Data and indicators for evidence-based livestock policies and investments: A strategic approach

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EXECUTIVE SUMMARY

There is consensus that livestock sector policies and investments should be evidence-based to be effective, but there is little appreciation of what information is needed along the various phases of the decision making process. This note systematizes the data and indicators that decision makers need to effectively formulate and implement policies and investments in the livestock sector. In particular, it provides examples of the type of data and indicators needed to answer the following questions, which can be interpreted as sequential steps in policy and investment design and implementation.

1. **Why invest in livestock?** Allocating resources to the livestock sector makes sense only if its development contributes to the broader socio-economic development goals of the country.

2. **Whom to target?** There is heterogeneity among livestock producers, and variety in their responses to changes in the economic and institutional infrastructure as determined by policy. Characterizing livestock producers is thus essential to formulate appropriate policies and investments.

3. **Which constraints?** Identifying the binding constraints that prevent different types of livestock producers and stakeholders from making efficient use of their animals is a critical input into identifying priority areas for investment, and for policy reform.

4. **What to target?** Understanding and interpreting the root causes of binding constraints is necessary for the formulation of policies and investments that ease or eliminate those constraints.

5. **How to design policies and investments?** Decision makers need to be informed of the pros and cons of alternative ways and means of easing and/or removing one or more binding constraints.

6. **How to ensure effective implementation?** Monitoring and evaluation are necessary to ensure that policies and investments are properly implemented and that the necessary adjustments can be made.

Basic data and indicators can provide critical information to decision makers to formulate appropriate policies and investments. When feasible, statistical analysis linking inputs and outputs should support decision processes. However, there are rarely data and indicators available to draft a fully informed evidence-based implementation plan for the simple reason that, presumably, something new is attempted. Indeed, the implementation of policy reforms and investments usually come along with some form of institutional changes – basically new ways of doing things – which calls for changed behaviors for both implementers and beneficiaries Targeted surveys may help reduce this information gap.

A statistical system that generates good livestock data and indicators, inclusive participatory policy processes, consultation with experts, synthesis of existing experience and analysis, and rigorous *ex ante* pilots can assist decision makers in designing and implementing policies and investments that are largely effective in promoting a sustainable development of the livestock sector.
INTRODUCTION

The challenge of strengthening the evidence base for agricultural and rural development policies and investments, including in livestock, is increasingly appreciated. The 2008 World Bank Development Report on Agriculture for Development states: ‘Sound agricultural development strategies require stronger capacity for policy analysis and evaluation, and a commitment to evidence-based policy making’ (World Bank, 2008, p. 265). The 2012 FAO State of Food and Agriculture on Investing in Agriculture for a Better Future mentions ‘improving the empirical base for policies and investment planning and impact analysis’ (FAO, 2012, p. 93) as one of the core principles for promoting effective investments in agriculture. The 2010-2014 Strategic Plan of the Inter-African Bureau for Animal Resources (AU-IBAR) comprises 6 overarching programmes, one of which, ‘Improving Knowledge Management’, aims ‘to collate, analyse and make available in a timely manner…reliable and up-to-date data, information and knowledge on animal resources to support planning and decision-making’ (AU-IBAR, 2009, p.6).

The growing awareness of the importance of informed policies and investments is being increasingly translated into actions in three main areas, including improving the quantity and quality of available agricultural data and indicators\(^1\) (e.g. the Global Strategy to Improve Agricultural and Rural Statistics); participatory and inclusive policy processes (e.g. the AU-IBAR, FAO and OIE Reinforcing Veterinary Governance Project); and ex-ante pilots, primarily to test on a relatively small scale, the effects of prospective interventions by comparing outcomes for those (households, communities, etc.) who participated in a given programme against those who did not (e.g. the Agricultural Technology Adoption Initiative). Better data and indicators, participatory decision-processes and ex-ante pilots are complementary ways to enhance the quality and quantity of information for evidence-based policies and investments. The entry point for their usefulness, however, changes throughout the decision making process. For example, good data are useful in identifying binding constraints to livestock productivity, and hence priority areas for investments; while ex-ante pilots are more appropriate for designing interventions to remove those constraints.

This note systematizes the overall information needed by decision makers to effectively formulate and implement policies and investments in the livestock sector. It provides guidance on when and which data and indicators are needed in the policy/investment dialogue; when participatory decision-making processes are most valuable; and when ex-ante pilots are most appropriate. It is recognized that the formulation and implementation of policies and investments is a continuous process and that a multitude of development partners condition the final outcome. But for clarity it is here assumed that the decision maker is the Ministry responsible for animal resources. Without loss of generality, it is further assumed that the Ministry’s overarching objective is the promotion of

\(^1\)Indicators are statistics that feature time and space dimensions. In the development community, indicator is a term more frequently used than ‘statistic’, as it attracts more attention from potential users, including decision-makers and the media. Indicators transform and communicate data. Data are pieces of information that are either directly observed and collected (primary data) or retrieved from other sources (secondary data), and then processed through appropriate methodologies to produce indicators.
sustainable and inclusive growth in the livestock sector. Therefore, the Ministry should consider the following questions:

1. **Why invest in livestock?**
   Allocating resources to the livestock sector makes sense only if its development contributes to the broader socio-economic development goals of the country. It is therefore necessary to understand the extent and nature of livestock’s development contribution, both negative and positive.

2. **Whom to target?**
   There is heterogeneity among livestock producers, and variety in their responses to changes in the economic and institutional infrastructure as determined by policy. Characterizing livestock producers is thus essential to formulate appropriate policies and investments. Identifying other benefactors from, and stakeholders in, livestock development is also valuable, particularly as conduits to value chain-based change.

3. **Which constraints?**
   Identifying the binding constraints that prevent different types of livestock producers and stakeholders from making efficient use of their animals is indispensable in identifying priority areas for investment, and for policy reform. Such constraints can impede development in various ways, at local, national, regional and continental levels.

4. **What to target?**
   Understanding and interpreting the root causes of binding constraints is necessary for the formulation of policies and investments that ease or eliminate those constraints, thereby allowing livestock producers and other stakeholders to capture all the potential benefits from livestock production and commerce.

5. **How to design policies and investments?**
   Decision makers need to be informed of the pros and cons of alternative ways and means of easing and/or removing one or more binding constraints. This requires assembly and analysis of information in appropriate forms and formats.

6. **How to ensure effective implementation?**
   Monitoring and evaluation are necessary to ensure that policies and investments be properly implemented and that the necessary adjustments can be made. This requires an information and analytic base that is iterative with the answers to the questions posed above.

The following sections respond to the above questions, with a focus on livestock data and indicators. The final section synthesises the main points, centring on the importance of accessing data and indicators which provide a statistically precise picture of the country as a whole and of its major agro-ecological / administrative regions, a vital aspect for investment and policy design.
WHY TO INVEST IN LIVESTOCK?

A pre-condition for the Ministry responsible for animal resources to invest in livestock is the generation of adequate resources, through the Ministry of Finance or via other funding sources, such as the Regional Economic Communities, donors, financial partners, including the private sector. Access to such funds requires demonstrating that investment in livestock contributes to the overarching development goals of the country. Such contributions might relate to income generation and/or poverty reduction and food security, support enhanced efficiency of resource use, or generate economic gains through stimulating trade. These contributions may also be regional in nature, such as the collective contribution to a goal such as control of animal disease. Success in generating investment funds to support sector development requires that the following question be answered.

Why to invest in livestock?

In much of the developing world, a convincing answer to this question should provide evidence that the development of the livestock sector contributes to economic growth, poverty reduction, food security, reduced vulnerability and other socio-economic goals. To this end, the Ministry should be able to access and package for advocacy livestock-related and socio-economic data and indicators which reveal sector trends, shares in various aggregates, and their correlations with key socio-economic variables. Examples of such indicators are listed below; the figures are often more illustrative and compelling when comparisons between countries can be presented.

- **Trends and projections in total and per-capita consumption of animal-source foods**, at country and regional level, and in specific locations or zones. This information could provide the basis for rationales for supporting sustainable livestock sector growth in response to observed growth in demand for high-value foods, including animal-source foods.

- **Trends in livestock value added over the years**, in absolute terms and as proportion of agricultural value added and GDP. Given that the importance of livestock in agriculture tends to increase with economic development, this information could highlight that investments in the sector are needed to ensure its efficient and equitable growth.

- **Number and proportion of rural households keeping selected livestock species**, disaggregated by income, region, gender and other variables of development interest. Available data from developing countries show that, in most cases, the majority of rural dwellers keep livestock, which suggests that broad-based increases in livestock productivity could directly support their livelihoods, while also increasing the availability of animal protein to urban dwellers.

- **Rates of under-nutrition, daily per capita intake of meat and milk, and the proportion and section of the population not consuming animal-source foods**. These indicators could highlight the nutritional benefits available from increasing the availability of affordable livestock products.
• **Number and type of persons employed along selected livestock value chains.** This provides guidance on the potential for investments in the livestock sector to generate employment, which represents a major pathway out of poverty for the less well-off, amongst both urban and rural populations and amongst vulnerable stakeholders such as women.

Simple data and indicators on livestock-related and socio-economic variables help make the case for investing in livestock. More powerful advocacy can be achieved by presenting rigorous statistical associations between livestock-based development and overall development. The following list of studies provides examples of such work, which requires high quality data that is standardized within or across countries. This list also supports the development and use of more advanced sets of indicators more geared to advocacy.

• In a seminal study on agricultural productivity differences across countries, Kawagoe et al. (1985) find that livestock – considered as an input representing long-run capital formation in the agricultural sector – is a significant determinant of agricultural production, as measured by gross output net of agricultural intermediate products.

• Bogale et al. (2005) look at the determinants of rural poverty in three Ethiopian districts, with poverty defined in terms of both per-capita household calorific consumption and per capita household expenditure on basic needs. They show that the probability of a household being poor declines as the number of oxen owned increases.

• Benin et al. (2008) use an economy-wide model to estimate the responsiveness of the poverty rate to per capita agricultural GDP growth in Malawi. A one percent increase in livestock GDP per capita is anticipated to reduce national poverty by 0.34 percent.

• Pica et al. (2008) show that increases in livestock productivity – as measured by value added per Tropical Livestock Unit – appear to be / have been a cause of per capita GDP growth in 33 developing countries in Africa, Asia and Latin America.

• Bashir et al. (2012) estimate the contribution of livestock to food security in the State of Punjab, Pakistan, using data from 12 out of its 36 districts. Food secure households are defined as those with calorie intake at or above 2,450 Kcal/per capita/day. Results show that ownership of large and small ruminants has a positive impact on household food security.

• Otte et al. (2012) estimate household livestock income multipliers for major world regions: in particular, the impact on total household income of a 1 US$ increase in either livestock production or livestock processing. Calculated multipliers range from 2.0 to 6.8, and are found to be larger than those associated with crops, fruits and vegetables, manufacturing and the service sector.

While basic data and indicators on livestock-related and socio-economic variables are available for most countries – though often not sufficiently disseminated or adequately analyzed – there are few examples of rigorous statistical analysis and modeled projections, and still fewer that can generate causality arguments to demonstrate the contribution of livestock to socio-economic development. This is partly because comprehensive datasets on livestock are not usually available – e.g. in most economy-wide models, livestock is included in the agriculture aggregate. At the same time, the
Ministry responsible for livestock is not mandated, and often not equipped, to undertake such analyses. Nor does the Ministry typically have the power to influence significant change in data collection systems by national authorities, typically the national offices of statistics. However, it can collate and interpret existing documentation, including from neighboring countries, and collaborate with regional, national and international research institutes to rigorously demonstrate that investing in livestock is an effective way to contribute to a number of socio-economic goals.

**WHOM TO TARGET?**

Once the Ministry responsible of livestock development acquires resources to invest for sector development, the question to answer becomes:

**Whom to target?**

Policies and investments are effective when they are consistent with the incentives of the livestock stakeholders, amongst which the producers are likely to be assigned some priority. The Ministry, therefore, needs information on current and emerging growth opportunities for animal based food, the distinguishing characteristics of livestock producers and products, and on the prioritized use of animals in targeted households. Basic data and indicators that serve this purpose include:

- Trends in, and the form of, the demand for various animal-source foods, including unprocessed and processed products nationally and regionally;
- Number of commercial livestock enterprises and number / share of rural households keeping farm animals;
- Herd size and herd composition of livestock producers;
- Livestock production per TLU and / or per unit of labour;
- Total income and share of total income derived from livestock for livestock-keeping households, disaggregated into rural/urban, male/female headed and other variables of development interest;
- Level of livestock production, including shares of home consumption and marketed product, for livestock-keeping households.

The above and other indicators should be used to identify a typology of producers, spanning the range from subsistence-oriented to specialized market-oriented livestock producers, through to large commercial farms. General typologies avoid pre-ante targeting, which often bases on ethnic or other socio-cultural dimensions. Different typologies of producers keep livestock for different purposes, use different technologies and respond differently to changes in the economic and institutional infrastructure, as determined by policy reforms within (and beyond) the sector. Such a typology has been proposed by Nouala *et al.* (2011):

- **Mixed subsistence-oriented livestock producers** are rural households that keep small herds, often mixing animals of different species; they sell a negligible part, if any, of their livestock production; and derive a relatively small share of their cash income from livestock.
For them, any increase in livestock productivity – such as through reduction in animal mortality rate – has a positive impact on welfare.

- **Specialized market-oriented livestock producers** are rural households that keep a (relatively) homogenous herd – e.g. they could be specialized in milk or egg production – sell a significant share of their livestock production; and consistently derive a significant part of their cash income from livestock. Improvements in livestock productivity for specialized market-oriented producers increase their cash income, assuming access to existing and growing market opportunities. These economic operators can also contribute to the generation of off-farm jobs along the value chain.

- **Commercial farms** are specialized enterprises: that maintain large homogenous herds, some permanent employees, and produce only for the market. Policies and investments to increase their productivity – such as reducing trade barriers to access inputs – make their business more profitable and competitive vis-à-vis imports. Increases in their efficiency could also potentially reduce the real price of animal-source foods in national markets – thus contributing to the food security of the (majority of) households that are net buyers of food – while generating a number of full time on- and off-farm jobs.

A variety of indicators are available and can be used to define typologies of livestock farms – e.g. herd size and composition; husbandry practices; market participation; etc. Depending on the data available, countries may construct their own typologies. While data are useful, however, consultations with expert informants provide a complementary source of information on meaningful producer typologies. Indeed, data alone may generate typologies which are of little use to decision makers – e.g. a representative dairy farmer with 1.7 cows and selling 12 percent of the milk produced may be generated as an average taken across multiple modes in a dataset containing very few such individuals. A distinguishing element that in all cases should be taken into account is the household’s motive for keeping farm animals, in particular whether it is related to subsistence or profit. This one factor will often condition the livestock producers’ response to different types of policies and investments.

**WHICH CONSTRAINTS?**

Once typologies of livestock producers have been constructed, the challenge arises as to how to create opportunities for growth and the following question becomes relevant:

**What are the critical and binding constraints that prevent the different livestock producers from making better use of their farm animals?**

Policies and investments should attempt to relax or remove such constraints, particularly to such key performance indicators as livestock productivity, which limit the benefits that producers derive from their animals. Simple data and indicators on factors that are deemed to influence production and productivity provide preliminary information to decision makers. Examples are:

- Prevalence of selected animal diseases, i.e. proportion of small ruminants affected by goat plague (PPR, Peste des Petits Ruminants) over the reference period;
• Number and proportion of livestock producers with access to veterinary services; who regularly vaccinate their animals against selected diseases; who use de-wormers; who spray / dip animals against tick-borne diseases;
• Number and proportion of livestock producers feeding their animals with selected feeds or feed concentrates;
• Number and proportion of livestock producers with access to extension and financial services;
• Number and proportion of livestock producers who raise improved / exotic breeds;
• Number and proportion of livestock producers with social networks / capital such as membership in marketing cooperatives;
• Difference between farm-gate and retail-level prices for live animals and major livestock products;
• Number and types of livestock markets (e.g. primary, secondary), including location, frequency of operation and size;
• Access to common property resources, availability of forage, and sources and reliability of water used;
• Access to infrastructure such as roads and telecommunications;
• Number of processing plants, including potential and used capacity.

While levels, trends and shares of input-, output- and marketing-related variables provide relevant information to decision makers, more sophisticated analyses – which systematically link outputs and inputs – are critical to identify major determinants of production and productivity, and hence to point to binding constraints and priority areas for investment. The lack of undertaking this type of more detailed analysis often leads to investments which don’t address the critical constraints, thus minimizing the impact of the investment.

• Akter et al. (2003) examine the efficiency in poultry and pig production systems in Vietnam. Output is measured as value of production plus the change in inventory. For pigs, it was revealed that land size, herd size, education of household head and proximity to market significantly reduce inefficiency. Conversely, the age of the household head, female-headed households, more access to government supplied inputs and higher proportion of family-supplied feed materials significantly increase inefficiency.
• Ishaq et al. (2007) find that, in the small ruminant system of Southern North West Frontier Province of Pakistan, expanding the herd size generates larger returns, in terms of milk production, than any other investment. In addition, the study indicates that doubling all inputs used more than doubles total milk output.
• Ashagidigb et al. (2011) examine the production and productivity of egg producers in Jos metropolis of Nigeria’s Plateau State. They find that larger flock sizes and a reduction in the cost of drugs would lead to an increase in total production, as measured by the total number of eggs produced.
• Gelan and Muriithi (2012) assess the economic efficiency of 371 dairy farms in Kenya, Rwanda and Uganda. They show that the adaption of improved breeds in the herd and feed and fodder innovations have significantly positive effects on the levels of economic efficiency. The latter is calculated as a function of total outputs (milk consumption, milk sales, animal sales and manure outputs) and total inputs (family and hired labour, fodder and feed, veterinary costs and other).

• Otieno et al. (2012) examine the determinants of technical efficiency in different beef production systems in four Kenyan districts. They conclude that the value of beef production would increase if farmers adopted controlled breeding methods; signed marketing contracts; hired farm-manager; and if their off-farm income increased (due to its being invested in the cattle operation).

A critical challenge to formulating targeted interventions/investments which ensure development impact is the paucity of basic and comprehensive data and indicators on input-, output- and marketing-related variables. Consequently ad hoc data collection and participatory processes are essential to identify productivity constraints, but a review of existing work is also revealing. Such reviews find that, in general:

• When livestock data are available from household surveys, most subsistence-oriented livestock keepers are shown to lack access to even the simplest production inputs, such as animal health services and feed (Covarrubias et al., 2012). This implies that interventions which focus simply on ensuring access to basic factor inputs are a straightforward way to enhance the contribution of livestock to livelihoods. Indeed, analyses that target subsistence-oriented livestock keepers invariably conclude that increases in the use of basic input factors – such as forage, feed and animal vaccines – significantly increase production.

• Analyses that target market-oriented specialized rural households and commercial enterprises typically conclude that increases in productivity (efficiency) could be triggered by dozens of different actions, many of which are beyond the control of the Ministry responsible for livestock (e.g. education, credit or year-around access to roads). This calls for collaboration between the government agencies, and amongst other public and private decision-makers, to use livestock as a catalyst for economic growth.

WHAT TO TARGET?

Once there is information on who to target (with a clear distinction of the objectives of the intervention, i.e. supporting livelihoods or expanding the sector’s contribution to economic growth), and on the binding constraints they face – e.g. limited access to veterinary services for subsistence oriented livestock producers, or lack of credit for market-oriented livestock producers – the following area to explore is:

What to target?

The identification of constraints and their subsequent prioritization, in practice, provides little guidance on how to relax and remove them, nor the sequencing of interventions which is required
to induce positive change. For example, what can or should be done to ensure that farmers feed their animals with concentrates? How can the prevalence of selected animal diseases be reduced? How to promote the use of controlled breeding methods? In order to address the root causes of constraints, decision makers need a multitude of data and indicators. Indicators relevant to our example of feed concentrates, the use of which is anticipated to increase productivity, are:

- Availability of feed concentrates in rural markets;
- Number of feed producers and their productive capacity;
- Availability of pasture;
- Relative prices of feed concentrates to the products to be produced, including their seasonal fluctuations;
- Quality of available feed concentrates;
- Access to information on feed concentrates by livestock producers;

Summary statistics associated with a particular constraint or set of constraints, such as those listed above, help disentangle the root cause(s) of a constraint and, therefore, to better focus any prospective investment. Analyses which attempt to identify rigorously the root cause of a constraint, provide additional information for better targeting interventions on the ground.

- Jabbar et al. (2002) examine the supply and demand for livestock credit in Ethiopia, Kenya, Nigeria and Uganda. They find that gender of household head, education, training, prevalence of outstanding loan and the number of improved cattle on the farm, all have significant influence on household borrowing and liquidity.
- Ajuha et al. (2003) study the demand for veterinary services in three States of India, namely Gujarat, Rajasthan and Kerala. They show that in all the States the demand for veterinary services, as measured by the number of veterinary visits over the reference period, is negatively associated with the price of the services and positively associated with the service time, a quality indicator.
- Bahta and Bauer (2007) assess the determinants of market participation among small-scale livestock producers in the Free State Province of South Africa. Their results suggest that market information, distance to the preferred marketing outlet, level of training, access to extension services and livestock fertility rate all have positive impact on farmers’ participation in livestock markets.
- Costales et al. (2008) study the factors that influence participation in contract farming of pig producers in Northern Vietnam. They conclude that level of education and large physical access holdings facilitate farmer’s engagement in formal contracts with large integrators.
- Achoja et al. (2010) examine the determinants of the demand for veterinary services by commercial poultry producers in the Delta State of Nigeria. They find that scale of production and distance to the nearest veterinary office significantly influence the use of veterinary services.

It is obviously not feasible to access detailed information on all constraints affecting livestock producers, in all locations and contexts of interest. And in fact, in some respects, the most
marginalized livestock systems offer the least information. There are not, for example, readily available datasets with information on the quality of animal feeds in a long list of rural markets or on the price paid by farmers to vaccinate their animals. This makes it challenging to both present basic statistics and conduct analyses of constraints. In formulation of policies and investments, decision makers should thus consult expert informants, promote participatory processes and, if possible, invest resources to undertake specialized surveys targeting a set of likely constraints.

**Box 1. Identifying constraints at farm level: the approach of the World Bank-FAO-ILRI-AU-IBAR Livestock Data Innovation in Africa Project**

Constraints identified through statistical procedures could be irrelevant for livestock farmers, either because the collected data are insufficient to make a comprehensive analysis of constraints or because the models used to interpret the data are unable to capture the complexity of the household decision process. At the same time, in participatory processes constraints nominated by stakeholders could be statements of frustration with symptomatic problems rather than identification of the underlying constraints, or could refer to short run problems rather than long term developmental bottlenecks. To overcome these issues, the World Bank-FAO-ILRI-AU-IBAR Livestock Data Innovation in Africa Project designed and tested a hybrid methodology, including household level data analysis and participatory processes, to identify binding constraints at farm level. The methodology consists of two steps. First, nationally representative household-level datasets are used to identify areas of high and growing demand for livestock products, so-called hot-spots, as well as to identify the major determinants of livestock productivity, which provide basic guidance on subsequent field work. The second step consists in a hybrid process blending participatory exercises and individual questionnaires for farmers to identify constraints preventing them from achieving their main purpose for running livestock. Constraints are addressed at two levels: ‘nominated’ constraints by farmers (e.g. seasonality in forage and feed availability), and ‘basic’ constraints, namely land, labour, capital, knowledge and information. These are recognized as the underlying cause or mechanism of nominated constraints (e.g. land and capital for seasonality in forage and feed availability), and represent the target for investments in the sector. This methodology has been tested to identify basic constraints for dairy producers in Tanzania and dairy and pig producers in Uganda (Baker et al., 2012).

**HOW TO INVEST?**

Once information has been collected on who to target, the constraints they face, and the root causes of constraints that can be targeted, the following process needs to be followed to determine:

**How to invest?**

Basically, decision makers should draft an implementation plan – including roles and responsibilities of various actors and with an estimate of the available budget – which works to identify actions needed to relax or remove the root causes of one or more binding constraints. It is clear that the uniqueness of countries’ or localities’ investments and limitations on data and indicators preclude
the drafting a fully informed evidence-based implementation plan. Indeed, implementation of policy reforms and investments usually entail or include some form of institutional change – basically new ways of doing things that have not been yet tried out and for which data is therefore not available. For example, available information is most likely of little use in assessing whether or not the quantity and quality of veterinary services in rural areas is best improved through forming a cadre of community animal health workers (a supply side intervention) or, alternatively, through the provision of veterinary vouchers to livestock keepers for the purchase of veterinary services and drugs (a demand side intervention). This in turn leads to a series of development questions for which little supporting information is usually available. How many animal health workers should be trained? Does a one-week training suffice or is a two-week course preferable? How frequently should refresher courses be held? Should community animal health workers be given basic equipment (e.g. needles, thermometers and a small stock of medicines, etc.) for free, or at cost?

In order to answer these types of questions, decision-makers can review development projects and examine past experience, conduct participatory decision-making processes, or set up pilots by which different alternatives are tested on a small scale to identify the most effective, which will be then scaled up. Some reviews include the following:

- Pica-Ciamarra et al. (2010) provide a comprehensive review of alternative policy instruments, including pros and cons for their implementation, in different livestock-related domains, such as risk-coping; animal health; feed and forage; access to credit; livestock research; trade; and other. They show, for example, that the quantity and quality of veterinary services could be improved through alternative institutional reforms, such as cost-recovery mechanisms; joint human-animal health service delivery; sub-contracting; provision of smart subsidies to service providers or to livestock farmers; the establishment of community-based animal health workers; and other.

- Murphy et al. (2003) compare the efficacy of three school snacks in improving growth and cognitive function of children in rural Kenya. The snacks are composed of equi-caloric portions of githeri (a vegetable stew), including githeri alone, githeri plus milk and githeri plus meat. Total energy intake increases more with the githeri plus a meat snack than with the other two, because the additional energy provided by the githeri alone and by the githeri plus milk is counterbalanced by a decrease in the energy content of the food consumed at home. From a policy perspective, the provision of githeri meat snacks to rural schoolchildren is shown to be an optimal strategy if the objective is to improve their nutritional status.

- Grace et al. (2008) carried out a control trial in South Mali to assess the effects of providing information on the diagnosis and treatment of bovine trypanosomiasis by farmers. Information was given through an eight-page booklet containing pictures with messages on diagnosis and proper treatments. Results show that knowledge of trypanosomiasis diagnosis and treatment are 23% and 14% greater, after 2 weeks and 5 months respectively, in the treatment group than in the control group. Relatively simple information seems sufficient to reduce the incidence of selected animal diseases.
• Henning et al. (2009) conducted controlled trials in 124 randomly selected backyard poultry keepers in nine villages in Myanmar to evaluate two strategies aimed at reducing chicken mortality, namely Newcastle disease (ND) vaccination using a thermostable vaccine and changes in the management of chick rearing (confinement and supplementary feeding). They find that vaccination against ND resulted in a lower incidence rate of mortality during ND outbreaks in households with vaccinated birds, but that crude mortality rate in chicken did not decline and was lower in households with altered chick management. From a policy perspective, investing resources to reduce mortality incidence due to ND makes sense only if all-cause mortality incidence is also reduced.

• Bandiera et al. (2011) undertook a randomized evaluation of an entrepreneurship programme that provides assets – including cows, goats and poultry birds – and training to run small businesses to the poorest women in rural Bangladesh. They find that, after two years, women participating in the programme allocate more time to self-employment (and less to wage-labour), which results in higher income, higher per-capita expenditure, and improved food security for their families.

• Wanyoike and Baker (2013) analysed 58 livestock development projects to identify factors affecting their effectiveness. Key factors were revealed to be large project size, specialization in livestock issues, inclusion of government in key communication roles, inclusiveness of implementation of exit strategy formulation, and targeting of interventions at several levels of the value chain.

To enhance the probability of good intervention design and implementation, decision makers should assess and rank alternatives, with additional information sourced from expert informants, through participatory and consultative processes, and from past projects and experience, including those from other countries. As a practical alternative, one more visible to stakeholders, ex ante evaluations can be undertaken through pilots on a limited scale which are geared for scaling up.

**HOW TO ENSURE EFFECTIVE IMPLEMENTATION?**

Once investment choices have been examined and policy options identified, impact is often determined through anticipating data and information requirements which influence:

- **How to ensure effective policy and investment implementation?**

Critical to monitoring the effectiveness of development interventions is the existence and/or establishment of a robust monitoring and evaluation system, which regularly assembles quantitative and qualitative indicators of success and project progress. There exist large numbers of reference documents on monitoring and evaluation (e.g. EC, 2006; UNDP, 2005), which basically target four types of indicators:

- **Input indicators**, which show whether appropriate financial, human and physical resources are allocated to policy and investment implementation. An example is the number and recruitment of public veterinarians,
• **Output indicators**, which measure the immediate effects determined by access to inputs, e.g. whether more animals are vaccinated against certain diseases as a consequence of increased numbers of veterinarians.

• **Outcome indicators**, which quantify the effects generated by the outputs, e.g. reduced incidence of certain animal diseases.

• **Impact indicators**, which measure the effects of the outcome beyond its direct and immediate results, e.g. increased animal productivity and improved households’ livelihood.

In general, input and output indicators should be readily accessible and measurable, as they relate and can be collected within the daily or regular activities of some actors. Outcome and impact indicators are harder to measure and baselines more difficult to derive, which often makes it difficult to properly monitor and assess project/policy impact. In addition, attribution is complicated in many circumstances with outcomes and impacts influenced by a variety of factors, including but not restricted to changes in the known inputs and outputs.

**CONCLUSIONS**

Decisions on investment and policy formation in the livestock sector entail a thought process which has been detailed here in terms of the sequencing and specific information needs. It is clear that decision makers need information on a variety of data domains in order to:

- Demonstrate that livestock sector development can contribute to the broader socio-economic goals of the country.
- Define some typologies of livestock stakeholders, including a clear distinction between market-oriented and subsistence oriented producers, who respond differently to policy and institutional change.
- Identify the major constraints that prevent the various types of livestock producers from making the best use of their animals.
- Identify and rank the root causes of the constraints, which represent the priority areas for investments.
- Design effective policy and investment implementation plans, including specification of roles and responsibilities of the various actors and a budget.
- Monitor and evaluate the implementation of policy reforms and investments.

Simple indicators provide critical information to decision makers as input into the formulation of appropriate policies and investments. When feasible, sophisticated statistical analysis linking inputs and outputs should support decision processes. It should be recognized, however, that the data and indicators needed to properly design policy and investment implementation plans are largely unavailable or inadequate due to the novelty and uniqueness of the intervention. Targeted surveys may help reduce this information gap at one or more stages of the question-driven process described here.
In general, data and indicators which are representative of the country as a whole, of its major agro-ecological zones / administrative regions and of typologies of farmers mostly suffice to identify priority areas for investments. This is to say that, to this end, sample surveys can provide adequate information to decision-makers. However, census data, or data which are representative for disaggregated administrative units, are needed to properly design policy and investment implementation plans. In particular, knowing with statistical precision the number of animals and the number of livestock farmers at some low administrative level, say at the district or county level, is essential information for effectively designing any intervention on the ground.

Full information, with all the desired data sets, is obviously not achievable, nor economically optimal, and the risk of designing bad policies and investments can never be reduced to zero. However, a statistical system that generates good data and indicators, supported by inclusive participatory policy processes, consultations with experts, synthesis of existing experience and analysis, and rigorous *ex ante* pilots, can assist decision makers in designing and implementing policies and investments that are largely effective in promoting a sustainable development of the livestock sector.

REFERENCES


