 1	× 0.8	× 0.5
Motorcycle		48			
Bicycle		6			
Cart (animal drawn)		12			
Productive			**< 3 yrs old**	**3 – 7 yrs old**	**> 7 yrs old**
Hoes		1	× 1	× 0.8	× 0.5
Spades/shovels		1			
Ploughs		4			
Treadle pump		6			
Powered pump		12			
Sewing machine		4			

Source: adapted from Agricultural Development Outcome indicators, 2010

Note that this asset index has a different way of valuing livestock compared to TLU values.

$$Household\ Domestic\ Asset\ Index = \sum_{g=1}^{G}\left[\sum_{i=1}^{N}(\omega_{gi} \times a)\right],$$

i = 1,2,….,N ; g = 1,2,…,G

where, ω_{gi} = weight of the i'th item of asset g, **N** = number of asset g owned by household, a = age adjustment to weight, **G** = number of assets owned by household.

- To calculate the asset index with respect to livestock only, use the above equation to sum only the livestock assets.
- For assessing impact or changes over time, the percent change in asset index can be calculated.
- An alternative method to the above is to obtain the value of assets using local market surveys and then use the modal value to calculate total household assets in cash value. This method could also include the value of land assets.

Gender asset disparity

The gender asset disparity is calculated as the ratio of women's asset index (same calculation as the household asset index but only include women's assets) to men's asset index. While there is no cut off point to indicate an appropriate ratio, projects should monitor changes in the asset disparity ratio and may, for example, include a project objective of increasing the ratio to a desired level (e.g. 0.75).

$$\frac{Women\ Domestic\ Asset\ Index}{Men\ Domestic\ Asset\ Index}$$

Quality of Housing

An adapted CASHPOR[1] House Index (CHI) uses external housing conditions as a proxy for poverty where each quality attribute is score 0, 2 or 6.

Ownership	Number of rooms	Floor material	Wall material	Roofing
Borrowed=0 Rented=2 Owned=6	1 to 2 rooms=0 2 to 4 rooms=2 > 4 rooms =6	Earth=0 Cement=2 Tiles=6	Earth/mud=0 Wood/Bamboo/ Iron sheets=2 Cement/Bricks=6	Grass=0 Iron sheets /Asbestos=2 Tiles=6

To classify housing :-
<5: Very poor housing
5 - 9: Poor housing
10 - 17: Average housing
18 – 30: Good housing

[1] CASHPOR is a network of 23 Grameen Bank replications in nine countries of Asia

Livestock contribution to household asset base

This is calculated as the percentage of household non-land asset index which is livestock assets:

$$\frac{Livestock\ Asset\ Index}{Household\ Asset\ Index} \times 100$$

Livestock contribution to women's asset base

Similar to the above,

$$\frac{Women-owned\ Livestock\ Asset\ Index}{Women\ Domestic\ Asset\ Index} \times 100$$

Total livestock holding (by species and TLU)

We often wish to use a common unit to describe livestock numbers across species to produce a single figure indicating the total 'amount' of livestock owned. In order to do this, the concept of an "Exchange Ratio" has been developed, whereby different species of different average size can be described by a common unit and compared; this unit is a Tropical Livestock Unit (TLU) (LEAD). Various methods of obtaining exchange ratios among species have been used, but none has been completely satisfactory. Different formulae for estimating TLUs may be utilised in different parts of the world, depending on common livestock breeds. However a single formula for estimating TLUs in this way is unable to account for different livestock breeds, which may differ significantly in size. If the feed eaten is reasonably the same for the species being evaluated, the ratio of metabolic weights provides the best means of comparison. The common standard used for one Tropical Livestock Unit is one cattle with a body weight of 250 kg.

The table below presents the exchange ratios for animals with different body weights in Tropical Livestock Units based on metabolic weight (TLU = metabolic body weight for body weight X / metabolic body weight for 250kg animal). It shows, for example that 5 animals (e.g. sheep/goats) of 30 kg will consume as much as 1 animal (e.g. cow) of 250 kg, i.e. both have a TLU value of 1. However, strictly speaking, they can only be compared in this way when the different species are under the same feeding system, something that is often not the case.

Body Weight (kg)	Metabolic Body Weight (kg $^{0.75}$)	T L U	Body Weight (kg)	Metabolic Body Weight (kg $^{0.75}$)	T L U
5	3	0.05	100	32	0.5
10	6	0.09	125	37	0.59
15	8	0.12	150	43	0.68
20	9	0.15	200	53	0.85
25	11	0.18	**250**	**63**	**1**
30	13	0.2	300	72	1.15
35	14	0.23	350	81	1.29
40	16	0.25	400	89	1.42

45	17	0.28	450	98	1.55
50	19	0.3	500	106	1.68
60	22	0.34	600	121	1.93
75	25	0.41	700	136	2.16

We recommend that projects consider using these basic metabolic weight conversions to form their own TLU index based on the particular species and breeds (and their average weight) considered in the project. However, for reference below are presented: global Livestock Units (useful for comparing across countries, continents and systems) (FAO, 2003) where 1 TLU is 1 cattle in USA and a TLU for sub-Saharan Africa (using 1 TLU as 1 mature cow of 250kg).

	Cattle	Buffalo	Sheep	Goats	Pigs	Horses	Camels	Chickens	Ducks / Turkeys / Geese	Rabbits
North Africa	0.7	0.7	0.1	0.1	0.2	0.8	1.1	0.01	0.03	0.02
Sub-Saharan Africa	0.5	0.5	0.1	0.1	0.2	0.8	1.1	0.01	0.03	0.02
South Africa	0.7	0.7	0.1	0.1	0.2	0.8	1.1	0.01	0.03	0.02
North America	1	1	0.15	0.1	0.25	0.8	1.1	0.01	0.03	0.02
Central America	0.7	0.7	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
South America	0.7	0.7	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
Asia	0.5	0.5	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
Eastern Europe	0.7	0.7	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
Oceania Developing	0.5	0.5	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
USSR	0.6	0.6	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02
OECD	0.9	0.9	0.1	0.1	0.25	0.8	1.1	0.01	0.03	0.02

FAO, 2003 (adapted by Chilonda & Otte, 2006)

Conversion equivalents of sub-Saharan Africa livestock into TLU:

Livestock class	**Weight (kg)**	**metabolic body weight (weight^0.75) (kg)**	**TLU**
Cattle			
Bulls (>3 yrs)	320	76	1.2
Castrated adult males (oxen>3 yrs)	400	89	1.42
Immature males (< 3 yrs)	200	53	0.85
Mature Cow (calved >once)	250	63	1.0
Heifers	180	49	0.78
Pre-weaning males	70	24	0.38
Pre-weaning females	80	27	0.43

Goats	25	11	0.2
Sheep	25	11	0.2
Poultry	3	2	0.04
Rabbits	3	2	0.04
Donkeys	175	48	0.8
Horses	200	53	0.8
Pigs	50	19	0.3
Camel	300	72	1.1

(Adapted from various sources by authors and using a Mature Cow as 1 TLU equivalent)

$$Total\ livestock\ holding = \sum_{i=1}^{n} TLU_i\ ,$$

n = number of species/type, TLU_i = TLU for species/type i

Livestock ownership by women

This can be calculated using various methods:

- % of households in survey where women own livestock (by and across species)
- % of livestock in survey owned by women (not using TLU) or % of total TLU under women's ownership (by and across species)
- Average number of livestock owned by women per household (by and across species)

2.2 Indicator 2: Access to, and use of, technologies and services by men and women

Calculated variables under this indicator include:

- Access to, and use of, technology and inputs related to livestock health, breeding, feeding, and management (including gender disaggregation)
- Access to, and use of, services such as extension, training, information and finance, and public services and membership in groups (including gender disaggregation)
- Membership of groups (including gender disaggregation)

2.2.1 Rationale

Increasing productivity and income and reducing environmental impacts is expected to hinge on improving access to, and use of, improved technologies and management practices. Uptake of these improved technologies and management practices signifies a change in the behaviour of farmers. Additionally, joint decision-making by men and women on the use of technologies at farm level is an indication of changes in intra-household relations with respect to agriculture. Women's decision-making and their access to services is especially important if the potential for agricultures is to be realised as they make a large proportion of the agriculture and livestock labour force in Africa and Asia.

2.2.2 Data

To calculate this indicator measurements are taken on the proportion of farmers in a sampling frame that (i) have a service or technology available and (ii) are using a given technology or service. Information on community group membership may also provide valuable data for this indicator. The recall period for these data are commonly '12 months prior to the survey', but may be extended for specific technologies (e.g. use of AI in past 5 years)

2.2.2.1 Access to, and use of, livestock related technology and inputs

Type of Technology / Input	Is the technology available?	Have you used this technology in the last 12 months?	Who mainly makes the decision to use it? (code)
Animal health			
• Preventive methods (incl. vaccination)			
• Curative (treatment)			
Breeding			
• Natural service (bull)			
• AI			
Supplemental feeding			
• Commercial feed			
• Minerals			
WHO MAKES THE DECISION TO USE THE SERVICE / WHO USED THE SERVICE			
1 = household male 2 = household female 3 = joint household (male & female) in HH		4 = non-household member 5 = other, specify	

The table above can be for all species combined, a specific species of interest to the project or duplicated to include multiple species.

2.2.2.2 Access to, and use of, services

Type of services	Is the service available?	Have you used this service in the last 12 months?	Who requested/received this service? (code)
Extension visits			
• Livestock			
• Crop			
• Other, specify [ ]			
Animal health services			
• Veterinarian			
• CAHW*/para-vet			
• Agro-vet			
Training			
• Livestock			
• Crop			
• Other, specify [ ]			
Information (other than extension and training)			
• Market			
• Weather			

• Other, specify [ ]			
Financial services			
• Savings			
• Credit			
• Health insurance			
• Domestic/home insurance			
• Crop insurance			
• Livestock insurance			
Electricity			
• National grid			
• Solar			
Piped water (to compound, available and working)			
WHO MAKES THE DECISION TO USE THE SERVICE / WHO USED THE SERVICE			
1 = household male 2 = household female 3 = joint household (male & female) in HH		4 = non-household member 5 = other, specify	
*CAHW – Community Animal Health Worker			

Sections of the table above (extension, animal health, insurance) can be for all species combined, a specific project species, or duplicated to include multiple species.

2.2.2.3 Membership of groups

Name of group*	Type of group	How many men in the household belong to this group?	How many women in the household belong to this group?
TYPE OF GROUPS (MAIN FUNCTION)			
1 = social/ welfare & community development groups 2 = savings and credit groups 3 = agricultural producer groups		4 = livestock producer groups 5 = agricultural marketing groups 6 = livestock marketing groups 7 = Other, specify	

**Complete one row per group which the household (any person) is a member of*

2.2.3 Calculation

Access to livestock technology and inputs (health, breeding, feeding and management)

Percentage of households with access to a technology or input:

$$\frac{Number\ of\ HH\ with\ access\ to\ livestock\ technology\ or\ input}{Number\ of\ HH\ with\ livestock\ in\ sample} X100$$

Use of the technology and inputs in the 12 months prior to the study

Percentage of households who have used, in past 12 months, a technology or input: equation as above but replace 'with access' with 'using':

- To assess the technology or input adoption potential, use the above but replace the denominator with: "number of livestock-owning households with access to the technology or input".

Women's decision-making on use of technology or inputs

Percentage of households where women made the decision to use a specific technology or input:

$$\frac{Number\ of\ HH\ where\ women\ make\ the\ decision\ on\ use\ of\ a\ technology\ or\ input}{Number\ of\ HH\ using\ technology\ or\ input} X100$$

- For the numerator we could also use "women-only decision-making technologies or inputs" or also include in the above jointly (men and women) made decisions.
- Can summarise at technology/input level or across technologies/inputs to household level. For the latter would calculate the "proportion of technology and input decisions made by women" per household then average proportion across households.

Access to, and use of, services such as extension, training, information and finance, and public services

- Use the above calculations replacing "technology or input" by "services" and replacing "Number of HH with livestock in sample" by total "Number of HH in sample" where appropriate (i.e. for non-livestock specific services).

Membership of Groups

Percentage of households in each type of group:

$$\frac{Number\ of\ HH\ with\ at\ least\ one\ member\ in\ group\ (by\ type)}{Number\ of\ HH\ in\ sample} X100$$

- Replace the numerator by "Number of HH with at least one female member in group" to calculate membership of groups by women.

Percentage of men/women in each type of group:

$$\frac{Number\ of\ men/women\ in\ each\ group\ (by\ type)}{Number\ of\ people\ in\ sample} X100$$

- Denominator for the above should be "Number of livestock-owning HH" or "Number of people in livestock-owning HH" for the 'livestock producer' and 'livestock marketing' group types.

2.3 Indicator 3: Production and productivity of Livestock

Calculated variables under this indicator include:

- Milk production per animal (by breed) per lactation and per year
- Milk production per household per day
- Egg production per hen, per clutch (by breed)
- Egg production per household

2.3.1 Rationale

A number of interventions at ILRI are aimed at increasing the production and productivity of livestock and livestock products. Changes in milk production per cow and egg production are important indicators for evaluating the effectiveness of these interventions in dairy and poultry projects. Such interventions may include, but are not limited to, feed technologies, improved management, breeds and breeding services, input supply systems and market services. This indicator therefore applies widely across the ILRI projects and programs. This is a key area planned for expansion in future versions of this document.

2.3.2 Data

2.3.2.1 Dairy production

Select up to 3 cows / goats / camels / buffalos that are currently being milked by the household currently. If household keeps more than one breed, do at least one animal of each breed and for each breed fill a column (i.e. add more columns if you expect households to keep more than 3 breeds).

* *fill first column only if only 1 breed owned*		**animal 1**	**animal 2**	**animal 3**
Breed (1= Local, 2= Cross and 3= Exotic)$				
Age at first calving				
Last calving date (MM/YY)				
Parity (number of live and/or still-births)				
Calving interval - if this is not the first calving (months)				
Lactation length (number of months cow is milked)				
Total Daily Milk Production (morning plus evening) in litre	At Calving - initial milk production			
	Yesterday			
Number of milking cows of each breed				

$ breed list should be same as breakdown in 2.1.2.4 livestock inventory

- It may also be useful to note down the 'season' (time of the year) when survey was carried out, especially if one of the survey objectives is to look at relationships between milk production and management (e.g. feeding quality/quantity). Or take information from 'Seasonal Calendar' activity of a PRA if carried out.

2.3.2.2 Eggs production

Select up to 3 hens, currently laying eggs, owned by the household. If household keeps more than one breed, do at least one of each breed. For each of these hens, fill a column.

** fill first column only if only 1 breed owned*	**Hen 1**	**Hen 2**	**Hen 3**
Breed (1= Local, 2= Exotic, 3=Cross)$			
Number of eggs produced per clutch (laying period)			
Number of clutches in the last 3 months			
Number of laying hens of that breed			

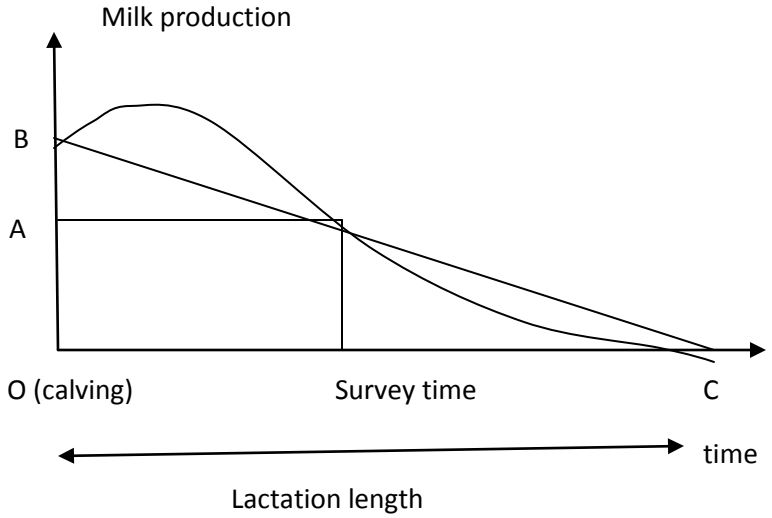
$ breed list should be same as breakdown in 2.1.2.4 livestock inventory

2.3.3 Calculation

Milk production per animal (by breed) – whole lactation

Milk production per lactation can be calculated in 2 ways:

1. Fitting of the lactation curve using at least two points (milk production at calving and yesterday milk production) per cow and calculating the average area under the curve. This method is possible if enough observations are available (by breed) or if the lactation profile for the breed is well known and documented in the literature.
2. Approximation of the level of production by calculating the area (triangle OBC): lactation length (OC) x milk production at calving (OB) divided by 2 as illustrated in the figure below. Depending on data availability, milk production levels are calculated by breed.



Milk production per animal (by breed) per year

In order to relate milk production to other household income sources there is need to calculate milk production per year (and subsequently per household) as most other income variables use a 1 year recall period. This is calculated using the calving interval to adjust the milk production per lactation (from above) to the amount produced in 1 year by breed i:

$$Milk\ production\ per\ animal\ per\ year_i = Milk\ production\ per\ cow_i\ x \left[\frac{365}{Calving\ interval\ (days)}\right]$$

Milk production per household per day

$$Total\ milk\ production = \sum_{i=1}^{n} Milk\ production\ per\ cow_i\ x\ Number\ lactating\ cows_i$$

where i = 1,2,…,n (breed) and n = number of breeds kept by household

- This summary gives a total milk production per household for one day, for most survey objectives this indicator alone may not be very useful.
- Assuming that, 'on average', the same number of animals are lactating at any specific time then approximate yearly milk production = Total Milk Production per day x 365 days. Could also add a variable in the dairy production table (2.3.2.1) for "Number of days per year when cows are milked".

Egg production per hen, per clutch (by breed)

Take directly from data collection table, then calculate average across households for each breed.

Egg production per household (3 month period)

$$Total\ egg\ production = \sum_{i=1}^{n} Eggs\ per\ clutch_i\ x\ Number\ of\ clutches\ in\ 3\ mths_i\ x\ Number\ of\ hens_i$$

where i = 1,2,…,n (hen breed) and n = number of breeds kept by household

2.4 Indicator 4: Labour use in livestock systems

Calculated variables under this indicator include:

- Amount of labour used in livestock, by activity, gender of worker and whether worker is family or hired.
- Expenditure on external labor for livestock activities (per year)

2.4.1 Rationale

Understanding of labour patterns in livestock production is an important step in technology development and dissemination. Some technologies, interventions or services will have different impacts on labour usage: reducing, increasing and/or changing gender patterns of labour use. Data on such changes is useful for understanding which interventions have potential to reduce labour in livestock production, generate employment or re-distribute labour across different members of the household or across the value chain. However, there are measurement issues in collection of labour data; time use patterns are usually labour intensive to collect and often rely on regular data collection over short intervals of time (e.g. 24 hours). Additionally, labour data, including repeated observations of these, should be collected at the same time (e.g. season, calendar month etc.) to avoid variations in labour use due to seasonal differences.

It is challenging to collect livestock labour allocation relative to other farm and/or non-farm activities. If a project needs this information then a detailed time-use module should be developed.

2.4.2 Data

2.4.2.1 Labour allocation

Use household recall from the previous 1 week (7 days) and note down the season when the survey is being carried out (cropping / non-cropping).

- Enter 0 under "No. people" and "Hrs / person" for activities not carried out
- Add/Delete sections for species not considered in the survey/project

Species* & Type of Activity	Household						Non-Household			
	Adult Males		Adult Females		Children (< 15 yrs)		Hired Females		Hired Males	
	No. people	Hrs / person	No. people	Hrs / person	No. people	Hrs / person	No. people	Hrs / person	No. people	Hrs / person
CATTLE (incl. DAIRY)										
Grazing										
Feeding (+ collecting & preparation)										
Watering										

Cleaning of animal shed/shelter										
Collection of Farm Yard Manure (FYM)										
Milking										
Milk processing										
Selling animals / animal products (incl. milk)										
Selling FYM										
Disease control / Caring for sick animals										
Other: [ ]										
GOAT										
Grazing										
Feeding (+ collecting & preparation)										
Watering										
Cleaning of animal shed/shelter										
Collection of Farm Yard Manure (FYM)										
Milking										
Milk processing										
Selling animals / animal products (incl. milk)										
Selling FYM										
Disease control / Caring for sick animals										
Other: [ ]										
SHEEP / PIG										
Grazing										
Feeding (+ collecting & preparation)										
Watering										
Cleaning of animal shed/shelter										
Collection of Farm Yard Manure (FYM)										
Selling animals										
Selling FYM										
Disease control / Caring for sick animals										
Other: [ ]										
CHICKEN / POULTRY										
Feeding (collecting & preparation)										
Watering animal										
Cleaning of animal shed/shelter										
Collection of Farm Yard Manure (FYM)										
Egg collection										
Selling animals / animal products (incl. egg)										
Selling of FYM										
Disease control / Caring for sick animals										
Other: [ ]										

**Labour for whole herd*

2.4.3 Calculation

Amount and value of labour used in livestock, by activity, gender of worker and whether worker is family or hired.

Amount of labour used in livestock, by activity and gender

Amount of labour per week (hours) for species X and activity Y:

$$Labour\ time\ (hours)_{XY} = \sum_{i=1}^{5} Number\ of\ people_i\ x\ Hours\ per\ person_i$$

where i = 1,2,…,5 (people type: 1 – Adult male, 2 – Adult female, 3 – Children, 4 – Hired female, 5 – hired male)

Amount of labour per week (hours) across all livestock species and activities:

$$Total\ livestock\ labour\ (hours) = \sum_{X=1}^{N1}\left[\sum_{Y=1}^{N2} Labour\ time_{XY}\right]$$

where X = 1,…,N1 (number species owned), Y = 1,…,N2 (number of activities for each species)

Gender adjusted summaries:

- For calculation of female labour use above equations but only include adult female and hired female for people type.
- To calculate proportion of livestock labour performed by women divide total female labour time by total labour time
- To calculate proportion of hired livestock labour performed by women divide total hired female labour time by total hired labour time

Other summaries

- Look at household reliance on external labour by calculating: total hours hired labour / total hours of labour.

2.5 Indicator 5: Contribution of livestock to smallholder farm and household incomes

Calculated variables under this indicator include:

- Income from livestock and livestock products
- Livestock income as a percentage of total farm income
- Livestock income as a percentage of total household income
- Women's control of livestock income

All variables can be considered as cash income only or cash + non-cash income (e.g. meat consumed value of stock) but below we only provide calculations based on cash income.

2.5.1 Rationale

Livestock serve multiple functions; as a source of income, savings and insurance and contribute to food security. Variables which quantify these functions and which are easiest to measure relate to the contribution of livestock to both farm and household income.

Farm income includes all income from farming activities including sale of crops and livestock (cash) and may also include the value of livestock and crops used for home consumption (non-cash).

Household income includes the farm income and other sources of income, e.g. off-farm employment, business, remittances or pensions etc.

2.5.2 Data

2.5.2.1 Livestock exits

- All animals that have exited the herd/flock
- Make 1 table per species
- Enter 1 row per exit 'type' (i.e. unique 'animal type' x 'how exited' x 'purpose of selling' x 'price' x 'where sold' x 'who controls the money' combination)
- For poultry a recall period of 3 months only is recommended

Have any <u>cattle/ sheep/ goat/ chicken/pig</u> exited the household herd during the past 12 months. (0 = No, 1 = Yes, X = don't know) [ ] If yes, fill in the below table.

	Animal type (code a)	How exited (code b)	How many animals exited?	If sold:			
				Purpose of selling (code c)	Average price per animal*	Where sold? (code d)	Who controls the money? (code e)
1							
2							
3							
4							
5							

a) ANIMAL TYPE		**d) WHERE SOLD**	
1=Adult male 2=Adult female 3=Young male	4=Young female 5=Male calf / lamb / kid / chick 6=Female calf / lamb / kid / chick	1=Farm gate 2=Village/local general market 3 = Nearest livestock market	3=Regional town or market 4= Abattoir / butchery 5=Other, specify

b) HOW EXITED		**e) WHO CONTROLS THE MONEY?**	
1 = Sale (live animals) 2 = Slaughter for sale 3 = Slaughter - household needs	4 = Given away (e.g. dowry) 5 = Died, lost or stolen 6 = Other, specify	1 = household male 2 = household female	3 = joint household (male & female) 4 = non-household member 5 = Other, specify

c) PURPOSE OF SELLING	
1 = To meet planned household expenses 2 = To meet emergency household expenses 3 = Livestock trading as a business	4 = Culling 5 = Other: (specify in cell)

**use common currency unit throughout survey (see Section 4 Meta-data)*

2.5.2.2 Production and sale of livestock products and services

	Production Unit (code a)	Number produced in last 1 month	Number sold in last 1 month	Number of months per year produced	Number of months per year sold	Average price per unit*	Who controls the money? (code b)
Eggs							
Fresh milk							
Sour milk							
Ghee							
Manure							
Hides and Skins							
Honey							
Draft power							
Other, specify							

a)UNIT		b) WHO CONTROLS THE MONEY	
1= piece, 2= liter, 3= kg,	4= Other, specify and indicate conversion to one of listed unit types	1 = household male 2 = household female	3 = joint household (male & female) 4 = non-household member 5 = Other, specify

**use common currency unit throughout survey (see Section 4 Meta-data)*

- Note that in the table above: Number produced – Number sold = Number consumed.

2.5.2.3 Other household income sources

- Income sources and levels should include income from all members of the household
- [1] No need to collect livestock, livestock products & services and crop sales data if have already collected information in previous tables
- Enter X in income amount column if farmer has income from source but cannot estimate the value

Income Source	Did anyone in the household earn income from source in last 12 months? (0 = no, 1 = yes)	Total HH income in past 12 months from this source	Rank of Source+	Who mainly earns/ controls this source? (code)
Sale of livestock [1]				
Sale of livestock products [1]				
Sale of livestock services [1]				
Sale of agricultural products (crops/ vegetable / fruit) [1]				
Trading in livestock and livestock products (not own produce)				
Trading in agricultural products (excluding livestock!) (not own produce)				
Formal salaried employment (non-farming, e.g. civil servant, private sector employee, labourer, domestic work in other home)				
Business – Trade or services (non-agricultural)				
Working on other farms (including herding)				
Sale of products of natural resources (forest and sea/rivers products)				

Pensions				
Rent out land / sharecropping (cash value of share crop or rent)				
Remittances				
Other 1: (specify) [ ]				
Other 2: (specify) [ ]				
Other 3: (specify) [ ]				
Other 4: (specify) [ ]				
Other 5: (specify) [ ]				

WHO CONTROLS THE MONEY		
1 = household male 2 = household female	3 = joint household (male & female) 4 = non-household member	5 = Other, specify

+ most important source = rank 1

**use common currency unit throughout survey (see Section 4 Meta-data)*

What is your average monthly household income? [ ]

AVERAGE MONTHLY HOUSEHOLD INCOME (convert to local currency)		
1= <$30/month 2= between $30 and $60/month	3= between $60 and $120/month 4= between $120 and $240/month	5= above $240/month

2.5.3 Calculation

Calculated variables under this indicator include:

- Income from sale of livestock and livestock products (cash and/or non-cash)
- Livestock income as a percentage of total farm income (cash and/or non-cash)
- Livestock income as a percentage of total household income (cash and/or non-cash)
- Women's control of livestock income

Annual Cash Income from livestock & livestock products

Sale of livestock: use Table 2.5.2.1 (code b "how exited" – category 1 = live animals and 2 = slaughtered for sale),

$$Cash\ income\ from\ sale\ of\ livestock = \sum_{j=1}^{m}\sum_{i=1}^{n} Ave.price\ per\ animal\ x\ number\ of\ animals\ sold$$

i = 1,2,…,n number of exits for species j, j = 1,2,…,m number of species.

- For species with a shorter recall period (e.g. poultry - 3 months) ensure standardisation of all income sources to this period or extrapolate to 1 year

Sale of livestock products: use Table 2.5.2.2

$$Cash\ income\ from\ sale\ of\ livestock\ products$$
$$= \sum_{i=1}^{n} Num.units\ sold\ in\ last\ 1\ month\ x\ Num.months\ per\ year\ sold\ x\ Price\ per\ unit$$

i = 1,2,…,n number of products

Finally, all sources of income are captured in Table 2.5.2.4. When summing income sources (sales of live animals and of livestock products) and other sources of livestock income, make sure you do not count twice the same income source, and make sure that units are the same (either months or years) before summing.

- ***Farm Income*** = All super-script [1] incomes from Table 2.5.2.3 (or their equivalent breakdown tables)
- ***Household Income*** = All sources of income from Table 2.5.2.3
- When summing income sources ensure no double-counting and equivalent time units (e.g. 3 months, 1 year) for all sources.

Contribution of livestock to total farm/household income

$$Percentage\ farm/household\ income\ from\ livestock = \frac{Income\ from\ livestock}{Total\ farm/household\ income}$$

- The above calculation (and annual cash income from livestock & livestock products) can also be carried out for specific livestock, for example the contribution of cattle to farm/household income.

Women's control of livestock income

The last column of the tables above can be used to measure the control of income by women for the specific income source of interest and over the entire farm/household income. It is calculated as the proportion of households in which women control income from the source of interest or, for example, control at least one aspect of farm/household income.

2.6 Indicator 6: Role of livestock in contributing to household food security

Calculated variables under this indicator include:

- Household/Individual Dietary Diversity Score (HDDS / IDDS)
- Proportion of households consuming at least one animal source food per day

- Food consumption score (FCS)
- Contribution of meat, fish and milk to the food consumption score
- Months of adequate household food provisioning (MAHFP)

2.6.1 Rationale

Livestock can contribute to food security via two different pathways; increased consumption of animal source foods and increased incomes that can be used to purchase additional food for the household.

2.6.2 Data

Three 'not too hard' to collect indicators can be used to measure household food security. Household dietary diversity is the number of different food groups consumed over a given reference period. The **Household Dietary Diversity Score (HDDS)** or **Individual Dietary Diversity Score (IDDS)** is an attractive proxy for food security because a more diversified diet is an important outcome, and is also correlated with such factors as caloric and protein adequacy, percentage of protein from animal source foods and household incomes (Hoddinot and Yohannes, 2002). The dietary diversity can be calculated for the household (Household Dietary Diversity Score) or for individuals within the household (Individual Dietary Diversity Score-IDDS). The consumption of food is collected using a 24 hour recall and should be asked to household members responsible for food preparation and should only focus on foods consumed within the home. Foods consumed outside the home that were not prepared in the home (e.g hotel food) should not be included as they will rarely represent household level food security. Using the dietary diversity score, the consumption of animal source foods can also be determined. The **Food Consumption Score (FCS**) is a more comprehensive indicator based on dietary diversity, food frequency and relative nutritional importance. The **Months of Adequate Household Food Provisioning (MAHFP) captures** the combined effects of a range of interventions such as improved production, storage and increased household purchasing power.

2.6.2.1 Household dietary diversity score and food consumption score (HDDS and FCS)

		Head of Household		Female Adult		Index child below 5 years)*	
Types of foods	How was the item obtained?	In the last 24 hours, have you consumed (1=Yes, 0=No)	In the last 7 days, how many **times** have you consumed these?	In the last 24 hours, have you consumed (1=Yes, 0=No)	In the last 7 days, how many **times** have you consumed these?	In the last 24 hours, has your child consumed (1=Yes, 0=No)	In the last 7 days, how many **times** has the child consumed these?
Staples or food made from staples including millet, sorghum, maize, rice, wheat, or other local grains, e.g. ugali, bread, rice noodles, biscuits, or other foods							
Potatoes, yams, cassava or any other foods made from roots or tubers							
Vegetables							
Fruits							
Beans, peas, lentils, or nuts?							
Red meat-beef, pork, lamb, goat, rabbit wild game, liver, kidney, heart, or other organ meats?							
Poultry including chicken, duck, other poultry							
Eggs							
Fresh or dried fish or shellfish?							
Milk, cheese, yogurt, or other milk product							
Oils and fats?							

Sweets, sugar, honey							
Any other foods, such as condiments, coffee, tea including milk in tea?							
Codes: How was the item obtained?							
1=Mainly produced, 2=Mainly purchased, 3=Gift, 4=Other (specify)							

2.6.2.2 Months of Adequate Household Food Provisioning (MAHFP)

In the last 12 months, did you have enough food to eat during all the months? [ ] 0=No, 1=yes	
If no, which were the months in the last 12 months that you **did have** enough food to meet your family's needs DO NOT READ THE LIST OF MONTHS. WORKING BACKWARD FROM THE CURRENT MONTH, PLACE A "1" IN THE BOX IF THE RESPONDENT IDENTIFIES THAT MONTH AS ONE IN WHICH THE HOUSEHOLD HAD ENOUGH FOOD TO MEET THEIR NEEDS.	Jan [ ] Feb [ ] March [ ] April [ ] May [ ] June [ ] July [ ] Aug [ ] Sept [ ] Oct [ ] Nov [ ] Dec [ ]

2.6.3 Calculation

Measurement and analysis of the food security indicators is adapted from the World Food Programs vulnerability assessment mapping (WFP, 2008) and from USAID's Food and Nutrition Technical Assistance Project (Bilinksy and Swindale, 2010; Hoddinot and Yohannes, 2002; Swindale and Biilinksy, 2006)

Household/Individual Dietary Diversity Score (HDDS / IDDS)

The HDDS is as the sum of all food groups consumed by the household in the last 24 hours divided by the total number of households.

The dietary diversity score should ideally be measured at individual household member level. This means that the questions (in 2.6.2.1) are asked for each individual member of the household. However, if there are time/budget limitations then they could be done for one adult male and one adult female per household and for all children under 24 months of age.

Proportion of households consuming at least one animal source food per day

This is calculated as the proportion of households that have consumed any of the following food items in the last 24 hours: Meats (F), Poultry (G), Eggs (H), Fish (I) and Dairy (J).

Food Consumption Score (FCS)

To calculate the FCS, the types of food considered are reduced down to 9 main food groups; main staples, vegetables, fruits, pulses, meat and fish, milk, oil, sugar and condiments (see weights table). Some of the food groups have more than one type of food contributing to it. For example, the main staples combine food type A and B. The meat and fish combine types F, G, H and I. The food types are weighted based on nutrient densities estimated by WFP for use in VAM (World Food Program, 2008).

The FCS is calculated by first calculating the consumption frequencies (number of times the food type was eaten in the last 7 days) for each food group. For food groups that combine different types of food then first sum the frequencies from each food type to provide a total for the food group. The maximum frequency is 7 for each food group, so if the total frequency for a food group is greater than 7 then replace with 7 (this is because if total is greater than 7 it implies that the food group was eaten at least once per day and to be comparable to food groups containing only one food type then the maximum must be set to 7). For example, in the calculation of Meats & Fish, if a household has eaten meat 3 times, poultry twice, eggs 4 times and fish once in the last 7 days then the frequency for Meat & Fish equals 10, which will be replaced by 7. Finally, multiply the frequency of each food group by its weight and sum the weighted food group scores to create the FCS.

Thresholds can be determined based on the consumption behaviour of the country or region under consideration. The WFP, for example, uses the following thresholds:

- 0-21 Poor
- 21.5-35 Borderline
- >35 Acceptable

Food Group Weights

Types of foods	Groups	Weight
A. Staples or food made from staples including millet, sorghum, maize, rice, wheat, or other local grains, e.g. ugali, bread, rice noodles, biscuits, or other foods	**Main Staples** (if sum of frequencies is > 7 set to 7)	**2**
B. Potatoes, yams, cassava or any other foods made from roots or tubers		
C. Vegetables	**Vegetables**	**1**
D. Fruits	**Fruits**	**1**
E. Beans, peas, lentils, or nuts?	**Pulses**	**3**
F. Red meat-beef, pork, lamb, goat, rabbit wild game, liver, kidney, heart, or other organ meats?	**Meat and Fish** (if sum of frequencies is > 7 set to 7)	**4**
G. Poultry including chicken, duck, other poultry		
H. Eggs		
I. Fresh or dried fish or shellfish?		
J. Milk, cheese, yogurt, or other milk product	**Milk**	**4**
K. Oils and fats?	**Oil**	**0.5**
L. Sweets, sugar, honey	**Sugar**	**0.5**
M. Any other foods, such as condiments, coffee, tea including milk in tea?	**Condiments**	**0**

Contribution of meat, fish and milk to the food consumption score

This is calculated as the proportion of the total FCS contributed by the food groups Meat & Fish and Milk.

Months of Adequate Household Food Provisioning (MAHFP)

This is calculated by adding all the months that a household had adequate food in the preceding 12 months.

An average for the sample may be obtained by adding all the MAHFP and dividing by the number of households. The denominator should include all households interviewed including those who did not experience any months of food shortage.

The indicator currently does not have thresholds but households can be classified as belonging to the top, middle and lower tercile (Bilinsky and Swindale, 2010). Projects can monitor changes on the percentage of households in these terciles with the average for the upper tercile being the target.

3 Basic Survey Data

Key identification variables should be collected in all surveys. These are used to locate (in time and space) each observational unit and to provide the linkage information needed for data management and analysis of the data.

- Every household should have a unique identifier/code. This may alter between projects but should be logical and linked to the location information about the household.
- The GPS coordinate system (e.g. UTM) should be documented – see Section 0.

Example: Cover page of a household survey

Date of Survey (DD/MM/YYYY) :	/ /						
Enumerator Name :							
Head of Household Name :							
Did the household consent to the interview? (0= NO; 1=YES)	[ ]						
If no, why? (code a)							
If no, request a replacement household from supervisor (and continue with this questionnaire)							
Time interview started :	HH:		MM:			Common currency unit:	
Time interview ended :	HH:		MM:				
Site/State/Region/District Name :						Site Code:	
Village/Settlement/Hamlet Name :						Village Code:	
Head of Household Name : (replacement name if original Head above refused)							
Name of survey Respondent :							
Relationship of survey respondent to Household Head (code b) :							
Household GPS Coordinates:	Latitude (N/S):			Longitude (E/W):			
Example HH ID System:							
Main Household Code (AABBBCCDDEE):							
AA = Survey Type, BBB = Country, CC = Site, DD = Village, EE = Household							
a) No Consent					**b) Respondent relationship**		
1 = Respondent refuses to participate 2 = Respondent does not have the time 3 = Household head (or other knowledgeable member) is not present at the house Other: (specify in cell)					1 = household head 2 = wife / spouse 3 = other family member 4 = other non-family member		

Quality assurance information may also be added to the survey to providing an audit trail from the field to publication. Suggested aspects to include are shown below:

Example: Quality Assurance Aspects

14. DATE OF QUESTIONNAIRE INSPECTION BY SUPERVISOR (dd/mm/yyyy):	/ /
15. DATE OF DATA ENTRY (dd/mm/yyyy):	/ /
16. NAME OF DATA ENTRY AGENT:	
17. NAME OF DATA ENTRY SUPERVISOR:	
Reviewing of questionnaire:	
Enumerator: Enter your comments here AFTER you have administered the questionnaire	
Supervisor: Enter your comments here AFTER you have inspected the WHOLE questionnaire	
Coordinator: Enter your comments here AFTER you have inspected the WHOLE questionnaire	

Example: Household Roster

- ***Start with the household head, followed by his wife or wives, children (ranked from old to young) and lastly other household members – include only members who live there at least 3 months per year***

ID	Name	Relationship to HH head (code a)	Gender (1 = Male 2 = Female)	Age (years)	Highest Level of Education (code b)	Primary activity (code c)	Home occupancy (code d)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

a) RELATIONSHIP TO HEAD	**b) HIGHEST LEVEL OF EDUCATION**	**c) PRIMARY ACTIVITY**
1 = Head 2 = Spouse 3 = Child 4 = Sibling (sister or brother) 5 = Parent 6 = Grandchild 7 = Other relative 8 = Non-relative (including employees who live in house) 9 = Other (specify)	0=No formal and illiterate 1=No formal but literate 2= Primary school 3= High / secondary school 4= College 5= University 6= Other (specify) **d) HOME OCCUPANCY** 1= permanently resident 2= sometimes away (< 3 months/year away) 3= frequently away (3 – 9 months/year away)	1 = Crop farming 2 = Livestock & poultry keeping (incl. sales) 3 = Trading in livestock and livestock products (not own) 4 = Trading in agricultural products (excluding livestock!) (not own produce) 5 = Formal Salaried employee (e.g. civil servant, domestic work) 6 = Business – trade / services (non-agric.) 7 = Not working / unemployed 8 = Old/Retired 10 = Infant (<6 years) 11 = Student/ pupil 12 = Disabled 13 = Other (specify)

Notes:

1. Add Koranic education where appropriate
2. Can alter definition of 'residency' (home occupancy) if required but standard is to include as household members anyone spending at least 3 months a year in the home. This column can be removed from the roster if only interested in looking at total number of 'residents'.
3. In many countries the definition of a 'household' can be complex, especially where multiple related nuclear families live in same compound. Definition of a 'household' should be included in any

survey training and training manual (e.g. "a household is the group of people who live together, eat together and pool financial & other resources").

4 Meta-data

Key meta-data information should be documented for all surveys and linked to related documents and databases (e.g. sampling protocol, database of observations, reports etc.). When someone wants, for example, to review the project, carry out further analysis etc. the meta-data gives them the information they need to do this. Meta-data are also vital for linking together our ILRI surveys so that indicators can be compared across regions and projects (along with the basic survey data described in Section 3).

Suggested template for survey meta-data:

Project Title:				
Project / Budget code:				
Contact name:	*Although staff come & go, good to have original contact who has the best knowledge of the survey*			
Name of survey database(s):		*Database Location:*	*i.e. physical location – e.g. server name*	
Type of database(s):	*E.g. MySQL, Access, CsPro, Oracle etc.*		*If not a relational database provide 'schema' showing relationships among tables*	
List of related documents:		*Locations:*		
Type of survey(s)	*E.g. Community level, Household, Herd/Flock, Market Agent, Value-chain, NRM and Baseline, M&E, Impact assessment etc.*			
Thematic area(s) included	*e.g. assets, food security, crops, cattle production, etc.*			
Year of survey:		*Date when data will be made publicly accessible (estimate) :*	*MM / YYYY*	
Location of survey:	*Country, Administrative areas or Site Description, preferably include GPS coordinates for some key points (e.g. centre of site, main urban centre)*			
GPS Coordinates for each observational unit?		*Yes / No*		
GPS Coordinate system used:	*E.g. WGS1984**	GPS Unit format used:	*E.g. decimal degrees (hd.ddddd)**	
Brief description of surveys:	*May include:* • *Total number of observational units and/or number in each 'site',* • *Key sampling aspects (cluster random, 2-stage etc.)& reference to design and/or sampling protocol* • *Objectives of survey* • *Topics/type of information covered in survey (e.g. income/expenditure of dairy cattle, list of the species/breeds of interest etc.)*			

**e.g. given are the preferred systems/units – WGS 1984 because you do not have to consider the zone you fall into, it is a global datum, that can later be projected to region specific projections once the data is downloaded*

5 Sampling

There are several books written on sampling for complex surveys. In this document we don't attempt to replicate these but instead provide a simple 'check-list' of issues that researchers should consider in the design of project surveys and preparation of sampling protocols. We will focus on sampling for household surveys but the check-list is equally applicable to community surveys (e.g. PRA's), market agent surveys, key informant interviews and individual (human or animal) level surveys.

The need for documenting a project's sampling processes in a sampling protocol cannot be over-emphasized. It encompasses the need for documenting an important component of study design together with the need for transparency regarding the extent to which the findings may be applicable more widely than the environment within which the research is taking place. The documentation of sampling plans also focuses attention on the need to take account of hierarchical structures in the population studied and the variability arising at each level. In particular, it is important to think out the sample sizes needed at each of the levels of the hierarchy and document the reasons for choices made and their limitations.

On sample size, if you are lucky enough to have only one or two key variable indicators for the project then you can use standard sample size calculations to calculate required sample size (insert reference). You'll need an estimate of expected variance of the indicator for that environment, from literature or pilot study, and the difference (before/after project) which you want to show to be significant (e.g. 1 litre increase in daily per cow milk production). You may also be able to use this approach if you have a clear idea of the analysis (e.g. economic / production model) which you will carry out and the parameters which will be included. If you have stratification in the design then the sample size is calculated per level of the stratification variable (e.g. if site is only level of stratification then sample size n = number of households per site). Almost always, you will need to do as large a sample size as your resources (time/money) can manage!

Checklist of considerations:

- ***What is my Target Population / To what extent can I Generalize my Results?***

What is the population (e.g. the people, animals, farming households, villages or other groups) to which the research results are expected to apply?

(i) Be realistic - to what population can the research results be generalised, while showing recognition and transparency as to the project's limitations.

(ii) Be precise – define exactly what population our results can be applied to. For example, it is better to say, "All mixed crop-livestock farming households in western Kenya owning less than 10 dairy cattle" rather than "all livestock farmers in western Kenya"

(iii) Be careful – we cannot claim a large breadth of coverage (e.g. results apply to all livestock farmers in East Africa) if the study is only taking place in a few sites / environments. The generalisation cannot be supported when study sites do not capture the variation in environments[2]. A small sample size *at site level* in the hierarchy makes for limited generalisation to other *sites*.

What can we generalise?

- In some situations, the research findings are limited to only the study locations as case studies for the research. Depending on the project objectives this may be entirely valid; for example, in selecting "hot-spots" to investigate resistance to the use of trypanocides.
- In some cases it is not the research findings we want to generalise but the research methodology; for example, "methodology for identifying the best dairy cattle breeds in smallholder dairy production systems of East Africa". It is still important to be realistic about under what conditions the methodology can be generalised, with possible adaptations to alternative environments. The same principles apply for our "proof-of-concept" research.

- ***What is the objective of my survey? (likely to be a combination of the below)***

The reason for carrying out the survey (i.e. the Objective) and our target population assist in defining our sampling frame (see below).

No.	Objective…	Population of interest…	Sample from…[3]
1	To establish baseline[4] prior to project interventions and/or to provide baseline for M&E of the project And/or As part of the M&E of the project	project participants only	project farmers only
		potential project beneficiaries (e.g. cattle owning households)	all potential beneficiaries
2	To characterize the site / population	potential project beneficiaries	all potential beneficiaries

[2] The term 'environments' here may relate to policy, agro-climatic, production system, market access or other conditions and relate to both our project goal and objectives.

[3] See later for additional samples from 'counterfactual' households and/or sites

[4] **Baseline:** The situation prior to the start of the project. This can be used as a reference point against which the outputs and outcomes of the project are measured.

		all households	all households
3	To identify / design project interventions	project participants only	project farmers only
		potential project beneficiaries	all potential beneficiaries

- ***Do I need to survey all sites?***

If sites can be classified as homogeneous (i.e. similar in their key characteristics) then only a sample of sites may be surveyed. Unfortunately, experience of smallholder farming systems in Africa and Asia indicates that this is rarely true. Frequently, key variables vary across site, e.g. local policy, market access, production system / agro-environmental situation etc. Variability in variables which are unimportant to the project and will not affect our project outcomes do not need to be considered.

- ***What methods can I use to sample households?***

There are a huge variety of sampling methods for selecting households to survey, often called by different names and frequently, especially for complex surveys, involve a combination of methods! Some basic methods are outlined below along with some comments on when they might be used:

Stratified random sampling –

- If we have important variables where the household survey response is likely to differ between levels of the variable (e.g. female-headed vs. male-headed households, households close to market vs. households far away) then we stratify by this variable.
- If we want to have a 'control' population for the with/without comparison then our stratification variable is 'project household' vs. 'control household'.
- We randomly sample households within each level of the stratification variable.
- *Sites* are often one of our stratification variables if sites have varying characteristics.

Completely random sampling –

- As the name suggests, this involves a completely random sample of households within the site. We use this if we have no obvious stratification variable.

Cluster random sampling (a.k.a. 2-stage sampling) –

- Randomly select clusters within a site (e.g. districts within provinces, villages).
- Randomly sample households within each cluster.
- Often our clusters are stratified (e.g. by village size, population density).
- The method is commonly used because resource constraints don't allow us to do completely random sampling
- We need to balance the number of clusters and number of households within a cluster. Our common principle is to maximize the number of clusters and minimize the number of households within a cluster, while ensuring that the households will give sufficient precision of variables within the cluster. This is based on the assumption that variation within a cluster is smaller than variation between clusters; although, this aspect should be considered by each project as in some situations this may not be true.

Sample size calculations using any of these methods are usually based on population data from secondary sources such as a census. To identify actual households to survey it is common to use community population rosters, which are discussed below.

- ***What type of Counterfactual do I need?***

The counterfactual is the situation that would have occurred in the absence of the intervention. Ideally, the outcomes and impact of an intervention are measured by comparing what happened with what would have happened to the same households and communities had the intervention not occurred. Since this can never be directly observed, alternative approaches are required to identify appropriate comparison or control groups. The type of counterfactual required by each project depends on the project Objectives but in order to establish that the impact of the project on participants (before/after) is attributable to the project then some form of counterfactual must be used.

Estimating before/after status of population of interest:
- carry out a survey at the start and end of project.
- if we're using a random sample of the target population then we don't need to use the same farmers at start and end of the project as both should be 'representative'.
- Only need to collect data necessary to calculate the outcome indicators

Options for with/without comparison to show that changes are attributable to the project –
- use control sites : is this realistic (given resources) and ethical? Do I have sites which are similar enough in environment to be considered equivalent to the project sites?
- use control villages/households within a site : is there likely to be 'spill-over' effect of project activities to neighbouring villages/households? do I know for certain now that 'control' households/villages will not join the project later or that I can document the time lapse and use them as 'staggered controls' (see below)?
- alternatives to control sites/villages/households :
  - identification and measurement of external factors which may explain changes in household variables (for key project indicators), in order to separate the effects of the project from the effects of other 'environmental' changes. Secondary data from key informants, government agencies or literature may provide this information,
  - differing combinations of interventions across sites (i.e. sites become the 'controls' for each other),
  - staggered interventions (i.e. status prior to each intervention becomes the control for previous interventions) or staggered recruitment to study – requires very detailed and regular M&E

- ***What is my sampling frame & how do I identify households to survey?***

- Once you have defined your sampling design (all the elements above) then the next stage is to identify the households to survey. These households are selected from your sampling frame (population of interest).
- The sampling frame contains all households who are members of your target population within the survey site; e.g. all households, livestock-owning households, smallholder dairy cattle owning households etc.

- Often we are unable to obtain a physical list of households because of logistical restraints (e.g. no money/time for full census) or because the information is just not available.
- Cluster sampling often makes it easier to obtain the physical list, i.e. if you are sampling villages within a site then you only need to obtain the list of target households from the sample villages. These often exist and can be obtained locally from key informants. If they do not exist, they can be constructed with input from key informants or from a village mapping. Care should always be taken, for example through triangulation of sources, to include that all members of the community are included in the roster.
- Alternative sampling in the absence of a physical list:

  Geographical sampling – e.g. GIS random sample of cells within a site, survey household in cell. Note though that there are certain biases associated with this type of sampling (e.g. households owning more land are more likely to get selected) but adjustments to the design can be used to minimize these (e.g. combine random point & random walk)

  Data collection – should say something about who is interviewed and how to handle gender disaggregated data collection, Could maybe go under what is now meta data?

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