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LIVESTOCK DATA AND STATISTICS FOR EVIDENCE-BASED POLICIES LESSONS FROM COUNTRY EXPERIENCES

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1.   Introduction

The National Statistics Offices (NSOs) are independent producers of official statistics. They are responsible for collecting, processing, disseminating as well as archiving data and statistics related to the population and the economy at different levels of disaggregation. Official data and statistics are not only a record of the society and the economy but also represent a tool for stakeholders, and the government in particular, to effectively formulate, implement and oversee policies and investments. In many circumstances, however, *"existing data remain unused because they are released too late or not at all, not well documented and harmonized, or not available at the level of detail needed for decision-making"* (UN, 2014).

This paper shares lessons from two sub-Saharan African countries, namely Tanzania and Uganda, on ways to improve the quantity, quality and utilization of livestock data and statistics by policy-makers and other stakeholders. It summarises the joint work undertaken, in collaboration with the FAO, by the National Bureau of Statistics (NBS) and the Ministry of Livestock and Fisheries Development (MLFD) in Tanzania, and by the Uganda Bureau of Statistics (UBOS) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in Uganda.

The next section clarifies the role of quality data in decision-making, with a focus on official statistics. Section three presents a tool, notably a survey questionnaire, to improve the quantity of livestock data available to decision makers, while section four suggests an approach to improve the quality of the collected data. Section five targets data dissemination, and section six recommends the implementation of *ad hoc* surveys and field experiments for policy design, which complement the information provided by official statistics. The concluding section presents recommendations that members of the African Commission on Agricultural Statistics (AFCAS) may wish to endorse in order to promote evidence-based policy and institutional reforms in the livestock sector.

2.   Livestock data and statistics for decision-making

The formulation and implementation of sustainable policies and investments is a continuous process that requires a variety of quality data and statistics. However, there is little clarity on the role of official statistics in this process, which often puts unfair pressure on and undue expectations from NSOs.

In order to clarify the type of data and statistics needed for evidence-based policies and investments, let's assume here that the decision maker is the Ministry responsible for animal resources, and that the Ministry's overarching objective is the promotion of a sustainable growth of livestock, from a social, economic, environmental and public health perspective. To this end, the Ministry needs information on the following (Pica-Ciamarra and Baker, 2014; World Bank, 2014):

- **Livestock, livelihoods and socio-economic development**
Allocating resources to the livestock sector makes sense if its development contributes to the broader socio-economic development of the country. The Ministry needs thus data and statistics that measure the extent and nature of livestock's development contribution, both negative and positive. Such contributions might relate to income generation, poverty reduction and/or food and nutrition security; to public health and greenhouse gas emissions. NSOs' surveys, such as living standards measurement studies (LSMS), generate these data and information, which provide the rationale for policies and investments in the livestock sector.

- **Livestock production systems – production constraints**
Once there is evidence that livestock development is good for society, the Ministry needs data and statistics to characterize livestock production systems and, more in particular, to identify the binding constraints that prevent livestock producers from making efficient use of their animals. Such constraints can relate to production technologies and practices (e.g. limited vaccination of animals against killer-diseases) as well as to market and institutions (e.g. high price variability). Again, sample surveys, such as NSOs' annual agricultural and livestock surveys, generate this information, which helps identify priority areas for policy reforms and investments.

- **Livestock production systems – determinants of production constraints**
The identification of constraints in the livestock sector provides little guidance on the form or sequencing of interventions required to alleviate them. Indeed, data on constraints say little, if anything, about their determinants or root causes, which should represent the target of policies and investments. Official statistics that show, for example, that animal diseases and milk price variability limit private investments in livestock, do not tell why animal diseases are widespread (e.g. high prices of vaccines; ineffective vaccines; broken cold chain facilities; inadequate extension services; etc.) or why milk price is volatile (seasonality in demand; environment-related shocks; lack of processing capacity; occasional milk contamination; etc.). Yet, information on the determinants of production constraints is necessary to identify areas for policy reforms and investments. The Ministry should consult expert informants, promote participatory processes and, if possible, undertake one-off surveys to identify the root causes of an agreed set of productive or institutional constraints.

- **Livestock – policy and investment design**
Once information has been collected on production systems, livestock producers and the constraints they face – i.e. once priority areas for policy reforms and investments have been identified – the Ministry needs information to plan interventions on the ground so as to ease or remove the identified constraints.

The Ministry needs data at a low level of disaggregation, such as for districts or counties, on say the number of animals affected by a certain disease or the number of livestock keepers that extension officers are expected to serve. These statistics, which are essential for budgeting purposes, can be sourced from NSOs' statistical operations, such as from the agricultural and/or livestock census, as well as from administrative records.

Even when this information is available, however, there remain data gaps precluding the drafting of an evidence-based intervention plan. Indeed, policy reforms and investments usually entail some form of institutional change, basically new ways of doing things that (by definition) have not been yet tried and so for which no data or official statistics are available. For example, official statistics could tell us the number of animals affected by a certain disease located in some district, and that the underlying constraint is not vaccines' availability but the delivery mechanism. They do not assist in assessing whether the delivery mechanism is best improved through forming a cadre of community animal health workers or, alternatively, through the provision of fuel vouchers to veterinarians to facilitate their travel. In order to answer this type of questions, decision-makers should examine past experience and review development projects, conduct participatory decision-making processes, or undertake pilots to test on a small scale the effectiveness of alternative policy instruments.

Overall, official statistics provide an objective and broad picture of the prevailing situation on the ground: they indicate to decision-makers priority areas for policies and investments, and whether they have met specified targets or not. Official statistics, however, offer little suggestions to decision-makers on what to do in order to improve their performance going forward. In order to identify the most effective policy instrument, therefore, the Ministry needs to examine past experiences, including from other countries, undertake stakeholder consultation, implement targeted surveys and pilots and other to complement the information available from official data and statistics.

3. Increasing the quantity of livestock data in Tanzania and Uganda

Livestock have been often neglected in statistical operations in developing countries, largely because agricultural development has long been associated with the production of staple crops (Pica-Ciamarra *et al*., 2011). Yet, the sector accounts for about one third of agricultural value added in developing countries, and anticipated to become the largest contributor to agriculture as economic development progresses (AFCAS, 2013).

Since 2010, the governments of Tanzania and Uganda have been collaborating with the FAO, the World Bank, the International Livestock Research Institute (ILRI) and the Africa Union (Interafrican Bureau for Animal Resources, or AU-IBAR) to draft a comprehensive household-level questionnaire aimed at improving the collection of livestock data in settled farming systems.

In particular, three livestock questionnaires were developed including a short, a standard and an expanded version. The three versions vary by size, but all target information on three domains, including animal ownership, livestock inputs (i.e. husbandry practices), and livestock outputs (Table 1). They have four common overarching goals:
   a) Generate basic statistics on livestock production practices;
   b) Measure the cash and in-kind production from livestock;
   c) Measure the value of household's livestock, which are an important economic asset; and
   d) Model household's livestock-related decisions.

Table 1. Content of the livestock survey questionnaire

Livestock domain	Sections	Remarks
Livestock ownership	Number of animals Change in stock in past 12 months	Questions are asked by individual animal, 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 by major group 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 by major group of animals, including both on the quantity and value of monetary and non-monetary outputs

The developed livestock questionnaires are public goods and a starting point for countries to design statistical operations that include livestock. The governments of Tanzania and Uganda built on the standard version of the livestock questionnaire to expand the livestock content of their integrated household surveys – called National Panel Surveys (NPSs) in both countries – implemented in 2012/13 in Tanzania, and in 2011/12 and 2012/13 in Uganda. The NPSs include almost 100 questions on livestock and, indeed, Tanzania and Uganda currently have the largest set of livestock data at household level available throughout Africa. The developed livestock questionnaires have also been used by the Ethiopia, the Niger and the Namibia NSOs to design statistical surveys.

4.   Increasing the quality of livestock data in Tanzania and Uganda

NSOs are not only responsible for collecting livestock data, but also for data cleaning, processing, dissemination and archiving. NSOs use standard statistical procedures to make the datasets consistent, such as detecting and treating outliers and missing values; generate statistical reports, which usually present summary statistics for a sub-set of the collected data; disseminate the reports and, in many cases, also the raw data. NSOs, however, are not subject-matter experts, and hence not in a position to validate datasets from a technical and a policy perspective, i.e. to tell whether the generated statistics are technically sound and policy relevant. They would need feedback from end-users to appreciate the strengths and weaknesses of the data, and improve the survey tool to better meet the needs of users.

With the objective to assess the quality of the collected livestock data from a user-perspective, the governments of Tanzania and Uganda set up working groups composed of staff from the NSOs and the Ministries responsible of livestock. These groups generated summary statistics for all livestock-related variables included in the NPSs, and looked at them from a statistical, technical and policy perspective.

- From a statistical perspective, the working groups scrutinized the number of observations, outliers and missing values for each livestock variable: it was a way to appreciate whether statistics for the variable at hand could be generated with some degree of confidence. For instance, a livestock question to which only ten households responded was a

candidate for exclusion in the survey questionnaire, as the generation of statistics from such a small sample is not recommended.

- From a livestock perspective, the working groups looked at summary statistics for each livestock variable, such as the mean, the median and the variance. These statistics provided an indication of whether farmers were able to respond to the question at hand with some accuracy. If farmers were found to provide inaccurate answers, such as on milk yield per cow, the question (and/or the relevant section of the questionnaire) was identified as one to reformulate.

- From a policy perspective, the working groups looked at the relevance of the produced statistics for the Ministries responsible for livestock and for the NSOs. Indeed, even if some data were found insufficient for any robust statistical analysis, they could well be relevant for policy makers and useful for other statistical purposes. For example, the Ministry of Livestock could have an interest in a question on ownership of broilers, even if only 15 farmers reported to keep them, to monitor the impact of a specific programme. Or the NSOs may wish to have a question on input prices, which are used to estimate livestock value added in the national accounts, as this information is not available from any other statistical survey.

The joint analysis of the NPS livestock data by statistics and subject-matter experts was pivotal for the NSOs in Tanzania and Uganda to appreciate the strengths and weaknesses of the survey tool used, and to identify areas for improvement. Examples include: (i) the sample size of the survey in both countries was not large enough to generate accurate statistics on livestock production practices in urban areas, which challenges the implementation of the livestock module in those areas; (ii) poultry keepers could not provide any answer to questions on preventive treatment of birds against external parasites or on animal housing, as these were formulated to only target large and small ruminants; (iii) only a handful of livestock keepers used artificial insemination as a breeding strategy. However, this information was relevant for the Ministries responsible for livestock, which are investing resources to improve animal genetics.

The joint analysis of the data also highlighted the limited or no use of the data by livestock stakeholders and/or inadequate communication between data suppliers and data users. In fact, many of the livestock questions identified for improvement, i.e. for which accurate statistics could not be generated, had been asked across a series of surveys. Validating datasets from a user perspective, therefore, is valuable also as it avoids that NSOs continue collecting poor-quality data, which is a waste of taxpayers' money.

5.   Improved dissemination and use of livestock data in Tanzania and Uganda

Effective data dissemination creates awareness and is also a a pre-condition for data utilization for decision-making. It depends on a thorough understanding of the statistical skills of policy makers, as well as of their information needs. NBS and UBOS undertook a series of focus group discussions to appreciate the statistical capacity of the Ministries responsible for livestock and their information needs.

a)   The Ministries responsible for livestock in Tanzania and Uganda have limited statistical capacity. Few staff, if any, are statisticians, and those are largely employed to enter, edit and tabulate administrative data using CSPro, Access or Excel. This is hardly surprising, as obviously the large majority of technical staff in the Ministries have a background in livestock-related disciplines, such as in animal production and animal health, which are the focus of their work;

b) The Ministry for animal resources is responsible for policies and investments targeting livestock. Therefore, it needs information on the livestock sector, and in particular data to generate basic statistics that provide guidance on resource allocation, e.g. statistics on the number of cattle to vaccinate against Food and Mouth Disease. These data are needed by livestock sub-sector (e.g. for cattle keepers or pig farms) and with regularity, at least annually when the Ministry's budget is agreed upon;

c) The Ministry also needs, though less regularly, other livestock sector data and statistics, such as on the productivity of the different livestock sub-sectors or on the processing capacity of milk processing plants. This information is necessary when the Ministry formulates broad sector policies and investments, which guide the overarching allocation of public resources for livestock development. These policies, such as the Agricultural Sector Development Programme in Tanzania, are usually designed every five or ten years;

d) Finally, the Ministry does have marginal need of data, statistics, information and reports on the correlations and causalities between livestock and poverty; livestock and food security; livestock and gender; etc. These are useful for the Ministry to make the case for investing in livestock, but have limited practical value.

Recognizing the statistical capacity and the information needs of the Ministries responsible for livestock, the Tanzania National Bureau of Statistics (NBS) and the Uganda Bureau of Statistic (UBOS) adopted a two-pronged approach for data dissemination.

a) NBS and UBOS, in collaboration with the Ministries, identified livestock variables of direct relevance for decision-making and built datasets having as statistical unit the livestock-keeping household. A first dataset includes variables on key household characteristics and livestock assets, such as on number of family members and herd size, and dummy variables on production practices, such as on adoption of breeding strategies and animal vaccination. It provides a snapshot of livestock production practices through the country. Additional datasets target cattle-, goat-, sheep-, pig-, and chicken-keeping households and include detailed data on husbandry practices, inputs used and production level. These datasets allow appreciating, with some accuracy, the different types of livestock production systems, which are the target of Ministry's policies and investments;

b) NBS and UBOS disseminated the livestock-related datasets not only as statistical files but also as simple data spreadsheets (notably excel spreadsheets), for which they developed a code to apply sampling weights and generate representative statistics at national level. The Ministries responsible for livestock could thus perform their own statistical analysis for policy purposes using available NSOs' datasets, which was a first ever. The analyses consisted in the generation of summary livestock statistics, which though resulted in important policy reforms. In both countries, the NPS data provided, for the first time, robust statistical evidence that about 80 percent of livestock farmers do not utilize extension services. As a consequence, in Tanzania, the Ministry of Livestock and Fisheries Development is currently investing resources to identify effective options to improve the system of livestock extension (MLFD, 2015); in Uganda, the 2015/16 – 2019/20 Agricultural Sector Investment Plan also targets the reform of the livestock extension system (MAAIF, 2015).

6.   Designing livestock policy reforms

"*The real value of data is that they can track performance and serve to indicate to decision-makers whether they have met their specified targets or not. While this is, of course, vital, they do not help decision-makers understand what they need to do in order to improve their performance going forward*" (SC, 2007). In other words, official statistics provide little help in identifying the most effective policy instrument(s) to remove or ease a given developmental constraint. For example, official statistics can show that milk productivity is low, and that this is largely due to poor breeding practices; but they do not tell how to make farmers adopt effective breeding practices, such as artificial insemination. Official statistics can show that cooperative members get good prices for their surplus milk; but they do not tell how to ensure that farmers become members of a cooperative.

Policy analysis, defined as "the task of analyzing and evaluating public policy options in the context of given goals for choice by policy makers and other relevant actors" (Paul *et al.,* 1989), provides guidance to identify the most appropriate policy instruments to achieve a certain objective. It suggests, for instance, looking at experiences from other countries with similar problems and consulting a variety of stakeholders. It recommends selecting policy instruments that are mutually exclusive; to avoid the policy instrument 'do-everything'; to look at the policy instruments from multiple perspectives, including the cost, equity, reliability, simplicity and communicability dimensions (Weimer and Vining, 2005). Since the last decade, however, advancements in two areas have been greatly facilitating policy analysis, i.e. the identification of the most effective policy instrument(s) to achieve an agreed objective.

The first are randomized controlled trials (RCTs): they are field experiments that use random assignment to allocate resources, run programmes, or implement investments to rigorously assess the impact of alternative interventions on households / farmers, communities or other prospective beneficiaries.

    a)   First, different households / farmers / communities are randomly selected;

    b)   Second, treatment groups of households / farmers / communities participate in a certain programme, e.g. are tasked / required to perform certain activities, while a control group does not participate in any programme;

    c)   Third, after the programme is implemented, the differences of some parameters of interest between the treatment and the control groups (e.g the utilization of livestock extension services; rate of animal vaccination; etc.) are measured, which allows quantifying the impact of the programme;

    d)   Fourth, lessons are drawn and the most effective policy instrument(s) is identified.

RCTs, while a powerful instrument, have also drawbacks. For example, their external validity can be limited; they have a fairly short time horizon in order to avoid contamination of the control group, which implies a selection of short term results over longer-term effects that may equally be important; they can be quite costly; they are not effective for improving the functioning of complex systems, such as an entire value chain; etc. In any case, while these drawbacks should be taken in mind, RCTs represent a powerful tool for more effective policy analysis.

Advancements in ICTs can also improve policy analysis, and in particular the use of tablet-assisted-personal-interview methods (TAPI), i.e. the use of tablets for data capture instead of paper questionnaires (PAPI). The availability of moderately priced tablets, expansion of cell phone

coverage rendering remote areas accessible, and user friendly survey and free software suites that minimize the need for programming expertise, such as Survey Solutions, makes TAPI tools currently accessible and cost-effective in most developing countries. In fact, the evidence accumulated so far signals that TAPI methods are a cost-effective alternative to PAPI due to the elimination of printing, transportation, and storage costs of paper questionnaires, in addition to resources saved for data entry. Furthermore, through strictly enforced skip patterns, cross checks, and validation conditions, data quality tends to be higher and less cleaning is required. Finally, the combination of higher quality data digitized upon entry results in good-quality data available for analysis many times within weeks of data collection, even for surveys with large sample sizes. This is of paramount value for policy purposes, as the decision-making process needs to be fast-moving to be successful, both because the situation on the ground changes unpredictably and because the momentum for policy reforms usually fade outs within few months.

In both Uganda and Tanzania, the Ministries responsible for livestock designed field experiments to test on the ground the relative efficacy of different policy instruments. In Uganda, the experiment targets improvements in the system of administrative data on livestock. Its objective is asses the effectiveness of different sampling methods to collect administrative data, thereby moving away from full enumeration. In Tanzania, the randomized controlled trial targets the improvement of livestock extension services. It explores whether cost-recovery mechanisms are effective at increasing farmer access to livestock extension services. As part of this experiment, the Ministry of Livestock and Fisheries Development undertook a benchmark survey, using TAPI (SuSo), targeting 415 livestock extension officers. The survey was implemented in the month of August 2015 and preliminary results were already available in September 2015, thereby providing "real time" information to decision-makers.

To summarize, the use of TAPI for collecting data, particularly when one-off surveys are to be implemented, and of randomized controlled trials to assess ex-ante the effectiveness of alternative policy instruments, have the potential to produce that information which, by complementing official statistics, allows livestock sector Ministries to design and implement evidence-based policies and investments.

7.   Conclusion and points for discussion

Livestock is one of the main sub-sectors of agriculture and, in the coming decades, is expected to become one of the largest, if not the largest, contributor to agricultural value-added in sub-Saharan Africa. Quality data and statistics on livestock are essential to design, implement and monitor effective policies and investments. The sector, however, has been so far given little priority in the national agricultural statistical system and there is a consensus among both livestock officials and national statistical authorities that methods for increasing the quantity and quality of livestock data need to be improved and harmonized across countries.

This paper presented a framework targeting the data and information needs for evidence-based policy reforms and its application in Tanzania by the National Bureau of Statistics (NBS) and the Ministry of Livestock and Fisheries Development (MLFD), and in Uganda by the Uganda Bureau of Statistics (UBOS) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Building on the lessons learnt from Tanzania and Uganda, AFCAS members are asked to express their views on:

1. The use of the livestock module developed by NBS, UBOS, MLFD, MAAIF and other partners to adequately include livestock in statistical surveys. The module, which has been implemented and validated in Tanzania and Uganda, includes over 100 questions

on livestock, and targets animal ownership, use of inputs and husbandry practices, and the production of tradable and non-tradable outputs;

2. A data validation approach, which involves consulting subject-matter experts; the generation of summary statistics for all variables of interest; data analysis from a statistical, a technical and a policy perspective. This approach, which is simple and low-cost, has proved highly effective at assisting NSOs in Tanzania and Uganda in better meeting the needs of data users, as well as in improving the quality of the survey tool;

3. A data dissemination strategy that involves building targeted and easy-to-handle datasets (such as in common spreadsheet), which are consistent with the statistical capacity and the needs of end-users. This dissemination strategy has proved effective at greatly enhancing the use of official statistics by MLFD in Tanzania and MAAIF in Uganda;

4. The utilization of TAPI as well as field experiments to collect data that complement official statistics, such as on the determinants of production constraints or on the effectiveness of certain policy instruments. This ensures that quality data and statistics are utilized throughout the decision-making process, a pre-condition for effective policy and institutional reforms;

5. Recommending countries to promote a cross-sectorial working environment, involving not only statisticians but also policy makers at national, regional and pan-African level, as a way to improve the quantity and quality of livestock data available for generating official statistics and for policy purposes. In particular AFCAS members may wish recommend the institutionalization of collaborative activities between the NSOs and Ministries responsible of livestock, from data collection through data cleaning to data dissemination and analysis. Current interaction is largely *ad hoc* and not geared towards a sustained data and information exchange between the parties. Collaborative activities on a regular basis would instead ensure continuous data exchange and re-prioritization of data needs to meet changing and growing demands.

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