PART II.
METHODS TO IMPROVE THE QUANTITY AND QUALITY OF LIVESTOCK DATA

2.1 COHERENT AND COMPREHENSIVE INFORMATION: DESIGNING A LIVESTOCK QUESTIONNAIRE FOR AGRICULTURAL AND INTEGRATED HOUSEHOLD SURVEYS

KEY MESSAGES

Neither agricultural nor living standards measurement surveys are regularly undertaken in sub-Saharan African countries. When they are implemented, the livestock sector is often under-appreciated in the survey.

A standardized questionnaire including livestock in agricultural and household surveys allows a better appreciation of the role of animals in the farm and household economy, which is a pre-condition for the effective design of sector policies and investments.

Challenges in developing a livestock questionnaire include the different objectives of the National Statistical Authority and the Ministry responsible for livestock, the former willing to keep the questionnaire as simple as possible and targeting few data items, while the latter aims to have it as detailed as possible, targeting broad information on livestock.

INTRODUCTION

Stakeholders contend that available agricultural data collection systems, as chapter 1.4 shows, are to a large extent insufficient to generate adequate livestock-related information, because of both a lack of and insufficient quality data. The most straightforward way to increase the available

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information on livestock is to ensure the adequate inclusion of livestock in the questionnaires of surveys, which are regularly undertaken by national governments, such as the agricultural census, the agricultural sample survey or the living standards measurement study (LSMS).

This chapter presents a set of livestock questions — so-called 'livestock module' — to be considered for inclusion in agricultural/livestock sample surveys and in multi-topic household surveys. The focus is on farm and multi-topic household surveys — and not on surveys targeting commercial enterprises — as in most developing countries the largest share of animals are kept by farm households or livestock keepers. Data from farm and multi-topic surveys, as Table 2 in chapter 1.4 illustrates, can on paper generate almost all the livestock-related indicators needed by stakeholders, though they are to be complemented by data from other sources when policy and investment plans are to be detailed (chapter 1.3).

The next section provides the rationale for developing a livestock module for agricultural/livestock sample surveys and multi-topic household surveys. A section that highlights the salient features of the livestock module follows, including the approach used to develop it. Then lessons from the implementation of the module in multi-topic household surveys in Niger, Tanzania and Uganda are presented, followed by recommendations on how to apply and improve it.

LIVESTOCK IN AGRICULTURE SURVEYS AND IN MULTI-TOPIC SURVEYS: A SNAPSHOT

Livestock keeping is a multi-functional activity in developing countries: farm animals generate food and income, are a store of wealth and act as a safety net in times of crisis. They provide draught power and hauling services, manure, fuel and building material; transform crop residues and food wastes in valuable protein and contribute to social capital (FAO, 2009). Rural households have thus a variety of incentives for keeping livestock and, indeed, data from 12 developing countries in Africa, Asia and Latin America show that between 46 to 85 percent of rural households keep farm animals, with a country average of about 60 percent (FAO, 2009). Many of these households are poor and, given the important role livestock plays in their household economy and that many livestock animals are not meeting their full productivity potential, it is anticipated that increases in livestock productivity can help achieve the overarching goals of poverty reduction and food security, and other broad socio-economic goals.

A review of a handful of both agricultural/sample survey and multi-topic household survey questionnaires, however, reveals that livestock is, in most cases, inadequately represented. For example:

- The 2008 Rwanda National Agricultural Survey includes only a few livestock-related questions: the number of animals by species; type of feed; farming methods, notably stabling or roaming; ownership of a cowshed; and then information on sales of animals and home slaughtering (NISR, 2010);
- The 2010/11 Livestock Sample Survey of Ethiopia, one of the few countries in sub-Saharan Africa that regularly undertakes agricultural sample surveys, includes questions on animal population by breed, age and purpose for keeping; on births, purchases, death and slaughters of animals; on livestock diseases, vaccination and treatment over the reference period; on utilization of livestock feed; and on participation in a livestock extension program (CSA, 2010);
- The 2008 Livestock Survey in the Arid Land Districts of Kenya collected information on livestock numbers by species and, within species, by breed, age and sex; on changes in stock due to births, deaths, purchases, sales, social reasons (gifts), slaughter and theft; on production and sale of milk, ghee, honey and hides and skins (ALRMT, 2007);
- The 2005 Ghana Living Standard Measurement Survey includes questions on livestock ownership by species, as well as sales and purchases of live animals over the last months; questions on expenditure for raising livestock, including feed, veterinary services and drugs, hired labor and some other; revenue from selling milk and eggs; and self-consumption of animal products (GSS, 2008);
- The Malawi Integrated Household Survey 2010/11, which does have a specific focus on agriculture, includes questions on livestock ownership by species; change in stock over the past 12 months (purchases, sales, slaughter, given away as gift, etc); disease and vaccination; and total expenditure on hired labor; feed, vaccines; veterinary services and other; production of milk, meat, eggs, manure and honey (NSO, 2010);

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- The 2010/11 Nigeria General Household Survey contains questions on animal holdings, including change in stock in the past 12 months due to births, sales, slaughter and other reasons; on major diseases affecting animals and vaccination; and a final question on the expenses incurred for tending the entire herd, such as on hired labor; animal feed; maintenance of pens and stables; and commission on sale of animals and a few others (NBS, 2010).

In general:

- Available data in agricultural/livestock sample surveys and in integrated household surveys are sufficient to generate descriptive statistics on livestock ownership; sometimes on production and, occasionally, on inputs with a focus on access to animal health services. Data from integrated household surveys do also allow classifying/grouping households according to some livelihoods criterion (e.g. income level).

- However, data are rarely sufficient to provide a systematic picture of the livestock sector of the country because of limited/missing information on husbandry practices, inputs and outputs, such as breeding practices; feed and water access; production and use of manure; the use of animals for hauling services and draught power; and other. The implication is that the overall understanding of the livestock sector is patchy at best.

- Data from both surveys do not provide a good understanding of the determinants of livestock productivity, which involves some ratio between outputs and inputs. Even when information is asked about inputs, this targets mainly value (and not quantity), and in most cases is asked regarding the herd as a whole, i.e. it is not possible to attach inputs to the different animal species or to individual animals.

- Data from integrated household surveys provides some ability to measure the contribution of livestock to household livelihoods and to investigate the basic determinants of livestock ownership, such as family size, land ownership, level of education, level of income; etc. However, this data neither captures the non-monetary livestock services provided by livestock, such as manure, draft power and insurance, nor allows exploring the livestock-gender and livestock-youth relations.

Overall, insights into the rationale for investing in livestock to reduce poverty, including identification of major production-related constraints, are in many cases challenged by a lack of adequate information on the role and use of livestock in the household/farm economy.

A LIVESTOCK MODULE FOR AGRICULTURAL AND MULTI-TOPIC HOUSEHOLD SURVEYS

With the objective to assist decision makers in collecting more comprehensive livestock-related information at household level, the FAO, the World Bank, the ILRI and AU-IBAR, in collaboration with national governments in Niger, Uganda and Tanzania, developed a short, a standard and an expanded version of a livestock module for multi-topic household surveys and agricultural surveys.

The module was developed as follows. First, a variety of multi-topic household survey questionnaires and

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agricultural/livestock survey questionnaires implemented in developing and transition countries were collected. Survey questionnaires are often included as appendices of statistical reports; are sometimes available on the website of the national statistical office; and some are made publicly available by the International Household Survey Network.

Second, a production function approach was used to identify the information set needed to provide a satisfactory picture of the livestock sector. This involved systematizing all inputs and outputs associated with animal keeping, such as feed, water, animal housing, animal health, animal slaughtering, milk production and marketing.

Third, working groups were formed around each component of the production function and tasked to identify a set of questions to possibly include in agricultural and integrated household surveys, using the collated questionnaires as a starting point. No upper limit was set to the number of questions to propose, but the scope, content and typical length of agricultural/livestock and integrated household survey questionnaires were illustrated to group members.

Finally, the questions proposed by the working groups for the various segments of the production function were assembled and made consistent to generate an expanded module for agricultural/livestock surveys and multi-topic household surveys. This expanded module consists of over 200 livestock-related questions, which makes its inclusion in typical agricultural and household surveys impossible. A standard and a short version of the module were therefore developed, which national governments may easily adapt and include in their survey questionnaires. The three versions of the module vary by size, but have four common, overarching goals:

- Generate basic statistics on key livestock-related variables, such as livestock ownership and access to animal health services;
- Measure the value of household's livestock, which are an important economic asset;
- Measure the cash and in-kind income from livestock;
- Model household's livestock husbandry and production practices.

The module solicits information in three major domains: livestock ownership; livestock inputs, i.e. husbandry practices; and livestock outputs. Processing is omitted (but for one question) as it is a non-farm enterprise activity that is typically addressed in other types of surveys.

TABLE 3. CONTENT OF THE LIVESTOCK MODULE FOR AGRICULTURAL AND MULTI-TOPIC HOUSEHOLD SURVEYS

Livestock domain	Sections	Remarks
Livestock ownership	• Number of animals • Change in stock in past 12 months	Questions are asked for individual animals, often differentiated by age, gender and breeds (local/indigenous and improved/exotic), which helps to appreciate herd structure and inter-species composition.
Inputs and husbandry practices	• Breeding • Feeding • Watering • Animal health • Housing	Questions are asked for major groups of animals (e.g. large ruminants, small ruminants, pigs, poultry birds, equines, other), as management practices usually do not differ between animals of the same species.
Monetary and non-monetary outputs	• Meat production • Egg production • Milk production • Animal power • Dung	Questions are asked for major groups of animals, including both the monetary and non-monetary value of production.

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Short version

The short version of the module includes questions on livestock ownership by species (e.g. cattle) and type of animals within species (e.g. bulls, steers, cows, etc.), and a question on the major purposes for keeping animals. It inquires about sales of animals by species over the reference period, which is 12 months for large and medium animals (e.g. cattle, sheep and goats) and three months for small animals, namely short cycle animals (e.g. chicken, ducks and rabbits). It includes some questions on meat, milk and egg production, and one only question on husbandry practices. The latter targets animal vaccination which, in most countries, is provided for free or subsidized by the public sector.

The short version of the module allows quantifying with some accuracy a household's livestock wealth, and hence classifying households into different types; it also provides a rough measure of the cash income derived from livestock. It does not provide a comprehensive picture of husbandry and production practices. This version comprises about 30 questions and is intended for use in surveys for which livestock is a minor interest.

Standard version

The standard version of the module collects a large amount of livestock-related information, including ownership of animals, inputs and husbandry practices, and livestock outputs by product, by-product and service, such as milk, manure and draft power. As in the short version, questions on livestock ownership target species and types of animals; while all other questions only inquire about animal species, such as large ruminants, small ruminants and equines.

Questions on change in animal stock over the reference period collect information on the causes of herd reduction/expansion, including purchases, sales, slaughters, gifts and loss of animals for different reasons (e.g. death due to disease; theft; etc.). Questions on inputs and husbandry practices target housing and breeding practices; access to and use of water and forage/feed; and animal health, including vaccination, deworming and treatment of sick animals.

Finally, questions on outputs inquire not only about meat, milk and egg production, but also about the use of animal power (draft and transport services) and the production of dung, mainly but not only, used as manure. Most sub-sections include questions on the use of family labor by gender, and on the non-family labor hired for raising animals.

The standard version of the module supports generating descriptive statistics for key livestock-related variables, for which nationally representative indicators are often unavailable. Examples include ownership of exotic breeds; prevailing breeding practices; and access to veterinary services. It also allows quantifying with accuracy not only a household's livestock wealth, but also the contribution of livestock to household livelihoods, including both their monetary and non-monetary value. In addition, depending on the sample size and the species at hand, it can be used to estimate production functions using the animals as unit of observation, particularly when it is included in specialized livestock surveys. The standard version of the module comprises about 95 questions.

Expanded version

The expanded version of the livestock module includes all the questions in the standard version, plus additional information in all sub-sections. In particular, it allows differentiating between animal ownership and animal keeping, as not all households owning livestock raise them on the farm; it includes questions on the providers of goods and services, such as the public and private sector, and NGOs; it asks details about the role of family members in selling animals and livestock products, including who controls the earnings.

The expanded version of the module allows generating key livestock statistics and undertaking analyses as with data from the standard version, but with higher accuracy. It's a long and heavy version and, as such, it should be seen as a rotational module that country governments implement only when they need comprehensive and detailed information on livestock, most likely for a specific sub-sample of the population (e.g. the cattle keepers). In response to specific information needs, however, survey designers may wish to include only one or selected sub-sections of the expanded version of the module in their survey questionnaires, such as those on breeding and animal health.

"The expanded version of the livestock module includes all the questions in the standard version, plus additional information in all sub-sections."

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IMPLEMENTING THE LIVESTOCK MODULE: LESSONS

The three versions of the livestock module for agricultural and multi-topic household surveys are starting points for developing questionnaires that fit the needs of the country. Survey designers are expected to build their own module that adapts to the country livestock sector, including its structural and transitory features.

Three sub-Saharan African countries so far have used the livestock module to improve the livestock content of their multi-topic survey questionnaires, including Niger (Enquête Nationale sur Les Conditions de Vie des Ménages 2011/12), Tanzania (National Panel Survey 2011/12) and Uganda (National Panel Survey 2011/12). Some lessons drawn out of questionnaire design and administration and from a descriptive analysis of the Niger data are as follows:

- While the Ministry responsible for livestock prefers to include as many questions as possible in survey questionnaires, the Statistical Authority prefers keeping the livestock module as short as possible, for at least three reasons. The first is savings: not only does a longer livestock module involve more costs, but it could also give non-livestock stakeholders arguments for expanding other sections of the questionnaire, such as those on health or education. The second is a statistical reason: agricultural/livestock and integrated household survey questionnaires are administered to a relatively small sample of households, and detailed questions are sometimes answered by just a few households, which make the collected data insufficient for any robust statistical analysis. For example, a question on the sale of dung cakes would make little sense in the context of multi-topic household surveys. Third, Statistical Authorities analyze — because of their specific mandate — only part of the collated data: for example, they have little interest in studying the

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preferred outlet markets used by farmers or in exploring the correlation between household size and structure and herd size and composition. In addition, they are well aware that there are few other actors in the country capable of analyzing the data. Indeed, there are several surveys for which most of the data remain unutilized, a net waste of public resources.

- The Ministry responsible for livestock has three arguments for advocating the adequate inclusion of livestock in multi-topic household surveys. The first is based on data showing that, as is the case in most developing countries, the majority of rural households keep some farm animals and that livestock contribute over one third to the value added of agriculture. The implications are that it is important to ask questions on livestock, as these are likely to be answered by the majority of households; and that a crop-focused questionnaire would be largely unable to properly appreciate the livelihoods of rural households. The second argument is that, even though some questions might be of little statistical relevance, these are potentially important for decision makers because they provide critical policy information, such as data on the proportion of households with exotic breeds of animals. Finally, the Ministry responsible for livestock must show a commitment to collaborating with the Statistical Authority to examine the livestock content of the surveys. It should be noted that, in almost all developing countries, staff in the Ministry responsible for livestock are not equipped to analyze the data collected through household surveys; however, they are the most important users of the data.

- While implementing the livestock module, survey designers should adjust the suggested list of animals in the module, which is comprehensive, to be consistent with the prevailing livestock production systems. This could be done at three levels. First, some animals are simply not present in a given country, such as yaks in Uganda, and should not be included in the survey questionnaire. Second, while the module allows separating local/indigenous from improved/exotic breeds, in many countries the diffusion of the latter is so minimal that it may make sense to only differentiate animals by breed in the section on animal ownership. In the same vein, there are animals that are not widely held by households, such as pigs in Niger. Again, in these circumstances, it makes more sense to collect minimal information on ownership of pigs in order to generate some basic statistics, but not to ask details about inputs and outputs, as the sub-sample of pig producers is not large enough to generate data for robust descriptive statistics or causal analysis.

- Animal health/disease information is critical for country governments, particularly that pertaining to trans-boundary and zoonotic diseases. Following a standard approach, the module suggests asking direct questions about animal diseases, such as brucellosis, ovine rinderpest (*Peste des petits ruminants*) and Newcastle disease in poultry. However, not all farmers are fully aware of the types of diseases that affect their animals. Complementary information, such as from veterinary officers, could thus be gathered while analyzing the animal health section of the module. Alternative options to collect animal health information also could be designed and tested. One possibility is to use a syndromic approach, which implies asking syndrome-related questions on the basis of clinical features (e.g. neurological, respiratory, dermatological and diarrheal syndromes); the collated data should be interpreted jointly with local animal health authorities. A second possibility is to include animal disease questions in both the household and community questionnaire of the multi-topic surveys, along the lines of participatory epidemiology.

- Measuring labor has been found to be particularly challenging for two reasons. First, in many circumstances, with the possible exception of milking, the labor force performs the same task (e.g. taking animals to graze) simultaneously for all animals in the herd, and in particular for large and small ruminants (e.g. cattle and sheep). Second, watering and feeding animals are often joint activities, with livestock taken to pastures where water sources are available. The implication is that attaching labor to a specific task or an individual animal is difficult, thereby making it challenging to measure labor productivity. The module presents one way to address this issue: by first asking whether animals of different species are fed and watered jointly; and then asking questions on the time allocated to feed/water animals by family and non-family labor. Other options could be designed and tested.

- When collecting information on livestock production, the module proposes an approach which differs from the one typically used in multi-topic household and agricultural surveys. In particular, rather than directly asking

information on meat, milk and egg production, the module asks a sequence of questions that link animals with production levels. This helps the interviewee to provide accurate information on production levels and to arrive at some measure of partial productivity (e.g. eggs per hen over the reference period). For milk, for instance, questions are included about the number of milked animals over a reference period; the number of months during which the animals were milked; whether suckling was allowed when the animals were milked; and the average quantity of milk produced per day during the milking period. Similar series of questions are suggested to obtain meat and egg production information.

The above are the major lessons emerging from the administration of the livestock module in the multi-topic household surveys of Niger, Uganda and Tanzania. Additional insights on strengths and weaknesses of the module will become clear as the country data for Uganda and Tanzania is analyzed. The analysis will highlight possible weaknesses in the module and priority areas for improvement. In any case, the Niger, Uganda and Tanzania surveys represent the most comprehensive household-level livestock datasets available in sub-Saharan Africa, thus facilitating the analysis and documentation of the many connections between livestock and livelihoods. The forthcoming insights from these surveys are expected to significantly enhance our understanding of the role of livestock in the household economy.

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CONCLUSIONS

Traditional agricultural/livestock sample surveys and multi-topic household surveys inadequately represent livestock, despite the fact that livestock are a widely owned asset among rural households in developing countries, including the less well-off. This challenges the design and implementation of equitable and efficient interventions in the sector.

This chapter presented a short, a standard and an expanded version of a livestock module for agricultural surveys and for multi-topic household surveys. The three versions of the module, with different level of details, aim at collecting data to generate statistics on key livestock-related variables; measuring the value of a household's livestock; measuring cash and in-kind income from livestock; and understanding and modeling the household's livestock husbandry and production practices.

The three versions of the livestock module are starting points for developing country modules that fit the needs of the country at hand. Three sub-Saharan African countries have so far used the module to improve the livestock content of their multi-topic survey questionnaires, including Niger, for the *Enquête Nationale sur Les Conditions de Vie des Ménages* 2011/12, Uganda, for the National Panel Survey 2011/12, and Tanzania, for the National Panel Survey 2010/11.

Lessons drawn from the design and administration of the survey questionnaires indicate that, unless the Ministry responsible of livestock is aware of the content and scope of the survey questionnaire and commits itself to analyzing the produced data, the Statistical Authority will prefer avoiding expanding the livestock section of any survey. As to the implementation of the module, at least in the context of multi-topic household surveys, the major challenges relate to measuring labor and animal health/diseases. These represent areas for further research.

The short, standard and expanded versions of the livestock module for multi-topic household surveys and the survey questionnaires for Niger, Tanzania and Uganda are available to download from the websites of the FAO-WB-ILRI-AU-IBAR *Livestock in Africa: Improving Data for Better Policies* Project and the World Bank LSMS-ISA Project. The data from the livestock module implemented in Niger, Tanzania and Uganda are also freely available for download and use.

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2.2 IMPROVING LIVESTOCK DATA QUALITY: EXPERIMENTS FOR BETTER SURVEY QUESTIONNAIRES

KEY MESSAGES

Asking questions that generate accurate livestock data — on animal diseases, labor inputs and milk production — is sometimes challenging, as farmers might have imprecise information on those and other variables.

Randomized experiments, by which different questions targeting the same information are asked to farmers, are an effective method for identifying the best way to formulate specific questions and improve survey questionnaires content.

Transparent dialogue and collaboration with livestock stakeholders is necessary to effectively formulate livestock survey questionnaires, particularly those targeting sub-segments of the population, such as pastoralists.

"When designing survey questionnaires, decision makers should take into account both livestock-specific and system-specific characteristics."

INTRODUCTION

The design of a livestock survey is not necessarily straightforward, due to the complexity in the production and marketing processes, in the management of livestock assets, and in the lifestyle of some population groups that are especially reliant on livestock for their livelihoods (e.g. nomadic, semi-nomadic, or transhumant livestock keepers). All of these factors pose particular challenges to data collection.

When designing survey questionnaires, therefore, decision makers should take into account both livestock-specific and system-specific characteristics. However, in most cases, practitioners who are tasked designing a new survey often have little to rely on other than their own technical expertise, experience and common sense. Moreover, the lack of a systematic approach to survey design often results in less than optional survey questionnaires, and hence in the generation of inaccurate data.

This chapter proposes that there is much to be gained by developing, adopting and disseminating good practices for survey construction which facilitates the systematic assessment of the choices made in questionnaire design and feeds into an understanding of how those choices influence the quality of the data collected. Drawing on survey experiments in Niger and Tanzania focused on milk production and pastoralist livelihoods respectively, this chapter sketches possible practical approaches to conducting various types of survey validation exercises.

PRE-TESTING: DO AS WE SAY, NOT AS WE DO

In their guidelines on methods for testing and evaluating survey questions, Presser *et al.* (2004a, p. 109) note that *"pretesting's universally acknowledged importance has been honoured more in the breach than in the practice."* Even in countries with well-managed and financed statistical systems, pretesting is often limited to a dry run of survey interviews, usually targeting a fairly limited number of households, which are then qualitatively evaluated by the survey teams so as to draw

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lessons from questions that seem to pose problems to interviewers or respondents. Sometimes this is complemented by a quantitative analysis of response frequencies and other simple statistics from the data collected during a pilot.

Often there is little that is systematic about these tests, despite the use of techniques which assess the performance of survey instruments (see e.g. those reviewed in Presser *et al.*, 2004b, and Iarossi, 2006). This is aggravated by a lack of documentation on the process and results of such tests. The evaluation of what 'works' is mostly left to the judgment and experience of the survey team.

Increasingly, however, survey practitioners are paying attention to pre-tests as a means of improving data quality. Also, specific methods are being developed, tested and codified and increasingly applied in survey practice. The interested reader is referred to Presser *et al*. (2004b) for a review of methods such as cognitive interviews, behavior coding, response latency, vignette analysis, experiments, and statistical modeling.

While the use of such methods, and their documentation, is more commonly found in OECD country surveys, their application is being adopted in low-income countries, including in Africa. A literature is slowly emerging, which includes tests of consumption expenditure data (Joliffe, 2001; Beegle *et al.*, 2012), recall methods in agricultural surveys (Beegle *et al.*, 2011), agricultural production diaries (Deininger *et al.*, 2012), child labor (Dillon *et al.*, 2012), labor statistics (Bardasi *et al.*, 2010), and micro-enterprise profits (de Mel *et al.*, 2009).

Within the livestock sector, numerous areas have been highlighted as particularly challenging for survey design. In consultations with livestock and household survey experts, the two specific topics which were cited as particularly problematic were the collection of data which feed into calculations of milk production, and the collection of data on mobile (pastoral) households/herders.

This chapter reviews experiments in livestock questionnaire elaboration within the context of household surveys in specific African countries, namely Tanzania and Niger. The process of conceptualization, design, implementation and analysis of these exercises is described for survey practitioners interested in potentially employing similar approaches to the pre-tests of new livestock-related questionnaires. The methods employed in these two examples represent distinct ends of the spectrum of possible approaches. The one targeting improved survey data on milk production in Niger is a randomized 'experiment' in which randomly selected sub-samples were asked alternative sets of questions aimed at capturing household milk production. The other is a more qualitative, but systematic and documented, pilot test of a questionnaire on pastoral households in Northern Tanzania.

It is important to note that the decision on the empirical approach to take is a function of the type of research objectives and the underlining questions being asked in each exercise. For reasons that will become clearer in the discussion that follows, randomized experiments can be useful to compare 'discrete' approaches, less so to fine tune a draft questionnaire where there are several interrelated and maybe far-reaching design questions that need to be pinned down.

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RANDOMIZED EXPERIMENTS: MILK PRODUCTION IN NIGER

Nationally representative household surveys typically lump the data collected on livestock products into one table listing the different products on the rows and a set of standard questions, common to all products and based on a 12-month recall period, in the columns. The module usually asks a variation on two rather simple questions: (1) "Number of production months in the last 12 months", and (2) "Average production per month during production months." Sometimes these questions are asked for milk as a homogeneous product, sometimes the product is broken down in different types of milk (cow, sheep, goat).

Because of the peculiarities of milk production[1], it is a well-known fact among livestock experts and statistical practitioners that collecting reliable milk production data with such simple recall questions is likely subject to errors. This has led livestock researchers and livestock survey specialists to devise more complex strategies to generate more accurate milk production data and additional information useful to evaluate milk production systems.

Examples of these alternative approaches include the *12_mo* method developed by researchers in CIRAD (see Lesnoff *et al*., 2010) which relies on the monitoring/recording of production over extended periods of time. To increase the accuracy of the responses, techniques are introduced that, while based on recall approaches, prompt more in-depth information from the respondent about the milk production system. In developing new survey approaches to integrate into household surveys that include an expanded agricultural focus, these methods are useful, but need to be adapted to conform to both the objective of the survey and to the survey operations. The only way to assess whether a change in approach results in an actual improvement in data quality is to validate the new method via fieldwork, ideally in an experimental setting, while reproducing as closely as possible real survey conditions.

1 There are a host of features of milk production for human consumption that make recall particularly hard: Milk is produced continuously, but with seasonal patterns. The lactating capacity of animals varies over time, across animals, and is dependent on the management of the animals. The farmer may additionally decide not to collect milk independently of the production capacity of the animals, and often part of the milk is used for suckling offspring.

It is beyond the scope of nationally representative household surveys, in terms of both objective and logistics, to collect milk production data over extensive time periods, or in a way that allows calculating the complex milk productivity parameters often required by livestock sector specialists. The objective of a nationally representative household survey is more modest, and limited to collecting a reliable measure of milk production that can accurately portray the role that milk production has in the overall household livelihood strategy.

At the same time, surveys aim to look at the heterogeneity across households. This implies that methods that rely on the application of technical production factors from the literature (e.g. average milk production per animal in a certain environment) combined with variables that may be easier to measure in a survey (such as the number of animals milked by the household) may result in accurate 'average' estimates, but may artificially reduce the observed differences in milk production (both in physical and value terms) across households. For most of the analyses performed with household level data, the analysis of the dispersion of the distribution is often as important, if not more so, than the analysis of the measures of central tendency (means, medians). For these reasons, alternative data collection methods need to be evaluated, not only on the basis of their ability to yield an accurate point estimate of, say, mean milk production, but also on their ability to return a distribution of observations that resembles as much as possible the 'true' distribution.

In view of these considerations, an experiment was implemented in Niger which reviewed and compared two methods that are often applied in livestock sector surveys. These two methods, supported by different questionnaires, are referred to as the "Average milk per day" (AMD) and the "Lactation curve" (LC) methods. Both seem to hold the promise of being adaptable to both the questionnaire design and logistics of a nationally representative multi-topic household survey.

The two questionnaires are amenable to testing in an experimental setting because they represent a discrete change in survey design. In a broad sense, they are virtually identical, except for questions related to milk production. Both questionnaires start off by prompting the respondents about the number of months during which animals were milked for human consumption, and how many animals, by animal type (bovines, sheep, goats, camels), were milked on average during each of those months.

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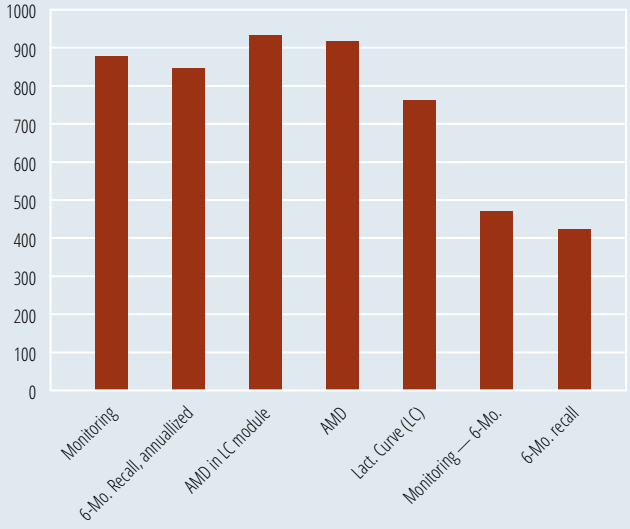
The questionnaires themselves differed in that the AMD asked for the average quantity per day produced by each milked animal during the period, whereas the LC questionnaire asked about the amount of milk produced by each animal at three (four) different points in time: one week, one month, and three (and six) months after parturition, e.g. after reproducing. The two modules then continue asking the same set of questions on issues of whether calves/lambs/kids were allowed to suckle, about the time gap between parturitions, and about the disposition of milk production (sales, consumption, and transformation into dairy products). Annual milk production can be calculated from both questionnaires. In the AMD, this involves simply multiplying the average daily production by 30 days (to get to monthly production per animal), then by the number of months of milk production. Using the LC method, the calculation is more complicated with annual production derived as the area under each animal's lactation curve, or the milk production curve.

One challenge in assessing data quality is that of identifying a benchmark, or a 'gold standard' against which the survey measures can be compared to assess their accuracy. In the experiment in Niger, such a gold standard was constructed by performing a physical monitoring of actual milk production every other week for 12 months, using a sample of around 300 households. The same households were then interviewed using the two recall methods. The comparison yielded interesting insights into the relative performance of the candidate recall methods. Statistical analyses were later used to analyze not only the relative performance of the alternative recall methods, but also, and perhaps more importantly, to review how measurement error (or the deviation from the benchmark) varied by household and respondent characteristics, as well as with specific variables of interest (e.g. does measurement error increase or decrease with larger herd size, or with respondent's education?).

In the case of the Niger milk production example, a comparison was drawn between four competing recall methods: the AMD and LC methods over 12 months; the AMD, but based on a combination with the LC questions; and the AMD, but based on a shorter recall[2]. The results allowed for ranking of the methods, based on their variance from the results of the monitoring. The AMD recall performed better, in all its variants, than the LC method, which appeared to underestimate production while also displaying a low correlation coefficient with the monitoring variable (r=0.38). Shortening the recall period to six months appeared to result in the most accurate estimate (about 3 percent difference in mean value compared to 5 to 6 percent with the 12 month recall). The six-month recall also showed the highest correlation to the benchmark at 0.71. When using a 12 month reference period for the AMD method, it appears that also including questions on the level of production at different points in the lactation can aid recall, resulting in a marginal difference in mean values, but in a substantial improvement in the correlation coefficient (from 0.44 to 0.61).

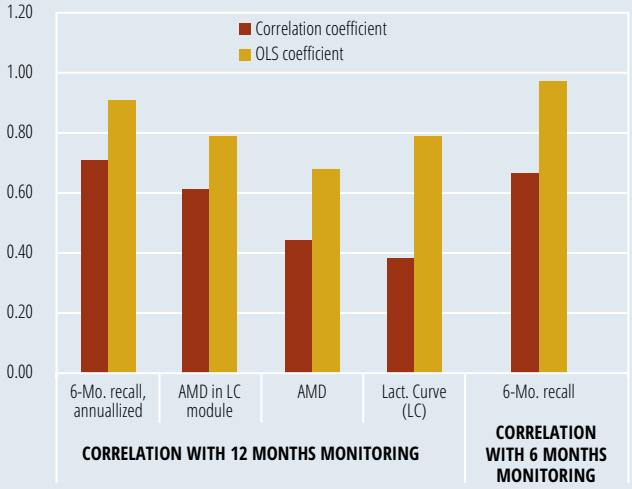
The experiment therefore revealed a clear ranking of methods in terms of their accuracy, and a clear idea of the extent to which the range and distribution of the estimates produced with each of the survey methods deviates from the benchmark value of choice.

FIGURE 3. MEASURING MILK PRODUCTION IN NIGER: BOX PLOTS COMPARING RANDOMIZED RECALL METHODS AGAINST PHYSICAL MONITORING



2 The results are discussed in full in Zezza *et al.* (2013).

FIGURE 4. MILK PRODUCTION DATA EXPERIMENT: COMPARING 6-MONTH RECALL DISTRIBUTION TO LACTATION CURVE METHOD.



SYSTEMATIC PILOTS: PASTORAL HOUSEHOLDS IN ARUSHA, TANZANIA

The above example highlights the complexity of survey design and lends itself to examining other challenges which are potentially more complicated and require different methods. Broader information needs often are required which cannot be generated by simply adjusting the survey design through refining how one specific (albeit crucial) piece of information is collected.

A critical example facing the African livestock sector is ensuring inclusion of special populations such as mobile herders (nomadic, semi-nomadic, transhumant) which are often not captured in national household surveys because of the problems posed with integrating them in the sample, and of finding them in a specific location at the time of the survey. The little data that exist on pastoralists is therefore usually the product of surveys geared specifically at surveying those populations or communities, which most likely invalidates any direct comparison with the population at large.

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BOX 5. ISSUES IN MEASURING PASTORAL ECONOMIES

Lack of panel data on pastoral production systems thwarts the possibilities of formulating investments which promote an efficient use of resources available in arid and semi-arid lands, including livestock. Whereas several studies have documented pastoralist production systems and pastoralist livelihoods in detail, the tools these studies use are time- and cost-intensive and not appropriate for monitoring trends in the pastoral economy on a regular basis. More practical ways need to be developed if Statistical Authorities are to collect, process and disseminate data and statistics on pastoral production systems.

There are at least three key issues associated with measuring pastoral economies. First, there is no standard definition of pastoralism, which may be identified on the basis of economic parameters (how much does livestock contribute to household income?), agro-ecological parameters (where is the household situated?), ethnic dimensions (to what tribe does the household belong ?), by exclusion (e.g. by defining crop and mixed crop-livestock farmers) or by combination of more than one variable. Each of the different approaches has its own advantages and weaknesses: for instance, using an economic definition could produce high variability in the number of pastoralists across the years because of rapidly changing livelihood strategies associated in response to weather fluctuations.

Second, pastoralists' regular or opportunistic movements during the year makes it difficult to set up a system of standard data collection. Trekking routes may change from year to year (nomads may even change animal movements after being informed of survey operations) and counting all animals that pass along a route is difficult; aerial or satellite surveys are powerful instruments to measure livestock populations in vast arid and semi-arid areas, but they produce little information on the pastoral economy, i.e. on their own they are an ineffective tool for designing programs and investments. Water points, which have been used as sampling units in some countries (e.g. Southern Ethiopia and Iran), are often unknown to statistical authorities and also present high seasonal variability, both in numbers and capacity of watering livestock, i.e. livestock data collected at water points may produce highly variable results across the years.

The third issue relates to data interpretation focused on pastoral people which prioritizes investment options consistent with their livelihood system. Given the multiple roles of livestock in pastoral economies, and the oftentimes opportunistic use of markets by pastoral peoples, using standard production or profit functions to identify key constraints affecting their livelihoods may lead to biased conclusions and policy indications. ■

As noted by Presser *et al.* (2004a: p. 122) pre-tests are especially lacking for special populations, which is where they are most needed given the special difficulties posed in surveying these populations. Survey challenges linked to pastoral households include two broad classes of difficulties: (1) capturing them in the sample, and (2) asking the right questions.

The experiment summarized in the following section focuses on the latter: assuming access to pastoral households, what are the priority questions? Given that the livestock management practices practiced by pastoralists (as well as many other challenges to their livelihoods) are profoundly different from those of sedentary livestock keepers (and households in general) relevant information cannot be extracted by asking them the same set of questions posed to other households.

Developing a pastoral specific questionnaire therefore requires carefully thinking about the key questions, adapting existing questionnaires from both sedentary and pastoral livestock and other living standard surveys, and putting together an entirely new questionnaire to be tested and validated before it can be applied on a larger scale. While it may not be possible to identify a 'gold standard' for comparison, one can, however, attempt to develop new sections of a survey instrument to address key questions for analysis, systematically pilot them in the field, and document the difficulties, successes and failures. Consolidating, collating and disseminating this learning can contribute towards establishing a body of knowledge that will incrementally improve survey design efforts. The objective should not be that of arriving at a blue-print, off-the shelf type of questionnaire, but rather to offer a starting point for other practitioners to adapt to the specific features, goals and circumstances of each survey.

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In the Arusha region of Tanzania, an exercise was conducted to adapt key sections of the Tanzania National Panel Survey (NPS) questionnaire for use with pastoral populations (Maasai communities, in this case). An initial draft module was developed which started from the NPS questionnaire and was then adapted to address key features which appeared not to work well with pastoral Maasai communities. The new questionnaire had a modified household roster which attempted to capture the complex organization of the Maasai household which was not adequately represented by a questionnaire built around a nuclear family. It also included a set of questions which related livestock ownership to the specific sub-households, questions on household and livestock mobility, sedentarization, grazing practices, and conditions which are not relevant to sedentary livestock keepers in Tanzania but are fundamental to interpreting the challenges to Maasai livelihoods.

While conducting fieldwork, the field team iteratively revised the questionnaire, documenting the underlining rational motivating the changes, and providing an account of how the questionnaires performed in the interviews. This was combined with a quantitative analysis of the data collected from about 200 households located in different communities with a wide range of underlying agro-ecological and socio-economic characteristics. Comprehensive results are documented in a detailed report (Loos and Zezza, 2013).

This systematic piloting of the new survey instrument provided some clear indications of the specific traits of pastoral livelihoods in Northern Tanzania that may be more amenable to inclusion in a national survey like the NPS while also revealing those that may not, or that would require considerable extra effort. Adjusting the household roster to reflect the complex structure of Maasai households, for instance, appears doable, and may have important implications for the analysis of livestock management. Table 4 shows the implications of using the Maasai definition of household (the *"olmarei"* in Maa language) versus one based on the nuclear family definition implied by the standard household definition used by the National Bureau of Statistics (NBS) in their National Panel Survey (NPS). (The latter would be identified by Maasai respondents mostly as a sub-household, referred to by its Kiswahili term, *"kaya"*). Because of the way livestock are assigned to different households members, and across sub-households, the key descriptive for the same sample would change dramatically. This would clearly have implications for any analysis of livestock management, in particular those related to animal movement, because of the way livestock is distributed across sub-households, as well

TABLE 4. TANZANIA: SUMMARY STATISTICS USING DIFFERENT HOUSEHOLD DEFINITIONS

		Self-defined *Olmarei*	NPS definition *Kaya*	% difference
Number of households		200.00	372.00	86.00
Household size		9.50	5.50	-42.00
Dependency ratio		1.31	1.18	-9.90
Female headed HH (%)		1.50	3.80	153.00
Age of head of household(years)		46.20	48.40	4.80
Head attended school (%)		28.00	23.70	-15.40
Animals	/ household	99.20	53.30	-46.30
	/capita	10.43	9.71	-6.00
TLU	/ household	23.33	12.54	-46.20
	/capita	2.45	2.29	-6.50

Source: Loos and Zezza, 2013

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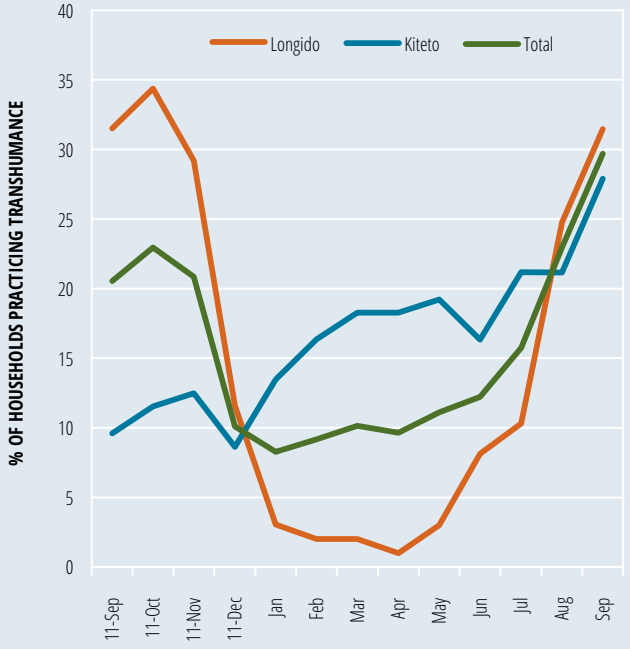
as per any per capita measure of welfare (because of the way household size needs to be computed to take into account the different eating and sleeping arrangements prevalent among the Maasai).

Gathering basic information on the extent and timing of mobility, and on the state of grazing areas also seems possible. Identifying the specific grazing areas used may be more challenging, although this may be feasible where community land use maps have been developed. Asking households in different communities about the extent, duration and mobility of households and livestock, responses were obtained that seemed to tally with the qualitative perceptions. This approach seems better able to capture the heterogeneity across households and communities (see Figure 5 for a graphic depiction of the responses).

A critical challenge to overall survey design is to ensure that all households can be found at the time of the survey. Surveys organized in two visits during a 12 month period may be more successful in reducing the number of households that cannot be contacted, in particular by understanding the expected timing of mobility so as to identify a suitable time for the second visit. This pilot has shown that it is possible to gather useful information for the analysis of pastoral livelihoods in a complex household survey, such as integrated household surveys. While it would have been quite challenging for the NPS operations to undertake such a pilot targeting such a relatively small population, the independent undertaking of the survey and the documentation and sharing of results with in-country stakeholders will increase the likelihood that the Statistical Authority will afford more specific attention to pastoral populations in future national surveys. Without such a focus, national level data will miss an opportunity to discuss policy options for the development of pastoral communities.

FIGURE 5. TANZANIA: PERCENTAGE OF HOUSEHOLDS PRACTICING TRANSHUMANCE OVER THE PAST 15 MONTHS BY DISTRICT



Source: Loos and Zezza (2013)

CONCLUSIONS

Surveys are conducted routinely on a wide range of topics in countries around the world. The amount of learning that is accumulated from each survey performed is arguably much less than what it could be. Pressed for time, resources and results, survey practitioners often draw on their own experiences, or those of their associates, as the main source of guidance.

A systematic approach to learning, as presented in this chapter, can contribute to improving the quality of the data that are generated by household surveys, and transform the learning process whereby best practices are adopted by others. This avoids reinventing the wheel every time a new survey is designed. Documentation and dissemination of lessons learned are crucial in that respect.

Targeted efforts at experimentation and documentation of innovative survey designs can have a positive impact not only on the quality of the data being produced, but also in the confidence that data users have in those data. While expert judgment and experience will continue to be an important input into designing surveys, a range of methods, drawn from experimental designs to systematic pilots, can feed into improved survey practices, generate better quality data, and contribute to innovative learning processes.

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2.3 PHYSICAL MEASURES OF PRODUCTION FOR BETTER STATISTICS: THE LIVESTOCK TECHNICAL CONVERSION FACTORS

KEY MESSAGES

Face-to-face interviews are often unsuitable for obtaining accurate data on the production level.

Physically measuring at the farm level and in abattoirs/slaughterhouses is necessary for properly quantifying production levels in traditional livestock production systems.

Unless production levels are physically measured at regular year intervals, official statistics on livestock risk being biased.

Methods to physically measure production level at farm level and in abattoirs/slaughterhouses are relatively straightforward, though they might be expensive.

INTRODUCTION

Increases in agricultural productivity, including in livestock, are essential for economic growth and poverty reduction in much of the developing world. Measuring livestock productivity, and understanding its determinants, is therefore critical to design and making investments that maximize the contribution of livestock to socio-economic development.

Livestock productivity connects inputs to outputs. Partial livestock productivity is the amount of output produced by one unit of a given production factor over a reference period, e.g. labor productivity could be calculated as liters of milk produced/hours of labor devoted to milking per cow per day; feed productivity could be computed as kg weight gain/kg of dry matter fed to the animal over a stated period of time. Total factor or multi-factor livestock productivity measures output(s) (e.g. milk, manure, transport services; etc.) per unit of a set of factors of production (e.g. animal stock, feed, water, etc.), and gives a single overall measure of productivity. Total factor productivity is calculated using indices of outputs and inputs (e.g. the weighted sum) or by some econometric technique that links output(s) to a set of inputs. Both partial and total livestock productivity measures are either based on the physical quantities of inputs and outputs (primal measures of productivity) or on price, profit and cost information (dual measures of productivity) (Chambers, 1988; Nin *et al.*, 2007).

The quality of any livestock productivity measure strongly depends on the quality of the data available to measure inputs and outputs. Data quality is typically high in research institutions or stations mandated to undertake scientific studies. It is relatively good when *ad hoc* data collection activities are undertaken for some investment purpose, such as for implementing a time-bound project in a given geographical area. It is less good, and often poor, when nationally representative livestock statistics or indicators are to be generated: limited financial and human resources devoted to data collection; limited focus on livestock in most surveys, i.e. lack of livestock data; sampling errors; non-sampling errors (e.g. improper survey livestock question formulation); and low frequency of livestock data collection, all make it difficult to generate good quality livestock productivity measures.

The consequences of not correctly measuring livestock productivity in nationally representative statistics can be serious. First, the Ministry responsible for livestock development will not be able to fully assess the returns to sector policies, including investments on the ground, which could lead to a biased allocation of ministerial resources. Second, livestock value added or the contribution of livestock to the Gross Domestic Product is unappreciated, which again could result in a less-than-optimal allocation of government resources.

This chapter presents some methodologies for improving livestock productivity indicators at country level. The focus is on the enumerator of all productivity measures, i.e. on the level of production, and in particular on parameters used to calculate so-called livestock technical conversion factors,

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which convert a measured livestock parameter to a different unit of measure: for example, 'milk yield per cow per day' allows estimating the level of milk production by only counting the number of milking cows over a given period/area.

The next section briefly reviews methods and challenges to collecting data on livestock production to generate nationally representative statistics; section three introduces livestock technical conversion factors and their role in producing good quality livestock statistics; section four presents some low-cost data collection methodologies to estimate selected livestock technical conversion factors, which have been recently applied by the Tanzanian government. Section five presents conclusions.

CHALLENGES IN COLLECTING DATA ON LIVESTOCK PRODUCTION

Four major survey instruments can be used to collect data useful to generate statistics on livestock production (see chapter 1.4):

- The agricultural census and, in some cases, the livestock census. These collate, process and disseminate data on a complete enumeration basis on a limited range of structural items of agriculture, which change relatively slowly over time. The agricultural/livestock census usually collects data on milk and egg production and, in some circumstances, on meat production.
- Agricultural sample surveys, including specialized livestock sample surveys, provide governments with comprehensive data on the livestock sector, which supplement census information. These surveys usually collect data on production levels of all major livestock products.
- Living standards measurement studies (LSMS) are multi-topic household surveys that aim to measure poverty and well-being and understand their major determinants. They collect data on livestock production, an important contributor of household livelihoods in developing countries.
- Administrative record data, also referred to as routine data, are regularly collected by national governments with the objective of planning, implementing and monitoring the delivery of public services. They often include data on livestock production levels, including of all major livestock products.

Whichever the survey instrument, there are two main methodologies of data collection. The first consists of direct interviews, whereby an enumerator visits the (farm) household or some other stakeholder and asks him/her detailed questions on some livestock production variables. The second consists of visual observations, whereby some actor, such as an extension officer or a market agent, observes (in a more or less structured way) production-related variables and fills a data spreadsheet (MLFD, 2012). Tables 5 to 8 provide examples of survey questionnaires and data sheets used by sub-Saharan African governments to collect data on livestock production levels.

Assuming that no actor has incentives to misreport, direct interviews and visual observations are appropriate to capture with statistical precision information on categorical variables which are slowly moving, such as the number of large and small ruminants owned by a household, or main water sources. They can also be used to capture, although with less accuracy, information on variables for which the respondent is likely to have some, but not full, knowledge/memory, such as the number of animals affected by a certain type of disease over the past 12 months or the amount of resources spent to treat sick animals over the reference period.

Direct interviews and visual observations, however, are not the best methods to collect data on variables which are difficult to measure: these are typically continuous variables with relatively high variability, and whose value also depends on factors that are not under the control of the household, such as rainfall. Cases in point are livestock production variables, such as meat, manure and milk production. In these circumstances, technical conversion factors are often used or should be to generate statistically robust livestock production indicators.

"Whichever the survey instrument, there are two main methodologies of data collection. The first consists of direct interviews… The second consists of visual observations."

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TABLE 5. UGANDA LIVESTOCK CENSUS 2008: QUESTIONS ON MILK PRODUCTION

Household identification number (ID)	Cattle			
	Indigenous	Exotic		Milk production (litres)
		Dairy	Beef	
Household ID				
Household ID				
Household ID				
Household ID				
—				

TABLE 6. ETHIOPIA LIVESTOCK SAMPLE SURVEY 2010/11: QUESTIONS ON EGG PRODUCTION

	None	Indigenous	Hybrid	Exotic
Laying hens				
Egg production per hen per clutch				
Average number of days per clutch				
Total number of clutches during the reference period				

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TABLE 7. NIGER NATIONAL SURVEY OF HOUSEHOLD LIVING CONDITIONS 2011: QUESTIONS ON MEAT PRODUCTION

Livestock type	How many [animals] did you slaughter in the past 12 months?												What was the average live weight (in kg) of animals that you slaughtered?	Over those months, what was the average quantity of meat that you produced?
	Number of animals slaughtered												Kg	Kg
	1	2	3	4	5	6	7	8	9	10	11	12		
INDIGENOUS														
Cattle														
Small rumin.														
Camels														
Pigs														
Poultry														
Guinea fowl														
CROSS/EXOTIC														
Cattle														
Small rumin.														
Pigs														
Poultry														

TABLE 8. TANZANIA ADMINISTRATIVE RECORDS: DATA ENTRIES ON LIVESTOCK SLAUGHTERED AND MEAT PRODUCTION

Type of Livestock	Total number slaughtered		Total carcass weight (kg)	
	This quarter	Cumulative to date	This quarter	Cumulative to date
Cattle				
Sheep				
Goat				
Pig				
Chicken (local)				
Chicken (improved)				
Others (specify)				

LIVESTOCK TECHNICAL CONVERSION FACTORS

Technical conversion factors are coefficients that convert a measured quantity to a different unit of measure. Examples of livestock technical conversion factors are:

- 'Meat per slaughtered animal', which allows calculating total meat production when multiplied by the number of animals slaughtered over a certain period in a certain area;
- 'Off take rate', which allows arriving at an estimation of the number of animals slaughtered from total livestock population data over the reference period;
- 'Milk production per cow/day', which allows estimating the level of milk production by counting the number of milking cows over a given period/area;
- 'Dung per adult cattle', which allows calculating the level of production for one of the major by-products of large ruminants, manure, by counting the adult cattle population over the reference period;
- 'Eggs per hen'; 'dry matter intake/day per animal'; 'weight gain per kg of dry matter intake'; etc. are other technical conversion factors that, if available, are useful to generate nationally representative production and productivity statistics for the livestock sector.

In order to measure the level of production of livestock products and by-products, three different levels of technical conversion factors are typically used. First level technical conversion factors allow calculating the amount of meat, offals, fat and fresh hides from every slaughtered animal; or the amount of manure and milk from every animal/milking animal. Second level technical conversion factors are used to decompose, say, meat in boneless flesh, butcher fat, salted meat, sausage, and other. At the third level, technical coefficients are used to convert, say, cattle butcher fat into animal oil, tallow and other (FAO, 2000).

In a developing country context, where self-consumption of livestock products is common and processing limited, first level technical conversion factors are of foremost importance and widely used to generate national livestock statistics. For example, in the Tanzania National Accounts, beef production is calculated by multiplying the total number of beef cattle slaughtered by 125, which is the technical conversion factor used to convert beef carcasses into kg of meat.

The 'meat conversion factors' for goats, pigs and indigenous chickens are 12, 45 and 2 kilos respectively; as for cow milk, the technical coefficient used is 1 litre of fresh milk/day per cow. The problem with Tanzania, and with most developing

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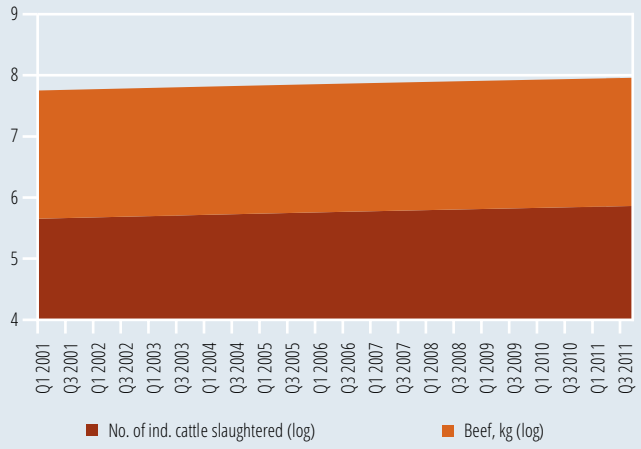
countries, is that the adopted technical conversion factors are often obsolete; calculated using data from non-representative or biased samples; taken from neighbouring countries; and/or rarely updated. The consequences for decision makers can be serious, as Figure 6 shows.

Figure 6 depicts the number of beef cattle slaughtered and the volume of beef production in Tanzania from first quarter 2001 to fourth quarter 2011, as reported in the National Accounts. Note that the slope of the two curves, and hence the distance between them, is constant over the reference period. This is so as, for the entire period, a constant technical conversion factor has been attached to carcasses to estimate beef production.

The implication is that increase in production is all accounted for by the increased number of animals slaughtered, and that likely improvements in animal productivity — which are in part reflected in the value of livestock technical conversion factors — are not captured in official statistics, which thus miscalculate the contribution of livestock to the gross domestic product. From another perspective, all policies and investments implemented by the Ministry responsible for animal resources aimed to increase beef cattle productivity, such as wider vaccination coverage and better feeding, are unappreciated in official statistics. And the latter influence the way public resources are allocated across sectors and between Ministries.

FIGURE 6. BEEF CATTLE SLAUGHTERED AND BEEF PRODUCTION IN TANZANIA, 2001–2011



Source: Tanzania National Bureau of Statistics, unpublished data

CALCULATING LIVESTOCK TECHNICAL CONVERSION FACTORS

The data needed to calculate livestock technical conversion factors, as explained above, cannot be obtained with statistical precision through surveys or visual observation, and some direct, physical measurement is recommended. This can occur at different points along the value chains but, for the purpose of calculating first level technical conversion factors, two are the appropriate sampling units:

- Farms, or households keeping livestock;
- Abattoirs and/or slaughterhouses.

At the farm level, data to calculate the following key conversion factors can be collected accordingly (MLFD, 2012):

- Milk production/day per milking animal

  Graduated transparent high-quality plastic containers can be provided to farmers, who are then required to record milk production at each milking, usually in the morning and the evening. Farmers are also to be given a record card. This is a standard methodology to estimate (partial) milk productivity.

- Manure production/day per large and small ruminants

  There are three methodologies available to measure daily manure production from large and small ruminants. The first consists of attaching a faecal bag to the animal and weighing the collected faeces at the end of the day. This method has been often used in research stations and mainly in stall-fed systems; in traditional systems, however, it is likely to influence animal 'behavior' and hence to generate biased results. The second method consists of weighing for a few days the faeces of some animal and then asking the farmers to count the number of times that the sampled animals defecate each day. The third method, which is the most labor-intensive, consists of following a sample of animals for a number of days and weighing their faeces as they defecate. The latter is possibly the most accurate method to quantify manure production per animal/day in traditional production systems.

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- Eggs/laying bird per clutching period

  A simple record card can be given to farmers to record the number of eggs produced by each laying bird, provided that she is in her clutching period. This methodology is straightforward, but farmers need also to provide information on the length of the clutching period, a pre-condition to arrive at quarterly/annual estimates of egg production.

In abattoirs/slaughterhouses, data to calculate the following technical conversion factors can be collected:

- Live weight and carcass weight of slaughtered animals; and meat, offals and fat content of carcasses.

  There are tools and equipment — such as scales and carcass weighers — that slaughterhouses use to measure live weight, carcass weight and the meat, offals and fat content of the carcass. Many slaughterhouse/abattoirs are already equipped with effective measurement tools and, in these premises, slaughterhouse managers should be easily able to record, if required, selected production parameters on a daily basis.

The above methodologies are not complex, but their implementation is challenging. First, to be meaningful for statistical, policy and investment purposes, technical conversion factors should be representative for the country as a whole and, possibly, for its major agro-ecological zones. In addition, seasonality should be captured. This has implications for both the sample size and the time length of data collection, making it expensive the estimation of statistically accurate livestock technical conversion factors (ILCA, 1990; Thomson, 2012).

Second, farmers in particular, but also abattoir/slaughterhouse managers, should be trained to properly collect the data needed to estimate livestock technical conversion factors, and be provided with equipment/tools for measuring and recording production parameters, such as a graduated plastic containers for quantifying milk production.

Third, some incentives should be given to farmers and slaughterhouse/abattoir managers for proper data collection. As a general rule, cash incentives should be avoided, as they may jeopardize future data collection activities, and in-kind incentives are to be preferred. At the farm level, these should possibly target livestock production (e.g. balanced/ supplemental feed for animals) and be provided at the end of the data collection exercise to avoid biased results. Basic equipment such as disinfectants, raincoats, knives and boots are appropriate incentives to ensure good data collection in slaughterhouses/abattoirs.

Finally, while one-off investments to update livestock conversion factors are valuable, country governments should make all efforts to ensure that livestock technical coefficients be regularly updated, a pre-condition for the efficient allocation of public resources. Updated technical conversion factors also reduce the need to collect data on livestock production through surveys or administrative records, thereby reducing the financial and human resources needed for implementing agricultural/livestock surveys and routine data collection (administrative records).

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CONCLUSIONS

Measuring livestock productivity, and understanding its determinants, is essential to design and implement investments that maximize the contribution of livestock to socio-economic development. Productivity relates inputs to outputs, and the quality of productivity measures strongly depends on the quality of the data available to measure them. These data, when it comes to producing nationally representative statistics, are often of poor quality.

Traditional methods of livestock data collection, including direct interviews and visual observation used in surveys and administrative records, are not the best methods to collect data on variables that are continuous and difficult to measure in low-income settings, such as meat, milk and manure production. In these circumstances, technical conversion factors are used or should be used to produce accurate, nationally representative statistics. These are coefficients that convert a measured livestock variable to a different unit of measure: for example, 'milk yield per cow per day' allows estimating the level of milk production by only counting the number of milking cows over a given period/area. Technical conversion factors are best calculated by physically measuring the value of selected parameters at different points along the value chains, but in most countries the value of technical coefficients is obsolete or sourced from inappropriate datasets.

This chapter presented methods to collect data to calculate key livestock technical conversion factors, namely milk production/day per milking animal; manure production/day per large and small ruminants; and eggs/laying bird per clutching period at the farm level; and to collect data to quantify live weight and carcass weight of slaughtered animals; and meat, offals and fat content of carcass in slaughterhouses and abattoirs. The methods presented are straightforward, but appropriate sampling, incentives and institutional arrangements are needed for proper data collection and the ensuing calculation of technical conversion factors. Livestock technical coefficients should be updated regularly to properly measure livestock production and productivity. This allows one to assess the effects of policies and programs on the ground and to properly estimate livestock value added, i.e. the contribution of livestock to GDP, which influences the way public resources are allocated for livestock developmental purposes.

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2.4 INSTITUTIONAL CHANGES TO IMPROVE THE QUANTITY AND QUALITY OF ADMINISTRATIVE LIVESTOCK DATA

KEY MESSAGES

Good administrative records, also called routine data, are critical for policies and investments design as they provide data at low administrative level.

Routine data are often considered of relatively poor quality, as they are collected by extension officers who are rarely, if ever, trained statisticians or trained in data collection.

Routine data, on paper, are collated on a complete enumeration basis, which make data collection extremely demanding. A sampling approach is possibly a more effective way to collect data at local level with some statistical accuracy.

Institutional experiments, whereby different methods to organize data collection at local level are performed on a small scale and their efficacy compared, are an effective way to improve the system of routine livestock data collection.

INTRODUCTION

Most livestock data publicly available in sub-Saharan African countries are collected either by the National Office of Statistics or by the Ministry responsible for livestock development. The latter, often in cooperation with local government authorities, collects livestock-related data at a low administrative level during its routine operation. These data, called routine data or administrative records, are, along with census data, the only ones that provide information at district/province or lower levels of disaggregation. For this reason, they are widely used to design, implement and monitor livestock sector policies and investments.

Routine livestock data also contributes to regional and international livestock-related information systems and/or databases, such as the Livestock Information Management System (LIMS) of the Southern Africa Development Community (SADC), the Animal Resources Information System 2 (ARIS 2) of the Interafrican Bureau for Animal Resources of the African Union (AU-IBAR), CountrySTAT and FAOSTAT of the Food and Agriculture Organization (FAO), and the World Animal Health Information System (WAHIS) of the World Organization for Animal Health (OIE). Indeed, international obligations require that African countries submit monthly, six-monthly and annual animal health/disease reports to the World Organization for Animal Health (OIE) — the reference organization to WTO with respect to trade-related trans-boundary animal diseases (TADs) — to the Africa Union-Interafrican Bureau for Animal Resources (AU-IBAR); and to some Regional Economic Communities (RECs).

Despite governments' and other regional and international institutions' wide-ranging use of routine livestock data, administrative records are often incomplete, out-of-date and unreliable. Insufficient resources, and limited skills in data-handling and processing, are the two most-cited reasons for the inadequacy of administrative records. Improvement is thus essential to promote evidence-based policy and investment decisions and implementation. Notably, the *Global Strategy to Improve Agricultural and Rural Statistics* considers administrative records to be one component of the integrated survey framework; it highlights that routine data are a key source of information for generating several indicators for agricultural statistics; and it includes administrative data as one of the priority research areas in its Action Plan for Africa.

Efforts to improve administrative records in developing countries, however, have to date been limited. But for few exceptions, such as the JICA-sponsored improvement of the agricultural routine data in Tanzania, national and international investments have mostly targeted censuses and sample

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surveys. There are thus few experiences and methodologies available to allow assessment and improvement of routine data systems. In turn, this further contributes to reduced investments in administrative records.

This paper presents a methodology for undertaking a rapid assessment of routine livestock data systems and identifies options for improvement. It has been developed by the Uganda Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and the Uganda Bureau of Statistics (UBOS), in collaboration with the FAO-World Bank-ILRI-AU-IBAR *Livestock in Africa: Improving Data for Better Policies* Project. Uganda, like several other developing countries, has a system of routine data collection that explicitly targets livestock. The next sections describe this system and present and apply to Uganda a rapid assessment methodology for livestock administrative records. A section follows that proposes actions for improvement. These proposals are intensive 'field experiments' or pilot approaches with control groups, which represent significant institutional changes in Uganda. A last section presents conclusions and recommendations.

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ROUTINE LIVESTOCK DATA COLLECTION IN UGANDA

The Directorate of Animal Resources within the Uganda Ministry of Agriculture (MAAIF) is comprised of two Departments, namely the Department of Animal Production and Marketing and the Department of Livestock Health and Entomology. The Directorate of Animal Resources is mandated to formulate and implement livestock sector policies, plans and programs, and to control and manage epidemic animal diseases. MAAIF makes use of census and survey data to fulfil its mandate, but its major source of information on livestock is administrative records. These represent the country's only information regularly available at district and lower administrative level and, therefore, are of primary importance to MAAIF.

The system of routine data collection in Uganda is structured as follows. Sub-county level Livestock/Veterinary officers are responsible for provision of extension services to rural households, and for collection of some livestock-related data during their routine work. These officers collect data according to a reporting form formulated at the district level: across districts there is no unique format used, as data are primarily collected to meet the differing information needs of District Authorities/Local Governments. On a monthly basis, the District Livestock/Veterinary Officer compiles and assembles the data gathered by extension officers in the various sub-counties and submits a pre-designed livestock data reporting form to MAAIF, through his/her respective Chief Administrative Officer. It is notable that District Authorities are not legally obliged to report to MAAIF, as they are subordinated to the Ministry of Local Government.

The livestock data report that districts compile on a monthly basis includes information under several headings:

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- 'General information', namely basic information on rainfall pattern; water availability and grazing conditions;
- 'Outbreaks of contagious diseases', including outbreaks of any of 28 major diseases, numbers of animals affected and at risk, and action taken to control/manage any outbreak;
- 'Rabies' cases, including those in humans;
- 'Vaccination', which refers to the number and species of animals vaccinated against any of 8 major diseases (CBPP, FMD, LSD, Black Leg, Brucellosis, NCD, Rift Valley Fever, CCPP);
- 'Other clinical cases handled', by species, which refers to first aid and surgical interventions, diarrhea, mastitis and others;
- 'Tick control', including number of cattle dipped; number of dip tanks available by ownership (communal or private);
- 'Dip wash testing', which reports on acaricide type, number of samples tested and the results of tests.
- 'Laboratory activities', i.e. results of analyses of blood/lymph node smears; faeces and serum.
- 'Vaccine stocks', with details on doses available and date of expiry;
- 'Internal animal movements in relation to animal laws', including from/to other districts and means of movement (e.g. foot; truck/train; or air);
- 'Artificial insemination' for four major dairy cattle breeds (Friesian, Ayreshire, Guernsey and Jersey);
- 'Veterinary regulatory activities', i.e. information on dissemination and sensitization meetings on animal-health related issues;
- 'Meat inspection', namely pre- and post-mortem inspection activities and results by species;
- 'Animal quarantine and other restrictions', including number of counties/sub-counties quarantined; number of livestock markets closed; control measure taken; etc.;
- 'Animal production', which refers to number of live animals in the district by species;
- 'Types of livestock farming systems in the district', i.e. number of animals in pastoral/communal, semi-extensive, semi-intensive and intensive production systems;
- 'Livestock markets', which collects information on number of live animals offered and sold in the different markets and maximum, minimum and average price;
- 'Hides and Skins', including salted and non-salted and kilograms produced;
- 'Staff disposition and vehicle strength', namely grade of staff and level of education; number of vehicles by type (e.g. trucks; 4WD; motorbikes; etc); and other equipment available, such as computers, GPS, refrigerators and generators.

The routine data that MAAIF collects largely target animal health and diseases, with some limited information on the livestock population (production) and on livestock markets. Indeed, almost 60 percent of the 2011/12 MAAIF budget for 'animal agriculture', excluding fishery, is allocated to 'vector and disease control measures', which basically means animal vaccination. Note that not all information in the livestock reporting format can be regularly sent by District Authorities to MAAIF: for example, new outbreaks of animal diseases do not occur every month, nor in all districts is there a functional laboratory or a quarantine station. In any case, the amount of information that districts should produce on a monthly basis is significant and should suffice to formulate and monitor the implementation of animal health-related policies and investments.

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BOX 6. ROUTINE LIVESTOCK DATA COLLECTION IN ZANZIBAR

Routine livestock data, or administrative record data, are regularly collected by the Ministry of Livestock and Fisheries (MLF) of the Revolutionary Government of Zanzibar. MLF staff work in the Central Government, the Districts and the Shehias. The first step of data collection is performed at Shehia level, where, as one of their tasks, so-called Livestock Production Assistants and Para-veterinarians collect livestock-related data from livestock keepers. These data are sent every month to the District Authority, where the District Livestock Officer and the District Veterinary Officer prepare monthly reports and send them to MLF HQs. In particular, every month District Officers submit to MLF HQs: (a) Animal Health Reports; (b) Animal Production Reports. MLF then compiles monthly Animal Health and Animal Production Reports, which cover the whole of Zanzibar. These reports are neither submitted to AU-IBAR nor to the World Organization of Animal Health (OiE).

In some circumstances, Shehia and District Officers also obtain data from Community Animal Health Workers, even though the latter are not MLF staff. Another source of data are the so-called Animal Health and Production Centres of MLF. There are about 20 such Centers in Zanzibar, which are located in the higher livestock concentration areas and provide livestock keepers with clinical, diagnostic, treatment and extension services. Finally, when there are disease outbreaks that risk spreading throughout the islands, MLF provides human and financial resources to Local Governments to control the disease. Additional data are collected in these circumstances, which can enter the monthly reports.

The Monthly Animal Health Report targets a variety of information, including: (a) disease outbreaks by type of disease and animal species (cattle, sheep, goats, donkeys, chicken, ducks, cats and dogs); (b) number of animals by species affected, treated (by type of treatment) and dead (by type of disease); (c) number of vaccinations, disease control and warm control practices by animal species and practice; (d) activities in quarantine stations (at ports and the airport), and related to meat inspections and laboratory investigations; (e) revenue collection, primarily generated by service fees (e.g. for AI or dipping) and movement permit; (f) number of staff available by gender and participation in training.

The Monthly Animal Production Report contains the following information: (a) number of livestock keepers by gender and animals owned, including cattle (indigenous and improved), goats (indigenous and improved), indigenous poultry, and layers and broilers; (b) number of farmer groups by animal species and membership; (c) animals owned by species by government farms, including multiplication units for dairy cattle and dairy goats; (d) number of animals sold, both within Zanzibar and between Zanzibar, Tanzania mainland and other countries; (e) number of animals slaughtered, yield (lit / kg) and production of cow and goat milk, beef, goat, chicken and eggs; (f) types of extension services provided (e.g. dairy husbandry practices; pasture management; animal welfare, etc.) and number of beneficiaries, as well as farmer field schools organized; (g) revenue collection, primarily from sales of pasture seeds and feed for animals; (h) number of staff available by gender and participation in training.

MLF's objective is clearly to ensure regular and good quality information on the livestock sector in Zanzibar, with a focus on animal health and production. However, the quantity and quality of available livestock data is often unsatisfactory, for a number of reasons. (a) officers in Districts and Shehias are not trained in data collection/analysis, which is one of their many tasks, and not among their top priorities; (b) Livestock Production Officers and Para-vets in Shehias collect data from the farmers they visit, which may differ from month to month; (c) while there is a common data format for MLF District staff to compile the monthly reports, at Shehia level, there is no common template, with extension officers collecting and reporting data as they prefer; (d) at local level, resources are often scarce and, therefore, Districts do not always send with regularity their Animal Health and Production Reports to MLF HQs.

MLF has plans to improve the quantity and quality of routine livestock data, including recruiting more staff and conducting staff training to establish benchmark data, and information systems. It recognizes the major challenges inherent in the generation of good quality production statistics, including information on off-take, carcass weight and milk yield per animal. Virtually all efforts to control and eradicate animal diseases have as an objective the improvement of livestock productivity. The challenge is to measure these productivity gains, and, ultimately, to contribute to improved livelihoods for livestock farmers. ■

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AN ASSESSMENT OF THE UGANDA ROUTINE DATA SYSTEM

Routine livestock data are a critical piece of information for the Ministry responsible for animal resources and, if properly collected, it could become an integral part of the statistical system. So far, however, despite ample criticism of administrative records, there have been few if any attempts to comprehensively assess routine data systems. In most cases, evaluations target specific issues of routine data systems in industrialized economies, such as the use of administrative records to identify undercounted population in the human census; or to update the survey framework by, for example, providing updated information on the dynamics of private and public sector businesses (Sheppard *et al.*, 2013).

This section first presents a low-cost methodology to assess routine livestock data and then applies it to Uganda. The proposed methodology builds on both quantitative and qualitative information and employs three measures:

- Number of data reports — A quantitative assessment of the number of statistical reports submitted by local staff and/or local authorities to the Ministry of Agriculture/Livestock versus the number of reports due. Although simple, this ratio is a good indicator of the effectiveness of the prevailing institutional architecture, including mechanisms of data collection and reporting.
- Completeness of data reports — A quantitative assessment of the completeness of the information in the different sections of the statistical reports submitted to the Ministry of Agriculture/Livestock, including the proportion of sections filled. This ratio provides an indication of the capacity of local staff/authorities to report on specific data items. Indeed, while information on some variables can be easily captured — number of vaccines administrated by extension officers — other is more difficult to gather, such as average market prices for live animals.
- Qualitative assessment — Semi-structured interviews with expert informants, including not only those directly involved in data collection and analysis, but also staff in the National Bureau of Statistics, who can provide a statistical perspective on data systems usually managed by agricultural/livestock experts.

Number of reports

Figure 7 displays the number of livestock data reports submitted by the 112 Uganda Districts to MAAIF from January to December 2012. Figure 8 summarizes the frequency of district reporting: the histogram shows a U-shape distribution as out of 112 districts, only 31, or 27 percent, regularly submitted their monthly livestock data report to MAAIF in 2012; on the other hand, another 16 districts, or 14 percent, never reported to MAAIF that year. The remaining 66 districts reported to MAAIF in a number of months between 1 and 11 in 2012. The overall reporting rate stands at 62 percent, i.e. of 112 reports expected each month — one per district — 70 were received by MAAIF in 2012. An immediate conclusion is that the current institutional architecture of data collection and reporting does not properly work.

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FIGURE 7. UGANDA: LIVESTOCK DATA REPORTS SUBMITTED BY DISTRICTS BY MONTH, JANUARY–DECEMBER 2012

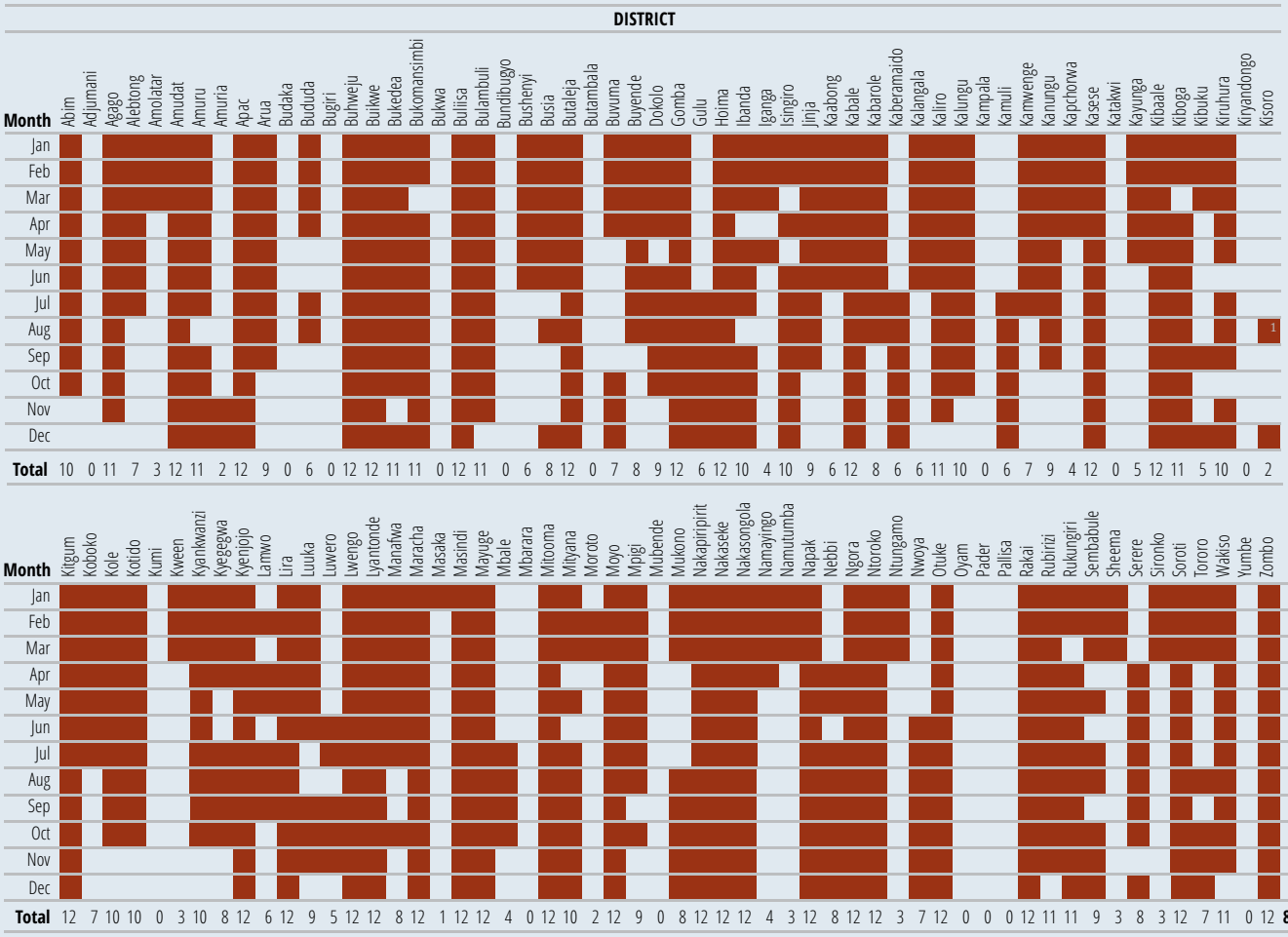

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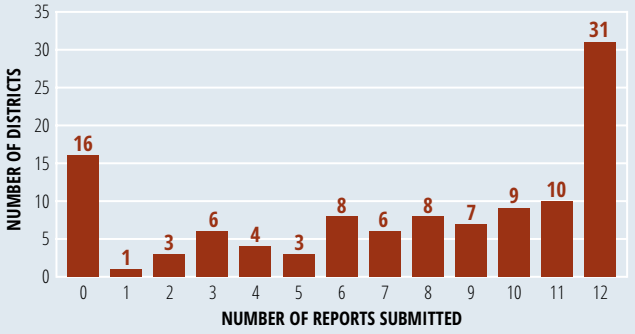
FIGURE 8. UGANDA: FREQUENCY OF DISTRICT REPORTING



Completeness of reports

The second step for assessing routine data systems is to look at the completeness of the reports received by MAAIF. As noted, the required information can be difficult to gather and assemble for data collectors and authorities at the local and national level. Figures 9 and 10 display the number of livestock data reports, by section, as a proportion of the total number of reports that should have been submitted (Figure 9), and over the number of actual reports submitted (Figure 10). In other words, Figure 9 shows the probability for MAAIF of getting the information for the data item at hand, while Figure 10 shows the probability of getting that same information conditional on selecting one of the reports submitted to MAAIF by the district authorities.

Figures 9 and 10 substantiate the evidence that the current system of routine data collection and reporting is somewhat inadequate: not only are relatively few reports regularly submitted, but those submitted are often incomplete. The most reported item is 'general information' which, as said, comprises basic information on rainfall pattern, water availability and grazing conditions: this is reported in 35 percent of expected cases, and present in 56 percent of the submitted reports. In other words, there is a probability of 33 percent of getting 'general information' from any district and a probability of 56 percent of finding that information among the available reports, with 'general information' being the most reported data item.

FIGURE 9. UGANDA: DISTRICT OVERALL REPORTING RATE

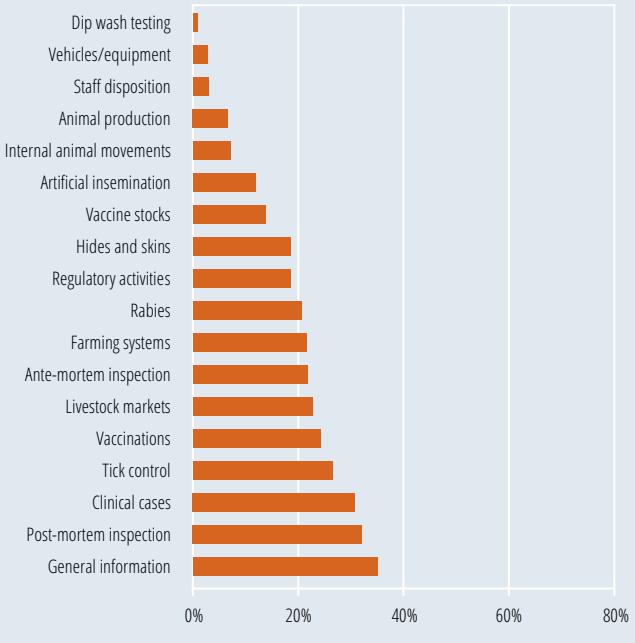
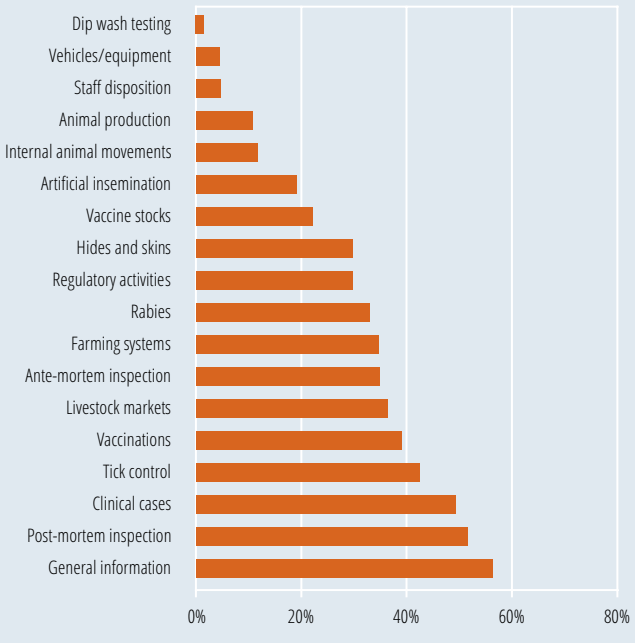


FIGURE 10. UGANDA: DISTRICT CONDITIONAL REPORTING RATE



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Qualitative assessment

A team from the Ministry of Agriculture, Animal Industry and Fisheries and the Uganda Bureau of Statistics conducted semi-structured interviews with expert informants to assess the system of routine data collection. The team travelled to three selected districts — namely Lira, Nakasongola and Soroti — which submitted all reports to MAAIF in 2012 and are located in the so-called cattle corridor, an area stretching from northeast, through central to southwest Uganda and with a high animal population density. Semi-structured interviews were conducted with extension officers, who are responsible for data collection at sub-county level, and with the district veterinary officers, who are tasked with assembly of the data gathered by extension officers and compilation of reports for MAAIF. Then discussions were held with staff from the College of Veterinary Medicine and Biosecurity, the National Agricultural Research Organization, the College of Agricultural and Environmental Science, the Animal Genetic Resource Centre and Data Bank, the Dairy Development Board and the National Drug Authority. The conclusions were:

- District authorities contend that livestock data are critical for management and planning, primarily for animal disease control and management. Indeed, in all districts data collection prioritizes animal vaccination and animal treatment, though some information is also collected on other tasks performed by extension officers and the veterinary officers, such as artificial insemination and post-mortem inspection of carcasses. Only Nakasongola district authorities mentioned animal population as a key indicator for management and planning. Only in Soroti district are data stored electronically; in Lira and Nakasongola paper forms are used.

- Extension officers lament that data collection — and other activities they must perform — involves significant movement for which they have insufficient resources, such as motorbikes, computers and fuel. Indeed, paper-based data collection should be done on a complete enumeration basis, but this is rarely, if ever the case.

- Even if extension officers had enough resources to visit all households that keep livestock in each sub-county, this would still pose a major challenge. According to UBOS data, in a typical sub-county there are about 4000 households, of which about 2400 or 60 percent on average keep some animals. This means that an extension officer, while performing his many other activities, should interview about 100 households per day — assuming he/she works 24 days a month — in addition to gathering information from other sources, such as in livestock markets and abattoirs.

"Extension officers lament that data collection — and other activities they must perform — involves significant movement for which they have insufficient resources, such as motorbikes, computers and fuel."

- Extension officers are not trained in data collection and handling, and gather their information during their daily activities. They do not follow specific rules and procedures, nor do they administer survey questionnaires to households that have livestock and other relevant stakeholders such as market authorities. Scattered direct observations are the norm.

- The livestock statistical report that District authorities submit to MAAIF includes data items that are not consistently defined. Some data reflect the routine work undertaken by extension officers, such as the number of animals vaccinated; other data are based on *ad hoc* data collection, such as data on market prices for live animals and on the livestock population; and data focus on both relatively static and highly dynamic items, such as number of staff and vehicles available in the district office and outbreaks of animal diseases. This inconsistency makes data compilation and reporting difficult.

- The College of Veterinary Medicine and Biosecurity, the National Agricultural Research Organization, the College of Agricultural and Environmental Science, the Animal Genetic Resource Centre and Data Bank, and the National Drug Authority collect their own data, such as on breeds, breeding practices and reproductive performance. These data would represent a valuable input into policy design and implementation if complemented by those collected by District authorities on a monthly basis.

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OPTIONS TO IMPROVE THE LIVESTOCK ROUTINE DATA SYSTEM

The MAAIF-UBOS assessment of the routine data system in Uganda revealed major weaknesses, which need to be addressed to ensure proper management of the livestock sector. MAAIF and UBOS duly established a small team to identify options for improvement of the routine livestock data collection system. This team based its work on four assumptions. First, any improvement in the routine data system should start from the set of core livestock indicators, as identified and endorsed by the National Agricultural Statistical Committee. These are indicators needed by MAAIF and UBOS on a regular basis and collected using their recurrent budget. They are the core indicators presented in Chapter 1.2.

Second, routine data, if collected according to sound statistical principles, could also be used by the National Statistical Authority, thereby facilitating data integration and improving the overall efficiency of the agricultural statistical system. As far as possible, therefore, statistical principles should be adopted by the routine livestock data collection system.

Third, the budget allocated to extension and data collection is limited and, most likely, will remain limited. Options to improve routine data, therefore, should attempt to simplify the current system and involve little or no increase in the current budget. Indeed, there will be transaction costs to move to an improved data collection system, but these are one-off, or *una tantum,* investment costs.

Finally, various institutional reforms can be devised to improve the routine livestock data collection system. *A priori*, however, it is difficult to identify the most appropriate and efficient reforms. Pilot implementation of alternative institutional reforms to identify the most promising options is widely appreciated as an effective way of promoting significant improvements. Based on these assumptions, and on the rapid assessment of the routine livestock data system, the following is recommended:

1. District authorities should produce monthly, quarterly and annual statistical reports to be shared with MAAIF, constructed so as to recognize demands on the time of the extension officers and the District Veterinary Officers. The monthly report will target only data related to animal diseases, including information on disease outbreaks, on vaccination and treatment, and other core activities related to animal disease management and control. This information should not be used to generate official statistics. The quarterly report will target only information on the livestock population and market prices for live animals and hides and skins. This information, if properly collated, can be used to generate official statistics. The annual report contains only information on major livestock-related physical and human resources available in the district, such as slaughterhouses, market facilities, and staff by grade. It could also contain summary tables derived from the monthly and quarterly reports.

2. Extension officers in all sub-counties should use a common collection and reporting format. In particular, one form should target the monthly information and the other the quarterly information that districts are supposed to send to MAAIF. While extension officers can collect data for the monthly report during their routine work, the information in the quarterly report requires some targeted data collection activity. Extension officers should be trained to administer questionnaires to collect these data.

3. Four pilots are suggested to implement sound statistical principles in gathering routine livestock data which are collected on a quarterly basis. The pilots build on the evidence that, as shown, data collection on a complete enumeration basis is not achievable with current human resources and, therefore, a sampling approach is needed. Sub-counties will be subdivided into enumeration areas (EAs) — a list of EAs is already available and, in most cases, one EA corresponds to one village. In each sub-county the extension officer will travel either in all, or a sample of, EAs for data collection; in the sampled EAs s/he will interview a sample of households and, depending on the case, s/he will be given an incentive for data collection, such as some free fuel. The four approaches, which are summarized in Table 9, vary because of different sampling and resources provided to extension officers for data collection. Note that in two cases the current budget should suffice to implement the proposed new systems of data collection at the country level, while in the other two some additional budgetary allocation is anticipated. To identify which of the different pilots provides better estimates of the livestock population in the country, a livestock census will be conducted in the pilot sub-counties, which will also allow building an updated frame for selecting the sampled households. Results will be compared with those from two control sub-counties, in which

the current monthly reporting systems will remain in place. Implementation of the pilots will be joint responsibility of MAAIF, UBOS and Local Government Authorities.

The implementation of the proposed pilots will provide evidence on whether or not statistical principles can be brought into the routine livestock data collection system. It will also help to identify the most appropriate institutional reform for improved routine livestock data collection. The proposed pilots target only data collection and do not include any activity related to data transfer and analysis. Finally, it is worth noting that independent of the implementation of any pilot, MAAIF can request Districts to adopt the proposed monthly, quarterly and annual livestock statistical reporting formats.

TABLE 9. UGANDA: PROPOSED PILOTS TO IMPROVE THE ROUTINE SYSTEM OF LIVESTOCK DATA COLLECTION

	Pilot 1 Sub-county 1	Pilot 2 Sub-county 2	Pilot 3 Sub-county 3	Pilot 4 Sub-county 4
EAs	All	All	Sample	Sample
Households	Sample	Sample	Sample	Sample
Training for extension officers	Yes	Yes	Yes	Yes
Resources to extension officers	No	Yes	No	Yes
Benchmark	Livestock Census	Livestock Census	Livestock Census	Livestock Census

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CONCLUSIONS

The Ministry responsible for livestock development, often in cooperation with local government authorities, collects livestock-related data on a regular basis in the course of its routine operation. These data, called routine data or administrative records, are compiled at relatively low cost and collected at ground level. They represent a critical input into policy and investment design, implementation, monitoring and evaluation, and the management of the livestock resources more generally.

There is scattered evidence that in developing countries routine livestock data are inadequate, and no standard methodology is available to assess their quality. This paper presented a methodology for a rapid assessment of the routine livestock data system, which builds both on quantitative and qualitative information. The quantitative information targets the number of available statistical reports and their completeness; the qualitative information includes semi-structured interviews with expert informants.

The methodology to assess the routine livestock data system was applied to Uganda. The current system of routine livestock data collection is inadequate because of missing information and poor quality of the data. The paper proposes to streamline the current livestock-data reporting form, by suggesting that MAAF should request District authorities to report on different items on a monthly, quarterly and annual basis. It then sketches four possible pilots to identify the first best institutional reform for an improved system of routine livestock data collection. The pilots contain three innovative elements. First, two of the proposed pilots are budget neutral, i.e. they could be implemented with a one-off investment and without the need to increase the recurrent expenditure budget. Second, they introduce sound statistical principles to administrative records by proposing a sampling approach for the routine data collection. Third, the pilots are designed to tests the relative efficiency of alternative institutional arrangements underpinning routine livestock data collection.

While designing and testing alternative pilots to improve the routine livestock data collection system in Uganda is recommended, the adoption of improved monthly, quarterly and annual livestock statistical reports — which is a no-cost action — is also expected to enhance the quality of routine livestock data.

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