Pro-Poor
Livestock
Policy
Initiative

Methods for the Assessment of Livestock Development Interventions in Smallholder Livestock Systems

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A Living from Livestock

PPLPI Working Paper No. 4

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ABBREVIATIONS

BCR	Benefit Cost Ratio
CSF	Classical swine fever
FAO	Food and Agriculture Organisation of the United Nations
FMD	Foot and mouth disease
GM	Gross Margin
ILRI	International Livestock Research Institute
IRR	Internal Rate of Return
KSh	Kenyan Shillings
NPV	Net Present Value
PASACH	Programa de Apoyo al Sector Agropecuaria en Chuquisaca
Rupees	Indian Rupees (at the time of the study US$ = 30 Rs.)
RVC	Royal Veterinary College
VEERU	Veterinary Epidemiology and Economics Research Unit

PREFACE

This is the fourth of a series of "Working Papers". The purpose of this series is to present information being generated from the Pro-Poor Livestock Policy Initiative*.

The livestock sector plays a vital role in the economies of many developing countries. It provides food, or more specifically animal protein in human diets, income, employment and possibly foreign exchange. For low income producers, livestock also serve as a store of wealth, provide draught power and organic fertilizer for crop production and a means of transport. Consumption of livestock and livestock products in the developing countries, though starting from a low base, is growing rapidly.

The current document presents a framework for the prioritisation of livestock development interventions using a mixture of participatory methodologies and quantitative analysis. Parts of the methodology have been applied to field situations in Bolivia, Kenya and India and the results from these analyses are presented. The methodology presented is flexible, with some components still requiring refinement and further work. Therefore, groups working on various components of the general prioritisation methodology have been identified and their strengths and weaknesses discussed. It is recommended that the methodology be applied in different situations in order to develop a database of prioritisation information.

It is hoped that the paper stimulates discussion and any feedback would be gratefully received by the author and the Livestock Information, and Policy Branch (AGAL) of the Animal Production and Health Division of the Food and Agriculture Organization (FAO).

Disclaimer

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Keywords

Livestock, animal, production, health, interventions, prioritisation, modelling, households, Bolivia, Kenya, India.

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* For more information visit the PPLPI Website at: http://www.fao.org/ag/againfo/projects/en/pplpi/home.html
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EXECUTIVE SUMMARY

This working document presents a framework to assess livestock disease impact at household and local economy levels. The aim of this framework is to help decision and policy makers in their selection of poverty focussed livestock interventions and try to protect them from strong non-objective political voices. Three key issues were identified that need to be implemented and/or strengthened in current systems:

- A systematic process for compiling and storing data on livestock, crop and household activities;
- A structure for user friendly and transparent analysis;
- Output that provides disaggregated information on the impact of changes in the livestock sector.

The users of the framework and its outputs are expected to be:

- **Assessment practitioners** – consultants who have to evaluate interventions and are users of the methodology;
- **Finance providers** – multi and bi-lateral donors and possibly NGOs. These are users of the output;
- **Finance recipients** – governments receiving aid, communities receiving support. These are also users of the output.

This paper is divided into the following chapters:

- Chapter 1 Introduction.
- Chapter 2 describes a conceptual framework for assessing the impact of livestock interventions at household and local level.
- Chapter 3 explains the "look and see" component of the proposed method. A worked example, using data from the southern region of Chuquisaca, Bolivia, illustrates how the method can be applied in practice.
- Chapter 4 provides in-depth analysis of the household and local economy modelling component. Examples of application are based on smallholder dairy producers in southern India and highland Kenya.
- Chapter 5 Conclusions and Recommendations.

Conceptual framework

The proposed conceptual framework for the assessment of livestock interventions involves three steps:

1. Rapid assessment or "look and see" to identify potential interventions and select interventions for further analysis. This analysis draws on secondary data sources and primary data.
2. More rigorous assessment of selected interventions using household and local economy models to determine the impact of an intervention.
3. Implementation of a selected intervention with monitoring that provides data to refine household and local economy models. These should produce results that are useful for future policy making.

All steps have a data and information capture component to provide a source of data and information for future assessments. Once a sufficient body of data and information is generated it is expected that steps 1 and 2 will begin to merge.

"Look and see"

The "look and see" method is based on participatory and scientific data collection, and analysis of primary data with secondary data. The identified livestock problems are assessed using a matrix that contains a mixture of qualitative and quantitative information on socio-economic aspects of livestock keeping and the impact of the problems. The latter uses the livelihoods approach. Problems selected using the first matrix are then analysed in a second matrix that examines the potential for success of intervention alternatives to solve the problems.

Classification, household and local economy modelling

For the more in depth analysis of livestock in the household and local economies there is a need to use modelling methods and systems of classification. This Working Paper proposes that, where possible, existing classification systems are used to direct primary and secondary data collection on household activities. Data can then be used to develop representative household models for each system that has been identified. The results from the household model can be combined with information on the number of households in each system in order to examine economic issues at local and regional levels. This could include, for example, the impact on employment and on market prices of livestock inputs and outputs.

The results of the household model provide important insights into livestock technologies and their impact at household level. It is believed that the data requirements for such modelling processes could be significantly reduced with access to secondary data or expert opinions. The aim would be that the analysis of household and local economies would become an integral part of the "look and see" methodology. The constraints to this goal are identified as being: access to reliable secondary data; and a model structure that is user friendly.

Groups working on different aspects of the conceptual framework

The groups working on different aspects of the framework are divided into five distinct areas:

1. Groups that are working on methods of assessing the socio-economics of livestock diseases.
2. Groups that are investigating the role of livestock in the livelihoods of smallholder producers.
3. Groups that are investigating the use of local or regional economy models.
4. Institutions with the capacity to manage a database system that can receive, store and provide access of secondary data.
5. Institutions working on bringing information together in a mapping format.

Points 1 to 4 are directly related to the further development of the conceptual framework. Point 5 is related to the need to present analysis in a format that is attractive and easily understood by policy makers.

Recommendations

In order to turn the conceptual framework into a workable model, the following actions are recommended:

1. The matrices described for the "look and see" assessment should be presented to potential users and refined according to their reactions.

2. Key institutions, groups or individuals should be identified to further develop different aspects of the conceptual framework.
3. Existing household and local economy models should be selected for further development and refinement.
4. A database structure should be developed on the basis of the data requirements of the models selected. This structure should be able to receive and allow access to data through the Internet.
5. Important output from the household and local economy models should be determined through consultation with potential users.
6. Key data are identified from the household model that can then be combined with the classification of smallholder livestock systems for use in the local economy model.
7. A user-friendly front-end structure for the household and local economy models is developed for data entry. The basic model should be "collapsible" and flexible, allowing it to be used either in a very simple manner, where data and time are lacking, or in a more complex way where resources are sufficient for further data collection and analysis.
8. A user friendly output screen structure is developed that can be downloaded electronically or as a hard copy.
9. Sites for testing the model should be selected in consultation with potential users.
10. The methods should be refined through further testing.
11. Training of users of the methodology and in the output produced.

It is anticipated that the time frame for the development of the methodology to a point where a database is accessible through the Internet and a flexible and user-friendly model structure is available for field use would be between two to three years. Therefore, it is a project of medium term impact, but the advantage is that it will generate tools that can provide a basis for informed policy decision-making. Hence the methodology will help to protect policy makers from making decisions under pressure from strong non-objective political voices.

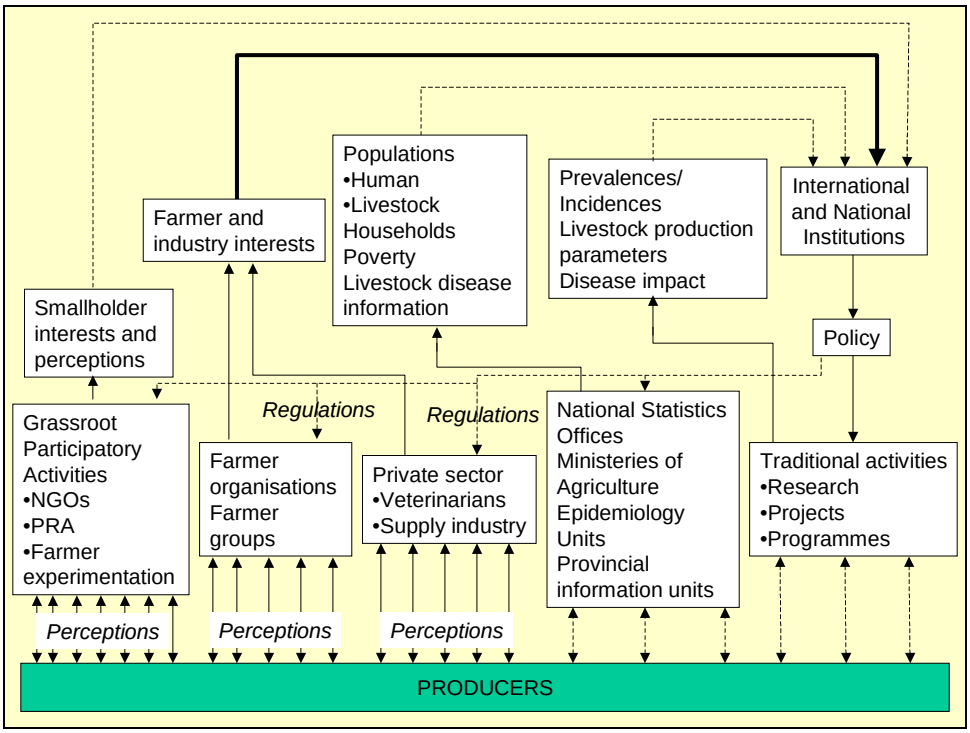
INTRODUCTION

Currently available enterprise and farm household analysis methods have limited application in assessing the impact of livestock interventions in smallholder farming systems. The simple methods are restricted to financial summaries and provide insufficient flexibility for examining changes. The more complex analysis structures require highly skilled analysts, both for construction and interpretation. A gap exists between these simple and complex methods of analysis. There is need for a flexible structure that can effectively model on-farm resource flows and produce an output that is accessible to people interested in assessing the impact of livestock interventions. The results from such analysis can then be scaled up to local economy models to provide information on the impact of interventions for policy and decision makers. These higher-level decision makers are influenced by data and information providers and specialist advisers. However within many countries the following problems exist:

- Lack of information and data or the data that exists is not easily accessible;
- Lack of knowledge in how to use models and hence poor analysis; and
- Lack of accountability. Assessments are not usually required from those applying for money nor is any pressure put on people who receive funds to justify how they have been spent.

This situation leads to a degree of ignorance at the decision-making level that allows interest groups with a strong political voice to have power in influencing policy. It also means that decision makers are not protected from feeling they have to react to pressure groups. However, as recent FMD outbreaks and control programmes have found, bad technical work usually means bad policy**.** Figure 1 provides a summary of the processes that lead to livestock policy decision making, with only certain groups having a political voice and a lack of analysis before reaching decisions.

Figure 1: *Data collection, analysis and policy making in a traditional system.*



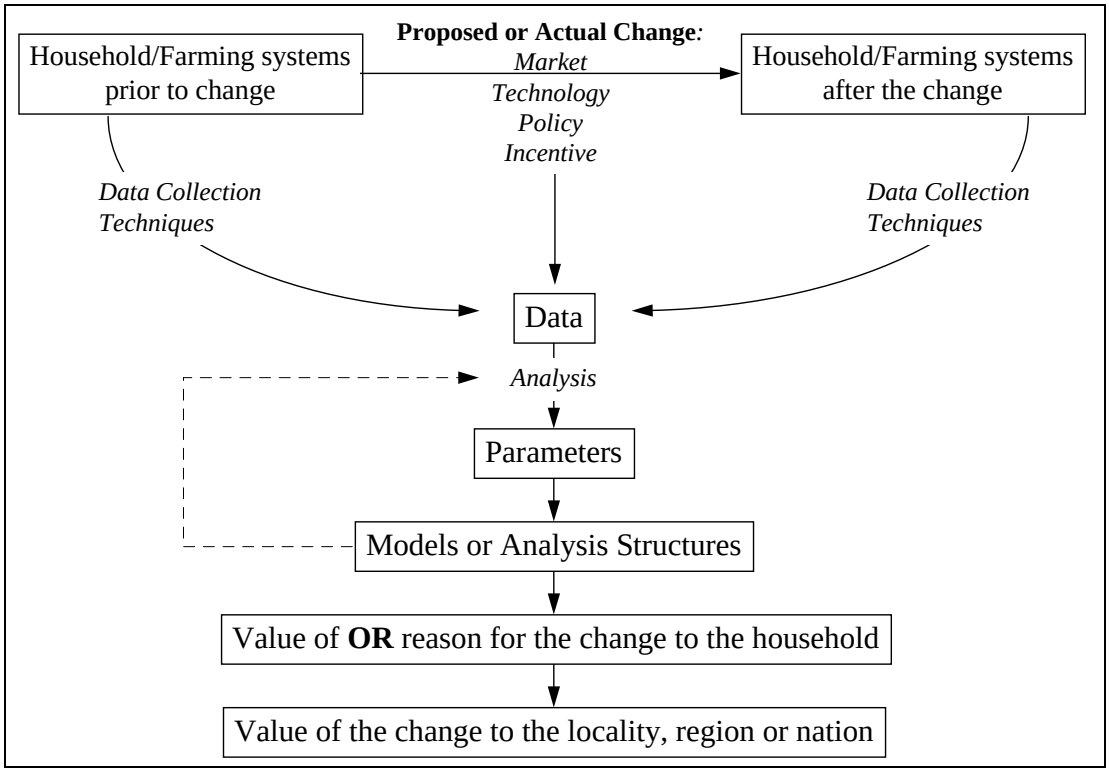
The goal of the working paper is to present a framework which can be used to assess a) the impact of livestock constraints and b) interventions to alleviate these constraints at household and local economy levels. The objective is to fill the current gap in assessment methodology.

Three key issues are identified that need to be implemented and/or strengthened in current systems:

- A systematic process for storing data on livestock, crop and household activities;
- A structure for user friendly and transparent analysis; and
- Output that provides disaggregated information on the impact of changes in the livestock sector.

Figure 2 provides an overview of how these different aspects could be used in assessing the impact of a change.

Figure 2: *Farming system change and subsequent analysis (from Rushton, 1996).*



CONCEPTUAL FRAMEWORK FOR ASSESSING LIVESTOCK INTERVENTIONS

Introduction

Before starting the process of developing the framework the following question had to be considered. What will make people use it? If it were a prerequisite in a funding application, this would be an obvious incentive. This is the stick. The carrot has to be that the methods are relatively flexible, easily understood and action rather than research oriented. People often say that it is not possible to examine impact in detail at the household level. This is because data are not available, or it cannot be analysed because the analysis structure would be too complicated. This is a catch 22 situation where there are inadequate resources for data collection or for data analysis. Here there is a great need for a data bank and also an analysis structure that produces quick "look and see" analyses. These points were kept strongly in mind when developing the framework and considering data storage and policy influence.

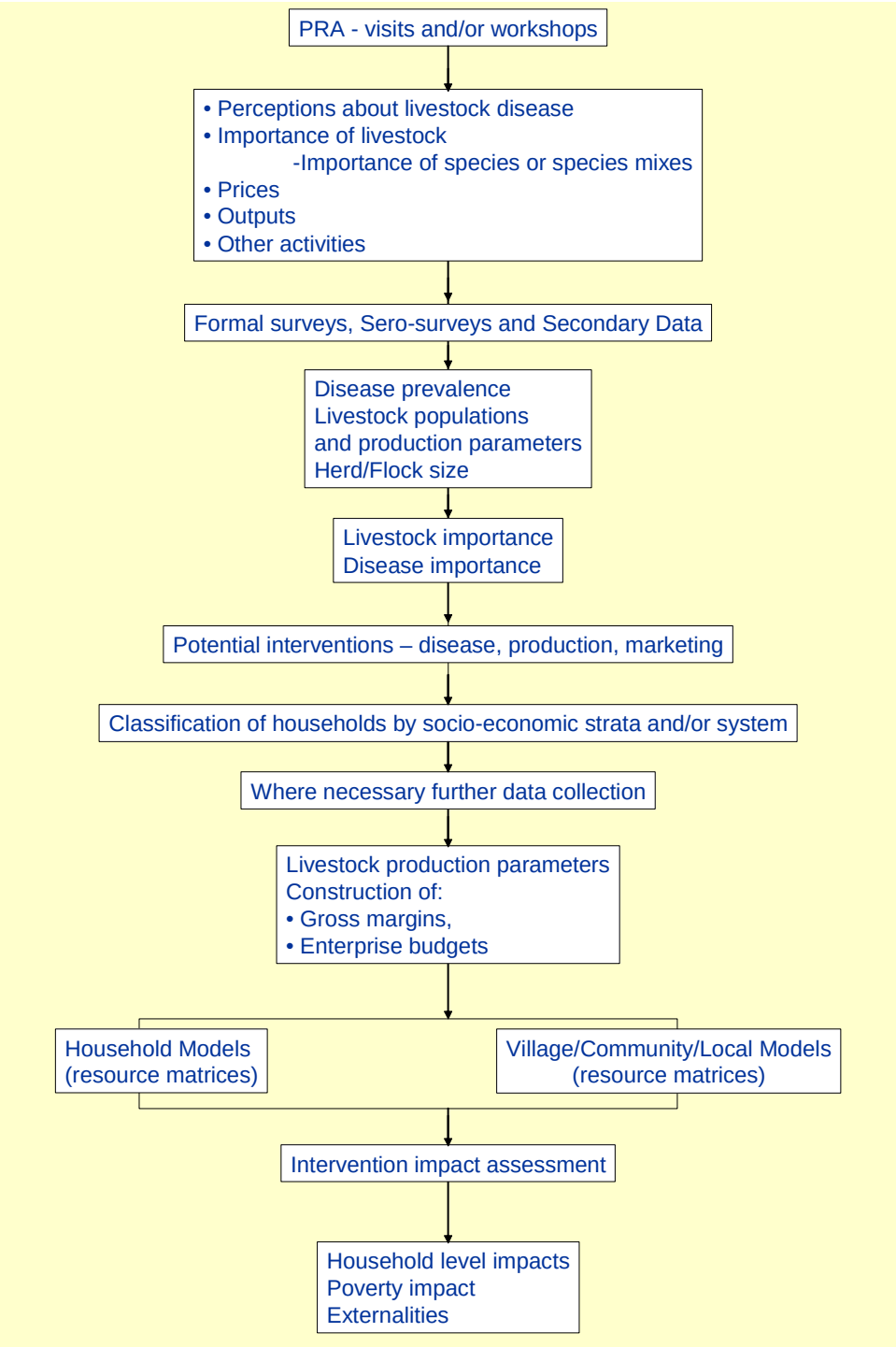
Assessment framework

The assessment framework contains a series of steps:

1. A "look and see" mixture of PRA, formal and sero-survey methods and secondary data analysis to:
   a. provide an overview of livestock development issues;
   b. eliminate obvious non-starters; and
   c. identify interventions that deserve further analysis.
2. Classification of smallholder livestock systems
   a. by system and then by other socio-economic determinant.
3. Where necessary further data collection
4. Analysis of livestock and **other activities**
5. Analysis of household and local economy issues using resource matrices
6. Presentation of results in matrices which contain quantitative and qualitative data

This process is presented in Figure 3 and the following chapters provide more information on "look and see" methods, the classification of smallholder livestock systems, household and local modelling issues.

Figure 3: *Process of arriving at an impact assessment for a livestock intervention.*



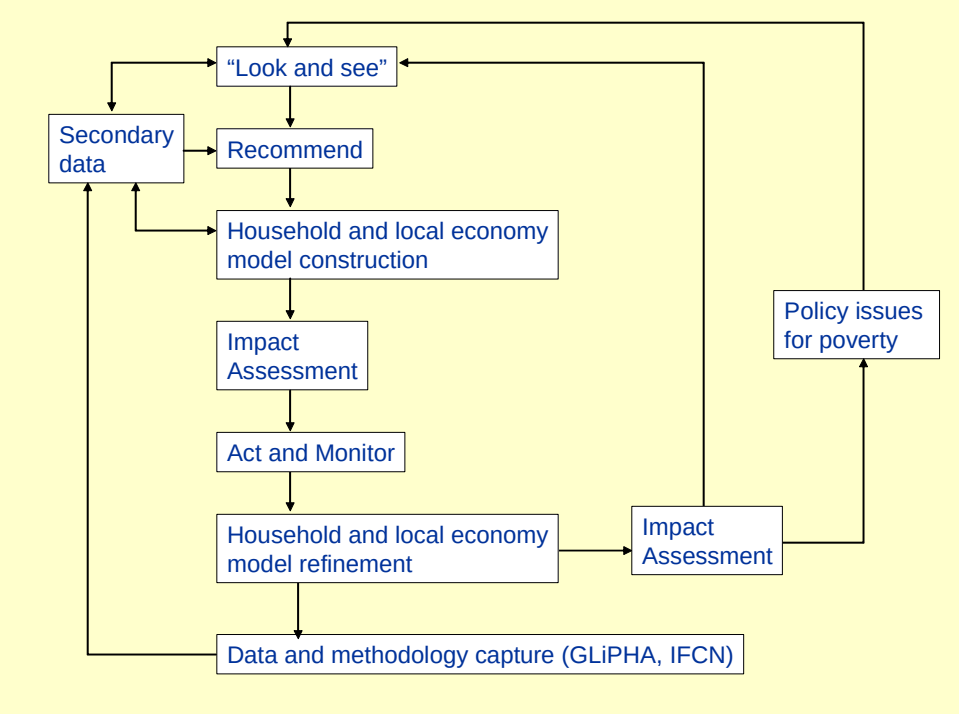
Data storage and policy influence

Figure 3 provides no information on how the data gathered in the impact assessment may be used in the future nor how the assessment itself could influence policy. During the assessment process and the implementation of selected interventions there is a need for structured data collection and storage. During the implementation, refinement of household and local economy models will help in targeting the intervention to poverty reduction goals. The creation of data and information through this process provides a database for future assessments and also helps direct policy to areas that need further intervention assessments.

Figure 4 shows how:

- secondary data should be used in assessments;
- the data and information generated in an assessment feeds back into the secondary data bank; and
- the information generated will help to direct policies that have an impact on the poor.

Figure 4: *Data storage processes with the impact assessment framework and its influence on policy issues that affect poverty.*



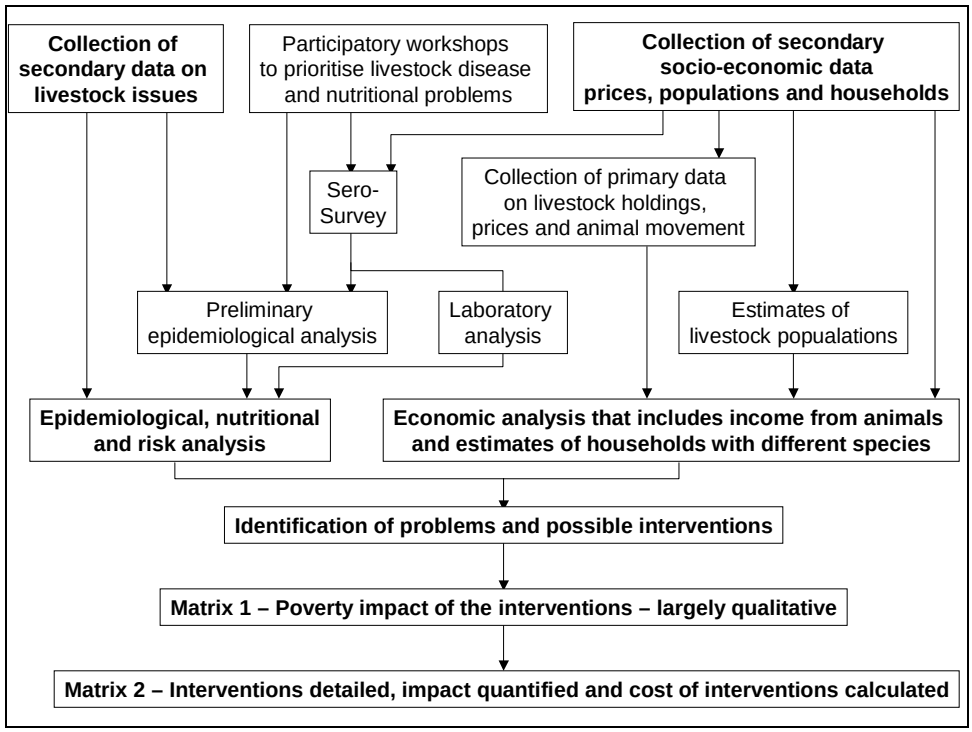
CASE STUDY OF THE USE OF THE "LOOK AND SEE" AND HOUSEHOLD IMPACT ASSESSMENT

Introduction

The next two sections provide more specific details of what is needed for the "look and see" assessments and the household and local economy models. The "look and see" methodology has been developed in Bolivia over the last three years (Rushton *et al* 2001a, 2001b and 2001c and Rushton 2002) in attempts to improve the focussing of resources for the control of livestock diseases. A study in the Department of Chuquisaca had a more wide ranging objective in that it covered all species in the zone of investigation and including problems and interventions from nutrition to animal health (Rushton *et al*, 2001c). The working document presents the methodology developed in Bolivia but, in addition, presents an impact assessment of problems and their possible interventions in the form of two matrices.

A summary of the methodology is presented in Figure 5. The boxes shown in bold are considered to be necessary for the analysis, but may be supplemented with the other activities where data are missing.

Figure 5: *Summary of the "look and see" methodology.*



The following sections detail the analysis of the livestock sector from the study in the Cintis of Chuquisaca with the additional matrices.

"Look and see" – Livestock sector analysis in the Cintis, Chuquisaca, Bolivia

The provinces of Nor and Sud Cinti are two of the poorest in Bolivia. The region has an agricultural development project, PASACH, funded by the Prefecture of Chuquisaca and DANIDA. This project tenders consultancies for the development of the agricultural sector in the Cintis. In early 2001 it put out a tender for a study on animal health and nutritional constraints in the livestock sector.

In hindsight, it is believed that the study could have been improved if it had widened its approach from being one solely concerned with identifying problems to one that was focussed also on opportunities and interests of the livestock sector. The following presents results of that study in terms of animal health, nutrition and the socio-economics of livestock keeping in the region and shows how 'look and see' works in practice.

Livestock disease prioritisation

Livestock prioritisation was carried out using a mixture of participatory and scientific methods and also combining secondary data and direct observations to determine animal movements. The methodology for disease prioritisation in participatory workshops is detailed in Rushton (2002), the full details of the sero-survey work are found in the final reports on the study (Rushton *et al*, 2001c). The summary of the workshop is found in Table 1, of the sero-survey in Table 2 and of a qualitative disease risk assessment in Table 3.

Table 1: *Diseases identified as being important during participatory workshops held in the Cintis, Chuquisaca, Bolivia (Rushton et al, 2001c).*

Species	Province	
	North Cinti	South Cinti
Cattle	FMD, rabies and external parasites	FMD, rabies, blackleg, external parasites, blood parasites
Sheep	Fever, moquera (often a symptom of maggots in the nose), muyu muyu (Cenurosis), external parasites	External parasites, muyu muyu (Cenurosis), moquera (often a symptom of maggots in the nose)
Goats	Abortion, moquera (often a symptom of maggots in the nose), fever	External parasites, muyu muyu (Cenurosis), internal parasites
Pigs	Niwa (parasite that buries itself under the skin, found in the feet and nose), vampire bites, external parasites, cysticercosis, classical swine fever	External parasites, cysticercosis, classical swine fever, niwa (parasite that buries itself under the skin, found in the feet and nose)

Table 2: *Sero-survey results for blood samples (percent positives) taken in the Cintis, Chuquisaca, Bolivia (Rushton et al., 2001c).*

Disease	Municipality					
	Las Carreras	Villa Abecia	Culpina	Camargo	Incahuasi	San Lucas
No. Families	**28**	**39**	**42**	**52**	**74**	**106**
No. Cattle samples	**26**	**26**	**83**	**42**	**102**	**122**
FMD	0%	0%	0%	0%	0%	0%
Bovine brucellosis	0%	0%	0%	0%	0%	0%
Blood parasites	0%	30%	40%	22%	0%	9%
IBR	0%	20%	23%	0%	11%	2%
No. Sheep samples	**43**	**57**	**50**	**78**	**50**	**148**
Ovine brucellosis	0%	0%	0%	0%	0%	0%
No. Goat samples	**45**	**48**	**70**	**77**	**73**	**130**
Caprine brucellosis	0%	0%	0%	0%	0%	0%
No. Pig samples	**50**	**51**	**82**	**37**	**102**	**52**
Cysticercosis	27%	75%	36%	72%	79%	100%
CSF	0%	2%	30%	3%	11%	8%

Using the information from the disease survey and workshops, and combining it with informally collected information on livestock movement, a qualitative risk assessment for different diseases was carried out (Table 3). The differences between the sero-survey results and the risk assessment are related to animal movement. Therefore exotic diseases such as FMD and blood parasites are considered to be of a higher risk in areas that regularly receive animals from the outside.

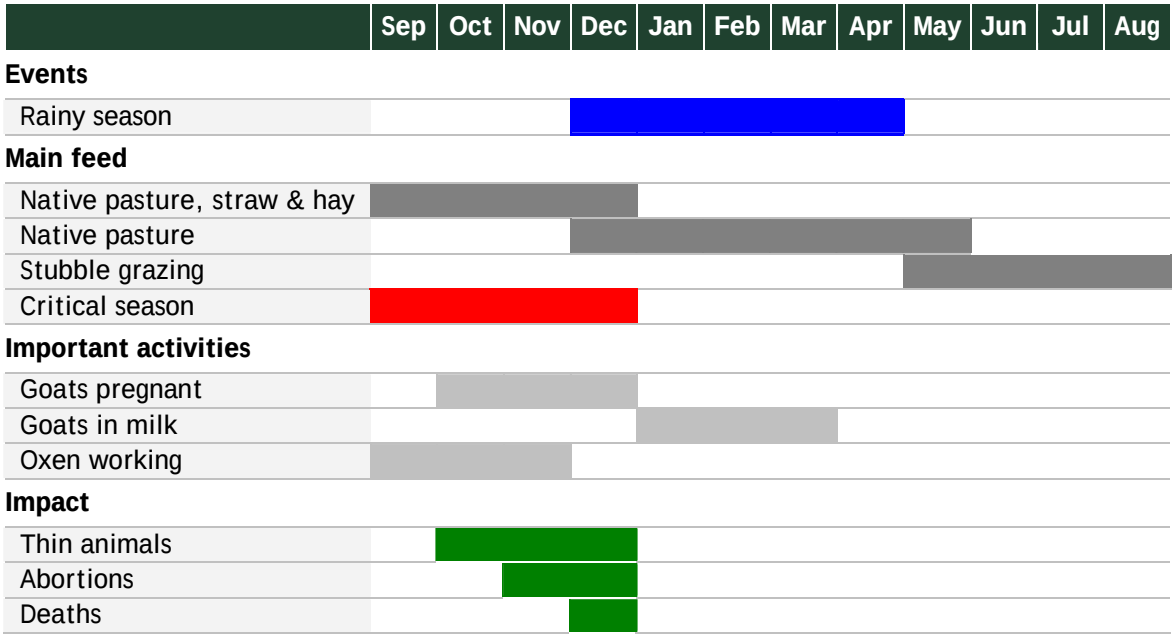
Table 3: *Qualitative livestock disease risk assessment in the Cintis, Chuquisaca, Bolivia (Rushton et al. 2001c).*

Disease	Province					
	South Cinti			North Cinti		
	Las Carreras	Villa Abecia	Culpina	Camargo	Incahuasi	San Lucas
FMD	Low	Low	High	High	High	High
Blood parasites	Low	Low	High	High	High	High
IBR	Low	Low	Medium	Low	Low	Low
Bovine brucellosis	Low	Low	Low	Low	Low	Low
Small ruminant brucellosis	Low	Low	Low	Low	Low	Low
Cysticercosis	Low	High	Medium	High	High	High
CSF	Low	Low	High	Low	Medium	Medium

Analysis of the nutritional problems of ruminants

The study collected information on animal feeding systems in the participatory workshops and during the sero-survey. The summary of the information collected on the critical issues is presented in Figure 6.

Figure 6: *Feeding systems and activities for ruminants in the Cintis, Chuquisaca, Bolivia (Rushton et al., 2001c).*



Analysis of the socio-economic importance of livestock

To place the problems into the context of the study area, estimates were made of the livestock population using data collected during the sero-survey. The new estimates were necessary as it was over 20 years since a census had been carried out. The population estimates and information collected on production parameters and prices of livestock output were combined to determine the value of livestock output in each municipality. Table 4 presents the structure of these estimates and the results for the Municipality of San Lucas.

Table 4: *Structure used to estimate the value of output from the different livestock species in the Municipality of San Lucas North Cinti, Chuquisaca, Bolivia (Rushton, et el. 2001).*

	Population	Offtake	Unit	Production	Value (Bs.)		Value		Income Person	% of Rural Income
		Rate	Weight	Kgs. or units	Per unit	Total	US$	%		
Cattle (population estimation CEVEP, 2001)										
Beef	27,355	10%	164	448,622	7	3,140,353	468,709	11.22	15	5.23
Hides	27,355	10%	1	2,735	30	82,065	12,249	0.29	0	0.14
Milk	5,471	50%	400	1,094,200	1	1,094,200	163,313	3.91	5	1.82
Draught power	2,735	100%	50	136,775	20	2,735,499	408,283	9.77	13	4.55
Total cattle						7,052,117	1,052,555	25.19	33	11.73
Poultry (Population based on each household having 5 birds)										
Backyard poultry										
Meat	48,220	300%	1.5	216,990	15	3,254,850	485,799	11.63	15	5.42
Total poultry						3,254,850	485,799	11.63	15	5.42
Sheep (Population estimation CEVEP, 2001)										
Meat	187,542	35%	15	984,598	6.5	6,399,886	955,207	22.86	30	10.65
Hides	187,542	35%	1	65,640	5	328,199	48,985	1.17	2	0.55
Wool	187,542	50%	1	93,771	3	281,314	41,987	1.00	1	0.47
Manure	187,542	100%	109.5	20,535,897	0.1	2,053,590	306,506	7.34	10	3.42
Total sheep						9,062,988	1,352,685	32.37	43	15.08
Goats (Population estimation CEVEP, 2001)										
Meat	96,531	50%	17	820,513	6.5	5,333,337	796,020	19.05	25	8.87
Hides	96,531	50%	1	48,265	5	241,327	36,019	0.86	1	0.40
Milk	19,306	50%	15	144,796	1	144,796	21,611	0.52	1	0.24
Manure	96,531	100%	109.5	10,570,142	0.1	1,057,014	157,763	3.78	5	1.76
Total goats						6,776,475	1,011,414	24.21	32	11.28
Pig (Population estimation CEVEP, 2001)										
Meat	14,671	45%	40	264,073	7	1,848,509	275,897	6.60	9	3.08
Total pigs						1,848,509	275,897	6.60	9	3.08
Total						27,994,940	4,178,349	100.00	131	46.58

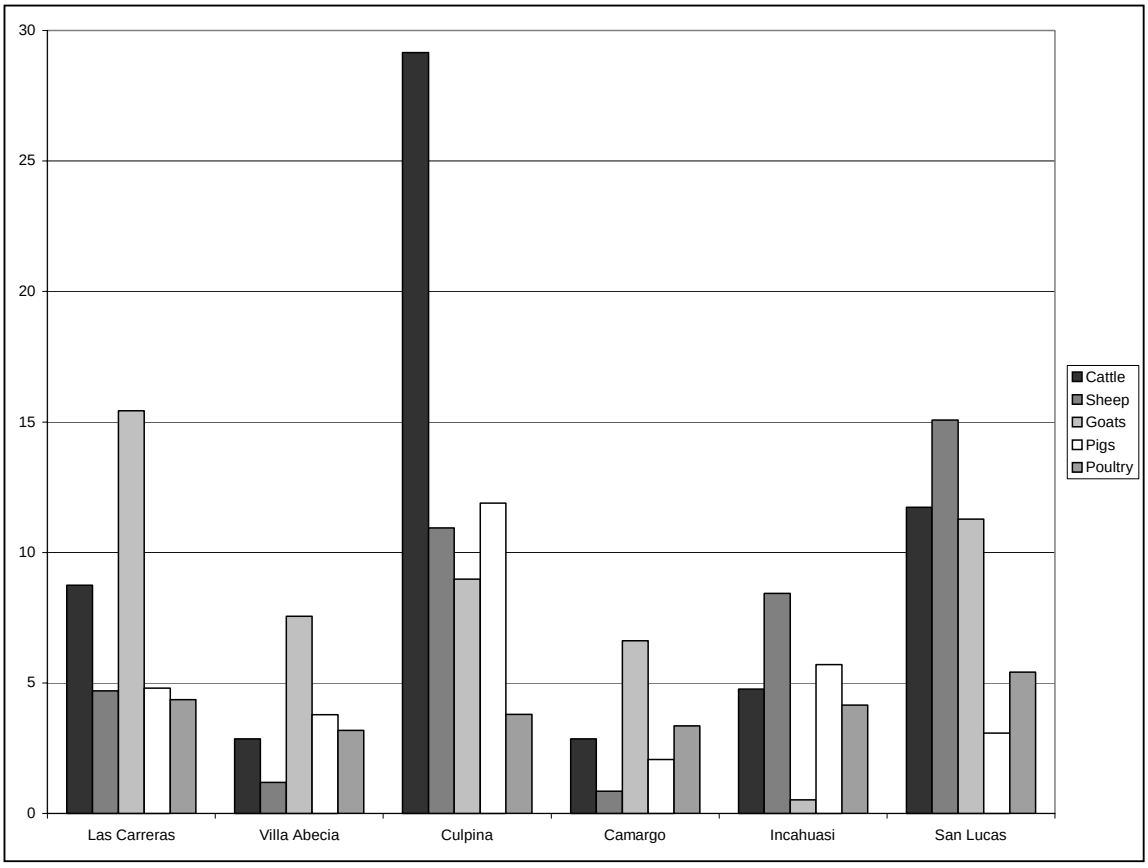
Estimated monetary values of output were combined with estimates of per capita income from a UNDP study in the early 1990s (UDAPSO-PNUD, 1997) to provide some indication of the importance of livestock in the different zones of the Cintis and also to indicate the importance of individual species. In addition, estimates were made on the importance of different species according to the percentage of households that keep them and the level of income they generate.

A summary of this socio-economic analysis is presented in Table 5 and Figure 7.

Table 5: *Summary of the socio-economic analysis of livestock in the region using secondary data and data generated during participatory workshops.*

Province	Estimation of the percentage of income from animals per household	Importance of the species by the percentage of households that keep these animals	Importance of the species by income generated by the animals per household
South Cinti			
Las Carreras	38	Pigs, sheep and goats	Goats, cattle and sheep
Villa Abecia	19	Pigs, sheep and cattle	Goats, cattle and pigs
Culpina	65	Pigs, sheep and cattle	Cattle, goats and sheep/pigs
North Cinti			
Camargo	16	Pigs, sheep and goats	Goats, cattle and pigs
Incahuasi	25	Pigs, sheep and cattle	Sheep, pigs and cattle
San Lucas	47	Sheep, cattle and pigs	Goats, sheep and cattle

Figure 7: *Estimation of the proportion of rural income from different species in the Cintis, Chuquisaca, Bolivia (Rushton, et al, 2001).*



Important problems or issues identified during the "look and see" process

On the basis of the analysis presented above various issues were identified as important.

Cattle

FMD and blood parasites (babesiosis and anaplasmosis) were identified as diseases exotic to the area occasionally brought in by cattle movement. This is a movement control and farmer education problem. Another disease agent, IBR virus, was found to be present in the zone and given the type of systems in the area it probably causes reproductive rather than respiratory problems. However, the impact of this disease is likely to be minimal. Finally cattle are not an asset of poor households, and impact assessment would have to concentrate on multiplier effects to justify interventions.

Small ruminants

Internal and external parasites were identified as being an important problem and faecal analysis confirmed that intestinal parasite burdens were high (see Annex 1). It is noted that the control of intestinal parasite problems is often complex and returns are very often marginal in communally grazed areas that are the common grazing system in the Cintis. In goats, abortions were identified as one of the main problems. The sero-survey found that brucellosis is not the cause of the problem, but the nutritional analysis indicates that it may be associated with nutritional stress during the most important breeding season. Inbreeding might also be a cause for abortions. It

is noted that poorer households keep sheep and goats, and that goats are a primary activity in those households. Within households it is children, young girls and old women who generally look after small ruminants.

Pigs

During workshops participants identified signs that are associated with classical swine fever (CSF) and this was confirmed with the sero-survey. It is a disease that is highly contagious and increases the risks of pig keeping as an outbreak causes high levels of mortality. The workshops also identified cysticercosis as an important problem and again this was confirmed with the sero-survey results. This disease has no production impact, but lowers the price of meat containing cysts of the parasite and therefore has an important economic impact. Cysticercosis also has important human health impacts causing taenia infections and with these infections introduces the risk of neuro-cysticercosis in humans. Pigs are important in the zone because a large percentage of households keep them and pig keeping is an activity normally carried out by women. Pigs are also a useful method for raising cash at critical times of the year to pay for school fees, emergencies and inputs for cropping activities. However, the socio-economic analysis indicates that pig keeping is a secondary or tertiary household activity.

Structured semi-quantitative assessment

To facilitate the assessment of the problems identified during the study two matrices were developed that summarised the information. The first matrix was designed to help identify poverty-focussed interventions and eliminate interventions that were not applicable. This matrix included the following information:

- Socio-economic analysis
  - Percentage of families with these animals
  - Average herd or flock size
  - Estimation of income from the animals per year
  - Estimation of the capital investment in the animals per household
  - Gender issues (who looks after the animals, who controls the management, who gains from the sale of animals and products)
- Interventions
  - Details of the intervention
  - Availability of technology to implement a change
  - Level of the intervention (farm, regional or national)
- An overall qualitative judgement of the direct poverty impact of an intervention on the livestock keeping families is made with a possible range of No, Possibly, Probably and Yes). For example cattle problems were classified as not having direct poverty impact because families keeping this species cannot be considered to be poor.
- Where a problem has been identified as having a direct poverty impact a more in depth analysis has been developed based on the livelihoods analysis framework, which includes:
  - Livelihood assets
    - Financial
    - Human
    - Natural
    - Physical
    - Social

- Livelihood outcomes
  - Income
  - Vulnerability

The impact assessment is qualitative for each factor and with a range of 'No', 'Possibly', 'Probably' and 'Yes'.

- Finally a section has been added to capture the potential impact of an intervention outside livestock keeping families. These have been named "**Externalities**". Initially an overall assessment is made, again with a range of 'No', 'Possibly', 'Probably' and 'Yes'.
- For interventions that are considered to have an impact outside the livestock keeping households a further analysis is made that includes:
  - Employment (where an intervention may be a factor in stimulating employment in the processing or servicing industries of the livestock sector),
  - Market Prices (where an intervention may improve the supply of a livestock product and lower prices in urban centres) and
  - Human Health (where an intervention may improve the safety of eating livestock products and reduce human health problems in families that are not livestock keepers).

Again this is a qualitative judgement with a range of 'No', 'Possibly', 'Probably' and 'Yes'.

The second matrix was designed to examine specific interventions in more detail and includes the following information:

- Specific intervention
  - Previous experience
  - Costs of implementation
- Losses due to the problem
  - Estimated total losses in the area affected
  - Losses as a percentage of income from the animals
  - Losses as a percentage of per capita income in the area
  - Percentage of household affected
- Other impacts – human health, trade barriers, consumer welfare
- Negative impact – environmental, internal household conflicts, nutritional issues
- Poverty focus – a qualitative judge from low, medium to high
- Potential for success - a qualitative judge from low, medium to high
- Focus of the intervention – development oriented, research/development focussed or research focussed

A worked example of the matrix is shown in Table 6 with information from the study in the Cintis. It is noted that the qualitative judgements have been completed by the author and could be improved using participatory workshops with producers, technical and development staff in the zone. From Table 6 pig problems were identified as being of potential interest and a worked example of these problems is presented in Table 7. Again the author has completed the qualitative components and it is recognised that their accuracy would be improved with wider consultation. A second matrix should also be developed for sheep and goat interventions as these species are of importance in terms of poverty and also have a more important economic role than pigs.

Table 6: *Summary of the analysis of problems and their impact in the communities of the Cintis, Chuquisaca, Bolivia.*

	Cattle		Sheep	Goats			Pigs	
Socio-economic analysis								
% families with these animals	37% (13 to 44)		40% (21 to 52)	22% (6 to 36)			42% (25 to 64)	
Average herd size	10 (3 to 25)		39 (11 to 46)	40 (20 to 83)			8 (4 to 17)	
Estimated income (US$/yr)	365 (131 to 962)		278 (60 to 335)	411 (105 to 872)			146 (72 to 324)	
Capital investment (US$)	1165 (409 to 3000)		308 (67 to 372)	398 (200 to 832)			47 (23 to 103)	
Gender issues	Male dominated		Young girls and old women look after the animals	Young girls and old women look after the animals			Woman related activity	
Interventions								
Potential interventions	FMD control and eradication	Blood Parasite control	Internal and external parasite control	Internal and external parasite control	Abortion control	Cheese marketing	CSF control and eradication	Cysticercosis control
Proven technology available	Yes	Yes	Yes	Yes	Possibly	Possibly	Yes	Possibly
Level of intervention								
Farm	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Community	-	-	Yes	Yes	Possibly	Possibly	Yes	Yes
Regional	Yes	Yes	No	No	No	No	Yes	No
Direct poverty impact	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Livelihood assets								
Financial capital	-	-	Possibly	Possibly	Yes	No	No	No
Human Capital (nutrition, health)	-	-	Possibly	Possibly	Possibly	Possibly	No	Possibly
Natural Capital	-	-	Possibly	Possibly	Possibly	Possibly	No	No
Physical Capital	-	-	Possibly	Possibly	Possibly	No	No	No
Social Capital	-	-	Yes	Yes	Possibly	Possibly	Yes	Yes
Livelihood outcomes								
Income	-	-	Possibly	Possibly	Yes	Yes	Possibly	Yes
Vulnerability (risk)	-	-	Possibly	Possibly	Yes	No	Yes	No
Externalities	Possibly	No	Possibly	Possibly	Possibly	Possibly	Possibly	Yes
Employment	Possibly	-	No	No	No	No	Possibly	No
Market prices	Possibly	-	No	No	No	Possibly	Possibly	Yes
Human health	No	-	No	No	No	No	No	Yes

Table 7: *Comparison of the different interventions possible for pig sector.*

Problem / disease	Cysticercosis			CSF	
Intervention	Latrines	Deworming of people	Pig Treatment	Vaccination	Movement control
Previous experience	People don't use them	Effective at reducing taenia infections but does not eradicate them	Potentially attractive. Success of treatment is unknown	Vaccination of multi-age pig herds is not easy. Vaccine is effective, but requires a cold chain.	Requires high level of community cooperation and good institutional coordination
Costs	-	-	US$2.50 per pig every 6 months	US$3.00 per pig every 6 months	Unknown
Losses	-	-			-
Estimated losses US$/yr (see Annex 2)	-	-	57,000	168,135	-
% Pig income	-	-	4% (range 3-5%)	11.7% (0-12.6%)	-
% per capita income	-	-	Between 0.1-0.5%	Between 0-1.5%	-
% households who benefit	-	-	42% (range 25 and 65%)	42% (range 0 and 65%)	-
Other impact	-	-			-
1	-	-	Positive impact on human health	International trade barrier	-
2	-	-	Trade barrier, allows access to other markets	Once eradicated vaccination can be stopped	-
3	-	-	Consumer welfare	Consumer welfare	-
Negative impact	-	-			-
Poverty focus	-	-	High	High	-
Potential for success	Low	Low	Medium to low	Medium to high	Low
Focus			Research/development	Development	

Summary

The methodology for identifying potential livestock interventions – and detailing their impact - is based on prioritisation work that was carried out in Bolivia over a 3-year period and subsequently refined. The methodology is based on participatory and scientific data collection and analysis of primary data with secondary data. The identified livestock problems are assessed using a matrix that helps to determine household impact and in part is based on the livelihoods approach. Problems selected using the first matrix are then analysed in a second matrix that examines the potential for success of intervention alternatives to solve the problems. A more in depth analysis of the household and local economy impact requires more detailed classification and modelling work and this is presented in the following chapter.

HOUSEHOLD AND LOCAL ECONOMY IMPACT – IN-DEPTH ANALYSIS

Introduction

This chapter covers three main topics:

1. Classification of farming systems;
2. Analysis of the role of livestock in household economies using models; and
3. Using the classification of farming systems and the household information up to scale up the analysis to local or regional economy level.

Classification

A number of authors have attempted to classify farming systems (Ruthenberg, 1980; Grigg, 1974; Mortimore and Turner, 1993; Dixon and Gulliver, 2001) and some have tried to classify livestock systems (Jahnke, 1982; Peeler, 1996; Wilson, 1995; Steinfeld and Sere, 1995; Otte and Chilonda, Forthcoming). At a micro-level, household classification is commonly used to compare different socio-economic strata (Rushton and Ellis, 1995; Murithi, 1998). Methods for the classification can be based on qualitative methods or use complicated statistical methods such as cluster analysis (Hardiman, Lacey, and Yang, 1990). Countries such as India have a recognised system of classification of farming systems based on the land area cropped. Official data sources provide information of the number of farms in different landholding groups and can be readily applied to scaling up processes. In Bolivia, households have been classified according to poverty levels based on the following:

1. Inadequate housing in terms of materials used;
2. Inadequate housing space;
3. Inadequate access to water and sewerage disposal;
4. Inadequate use of energy;
5. Insufficient education; and
6. Inadequate medical care.

The value of a system of classification is that it helps to target research findings (Collinson, 1981; Jolly, 1988; Williams, 1994). A good classification system should also provide indications of the critical information required for each system and can provide a means of scaling up household level analysis to local economy levels.

The type of classification methodology used and the criteria for identifying different smallholder farming systems types is dependent on the data available and the skill of the analyst. However, to facilitate the scaling up of household outputs it is recommended that secondary data are sought on the number of households in different groups and how the households have been classified. Ideally, these data on household groups would be from official sources. The methods of household classification should direct data collection for the development of a representative household model for each group of households.

Application of household model approach

The following is a description of research carried out during the 1990s to investigate the role of livestock in smallholder farming systems in developing countries.

Description of the household model

A household model was developed by the author in Visual Basic 3 and Access 2 (Rushton, 1996). Although this is not the only model that has been developed to examine the role of livestock in household economies[1], the author is able to present two simple case studies of its application. The model was designed to capture internal household transfers, social interactions and deal with the variability of livestock output.

The model separates aspects of the household into three components:

- Resources;
- Activities; and
- Farm or household plan.

Resources

Resources are goods that are tradable and non-tradable. Tradable goods include resources such as seed, fertiliser, manure, milk, meat, etc. Non-tradable goods are items such as communal grazing, communal labour days and goodwill. The model requires that the resources are specified in terms of:

1. units of measurement; for example land may be acres or hectares,
2. storage life of the resource,
3. seasonal buying and selling price of the resource.

There is a distinction made for three resources that are different in that they cannot be easily included as normal resources. These are labour, land and capital.

Labour

Labour resource is not homogenous. It can be provided by males or females, by different age groups, by different skill levels and for different time periods. The heterogeneity of labour resource requires a flexible definition structure. The possession of a labour resource is unlike that of possessing other resources, because labour is not physical. This in turn means that although labour resource can be defined, its possession in a household requires the definition of an activity.

Land

Land resource is also heterogeneous. It can be heavy or light, with good or poor fertility, steep or flat incline. However, land is not the usable resource; it is cultivable land area, be it good or poor cultivable land area. Again, a flexible resource definition structure is required to cope with heterogeneity. This can only be generated with access to that land through ownership either by purchase, hire or communal arrangement, which requires the specification of an activity.

Capital items

Capital items would include machinery and housing necessary for the household to function. A capital item cannot be classified as a resource, but its output can. For example, a tractor produces horsepower that can be used for pulling ploughs or driving other machinery. Therefore, the ownership of a capital item needs to be specified as an activity.

Activities

Activities can be:

- productive; e.g. crop growing, livestock rearing, business enterprise

[1] Technology Impact evaluation Systems (TIES) was developed by ILRI (formerly ILRAD) and Texas A&M (Richardson, 1995)

- consumption; e.g. drinking milk, eating food grains
- buying and selling of resources
- storage of resources
- ownership or possession of resources; e.g. land, capital goods, a family

Each activity has a duration, and uses and/or produces resources. The resources used and produced are specified as physical quantities. For the specification of resource use and production, three basic transactions are identified:

1. Physical - the resource produced or used will be added to or subtracted from the on-farm register;
2. Cash - the resource produced or used is sold or purchased at the time of the transaction;
3. Notional - the resource produced or used is added to or subtracted from the resource balance.

The distinction between physical and notional transactions is due to the possibility of a notional resource having a negative balance. If a negative resource balance is created by a physical transaction, the household is assumed to have to buy the resource to maintain the activity using that resource. This type of transaction is necessary for resources such as seed, fertiliser, concentrate feeds etc. However, where resources come from communal sources, a negative resource balance can be created without affecting the completion of an activity. In addition, some resources, such as social status, cannot be traded. Finally, some activities may use or produce resources, but this may have no immediate cost or benefit. These types of resource use and production would be specified as notional transactions. It is likely that the use of this transaction type will be restricted to analysts interested in reciprocal arrangements of resource use and the status of families within the general community. Notional transactions of resources allow the recording of:

1. Communal exchange of resources. For example, many smallholder systems have access to communal grazing and utilise reciprocal labour arrangements to complete activities.
2. Qualitative resources in the household plan, which would include resources such as social status, community credits, personal well-being etc.
3. Resources that do not have immediate costs and benefits. For example, some farming systems remove organic matter from the soil, thereby affecting soil quality. The full impact of such “extractive” practices may only be recognised some time after the practice was first implemented. Other farming practices may improve soil quality, personal health etc. In a plan, these resources could be given a value to examine the impact on the household balance sheet and household cost-benefit analysis.

An activity specification also requires an asset value for each time period of the activity. For example, a crop enterprise would have an asset value equivalent to the value of the standing crop, and a livestock enterprise would have an asset value equivalent to the value of the livestock.

Farm or household plan

A household plan specification includes a duration and the point in time a plan begins. The plan has a list of the household resources at the beginning of the plan, the on-going household activities and the future household activities. The household resource list requires the age and quantity of each resource. The household activity lists require the scale and the starting time for each activity.

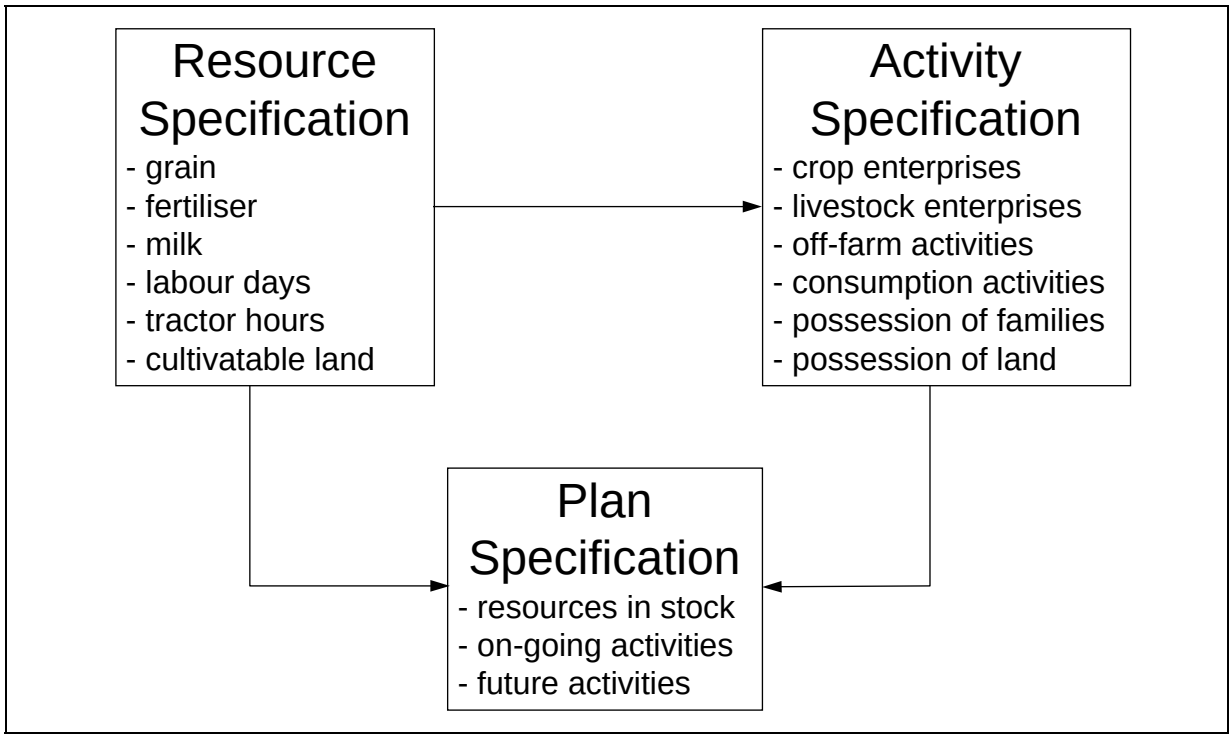
Linkage between the resource, activity and plan specifications

The resource, activity and plan specifications are linked in the following way:

- An activity specification refers to resources defined by the resource specification.
- A plan specification refers to resources and activities defined in the resource and activity specifications, respectively.

The overall outline of this link is shown in Figure 8.

Figure 8: *The link between resources, activities and plans.*



The model uses a simple simulation matrix to determine resource use and production, cashflow, balance sheet and, when necessary, a cost-benefit analysis of the system. The basic working of this matrix is shown in Figure 9.

Figure 9: *Flowchart showing the conceptual resource allocation model.*

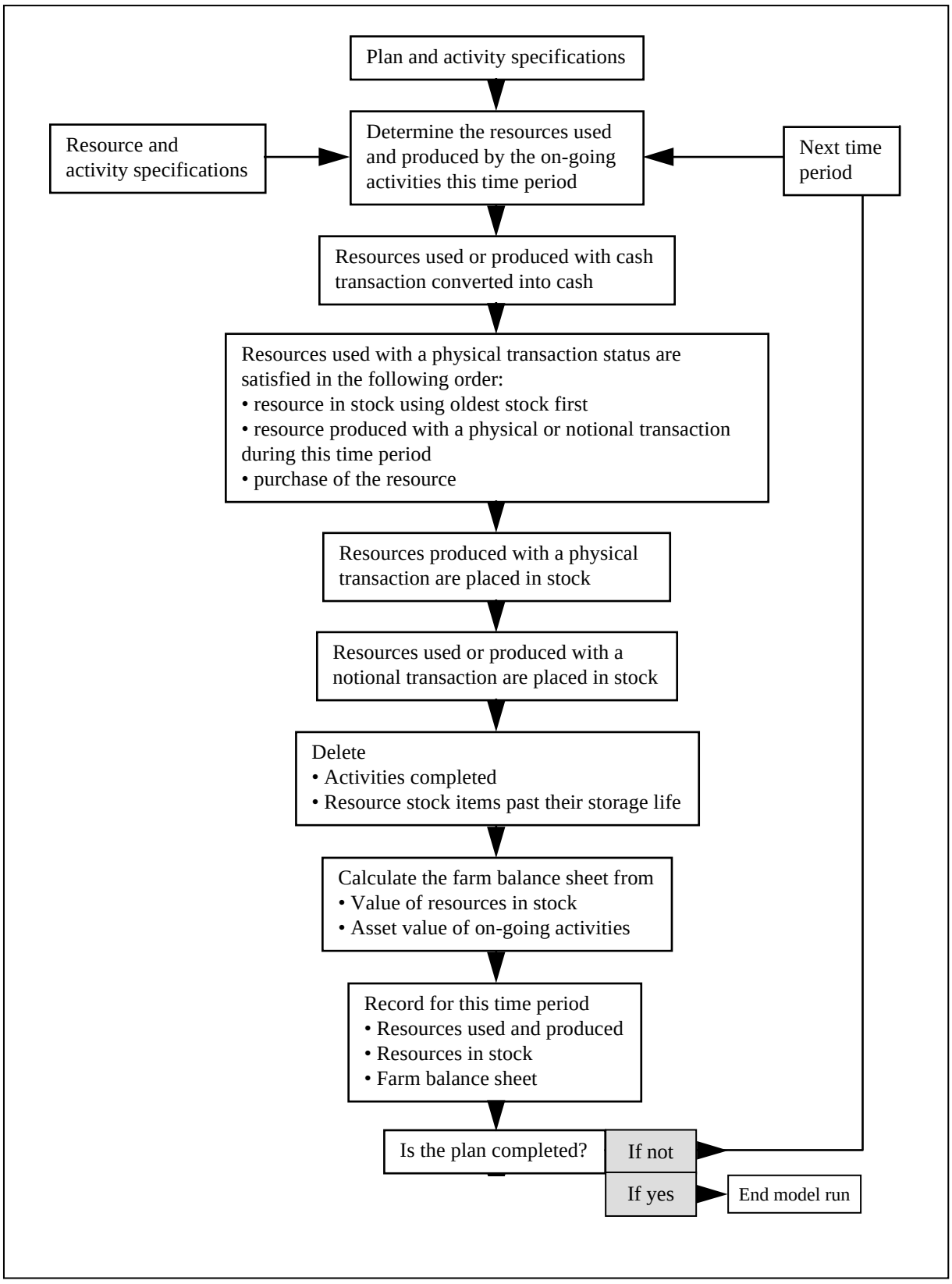
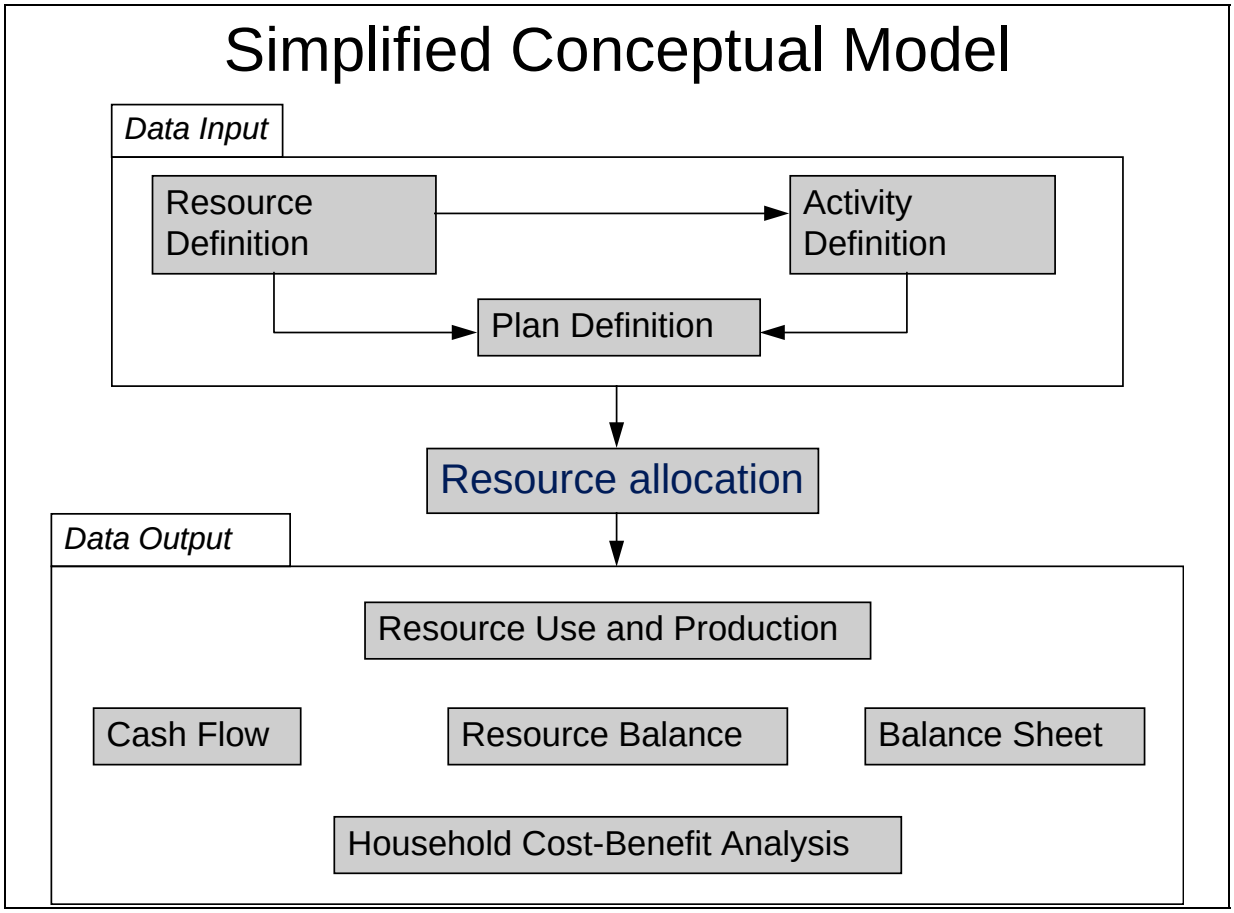


Figure 10 presents the conceptual structure of the model and its outputs.

Figure 10: *A simplified conceptual household resource model showing input and output structures.*



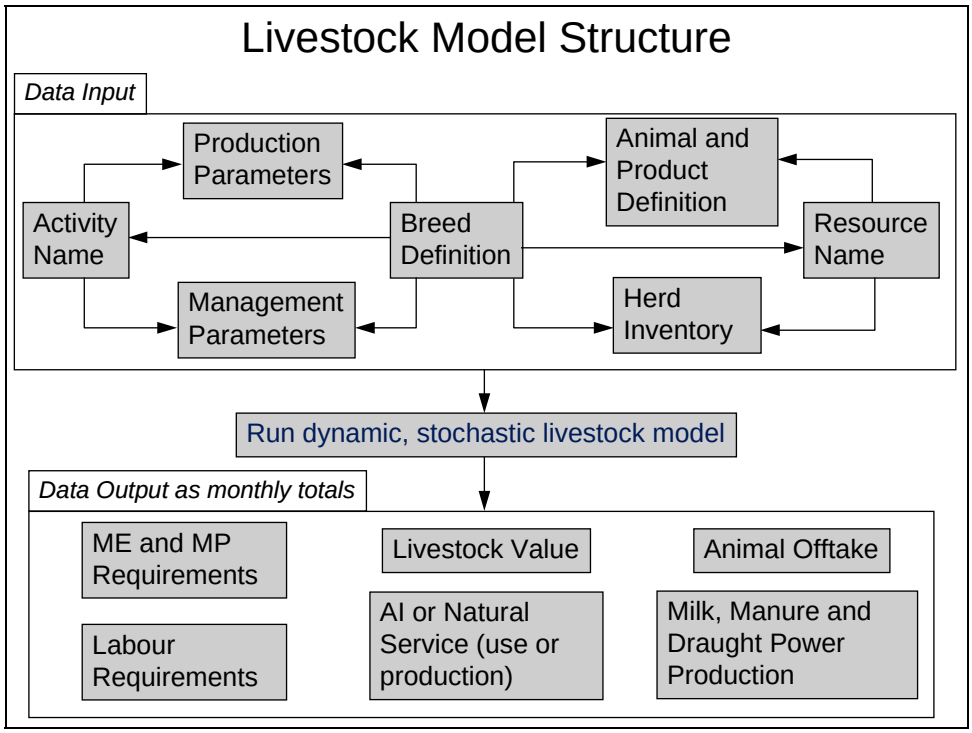
To capture other aspects of livestock activities another model was developed with the household structure, which generated the activity definition of the livestock activities. This model is stochastic[2] and requires information on the variation of a list of production parameters. The main output of the model is:

1. Outputs
   a. animal sales including dead animals,
   b. milk,
   c. manure,
   d. natural services,
   e. draught power.
2. Inputs
   a. feed in terms of metabolisable energy and protein,
   b. labour.
3. Input/Outputs
   a. milk,
   b. services.
4. Capital Value

[2] Governed by the laws of probability and meaning that some of the input parameters will be a mean with the standard deviation rather than a set value. The actual value of these parameters is determined by their distribution during the model run and will generally not be the same for each run. This implies that each model run output will also be different and there is need to run the model a number of times to generate a final output which is a mean and a standard deviation.

This output can the be used in a household plan to see how the livestock activity affects the household economy. The structure of the livestock model and its output is shown in Figure 11.

Figure 11: *Basic input and output structure of the livestock model.*



The household model presented is a simulation model that requires information on resources, activities and plans. To investigate the role of livestock in a broader manner a stochastic livestock model has been developed that generates livestock activity information that can then be used in a household plan. The model is flexible in that it can accommodate any number of activities with different durations and also can handle different types of resource transactions between activities. The stochastic nature of the livestock model also allows the investigation of the risks of livestock keeping.

The following describes the application of the model to two different smallholder livestock systems:

1. Adoption and management of dairy cattle in southern India (Rushton, 1996) based on data collection over an 18 month period.
2. Role of livestock and adoption of Calliandra in Kenyan Highlands (Murithi, 1998) based on intensive data collection over a 24 month period.

Application of the model - Smallholder household systems in southern India with a dairy activity

The following example is based on a study where data were collected from a group of smallholder dairy producers in the milkshed area of Bangalore, India for a period of approximately 18 months. Data were collected on livestock, agricultural and off-farm activities. For two of the households, which were representative of the poorest dairy

smallholders (they had 1 acre of dryland[3]), a household plan was developed using the model described above. The purpose of using the model was to examine how successful the adoption of dairy animals was in improving income levels and the stability of poor smallholders.

As described above, the livestock model is stochastic which requires that the simulation of the livestock activity is run a number of times. In the current example the livestock model was run ten times, each run generating a different livestock activity output. To capture this variability ten different household plans were created each with a baseline of crop and off-farm activities. Each had a different livestock activity output generated by the stochastic livestock model. Table 8 presents the cost-benefit analysis output of one of the smallholders modelled.

Table 8: *Cost benefit analysis of an Indian household system with and without a dairy activity (Rushton, 1996).*

	Mean	Minimum	Maximum	SD
Household system with dairy cattle including capital costs and benefits				
NPV	-48,704.09	-60,038.42	-41,829.30	5,279.03
BCR	0.78	0.73	0.81	0.02
Household system with dairy cattle excluding capital costs and benefits				
NPV	-16,699.46	-20,996.18	-11,784.01	3,291.29
BCR	0.15	0.05	0.38	0.10
Household system without dairy cattle including capital costs and benefits				
NPV	-56,101.88	-	-	-
BCR	0.74	-	-	-
Household system without dairy cattle excluding capital costs and benefits				
NPV	-1,984.84	-	-	-
BCR	0.77	-	-	-

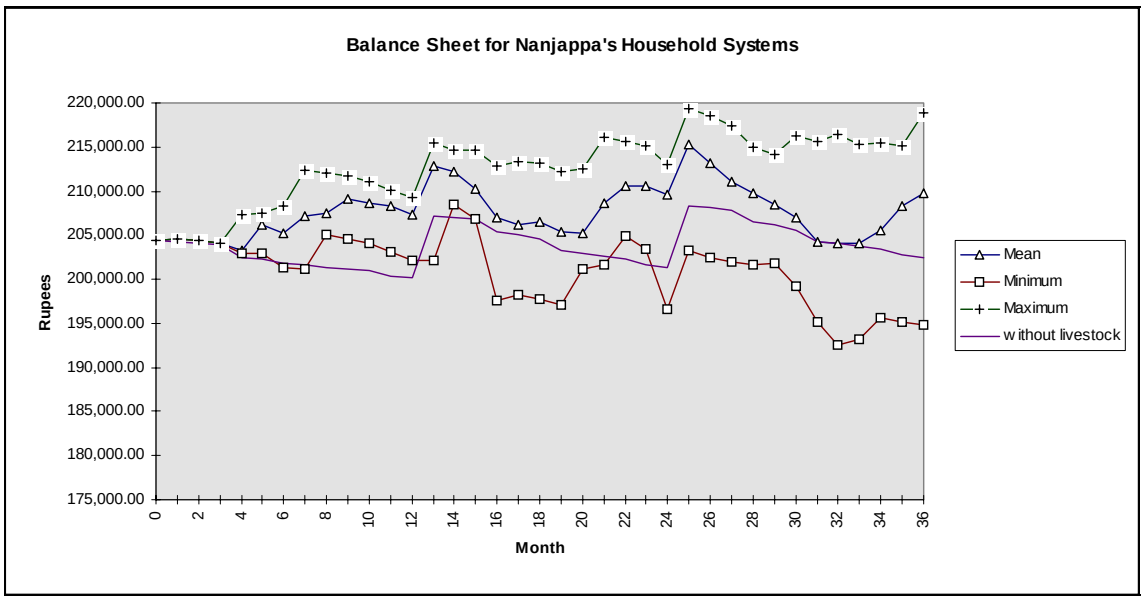
NPV Net Present Value (Rupees)
BCR Benefit Cost Ratio
SD Standard Deviation

The capital costs and benefits relate to the investments in land, livestock and other investments required to run the farm. The aspect which does not seem to make sense in the analysis is that the household does not cover its costs with its income. This would indicate that all income generating activities were not identified during the data collection process, but also that the farm level activities are simply inadequate to meet the needs of the family. In addition the dairy enterprise is of no help in solving these chronic problems. In fact the enterprise makes the family situation worse.

It can be seen that the adoption of a dairy activity creates a higher negative NPV for the smallholder. However, the average balance sheet (this includes all assets that the household has, land, livestock, investments and also food) for a plan with a dairy activity is better than a plan without the dairy activity (Figure 12).

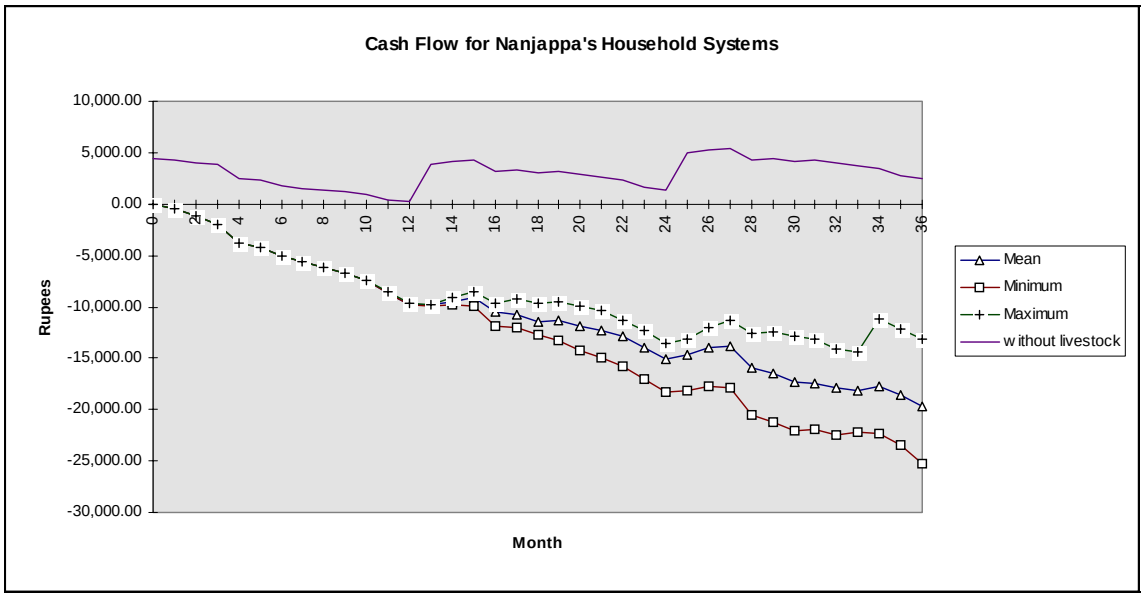
[3] This used the Indian government classification system of farms which is based on land area farmed

Figure 12: *Balance sheet of an Indian household farm system with and without a dairy activity.*



The reason for the poor cost benefit analysis results is the poor cashflow with a plan that includes a dairy activity (Figure 13).

Figure 13: *Predicted cashflow of an Indian household system with and without a dairy activity.*



To understand why the dairy activity has such a negative impact the cashflow figures were further analysed and it was found that the predicted production levels of the dairy animals required the regular purchase of feed. The income generated from the sales of milk did not cover the costs of buying feed.

These rather negative findings were confirmed by observations of this particular family. The family started well with their dairy activity but, after the first 12 months, they could not feed their animals well enough to avoid fertility problems. In the end they had three adult female cows that were infertile and not producing milk. The model therefore confirmed that feed constraints in the poor smallholder farming systems were the most important and that purchased feed was too expensive to maintain dairy animals in a productive state.

Application of the household model – The predicted impact of the adoption of Calliandra in smallholder dairy systems in Embu, Kenya (Murithi, 1998)

The following example is based on data collected from smallholder dairy systems in the highland region of Kenya. Data were collected on all household activities over a 24 month period. The study was coordinated by KARI-Embu where trials were being carried out with Calliandra. Murithi (1998) created household plans with and without a Calliandra activity to see if the adoption of this forage source had a positive impact on smallholder dairy systems. He ran the plans through the model in the same way as described for the India example. A summary of the cost benefit analysis results are presented in Table 9.

Table 9: *The impact of the adoption of Calliandra in smallholder dairy systems in Embu, Kenya (Murithi, 1998).*

Variable	Including capital costs and benefits*	Excluding capital costs and benefits*
Mean NPV (base plan, with dairy meal, no calliandra)	72,837 (42,373)	-229,228 (69,695)
Mean NPV (base plan with calliandra)	989,246 (34,709)	404,398 (19,761)
Change in NPV due to inclusion of calliandra to base plan	916,418	633,627
% change in NPV due to inclusion of calliandra to base plan	1,258.20	276.4
Mean NPV (with calliandra, no dairy meal)	966,674 (35,721)	400,641 (19,942)
Change in NPV due to calliandra inclusion, but no dairy meal	893,836	629,869
% change in NPV due to inclusion of calliandra but no dairy meal	1,227.20	274.8
Mean BCR (Base plan)	1.09(0.05)	0.59 (0.10)
Mean BCR (Base plan with calliandra)	2.56 (0.10)	2.23 (0.16)
Mean BCR (with calliandra, no dairy meal)	2.49 (0.10)	2.17 (0.15)
Mean IRR (Base plan)	13.7% (2.0)	--
Mean IRR (Base plan with calliandra)	48.0% (1.1)	--
Mean IRR (with calliandra, no dairy meal)	46.9% (1.0)	--

* Figures in brackets are standard deviations
BCR Benefit Cost Ratio
IRR Internal Rate of Return
NPV Net Present Value (Kenyan shillings)

The adoption of Calliandra had a positive impact in terms of the household balance sheet (Figure 14).

Figure 14: *Predicted balance sheet for a smallholder dairy household system in Embu, Kenya with and without the adoption of Calliandra.*

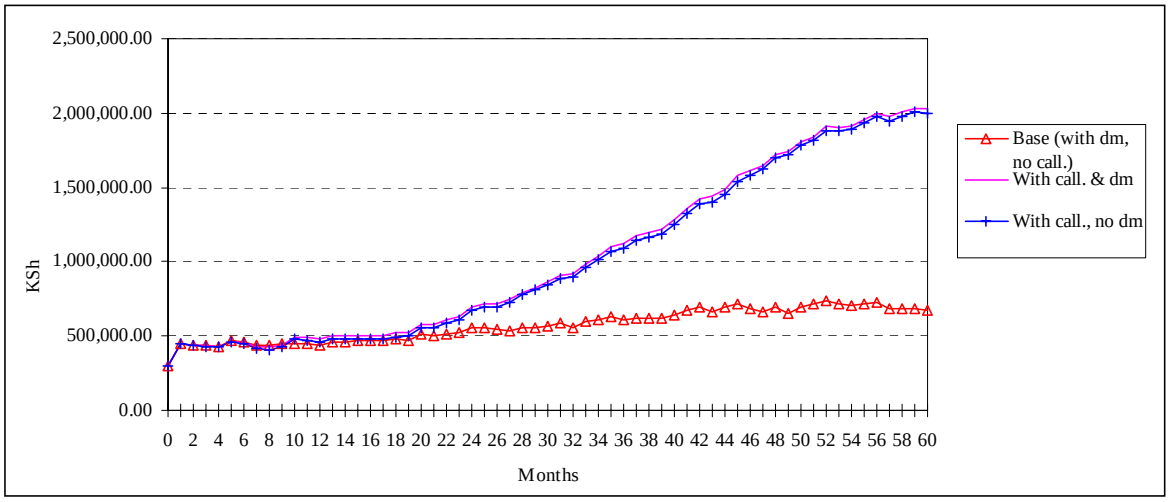
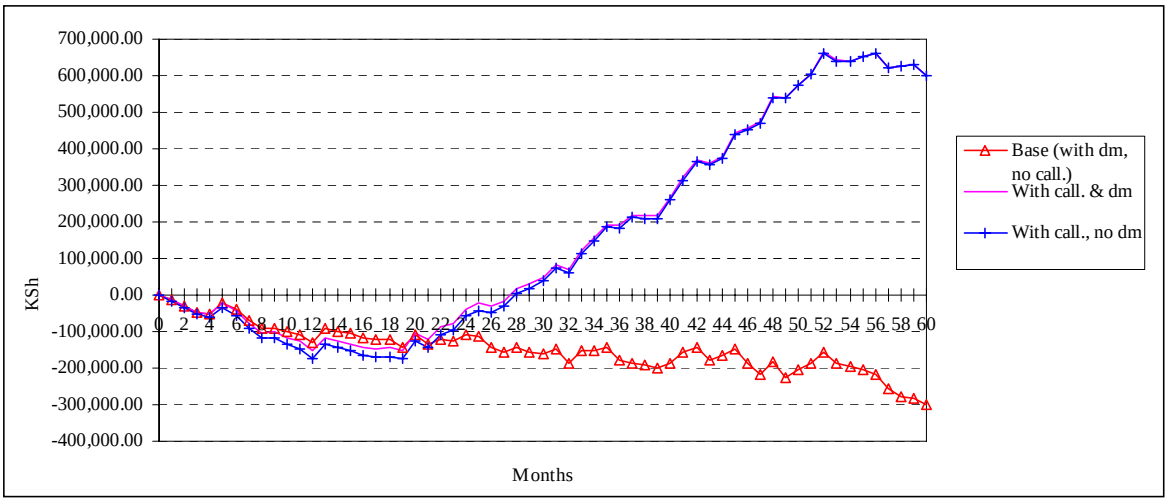


Figure 15 shows clearly that Calliandra had a positive impact on the household cashflow after a period of approximately 24 months. The reasons were that at this point there was sufficient forage production to cover the needs of the dairy system and the household did not have to buy in feed to cover the production needs.

Figure 15: *Predicted cashflow for a smallholder dairy household system in Embu, Kenya with and without the adoption of Calliandra.*



The household model presented can analyse internal household interactions, social interchanges and examine risk with respect to the livestock activity. A large proportion of time is required in data collection for the model runs. However, with the use of secondary data sources time for data collection can be reduced and in some cases could be eliminated. It is argued that the extra detail provided by such models is important and the two examples presented indicate that the model can highlight important issues with regard to the adoption of livestock technologies in poor smallholder farming systems. These issues would be impossible to analyse with less detailed models. The ideal would be that sufficient secondary data are available to

make the use of such models as a component of the "look and see" method described in the previous chapter. Finally one of the important outputs of the model is information that can be used with a system of classification to build local or regional economy models.

Village or local economy matrix

The common approach is to go from macro-economic methods down to local economy models. The methodology proposed here is from the bottom to the top, building on activity gross margins and budgets to household models and then to local economy models. This approach is recognised as being more data demanding and requiring more resources in data collection, but the quality of analysis produced will be increased and there will be no feeling of uneasiness that the estimates are based on shaky data. The general approach should also enhance how people develop monitoring systems, which in the end need to have somewhere to store data. The approach would be as follows:

1. Classification of households, preferably combining official data on number of households and the systems of classification.
2. Data collection from each household group to build representative household models for each group.
3. Using the household as the productive unit and the data on the number of households in each group to calculate:
    - Information on traded outputs and inputs and under-utilised resources
    - indications of supply issues and impact on market prices
    - Labour constraints

Unfortunately the author had no worked examples for building up a local or regional economy matrix. Comments are made in the next chapter concerning groups who are working in this field.

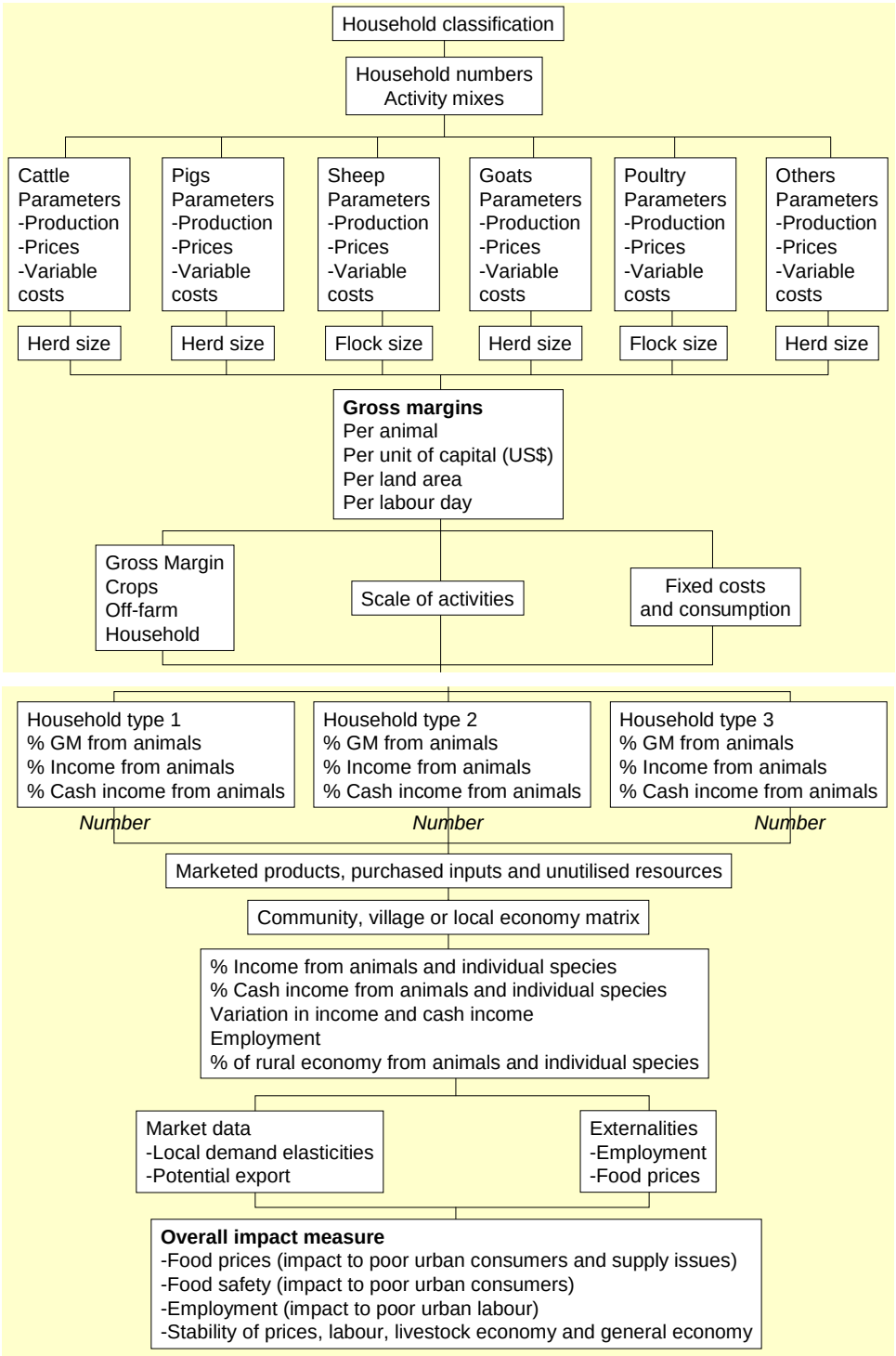
Summary

For the more in depth analysis of livestock in the household and local economies there is a need to use modelling methods and systems of classification. Two examples: the adoption of a dairy activity in smallholder farming systems in southern India and the adoption of Calliandra in smallholder dairy systems of highland Kenya provide important insights into livestock technologies and their impact at household level. It is believed that the data requirements for such modelling processes could be significantly reduced with access to secondary data or expert opinions. The aim would be that household model analyses would become an integral part of the "look and see" method described in the previous chapter. The constraints to this goal are identified as being: access to reliable secondary data; and a model structure that is user friendly.

A classification of smallholder livestock systems could be combined with household model analysis to develop matrices for local or regional economies. This step is an important part of examining the externalities of livestock technology changes such as labour requirements and food prices.

A summary of the methodology is shown in Figure 16. It is important that groups working in various fields are identified to help support the further development of the conceptual methodology into a working, quantitative model. Annex 3 therefore presents information on groups working in the field of assessing livestock technologies and their impact on smallholder livestock systems.

Figure 16: *Analysis of livestock interventions using a combination of household and local economy models.*



CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This Working Paper has presented a methodology for improving the assessment of livestock interventions using a stepwise process involving:

1. A "look and see" phase to identify potential interventions which involves participatory and scientific data collection and the presentation of key results in two matrices. The matrices present a mixture of qualitative and quantitative information including socio-economic data on the importance of livestock to rural livelihoods, an assessment external impacts due to a livestock intervention and an indication of the success of the livestock intervention.
2. Classification of smallholder livestock systems.
3. Development of household models using gross margin type data and livestock production parameters.
4. Development of local or regional Social Accounting Matrices (SAMs) to make quantitative assessments of the external impacts of a livestock intervention in terms of employment and food prices.

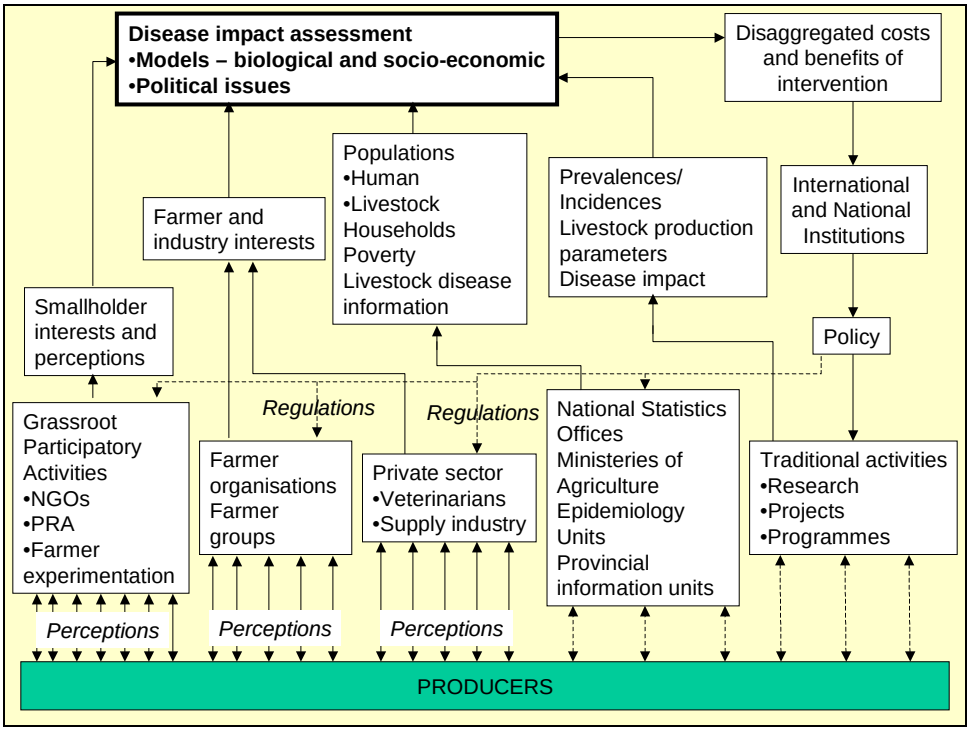
Where possible these different steps have been demonstrated with data from three different countries: Bolivia, India and Kenya. The analysis presented indicates that:

1. Data exist for "best guess" assessments.
2. Models for livestock, household and local economies exist.
3. Data requirements for the models are high and run the danger of being seen as unfriendly and research focussed.

However the household model examples have shown that in depth analysis has value in the investigation of more detailed impacts of a livestock intervention. The use of both household and local economy models would be greatly facilitated with access to secondary data sources on household activities and models that are user friendly and flexible. Given the widespread access to the Internet and modern programming methods, it is believed that making household and local economy analysis a part of the "look and see" impact assessment of livestock interventions is not a distant goal. However, it requires a clear plan of action, which identifies key groups working in different aspects of the conceptual methodology presented in the report. Annex 3 of this Paper has, therefore, presented information on institutions, groups or individuals working on the different components.

It is envisaged that the methodology would fill the gap in analysis described in the introduction of the report (Figure 1), providing information that will help guide policy decision makers on which type of livestock interventions have greatest poverty impact (Figure 17).

Figure 17: *Policy decisions influenced by analysis of the impact of interventions on household and local economies.*



Recommendations

Certain aspects of the methodology such as the "look and see" components, and to a lesser extent the household models, require presentation to clients and then further refinement.

The development of models for regional or village level impact assessment requires further work and case study testing in order to make it a quantitative part of the methodology.

Finally work needs to be carried out to develop data storage and retrieval processes that will facilitate assessment impacts.

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ANNEX 1: INTERNAL PARASITES IN SMALL RUMINANTS

Table 10: *Internal parasite problems in small ruminants in the municipalities of Camargo, Incahuasi and San Lucas, Chuquisaca, Bolivia.*

Parasite	Municipio					
	Camargo		Incahuasi		San Lucas	
	% Positive	Parasite burden	% Positive	Parasite burden	% Positive	Parasite burden
Strongyloides	90%	36% high	98%	61% high	98%	31% high
		34% medium		22% medium		38% medium
		30% low		17% Low		31% Low
Lung	19%	----------	24%	----------	3%	----------
Liver (fasciola)	0%	----------	0%	----------	0%	----------

Table 11: *Internal parasite problems in small ruminants in the municipalities of Las Carreras, Villa Abecia and Culpina, Chuquisaca, Bolivia.*

Parasite	Municipio					
	Las Carreras		Villa Abecia		Culpina	
	% Positive	Parasite burden	% Positive	Parasite burden	% Positive	Parasite burden
Strongyloides	95%	36% High	89%	22% High	88%	28% High
		29% Medium		40% Medium		45% Medium
		35% Low		28% Low		27% Low
Lung	34%	----------	16%	----------	19%	----------
Liver (fasciola)	0%	--------	0%	----------	0%	----------

ANNEX 2: ESTIMATED LOSSES FOR CSF AND CYSTICERCOSIS

Table 12: *Estimated losses from Cysticercosis*

	Nor Cinti			Sud Cinti			Total
	Camargo	San Lucas	Incahuasi	Villa Abecia	Culpina	Las Carreras	
Pig Population	5,065	14,671	14,885	1,874	32,316	2,331	71,142
Income from pigs	95,246	275,897	373,247	35,247	607,742	43,830	1,431,208
Total income from animals	724,131	4,178,349	1,484,740	173,103	3,310,549	347,631	10,218,503
% of animal income from pigs	13%	7%	25%	20%	18%	13%	14%
Number of families with pigs	779	3,821	1,804	375	1,877	487	9,144
% families with pigs	25%	40%	45%	64%	49%	62%	42%
Estimated income from pigs for pigkeeping families	122	72	207	94	324	90	157
Number of pigs per family	6.50	3.84	8.25	5.00	17.21	4.78	7.78
Production parameters							
Offtake rate	45%	45%	45%	45%	45%	45%	45%
% of pigs affected with cysticercosis*	20%	20%	20%	20%	20%	20%	20%
Price difference for a pig infected	50%	50%	50%	50%	50%	50%	50%
Value of healthy pig	120	120	120	120	120	120	120
Animals sold with cysticercosis							
Number of animals	456	1,320	1,340	169	2,908	210	6,403
Healthy value	54,698	158,444	160,763	20,242	349,017	25,171	768,335
Disease value	27,349	79,222	80,381	10,121	174,509	12,585	384,167
Losses							
Bs.	27,349	79,222	80,381	10,121	174,509	12,585	384,167
US$	4,040	11,702	11,873	1,495	25,777	1,859	56,746
% of income	4.24%	4.24%	3.18%	4.24%	4.24%	4.24%	3.96%

* This is the percentage of pigs that are detected when slaughtered. The serological test values were higher, but it recognised that the test is sufficient to detect a low level infection which is probably insufficient for detection at slaughter.

Table 13: *Estimated losses for CSF and costs of its control. Vaccine price including the application = Bs. 3.00. Number of vaccines per year = 2*

	Nor Cinti			Sud Cinti			Total
	Camargo	San Lucas	Incahuasi	Villa Abecia	Culpina	Las Carreras	
Impact of CSF							
% of pig population affected	5%	20%	20%	5%	20%	0%	20%
% of pigs affected that die	100%	100%	100%	100%	100%	100%	100%
Number of animals that die of CSF	253	2,934	2,977	94	6,463	0	14,228
Average value of a pig	80	80	80	80	80	80	80
Estimated losses							
Bs.	20,259	234,731	238,167	7,497	517,063	0	1,138,274
US$	2,992	34,672	35,180	1,107	76,376	0	168,135
% of the pig income	3.1%	12.6%	9.4%	3.1%	12.6%	0.0%	11.7%
Cost of vaccination							
Bs.	30,388	88,024	89,313	11,246	193,899	13,984	426,853
US$	4,489	13,002	13,192	1,661	28,641	2,066	63,051
% of the pig income	4.71%	4.71%	3.53%	4.71%	4.71%	4.71%	4.41%
Cost per producer							
Bs.	39.00	23.04	49.50	30.00	103.29	28.70	46.68
US$	5.76	3.40	7.31	4.43	15.26	4.24	6.90

NB The pig populations and income are the same as for cysticercosis.

ANNEX 3: GROUPS WORKING ON THE ASSESSMENT OF LIVESTOCK DISEASES AND THE ROLE OF LIVESTOCK IN SMALLHOLDER FARMING SYSTEMS

The groups have been divided into five distinct areas:

1. Groups that are working on methods of assessing the socio-economics of livestock diseases.
2. Groups that are investigating the role of livestock in the livelihoods of smallholder producers.
3. Groups that are investigating the use of local or regional economy models.
4. Institutions with the capacity to manage a database that can receive, store and provide access of secondary data.
5. Institutions working on bringing information together in a mapping format.

Points 1 to 4 are directly related to the further development of the conceptual framework present in the previous three chapters. Point 5 is related to the need to present analysis in a format that is attractive and easily understood by policy decision makers. The information on the institutions or groups working on each area is summarised in Tables 14 to 18.

Table 14: *Main groups or individuals identified as working on livestock disease impact assessment.*[4]

Group or institution	Regional focus	Research and development focus
ILRI – Epidemiology group led by Brian Perry	Mainly Africa	Recently worked in disease prioritisation in Africa, South and South-East Asia. Have carried out studies on FMD in Thailand and Peru. Published papers on epidemiology and economic and the economics of parasite control. Adrian Mukhebi previously carried out work on assessing the impact of tick-borne diseases at household level.
University of Queensland – Professor Clem Tisdell	South-East Asia	Produced a range of internal documents on the use of economic tools for the assessment of livestock diseases. Their main findings have been published in a manual for epidemiology and economics and are centred on economic assessments of FMD in Thailand
VEERU, University of Reading, UK		Recently worked on FMD impact in the UK. Have worked on the economic impact of rinderpest in Africa, FMD in south Asia and trypanosomiasis in Africa. The latter work was coordinated by Nick Putt and Alexander Shaw.
University of Wageningen, Holland	Mainly Europe	Carried out assessments of FMD and CSF in Europe, but focussed on Holland. Also have a significant body of work on reproductive economics in intensive systems.

[4] This list is presented as a format for discussion rather than a definitive list. It is recognised that there are number of groups in USA working on animal health economics. These groups have not been included because they focus on intensive production system problems that are rarely applicable in developing country and smallholder farming systems. There are also a number of French institutions working in this field.

Table 15: *Main groups or individuals identified as working on the role of livestock in mixed farming systems.*[5]

Group or institution	Regional focus	Research and development focus
Imperial College, University of London – Research into the role of livestock and farmer experimentation led by Simon Anderson and Andrew Dorward	Latin America and Africa	Developing indicators to help assess livestock interventions. Examining institutional aspects of farmer experimentation
VEERU – Claire Heffernan	Africa, India and Bolivia	Livestock services for the poor and prioritisation of animal health problems to improve these services.
ILRI and University of Edinburgh – Mario Herrero	Latin America and Africa	Development of decision support models for smallholder farming systems. The models focus on ruminant nutrition requirements and the production of forage.
CEVEP – Jonathan Rushton	Latin America, Africa and India	Currently working on disease prioritisation using a mix of participatory and scientific methods. Involved in the ILRI study disease prioritisation study and Imperial College study. Household model development to examine the role of livestock in smallholder farming systems.

Table 16: *Main groups working on local or regional economy models.*[6]

Group or institution	Regional focus	Research and development focus
FAO – Aysen Tanyeri-Aybur	Worldwide	Working on methodologies for village-wide economic analysis to investigate impacts of globalisation and structural adjustment on smallholders
Edward Taylor – University of California, Davis	Worldwide	Co-authored "Village Economies: the design, implementation and use of village-wide economic models". Recently completed a World Bank study using these methodologies for Mexico, China, El Salvador and the Galapagos Islands.

Table 17: *Main institutions offering database services for the storage of secondary data.*

Group or institution	Regional focus	Research and development focus
IFCN	Mainly developed countries, but expanding into developing countries	Analysis of the profitability of agricultural activities with a standard format for international comparisons. Data storage of parameters
CABI	Worldwide	Recently completed a Animal Health and Production Compendium that is accessible through the internet. CABI is interested in making the site more interactive and is examining the possibility of running an interactive database.

[5] Again this list is presented as a format for discussion rather than a definitive list.
[6] This is a very tentative list and needs to be strengthened.

Table 18: *Main institutions working on mapping of livestock populations, livestock diseases and poverty.*

Group or institution	Regional focus	Research and development focus
ILRI – systems group led by Philip Thornton	Mainly Africa	Mapping of livestock systems and poverty indices
FAO – GLiPHA – Joachim Otte and Pius Chilonda	Worldwide	Linking FAO and national level statistics population estimates with OIE and national level disease reporting

Potential testing points, data sources and collaborators

In addition to the institutions or groups working on livestock disease assessment and the role of livestock in smallholder farming systems there are number of groups who have important databases on smallholder livestock systems. Table 17 provides information of these groups.

Table 19: *Institutions with data and information on smallholder livestock systems.*

Institution or Individuals	Region	Data
ICARDA	Middle East	Sheep and goat systems
ILRI	Kenya	Dairy systems of Mombassa
ICRISAT	India	Smallholder household systems and the interaction between crop and livestock activities
Steve Wiggins – Overseas Development Institute	Mexico	Has developed a number of Social Accounting Matrices for villages in Mexico, which include information on livestock activities.

As can be seen from the table a majority of the institutions identified with data belong to the CGIAR.