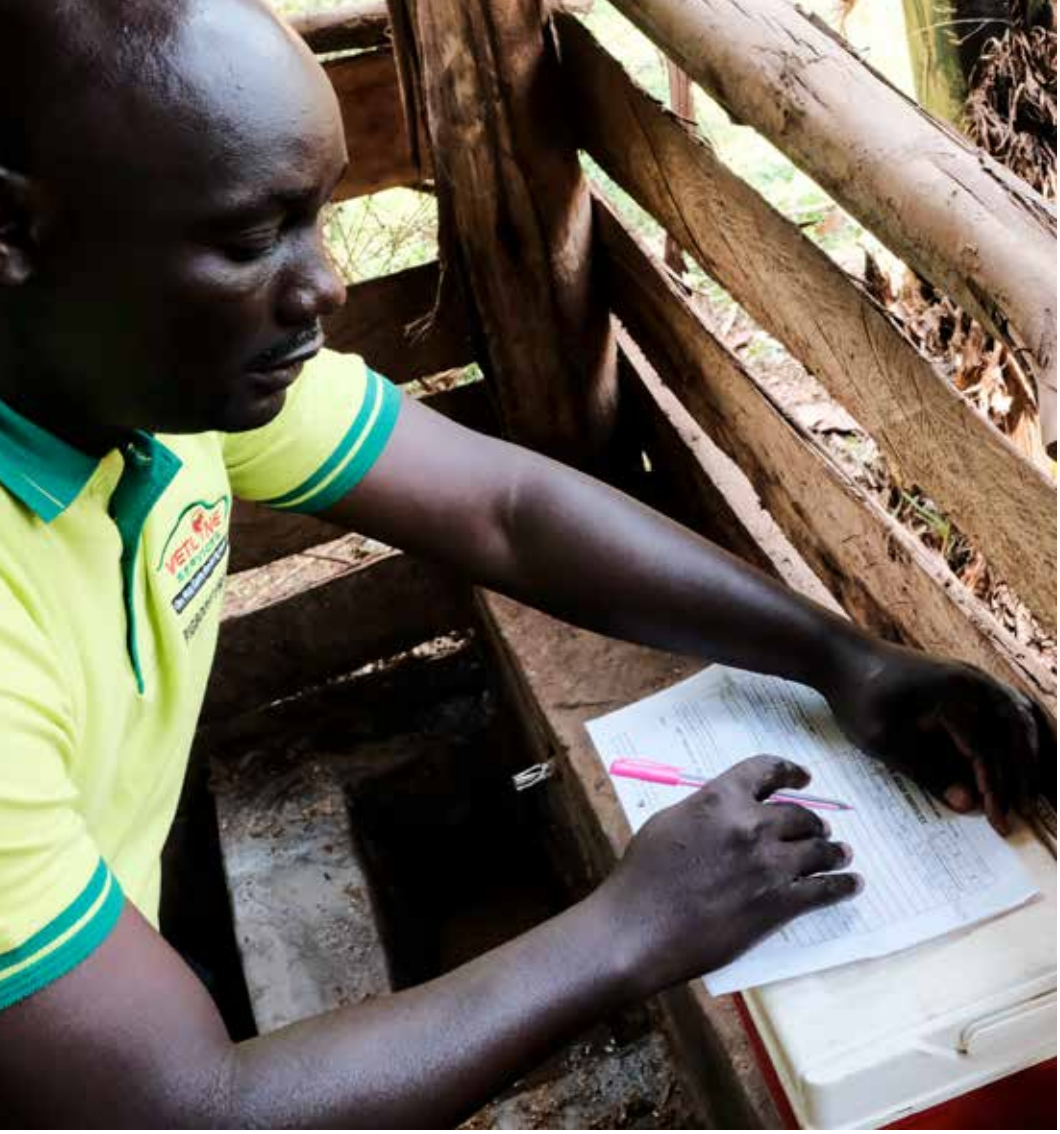

ILRI MANUAL

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Improved livestock system modelling and data capturing tools

Improved livestock system modelling and data capturing tools

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Acknowledgements

This work has been done in collaboration with partners from the International Livestock Research Institute (ILRI), the French Agricultural Research Centre for International Development (CIRAD) and the Food and Agriculture Organization of the United Nations (FAO) to more accurately capture livestock systems characteristics, crop-livestock interactions, and their evolution. It highlights key aspects of the work done by these partners on the multiple contributions of the livestock system at the household level, with a focus on its contribution in terms of vulnerability reduction.

This document constitutes a guideline for information technology (IT) specialists to implement the online version of the Option 2 (based on household survey) to conduct the assessment of the socio-economic contributions of the livestock activities at the household level in the Livestock Sector Investment and Policy Toolkit (LSIPT).

We acknowledge technical support and other valuable inputs provided by the CGIAR Research Program (CRP) on Livestock and all donors and organizations which globally support CGIAR research work through their contributions to the CGIAR Trust Fund.

Foreword

The Livestock Sector Investment and Policy Toolkit (LSIPT) that has been implemented and used in different countries (such as Ethiopia, Rwanda, Tanzania, Uzbekistan, and India [Bihar]) to develop livestock master plans (LMPs), is composed of a set of integrated and articulated tools. The tools assess the multiple functions and contributions of the livestock sector at different scales of the economy, from the livestock system to the national economy. The LSIPT toolkit is a 'household-centred approach' to livestock sector development that seeks to estimate the existing contribution and demonstrates the potential to increase the contribution of the livestock sector to poverty reduction and economic growth. In summary, the tool has been designed to assist members' countries in preparing an evidence-based Livestock Sector Strategy and Investment Plan aiming at promoting and increasing public and private investment in the livestock sector, including increasing the quality of the World Bank and other international financial institutions (IFI)'s investment in the sector.

Since 2017, the future development of the toolkit has been entrusted to a consortium comprising of the Food and Agricultural Organization of the United Nations (FAO), the World Bank, the French Agricultural Research Centre for International Development (CIRAD) and the International Livestock Research Institute (ILRI). Joint actions by the consortium members have already taken place. As such, a workshop was organized in Ethiopia to initiate the institutionalization of the LSIPT and the Global Livestock Environmental Assessment Model (GLEAM) within the Ministry of Agriculture of Ethiopia. At the request of the Government of Nepal, a joint project proposal was submitted for the development of a livestock master plan using LSIPT and GLEAM. More recently, the Government of Kenya has requested technical and financial support for the development of its LMP.

However, in order to help in further development of LSIPT as a support tool to implementation of LMPs, an initiation of the migration of the LSIPT onto a user-friendly web-based platform started during the last trimester of 2019 with a study of feasibility. A new phase started in January 2020 with three main objectives: (i) to implement a new LSIPT Analytical Model by translating the logic from the Excel-based system into a modern self-documented Analytical Model; (ii) to lay out the foundations for the advanced version of the LSIPT through a solid system architecture; and (iii) to launch the new application implementation process. The expected products by the end of this third phase are: (i) a new LSIPT Analytical Model capable of producing the same result analysis as the Excel version; and (ii) detailed user interface (UI) guidelines and mock-ups for the new LSIPT web system that will be discussed between key partners and users (e.g. the Animal Production and Genetics Unit (AGG) or Information Technology Division (CIO) at FAO, CIRAD and ILRI).

To implement the new LSIPT Analytical Model, it has been proposed to develop a narrative for each Excel tool that will serve to build the architecture of the new version. Under the Livestock Livelihoods and Agri-Food System Flagship of the CGIAR Research Program on livestock, our work aimed to review the narratives related to LSIPT pathways, livestock system characterization and typology, the approach of the technical and financial analysis of the livestock farming system and the narratives related to the assessment of the livestock's sector contribution to gross domestic product (GDP) and poverty analysis; with punctual supports on the links between Excel sheets to build the indicators.

Besides, we have developed the narrative of 'household poverty and vulnerability' in Option 2 of the LSIPT that aimed to assess the livestock contribution at the household level in terms of monetary viability, food security, employment and poverty reduction (presented here). This narrative has constituted the support for training the FAO-IT team in charge of the toolkit transfer and it will also constitute the basis for the users' guideline of the new online version.

1 Goal

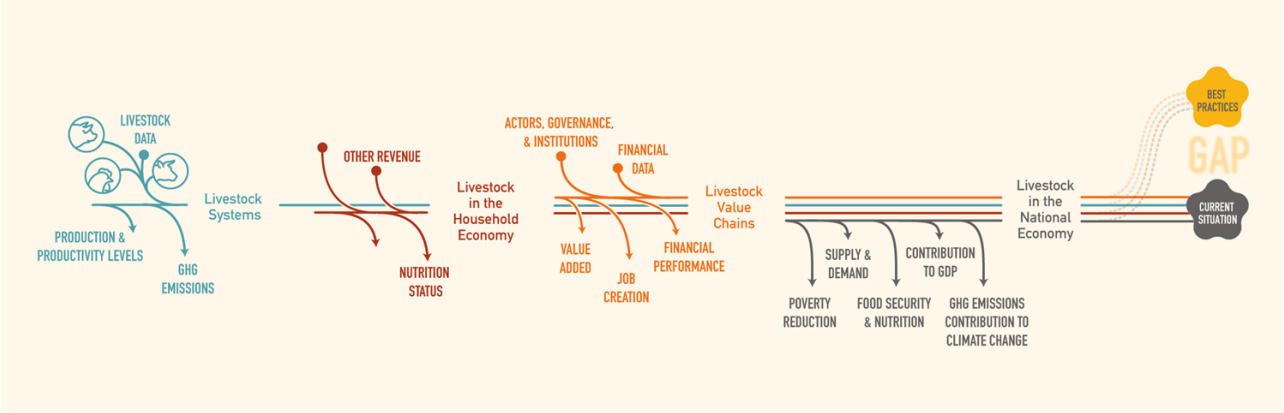
The majority of livestock farming systems in developing countries, especially in small and medium family farms, is composed of different animal species. For example, in pastoral or agro-pastoral farms it is frequent to find mixed sheep and goat flocks. In the rural zone, some family farms have some dairy cattle, with a small flock of sheep and goats, plus some hens or ducks. Generally, this complementary of income and food sources reduces the vulnerability faced from shocks. So, addressing the contribution of livestock to reduce vulnerability needs to consider the whole livestock system and its place with the other agricultural or non-agricultural activities.

The sub-module 'Household poverty and vulnerability' in the LSIPT toolkit seeks to describe the profiles of monetary poverty, food security, employment and inequality among the rural households involved in a livestock activity and to highlight the livestock contribution in reducing vulnerability and poverty.

In the end, this sub-module aims to identify the households that are in a precarious position within the different production systems (corresponding to agroecological zone).

This analysis at the household level intervenes between the livestock production system analysis and the overall contribution of the livestock sector at the national level (see Figure 1).

Figure 1. Operational framework of the LSIPT toolkit.



Source:Extracted from the training course, Bangkok, FAO-ILRI-CIRAD.

2 Background of the current version of the household sub-module in the Excel version

2.1 Conceptual approach

The economic and financial analysis of the different livestock production systems allowed assessment of the livestock net income per animal for the different animal species considered as dominant. Figure 2 represents the different entry parameters that have the deriving of a set of performance indicators of each of the livestock dominant systems.

Figure 2. Economic and financial approach of the livestock contribution at the production system.

<table>
<tr><th></th><th>General parameters</th><th>Inputs</th><th>Products</th><th>Investment cost and credit</th></tr>
<tr><td>Entry parameters</td><td>Herd composition
Family composition</td><td>Feeding systems
Veterinary costs
Labor (family & workers)
Purchased animals
Others costs (taxes, water charges, etc.)</td><td>Estimation of animal products by mode of valorization</td><td>% production and general costs covered by loans; interest rates</td></tr>
<tr><td rowspan="4">Exit parameters</td><td rowspan="4">Livestock capital
Family nutrient needs</td><td>Cost price</td><td>Total animal products</td><td>Working capital: short loan for cash or working capital requirement</td></tr>
<tr><td>Structure of production costs</td><td>Structure of products</td><td></td></tr>
<tr><td colspan="2">Gross Profit or Unit Margin</td><td>Livestock net income</td></tr>
<tr><td colspan="2">Rate of return: gross profit / cost price</td><td>Profit (net income / product)
Net income per animal unit</td></tr>
</table>

Source: Richard et al. (2019).

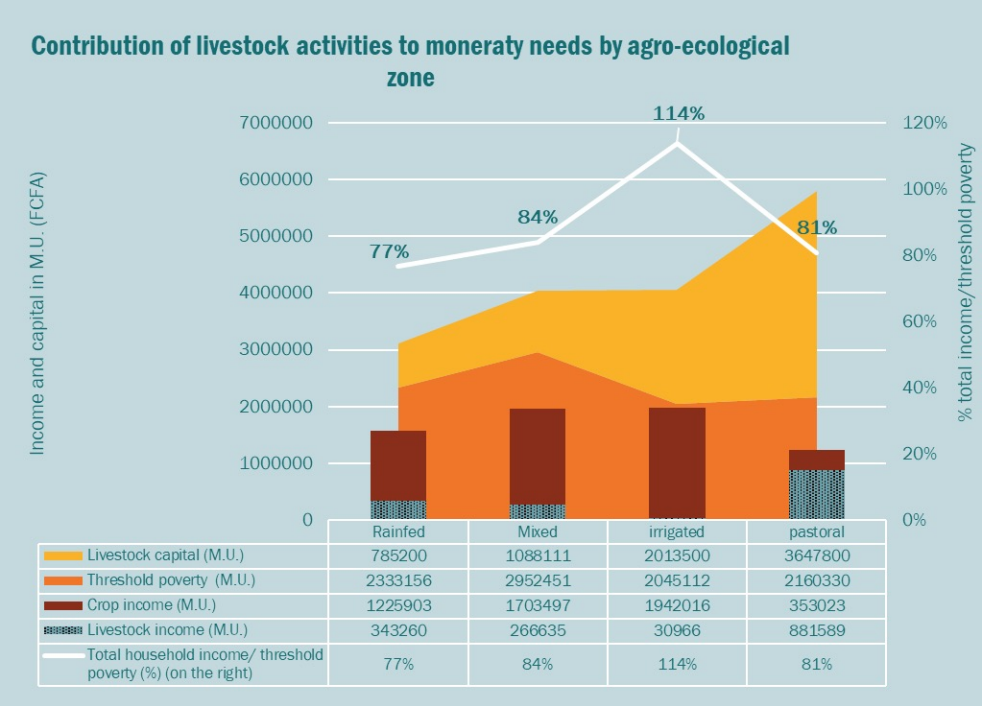
However, this economic assessment presents several biases when approaching the livestock contribution at the household level. Among them, we can cite: 1) the uunderestimation of the complementarity of animal species; 2) the emphasis on large herds and economic growth; and 3)we neglect the different roles of livestock in diversified system.

So, the objective of the household analysis was to understand the multiple functions of livestock farming at the household level to be able to propose a poverty reduction approach based on the complementarity of animal species at the household level.

Two main hypotheses have guided our approach (Alary et al. 2011):

1. Role of multi-activity (diversification) to the livelihood => needs to include all family activities.
2. Livestock as capital (security, saving) varies according to the agro-ecological areas.

Figure 3. Example of the multiple contribution of livestock activity at the household level based on the livelihood approach.



Source: Extracted from Alary et al. 2011.

So, we proposed to develop a multi-dimensional approach for assessing the several livestock contributions to household livelihood, including the multiple products and by-products generated by the livestock systems and their contribution in terms of saving, investment, net safety and solidarity through social exchanges.

2.2 Current LSIPT toolkit structure

The current LSIPT toolkit structure is accessible from: http://www.alive-lsiptoolkit.org (Username: alive; Password: toolkit). The specific tool at the household level are accessible here: Alive - Livestock Sector Investment and Policy Toolkit - A4-Household poverty and vulnerability (HHD) / SM1-LS performance & HH vulnerability / M3-Household level (alive-lsiptoolkit.org). The Excel file is named m3_sm1_a4_TOOL_household.xlsm.

The main objective in the design of the spreadsheets was to facilitate a rapid analysis of monetary, food and employment vulnerability at the household level.

In the toolkit, the vulnerability assessment at the household level was conducted through the following sheets:

- **The database at the household level inserted in the sheet 'Option_2a'** of the m3_sm1_a4_TOOL_ Household_[LG/MR/MI] file.
- Define the typology of the livestock production system **in the sheet 'Typo_LS' that will be imported in the** file 'm3_sm1_a1_TOOL_Synthesis'. From this typology, we can directly generate the LS models and conduct the technical and financial diagnostic at the livestock farming system level.

- Reconstituting household incomes and the home-consumption of animal products in the sheet 'Param_A3' from which the user can generate the various indicators related to monetary and food security vulnerability.
- Describe the different profiles of household according to the livestock contribution to household income ('typo_HHI'), the livestock orientation ('typo_HHD'), livestock asset (Assets_HH), or the combination of the livestock income*asset (Typo_HHD*I).
- **Key indicators are summarized** in the sheets 'V_financial', 'V_Food', 'V_work' and Poverty & Gini' for the different categories of households.

2.3 Prerequisites

The Option 2 toolkit is built on the basis of a household database that describes the main assets and sources of income of the household. Before starting with the Option 2, you must check:

1. Mandatory data for conducing the household vulnerability diagnostic are available in the household database that will be used and they are derived from primary data of the related survey.
2. The sample is representative of the diversity of households with livestock systems in the agro-ecological zone that is considered.

This methodological note concerns the analysis of the vulnerability of the households from the main production systems: grassland-based (LG), rain-fed (MR) and the irrigated (MI) (including village (backyard) pig and poultry systems). It has been built from the note: m3_sm1_a4_NOT_vulnerability_option2_EN.pdf (website of the LSIPT toolkit).

For households with specialized livestock production, the analysis of vulnerability is conducted using the tools m3_sm1_a2_TOOL_[Species].xls, from the sheets 'Diagnostic' and 'Impact Analysis'. Refer to the methodological note of Step 1].

3 Narrative on 'household poverty and vulnerability' in five steps

Step 1: Household database elaboration and import

Entry Household database in the sheet 'Option 2a' of the Excel file: 'm3_sm1_a4_TOOL_household_[LG/MR/MI].xls' with [LG/MR/MI] the short name of the agro-ecological region (MI, MR, LG) defined in the studied areas (for example, at a national level) (see Step1 for that).

Each line corresponds to one household.

The Excel sheets are structured in 2 sets of data:

1. 'Mandatory date' that needs to be informed to analyse vulnerability at the household level.
2. 'Supplemental data' that can be used for defining the entry parameters in the livestock farming system (m3_sm1_a2_TOOL_[Species].xls). Sheet 'Diagnostic'

The mandatory data includes

- Number of heads by animal species (including cattle, sheep, goats, camels, hens, sows, donkeys equines and others).
- Structure of herd by age of cattle in number (according to previously determined age groups) (for calves, bullocks, bull, heifer calves, heifers, cows, total).
- Mobility cattle? (1=yes, 0=no)
- Total cultivated area, agricultural income
- Household size, number of children, active labour, % farm labour in cropping, % labour in livestock production, % off-farm labour, % female labour (livestock), % child labour (livestock), Number of months of external labour employed in the household, % of external labour employed in a livestock production unit.
- Off-farm income, off-farm income linked to livestock (like live animal trader).

The supplemental data

General data on the household and crop system

- Percentage area food crops, cereal production, income from food crops, income from cash crops, % sale of cereal production, % sale of food crop.

- The average level of education per person in the household.

Data related to a livestock production system that can be used to define the entry parameters in the integrated tool which is proposed to simulate the bio-economic performances of livestock - ECORUM, model (Import in Data_A3 in the file m3_sm1_a1_TOOL_Synthesis) includes:

- Number of heads by animal species
- Cattle herd structure: age of males at culling, age of females at culling
- Number of draught animals
- Herd mobility characteristics: mobility sheep (Y/N), mobility goat (Y/N), mobility camel (Y/N),
- Type of valuation of exploited animals: [cattle/sheep/goat/camels/pigs/poultry]
    - Animals home-consumed (number/year)
    - Direct sales money (number/year)
    - Direct sales barter + gifts(number/year)
    - Sales through intermediaries (number/year)
    - Animals purchased
- Type of valuation of milking: [cattle/sheep/goat/camels]
    - Milk home-consumption (%)
    - Direct sales to consumers in money (%)
    - Direct sales to consumers barter (%)
    - Selling through intermediaries (%)
    - Milk given as compensation for the wage of the shepherd (%)
- What is the number of animals fed/fattened for cattle, sheep, pigs
- Other functions of livestock: [cattle/sheep/goat/camels/pigs/poultry/donkeys/horses/other]
    - Draught/transport operation (%) [ONLY cattle)
    - Draught/transport (exchanged) (%) [ONLY cattle)
    - Manure used on the farm (%)
    - Manure exchanged in barter (%)
    - Manure exchanged (monetary) (%)
    - Other function (specify)
- For cattle, what use is made of manure and animal traction
    - Manure spread (% cultivated area)
    - Manure sold (kg/year)
    - Traction: days/year total
- Sources of fodder resources (FR) and other feed costs: [cattle/sheep/goat/camels]
    - R grazed/collected (%)

    - FR cultivated (%)
    - FR purchased (%)
    - Verification total equal to 100%
    - Annual expenditure on food (FR excluded)
    - Annual expenditure on supplements (vitamins, etc.)
- Other feed costs: [poultry, pigs]
    - Annual expenditure on food (FR excluded)
    - Annual expenditure on supplements (vitamins, etc.)
- Other livestock production costs: [cattle/sheep/goat/camels/pigs/poultry]
    - Veterinary care and drugs fees (amount/year)
    - Costs for access to pastures (amount/year)
    - Fees for access to water (amount/year)
    - Other costs (amount/year)

Step 2: Define the typology of a livestock production system

In Option 2, the typology of a livestock production system is defined from the household database (Option_2a) by considering the distribution of flock size for each animal species.

This typology will be used to estimate the technical and financial performance of the livestock production systems (as described in Step 1).

Distribution of flock size for each animal species

From the household database, we can calculate by animal species (see Tables B4 to D9 in the sheet 'Typo_LS'):

- The total number of animals
- The number of households with this animal species

Based on the herd composition per animal species in the household survey (Sheet 'Option_2a') and the total number of animals (calculated above), we can get the distribution of each animal species by herd size.

Choice of herd size classes

By default, the toolkit proposes a typology based on tercile to define the categories of herd size for each animal species. The user can modify the categories of herd size in columns I and J (sheet 'Typo_LS').

The tool gives an overview of the categories ('Final choice') with the minimum and maximum of the herd size and the average by class in columns M and O.

A summary table is proposed for each animal species and each class named [small/medium/large] giving:

- Number of herds (in the total household sample)
- % of each [small/medium/Large] categories for each animal species (herd distribution)
- Average herd size in each category [small/medium/Large]
- Representativeness by species based on % of animals in each [small/medium/Large] categories for each animal species (animal distribution)

Import the typology in the file synthesis

At this stage, the user needs to import the typology in the sheet 'data_A1_opt2' of the file Synthesis.

Automatically, the cell in grey (col M and N in the sheet 'data_A1_opt2') will be filled based on the table described in 2.1 (above).

The user can generate the files

- for ruminant LS: 'm3_sm1_a2_TOOL_ruminants_[LS]'
- and for monogastric: 'm3_sm1_a2_TOOL_[chicken/pig]_[LS]'

Before moving to Step 3 (in the present document), the user needs to fill each LS model (***or ECORUM Excel file).***

For that, the user has two paths to complete the ECORUM models.

1. No supplemental data regarding the livestock management as described in 2.1. (above): then the user needs to follow the pathways described in Option 1;
2. Full data in the household database with the supplemental data: in this case, the user can use these data to define some technical or economic parameters in ECORUM.

In 2), from the database [Option_2a], the user can define some financial parameters of livestock farming systems for RUMINANTS LS (excluding fattening systems) and then export these data into files m3_sm1_a2_TOOL_ ruminant[CODE].xlsm / diagnosis. At this time there is no automatic calculation and transfer of these parameters…(It will be considered in the NEW VERSION)

When the user finalizes the technical, financial and economic diagnostic for each LS, they can return to the file 'm3_sm1_a4_TOOL_household_[LG/MR/MI].xls' to complete the diagnosis (Step 3 and 4) at the household level.

Step 3: Reconstituting household incomes and the home-consumption of animal products (sheet 'Param_A3')

Preamble

For conducting any financial or nutritional analysis at the household level, we need to reconstitute the household income and the nutritional contribution of animal products for each household in each main agro-ecological zone (LG, MR, MI).

In the case of option 2,

- the incomes are estimated at the household level based on the family farm activities defined in a household survey (sheet 'Option_2a') and technical coefficients from the file 'm3_sm1_a1_TOOL_synthesis.xls'.
- the nutritional contributions of animal products are estimated at the household level based on the herd composition and % of home consumption defined in a household survey (sheet 'Option_2a') and technical coefficients from the file 'm3_sm1_a1_TOOL_synthesis.xls'.

Entry/import parameters

First, the user must import the general parameters from the file m3_sm1_a1_TOOL_synthesis.xls into the sheet 'Param_A3' (in grey on the sheet) related to:

- Coefficient TLU per animal species [from sheet 'Data_A2' in 'Synthesis']
- Currency [from sheet 'Data_A4_Opt2' in 'Synthesis']
- The poverty line [from sheet 'Data_A4_Opt2' in 'Synthesis'] is based on the absolute monetary poverty threshold (per capita) determined from the minimum expenditure to ensure an acceptable standard of living.
- Nutritional contribution of animal species [in calories and protein for meat, milk, and egg]. [from sheet 'Data_A4_Opt2' in 'Synthesis']
- If Option 2b: the income per ha for each crop [from sheet 'Data_A4_Opt2' in 'Synthesis']

For specialized systems or other animal species, the user must enter manually/directly the parameters in the sheet 'Param_A3' (white boxes).

Second, the user imports the intermediary data related to the financial performance or nutritional intake of the LS models synthesized in the sheet 'Output_A3' of the file 'Synthesis'. These data result from the financial and economic analysis of the livestock farming system (see LS model in Option 1) and are given for each animal species and livestock production system and in the two situations (Actual and Improved situation):

- The net financial income and the cash-flow (treasury) generated per animal
- The average annual production per animal for meat [kg], milk [l] or eggs [numbers])
- Nutritional value of the average annual production of an animal (in calories and proteins)
- The ability of an animal to cover the annual needs of an adult in calories and proteins for meat and protein for eggs and milk
- % home-consumption (for meat, milk and eggs)

Main outputs

Output 1: Calculation of 'total income' at the household level

Based on the parameters in 'Param_A3' and the activities in 'Option_2a', the household incomes are automatically calculated in the sheet 'database_without' for the 'current situation' and in 'database_with' in the 'Improved situation'. The user does not have to do anything in these files.

The household income is the sum of:

- Income from livestock production: sum of the income per animal species estimated from the number of heads of livestock owned by the household (entry data in Option_2a) multiplied by the average income generated per animal head in the livestock production system (LS), average income estimated in M3-SM1-A3 (Import in Param_A3).

- Agricultural incomes:
  - In Option 2a: the 'agricultural incomes' is already given in the database (sheet 'Option_2a'). No action.
  - In Option 2b: the agricultural incomes are calculated from the primary data. The cropland allocation (the number of cultivated hectares with cereal crops, other subsistence crops, cash crops, market gardening) (in 'Option 2a') is multiplied by the average income per ha (filled in the sheet data_A4_opt2 in file Synthesis]. In this case, the parameter 'Average income/ha' is imported in Param_A3. Then the 'Agricultural income' results from the cultivated area (Option_A2) by the average income/ha for each category of crops (Param_A3).
- Off-farm incomes: income from services, craft or salaried activities or transfers received (income from migration). 'Off-farm income' is directly derived from the household data and constitutes mandatory entry data.

Output 2: Calculation of nutritional contribution from animal products in household requirement

From:

- Default values for caloric and protein intakes of livestock products (meat, milk, eggs) for each animal species are proposed in the sheet 'data_A4_opt2' (file 'Synthesis') that have been imported in Param_A3. The user can modify these default values in the sheet 'data_A4_opt2' (file 'Synthesis').
- The daily nutritional requirements in protein and calories for an adult or a child are also default values given in the sheet 'data_A4_opt2' (file 'Synthesis').

We can estimate the average calorie and protein contributions provided by one animal head per year and for a given livestock production system (columns K and L in sheet Param_A3).

From:

- The percentage of animal products used by the household for home consumption (col R and S in the sheet 'Param_A3' coming from the sheet 'data_A3' in 'Synthesis':

We will be able to estimate the nutritional contribution of animal products in the full-nutritional requirement at the household level for the food security approach (see below 'V_food').

NB. Households' individual home consumption is calculated automatically in the sheet 'database_without' for the current situation and in 'database_with' in the Improved situation (as a function of the change in the level of production per livestock system resulting from an intervention). The user does not have to do anything in these files.

Step 4. Define the 'household' typologies (four brown sheets)

Once the household income has been reconstituted, the user obtains automatically the relative contribution made by the livestock production activity to the household economy and the income contribution made by each animal species to the household income.

This will be the basis for the following typologies, respectively **'Household typology 'sources of income' (HHI)' and 'Household typology 'dominant livestock production' [HHD/HHS]'**

(i) Household typology 'sources of income' (HHI)

A preliminary typology for households, which is proposed in the sheet 'typo_HHI', consists of crossing the household's level of income (three levels [poor/medium/rich]) with the relative contribution from sources of income (livestock production, agriculture, off-farm, mixed).

This typology is built in two steps:

1. Determining the income categories: the households are classified by default, according to income terciles (33.3% of households with the lowest incomes 'Poor', 33.3% of households with intermediary incomes 'Medium' and 33.3% of households with the highest incomes 'Rich'). Nonetheless, the user can modify these categories by choosing a different percentage of households represented per category in the table of income partitioning (cells D13 to D15].
2. Determining the categories of activity: the households are then classified according to their main activity, which is determined in the model as follows:
    - 'Livestock producer': if the income from livestock production constitutes over 50% of total income.
    - 'Cultivator': if the income from agriculture (crop system) represents over 50% of total income.
    - 'Off-farm activities': if the off-farm income represents over 50% of total income.
    - 'Mixed': if none of the activities is dominant.

In the HHI typology, the user gets a rapid description of each household category based on:

- Representativity of the system:
    - Number of households
    - % households
- The average number of heads for [ruminant TLU, cattle, sheep, goats, camels, poultry, swine]
- Active members of the household
    - Income per capita
    - Hectares cultivated depending on the main activity and the level of income
    - Non-agricultural income
    - Household size
    - Number of working people
    - The average level of education

(ii) Household typology 'dominant livestock production' (HHD and HHS)

In the sheet 'typo_HHD', the households are categorized according to the species of the animal reared and, in particular, the dominant species.

Two modes of 'dominance' can be envisaged:

- Relative dominance (**HHD**): here, by dominant species, we mean the species that contribute the most to the household income derived from livestock production. Thus, the households are classified according to the dominant species and the dominant species' herd size. **This typology will be chosen by default for the rest of the analysis in M3 and M4**. In other words, it provides the basis from which an intervention can be envisaged (in relation to the dominant species). However, it is important to remember that in some cases, the numbers of animals of one species can largely be apportioned between households for which this species is not a dominant one, rather than between households for which it is dominant (often the case for village chickens).
- Absolute dominance (**HHS)**: here, by dominant species, we mean the species that contribute more than 50% to the household income from livestock production. The households are thus classified per household with:

- A single species (income from livestock production derived from a single species of animal).
- A dominant species (income derived from livestock production for which over 50% comes from one particular species).
- A mixed herd (income derived from livestock production that comes from several species, none of which is dominant).

In the HHD and HHS typology, the user gets a rapid description of each category based on:

- Representativity of the system:
  - Number of households
  - % households
- Average number of heads for [ruminant TLU, cattle, sheep, goats, camels, poultry, swine]
- Average size of herds [small/medium/large]
- Herd representativity in the system (and the other system for dominant livestock production systems)
- Active members of the household
  - Income per capita
  - Hectares cultivated depending on the main activity and the level of income
  - Non-agricultural income
  - Household size
  - Number of working people
  - Average level of education

Results visualization

The main results are presented in the sheets 'Assets_HH' and typo_HHd*I' for the characterization of the household categories and in the sheets 'V_financial', 'V_food', 'V_Work' and 'Poverty & Gini' for the vulnerability assessment.

Characterization of the households' assets (sheet 'Assets_HH')

The analysis of poverty in terms of assets helps identify the households that are structurally vulnerable.

The sheet 'Assets_HH' shows the profiles of households according to:

1. the main assets (based on 'Ruminant TLU', 'Off-farm' income, 'Household size' and 'Number of working people'), and
2. the livestock assets, by focusing on the ruminants (cattle, sheep and goat) for the households studied and this according to the different typologies (HHI and HHD/S) and level of monetary poverty considering the households with low incomes 'Poor', medium incomes 'Medium' and high incomes 'Rich'.

This classification makes it possible to determine how the herd structure varies, in particular, as a function of the income groups.

Crossing typologies (sheet 'typo_HHD&I')

The sheet 'typo_HHD&I' crosses the two typologies: HHD and HHI, as well as HHS and HHI.

Thus, the tables and diagrams can help to identify which households, with which dominant livestock production systems, are the poorest or have incomes that depend mainly on livestock production.

Indicators of financial vulnerability (sheet 'V_financial')

This stage aims to identify if and how livestock production helps secure monetary resources and capacities.

The financial vulnerability of a household is generally estimated by comparing the total household income (agricultural and non-agricultural activities) to the poverty threshold. This generic indicator of household poverty is available in the sheet 'poverty&GINI' (see below).

To estimate livestock's contribution to poverty alleviation, three indicators are provided in the sheet 'V_financial' and given by HHI and by HHD:

1. 'Income from livestock/total income' or livestock production's contribution to total household income. This indicator is essential for determining whether the household is poor as a 'livestock producer' (livestock production is the main activity) or whether livestock production is a secondary activity and thus a means of diversifying activities. This reduces the risks inherent with a single production system and reduces dependence on the seasonal cycle of agricultural harvests.
2. 'Income from livestock/poverty line' or the difference (negative or positive) between household income from livestock production and the poverty threshold. This indicator should be analysed simultaneously with the indicators of the household's poverty.
3. ' % livestock production cash flow' or livestock production's contribution to the household' cash flow. In rural economies, where subsistence farming is the main activity, livestock production represents the main (indeed sometimes the only) source of monetary income. This indicator can be used to determine how the provision of cash works for households.

Vulnerability in relation to nutritional security (sheet 'V_food')

This stage aims to identify how the home consumption of animal products by households with a livestock production activity contributes to covering the nutritional requirements of members of the household.

The notion of nutritional requirements refers to the basic nutrients to ensure biological functions. For simplicity, the contributions from two nutritional elements, calories and protein, are considered. Requirements are estimated on the basis of the daily requirements for adults and children in the household.

The contributions are estimated on the basis of the animal products used for home consumption (meat, milk, eggs) and the nutritional value of these products (in the sheet 'Param_A3').

The estimated coverage as a percentage of household requirements is calculated in the two household typologies HHI and HHD, as well as in terms of the animal products that come from the dominant livestock production system or the household's entire animal production.

The main output indicators are:

- The total contribution of livestock activity in the household nutritional requirement in calories and protein.

- The total contribution of each animal species in the household nutritional requirement for calories and protein.

Other quantitative indicators for evaluating food insecurity are proposed in the vulnerability approach of Option 1 as the livestock production activity's contribution to household cereal security, for example.

Livestock production as an employment-generating activity (sheet 'V_work')

The livestock production activity creates a wide range of jobs and, thus, helps generate resources for numerous unqualified or landless stakeholders. By identifying the workforce involved in each production system and their volume of activity, we can determine the total volume of activity generated in the number of person-months per year and per livestock production system.

In the sheet 'V_work' of the 'household' file, the volume of family and salaried activity generated by the households that own livestock is estimated in person-months per year.

These indicators are aggregated by household types [HHI and HHD] given:

- % household labour [for agriculture/off-farm/livestock production]
- % household labour/livestock production (women %, children %]
- External labour (pers/month/year) ['total' household and for 'livestock production']

Employment generated by livestock production per household (pers/month/year) [total/men/women/children/external]

Indicators of poverty and inequality (sheet 'Poverty&GINI')

The last sheet 'Poverty & Gini' proposes key indicators of poverty and inequality that can be used to draft a full report of the link between the livestock production activity and poverty at the national level (M4-SM1-A4).

Three indicators of poverty for the different household categories (HHI, HHD, HHS) are calculated:

- 'Incidence' of poverty: percentage of households living below the poverty line.
- 'Depth' of poverty: the average difference between the incomes of poor households and the poverty threshold.
- 'Distribution of the poor': calculates the percentage of poor people from each household category for each typology given as a function of the incidence of poverty and the representativity of household categories.

These indicators allow targeting the households that are the most vulnerable related to monetary poverty according to two criteria: the households with the highest incidence of poverty or those with the greatest number of poor people.

The GINI coefficient is an indicator that is frequently used to characterize the income distribution within a given population. It is calculated using the Lorenz curve (the cumulative share of income as a function of the cumulative share of the population). The GINI coefficient is between 0 (which corresponds to perfect equality, the previous curve is on the right) and 1 (which corresponds to maximum inequality).

The indicator GINI is calculated as followed:

1. GINI_max: sum (% cumulated income * weigh in the population (decile=0.1)) (Z7 to Z16)
2. GINi_min: sum (%cumulated income * weigh in the population (decile=0.1)) (Z8 to Z16)
3. GINI_mean: (Ginimax+Ginimin)/2

4. Final 'GINI Coefficient'=2 * (0.5-Gini_mean)

Step 5. Final results

The main results of this activity (M3-SM1-A4) are imported in the file 'm3_sm1_a1_TOOL_synthesis.xlsm', **sheet 'output_A4'**. Click on the 'Import' button to transfer the results from the three 'Household' tools and the 'specialized_LS' tools.

This sheet gives an overview of poverty based on:

- Monetary vulnerability
    - At household level: 'Poverty incidence (% poor households)';' Total net income of household per capita'
    - In relation to the dominant farming system with the 'Net income from livestock system/total net income', 'Net income from livestock farming system/household poverty', 'Number of animals needed to reach the poverty threshold';
    - In relation to all animal productions: 'Net income from livestock production/household total net income', 'Net income from livestock production/poverty line';
- Food security – coverage of household requirements
    - By the dominant LS: in calories (%), in protein (%);
    - By all livestock: in calories (%), in protein (%);
- Employment generated by livestock production: 'Family employment (pers/month/year)'; 'Salaried employment (pers/month/ year)'.

4 To go further

The current LSIPT toolkit structure is accessible from: http://www.alive-lsiptoolkit.org (Username: alive; Password: toolkit). The specific tool at the household level is accessible here: Alive - Livestock Sector Investment and Policy Toolkit - A4-Household poverty and vulnerability (HHD) / SM1-LS performance & HH vulnerability / M3-Household level (alive-lsiptoolkit.org). The Excel file is named m3_sm1_a4_TOOL_household.xlsm with supplemental documents.

The overall vulnerability of households is determined in relation to an analytical grid, which also includes vulnerability in relation to social capital, access to resources, access to social services, access to technical services, access to the main marketing sectors and, lastly, vulnerability in relation to climatic and economic crises. For these additional indicators, we propose to refer to a supplementary methodological note: m3_sm1_a4_NOTC_vulnerability_nonQindicators_EN.pdf (on the website).

5 References

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For further reading

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