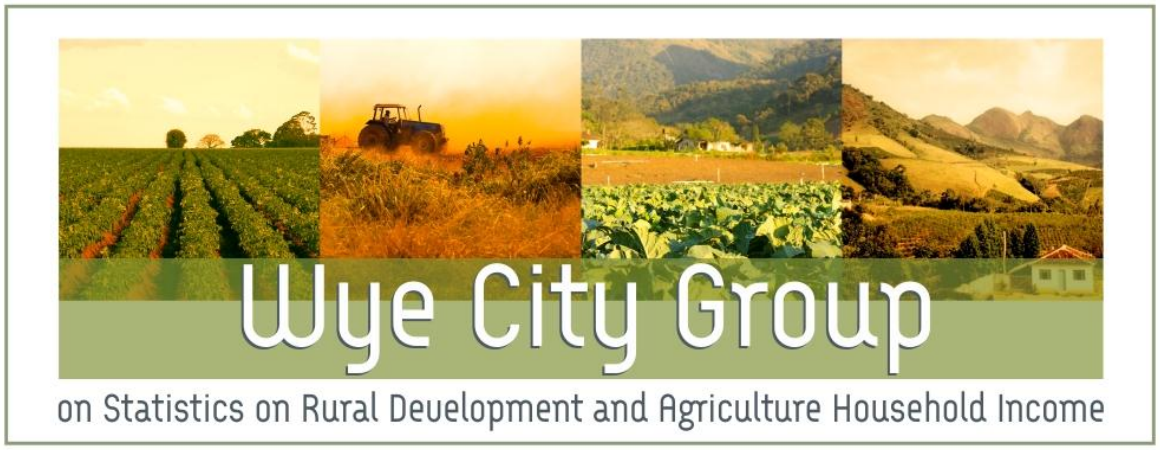


Linking Smallholders to Livestock Markets: Combining Market and Household Survey Data in Tanzania

Ugo Pica-Ciamarra
FAO Animal Production and Health Division & WB-FAO-ILRI Livestock Data Innovation Project
Viale delle Terme di Caracalla, 00153, Rome, Italy
ugo.picaciamarra@fao.org

Derek Baker
International Livestock Research Institute & WB-FAO-ILRI Livestock Data Innovation Project
Box 30709, 00100 Nairobi, Kenya
d.baker@cgiar.org

John Chassama
Ministry of Industry and Trade,
NSSA Waterfront House, Sokoine Drive, PO Box 9503, Dar es Salaam, Tanzania
mbiti07@yahoo.co.uk

Mohamadou Fadiga
International Livestock Research Institute
s/c ICRISAT Box 320, Bamako, Mali
m.fadiga@cgiar.org

Longin Nsiima
Ministry of Livestock and Fisheries Development
Temeke – Veterinary, Mandela Road, PO Box 9152, Dar es Salaam, Tanzania
nsiimalongin@yahoo.co.uk

ABSTRACT

Linking farmers to markets is widely viewed as a milestone towards promoting economic growth and poverty reduction. However, market and institutional imperfections along the supply chain thwart perfect vertical and spatial price transmission and prevent farmers and market actors from getting access to information, identifying business opportunities and allocating their resources efficiently. This acts as a barrier to market-led rural development and poverty reduction. This paper reviews and analyses household information, and the major livestock market and marketing data available in Tanzania, in relation to market-led development possibilities. Household-level data collected by the Tanzania National Bureau of Statistics and market data collected and disseminated by the Livestock Information and Knowledge System of the Tanzania Ministry of Industry and Trade are reviewed and utilised together. Both types of data help identify market opportunities for livestock producers, but only their joint use could provide policy makers with the information needed to design and implement policies that facilitate access to markets for livestock producers. Options to promote integration of household-level data and market data are discussed, which would facilitate the implementation of the Tanzania Statistical Master Plan and contribute to the implementation of the Global Strategy to Improve Agricultural and Rural Statistics.

Keywords: household surveys, market data, livestock, Tanzania.

1. Introduction

Linking farmers to markets is widely viewed as a milestone towards promoting growth of agriculture and poverty reduction in the developing world. The 2008 World Development Report 'Agriculture for Development' identifies 'Enhance smallholder competitiveness and facilitate market entry' and 'Improve market access and establish efficient value chains' as milestones to support an agriculture-for-development agenda (World Bank, 2008). In sub-Saharan Africa, Pillar 2 of the Africa Comprehensive Agricultural Development Programme (CAADP) titles 'Market Access', and most governments in the continent have been developing policies and programmes aimed at linking farmers to domestic, regional and international markets. Any cursory review of Poverty Reduction Strategy Papers, Agricultural Development Strategies and CAADP Compacts endorsed by African governments reveals that access to markets and supply chain development are priority areas of interventions.

Available agricultural data and statistics, however, are insufficient for governments and private investors in sub-Saharan Africa to design and implement interventions which efficiently and equitably link farmers to agricultural markets: '*Many countries, especially in the developing world, lack the capacity to produce and report even the minimum set of agricultural data necessary to monitor national trends*' (World Bank, 2011). Improving the quantity and quality of agricultural data available to decision makers, including both public and private sector actors, is thus a pre-condition for formulating effective agricultural and rural sector investments, which help farmers tap into market opportunities.

There are a variety of initiatives in place which aim at enhancing the quantity and quality of agricultural data, the major one being currently the Global Strategy to Improve Agricultural and Rural Statistics, endorsed by the UN Statistical Commission in February 2010 (World Bank, 2011). The strategy builds around three pillars: (i) the establishment of a minimum set of core agricultural data that countries should provide to meet current and emerging data needs; (ii) the integration of agriculture into the National Statistical Systems; (iii) governance and statistical capacity building of the National Agricultural Statistical System.

This paper focuses on livestock sector data in Tanzania, with the objective to recommend ways to improve systems of livestock data collection and use so as to support the implementation of the Tanzanian Statistical Master Plan and, more in general, that of the Global Strategy to Improve Agricultural and Rural Statistics. In particular, the paper focuses on issues and challenges related to the joint use of different sources of livestock data – which falls into the second pillar of the Global Strategy, i.e. integrating agriculture into the National Statistical System. Integrating different sources of data is in fact critical to support the implementation of the Tanzania National Strategy of Growth and Poverty Reduction: there are currently no datasets available that allow, on their own, to design and implement investments that help farmer access profitable markets, a requirement for sustainable growth and poverty reduction.

The next section briefly presents prospects for livestock sector growth in Tanzania and related data issues. Section three and four review two major systems of livestock data collection, namely the Tanzania National Panel Survey (TZNPS) administered by the National Bureau of Statistics, and the Livestock Market Information Network and Knowledge System (LINKS) implemented by the Ministry of Industry and Trade. Section five attempts to infer some policy recommendations from the joint use of TZNPS and LINKS data, and then makes some proposals to facilitate the integration of the two data systems. Section six draws some conclusions.

2. Prospects for Livestock Sector Growth in Tanzania: data issues

The Tanzania Second National Strategy for Growth and the Reduction of Poverty II (NSGRP II or MKUKUTA II in its Kiswahili acronym) '*is a framework to rally national efforts during 2010/11 – 2014/15 in accelerating poverty-reducing growth by pursuing pro-poor interventions and addressing implementation bottlenecks*' (MFEA, 2010). MKUKUTA II targets agriculture as one of the main sectors to develop to reduce poverty, as the majority of the population live in rural areas where poverty incidence is the highest (39 percent of rural households are estimated to live below the 'basic needs' poverty line, vis-à-vis about 26 percent of urban households). MKUKUTA II aims at increasing the agricultural growth rate from 3 percent in 2009 to 6 percent in 2015 (MFEA, 2010).

MKUKUTA II plans to address '*the usual constraints to agriculture and rural development*', such as limited access to inputs and extension services by farmers (MFEA, 2010). '*In order to have impact, emphasis needs to be on interventions that address bottlenecks along the value chains of strategic agricultural produce – selected crops and livestock*' (MFEA, 2010). MKUKUTA II will thus prioritize interventions that relax / remove those constraints which prevent farmers both from being efficient and from accessing lucrative agricultural markets, thereby contributing to a market-driven and sustainable growth of agriculture.

The development of the livestock sector is anticipated to contribute to the objectives of MKUKUTA II as livestock provide livelihood support to a total of 1,75 million households (37%) out of 4,9 million agricultural households (NBS *et al.*, 2010). The Ministry of Livestock and Fisheries Development is mandated to support the growth of the sector and in 2011 formulated the Livestock Sector Development Programme (LSDP, draft) '*to implement the National Livestock Policy (NLP) of 2006 and its Livestock Sector Development Strategy (LSDS) of 2009*' (MLFD, 2011). LSDP identifies interventions in 7 so-called components, which consist of several sub-components.

Table 1. Livestock Sector Development Programme: Components and sub-Components

Components	Sub-components
Livestock Resource	Grazing land development Pastures development Animal feeds and feed additives Water for livestock
Livestock Production and Productivity	Meat production Milk production
Livestock Support Services Delivery and Empowerment	Livestock research Livestock training Livestock extension
Animal Diseases Control and Veterinary Public Health	Trans-boundary animal diseases Parasitic, vector and vector borne diseases. Veterinary public health
Livestock and livestock products marketing	Livestock marketing infrastructure. Livestock marketing information Identification, traceability eco-labeling and animal welfare processing and value addition

Components	Sub-components
Legal and Institutional Framework	Regulatory framework of the livestock sector Institutional Framework
Cross Cutting and Cross-Sectoral Issues	Gender mainstreaming in the livestock industry HIV/AIDS, malaria and tuberculosis Environmental conservation Finance and credit

Source: MLFD, 2011

LSDP involves interventions all along the livestock supply chain, from input supply to husbandry practices to marketing, which only would ensure that livestock keepers be able to produce some surplus meat, milk and eggs to sell in domestic, regional and international markets. However, available data to implement the LSDP are scant at best. A recent review of the status of livestock data conducted by the Ministry of Livestock and Fisheries Development reads:

> '*A lot of livestock data are inadequate to varying degrees as they lack consistence through time and between sources; and are not complete as they possess a lot of gaps. In addition, most of the data are unreliable due to lack of culture of data collection and data provision. There is general lack of responsibility of data verification for the purpose of ascertaining their adequacy at all levels. On the other hand, often livestock data are not readily accessible to users for a variety of reasons and available data are not always put to optimal use by data users as they are not made available in a timely manner, are not in the form required and are not disaggregated to appropriate levels'* (MLFD 2010).

The Tanzanian Statistical Master Plan 2009/10 – 2013/14 (TSMP) aims to '*strengthen the NSS* [National Statistical System] *in Tanzania so as to enable it to produce quality statistics for decision makers in an objective timely and cost effective manner*' (NBS, 2010a). It identifies five areas of interventions to improve statistics, including agriculture (and livestock) data. These are: human resource development; development of statistical infrastructure; data development and dissemination; physical infrastructure and equipment development; programme management and coordination. In coordinating the implementation of the Master Plan, the National Bureau of Statistics is expected to ensure that agreed '*statistical standards are used so as to facilitate the integration and comparison of the statistics produced both nationally and internationally'* as well as '*to avoid duplication of efforts in the production of statistics*' (NBS, 2010a). Comparability and integration of different sources of data is in fact critical to build an efficient agricultural NSS, which is consistent with the Global Strategy to Improve Agricultural and Rural Statistics that provides guidance to country governments to implement '*a coordinated data collection program to produce timely and accurate data that are coherent and comparable; and a strategy for data dissemination to ensure accessibility*' (World Bank, 2011).

Integrating different data systems to generate statistics which are comparable requires not only identifying strengths and weaknesses of different data systems and common elements for integration, but also appreciating the value added that combining different data systems can generate, particularly with a focus on the implementation of the poverty reduction strategy papers and major agricultural development programmes and policies. In other words, integration of different data systems should not be pursued for the sake of integration, but on the evidence that the joint use of data from different sources provides better information to decision makers to formulate and implement public and private sector investments. In what follows, two major systems of

livestock data collection in Tanzania are described and briefly analysed; opportunities for improved integration are then identified, which is critical for the successful implementation of both MKUKUTA II and the LSDP.

3. The Tanzania National Panel Survey: identifying investment opportunities in the livestock sector

3.1 The dataset

Living Standard Measurement Surveys (LSMS) are multi-topic household questionnaires designed to assess household welfare, understand household behaviour and evaluate the effects of various interventions on the livelihood of the population. Accordingly, LSMS surveys collect data from a nationally representative sample of households on their characteristics and many dimensions of their wellbeing, such household size and composition, education and assets, food consumption and health (Grosh and Glewwe, 1995).

The Tanzania National Panel Survey (TZNPS) is part of a series of LSMS-type surveys and collects information from a sample of households sufficient to generate statistics which are nationally representative as well as representative at the level of macro-zones, including North, Central, Eastern, South, Southern Highlands, West and Lake. The main objective of the TZNPS is '*to provide high-quality household-level data to the Tanzanian government and other stakeholders for monitoring poverty dynamics, tracking the progress of the National Strategy for Growth and Poverty Reduction, and evaluating the impact of other major, national-level government policy initiatives*' (NBS, 2010b).

The first wave of the TZNPS was conducted over twelve months from October 2008 to October 2009 by the Tanzania National Bureau of Statistics (NBS). The survey was implemented by six mobile field teams, each composed of one supervisor, three enumerators, one data entry technician, and one driver. The survey, administered to 3,280 households (2,064 households in rural areas and 1,216 urban areas), consisted of a Household Questionnaire, an Agriculture Questionnaire, and a Community Questionnaire. [1] The Household Questionnaire comprises over 20 sections – e.g. on household education, on food expenditure, on household assets, etc. – which allows for the construction of a full consumption-based welfare measure. The Agriculture Questionnaire contains 13 sections relative to household agricultural activities, such as on plots, crops, livestock and access to extension services. The Community Questionnaire includes 9 sections on physical and economic infrastructure and events in the surveyed communities. Respondents of the Household and Agriculture questionnaires are the household members most knowledgeable about each section; respondents of the Community questionnaire are the Village/Block Chairperson, the Village/Ward Executive officer, and several sub-village chair-people (NBS, 2010b).

The Agriculture Questionnaire contains 21 questions on livestock on ownership / changes in livestock stock over the past 12 months due to sales/purchases, thefts, diseases and slaughtering. Noteworthy is that information is collected on cattle breeds, differentiating between local/indigenous and improved/exotic breeds. It also includes some basic questions on labour force used for tending livestock, on fodder and on animal diseases / vaccination. A final section is on the production and sale of major livestock products. On the consumption side, the Household Questionnaire contains questions on the consumption of different types of animal source foods.

[1] The TZNPS is part of the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) Project of the World Bank, which supports governments in seven Sub-Saharan African countries to generate nationally representative, household panel data with a strong focus on agriculture and rural development. The TZNPS questionnaires are available from download at http://go.worldbank.org/YPHB6EK7Q0.

Overall, TZNPS questionnaires contain more (crop and) livestock-related questions in comparison with most LSMS-type questionnaires administered in developing countries.

3.2 TZNPS, MKUKUTA II and LSDP.

Analysis of the TZNPS data provides critical insights for implementing MKUKUTA II and the Livestock Sector Development Programme (LSDP). TZNPS data are appropriate to characterize rural households, appreciate livestock-livelihood relationship and may also help identify determinants of livestock production and productivity, thereby assisting in the design of investments that promote '*market developments, comparative and competitive advantages and domestic capacity to supply the markets*' (MFEA, 2010).

Table 2 displays some descriptive statistics on the supply / production of livestock products by Tanzanian rural households, differentiated by expenditure quintile.[2]

Table 2. Livestock participation, income share and herd size by households in different expenditure quintiles

	Rural expenditure quintile					
	All	1	2	3	4	5
Participation in livestock activities	0.61	0.49	0.62	0.63	0.63	0.69
Share of livestock in total household income	0.13	0.09	0.12	0.13	0.16	0.16
Share of livestock income for livestock-dependent households	0.22	0.19	0.19	0.21	0.25	0.24
Average herd size (TLU) for livestock-dependent households (TLU)	3.37	2.57	3.47	3.12	3.53	3.89

- About 99 percent of rural households are involved in self-employed agriculture and around 61 percent of them, i.e. 1,197 households, are dependent on livestock for part of their livelihoods.
- Across the whole rural sample, livestock contribute about 13 percent to total household income. This proportion increases to about 22 percent for a 'typical' livestock keeping household.
- The average herd size for livestock-keeping households is 3.37 Tropical Livestock Unit (TLU)[3], ranging from 2.57 TLU for rural households in the bottom expenditure quintile to 3.89 TLU for those in the top one. The livestock sector is thus largely smallholder-based, a characteristic of the agriculture sector as a whole. For instance, the Ministry of Livestock and Fisheries Development reports that 94 percent of the beef consumed in the country originates from the smallholder sector and that, in urban areas, only about 20 percent of the poultry meat consumed is produced by commercial broiler farms (MLFD, 2011).
- Cattle, goats and chicken are held by 64, 45 and 90 percent of rural households respectively, while other species are kept by a minority of farmers.
- Livestock keepers have limited access to productive inputs and services. As examples, only about 1 percent of livestock keeping households own some improved breed of dairy cattle and, in the past 12 months, only about 18 percent of them received livestock extension services.

[2] Most of descriptive statistics from the TZNPS presented in this paper have been produced by K. Covarubbias and A. Zezza. A paper of theirs is forthcoming on livestock and livelihoods in Tanzania, which builds on the TZNPS data.

[3] The Tropical Livestock Unit (TLU), equivalent to 250 kg live weight, standardises live animals by species mean live weight. The TLU conversion factors used are as follows: cattle (0.60), sheep and goats (0.10), pigs (0.25) and poultry (0.01). Livestock are aggregated into TLUs of 250 kg live weight, disregarding differences in breed, sex, age and health status.

- Livestock keepers are market-oriented and sell a large part, if not the majority of their livestock / livestock production, which is hard to store. Over a year, households in the bottom quintile sell about 67 percent of their livestock / livestock production, while those in the third and top quintiles sell about 49 and 35 of their livestock / livestock production respectively.
- About 58 percent of households sell alive animals, while only about 4 percent slaughtered and sold some livestock during the past 12 months. 7 percent of households sell some milk and 11 percent eggs. Overall, sales of live animals contribute to about two-thirds of livestock derived income.
- Majority of households, i.e. about 60 percent, market their livestock through traders / intermediaries, but many also sell live animals / livestock products in the marketplace (25%) or to some neighbor (27%). Farmers sell their livestock in local markets and only about 2 percent have travelled to sell their animals in markets in other regions.

Beyond insights on ownership, production and commercialization of livestock / livestock products, TZNPS data also provide information on the consumption of animal foods. Table 3 below presents some descriptive statistics on the consumption of livestock products by households in different expenditure quintiles, while table 4 presents estimated income-expenditure elasticities for major animal foods, i.e. the ratio of the percentage change in expenditure on animal food to a percentage change in income.

- About 59 percent of all households consume some meat, milk or meat (i.e. 41% of them do not eat at all livestock products). This proportion goes up to 68 percent among livestock keeping households, and down to 51 percent among non-livestock keeping households, which is suggestive that livestock ownership could be associated with better nourishment of household members, given the bioavailability of protein, iron and vitamin A in meat, eggs, and milk.
- With a per capita of 5.3 kg/year beef is the most consumed meat, followed by poultry (3.1 kg/year), eggs (2.3 kg/year) and goat meat (3.1 kg/year). About 11.4 liter/year of milk are consumed by the 'typical' Tanzanian. As expected, households in the bottom quintiles consume less livestock products than those in the upper ones, with the exception of goat meat.
- Beef is the most purchased meat: 32 percent of households, including in both rural and urban areas, reported to have purchased some beef in the week prior to the interview, a proportion higher than that for all other livestock products.

Table 3. Per capita annual consumption (kg) of livestock products by households in different expenditure quintiles

		Rural expenditure quintile				
	All	1	2	3	4	5
Mean income (US$)*	783.8	42.5	191.8	488.8	1165.5	5346.7
Beef	5.3	2.1	2.5	3.7	7.4	8.8
Goat	2.1	2.0	3.3	2.0	1.4	2.2
Pork	0.7	0.2	0.5	0.7	0.8	0.9
Poultry	3.1	1.7	2.5	3.5	3.2	3.8
Eggs**	2.3	0.5	0.5	1.3	7.6	1.8
Fresh milk	13.0	7.4	7.6	11.9	14.5	15.4

* 2009 exchange rate

** Converted to kilos assuming 70g per egg.

Table 4. Income-expenditure elasticities for livestock products by households in different expenditure quintiles

		Rural expenditure quintile				
	All	1	2	3	4	5
Mean income (US$)*	783.8	42.5	191.8	488.8	1165.5	5346.7
Goat	-0.267	0.027	-0.040	-1.132	-0.016	-0.176
Beef	1.861	0.135	1.654	2.908	3.161	1.447
Pork	0.082	-0.023	0.487	0.155	-0.216	0.007
Poultry	0.406	-0.251	1.785	-0.623	0.368	0.752
Eggs	0.846	-0.168	0.961	1.518	0.581	1.338
Milk	0.638	0.363	0.699	0.494	1.145	0.487
Goat	-0.267	0.027	-0.040	-1.132	-0.016	-0.176

- The value of the beef purchased by the typical household (i.e. about TzSh 70,175/year) is between 74 (milk) and 98 percent (goat meat) higher than expenditure for all other livestock products, suggesting the Tanzanians, when it comes to purchasing animal foods, primarily spend their money on beef products.
- The income-expenditure elasticities are positive for all animal foods but for goat meat, and are particularly elastic for beef. Expenditure for the latter is estimated to increase more than proportionate to a change in income for households in the second, third, fourth and top expenditure quintiles.

A cursory look at the TZNPS data suggests that there are both supply and demand opportunities for a development of the livestock sector, which can contribute to economic growth and poverty reduction. On the supply side: (i) majority of rural households keep some livestock – primarily goats, cattle and chicken; (ii) the share of households keeping livestock, the average herd size and contribution of livestock to household income increase with welfare, as measured by expenditure quintiles; (iii) livestock-keeping households are market oriented and primarily market their live animals through traders / intermediaries. On the demand side: (i) beef, poultry, eggs and milk are the most consumed livestock products and their consumption is anticipated to increase with growth in real per capita income; (ii) the demand for beef is expected to grow faster than that for any other animal food; (iii) given that daily per-capita income is lower than US$ 5 for the largest majority of consumers, demand will be largely for relatively low-quality low-processed food items (McDermott *et al.*, 2010). A rapid appraisal conducted by the Tanzania Ministry of Livestock and Fisheries in July 2011 highlights, for instance, that the largest majority of consumers purchase mixed cuts of beef in open-air markets and local butcheries (Pica-Ciamarra *et al*, 2011).

Overall, TZNPS data provide critical insights into prioritizing investments for livestock sector development. However, '*due to the limits of the sample size it is not possible to produce reliable statistics at the regional or district level*' (NBS, 2010), which are needed to design and implement investments on the ground. It is thus necessary to complement TZNPS data with other sources of data to fully exploit their potential.

4. Livestock Market Information Network and Knowledge System (LINKS)

4.1 The dataset

The Ministry of Industry and Trade (MIT) of Tanzania is mandated to '*facilitate the development of sustainable industry and trade sectors through creation of enabling environment*

and provision of improved services' (www.mit.go.tz). With the aim to '*facilitate the development*' of the livestock sector, since 2005 the Ministry of Industry and Trade has been operating, initially with support from USAID, the Livestock Information Network Knowledge System (LINKS), which collects, processes and disseminates livestock market data.

In Tanzania there are currently over 400 primary, 12 secondary and 10 border livestock markets for cattle, sheep and goats, but none for pigs and poultry. Primary markets are under the jurisdiction of Local Government Authorities, and their functioning is often limited because of inadequate marketing infrastructure. Secondary and border markets are managed by the Central Government and are bigger and with better facilities than primary markets (MLFD, 2011). Most markets are held once per week while some are held twice per week. LINKS collects information from 53 livestock markets, of which 41 are primary markets and 12 are secondary markets in 18 out of the 21 mainland regions.[4]

A so-called 'market-monitor' collects livestock market information on behalf of MIT every market day. S/he collects price information from buyers on concluded transactions for four types of animals, with details on breed, age, gender and grade.

- Livestock type: cattle, goats, sheep and donkeys.
- Breeds: e.g. Ankole, Boran, Danakil, Exotic and other for cattle.
- Age group: immature, mature, mixed, young.
- Gender: female, male, castrate.
- Grade: grade 1 to grade 4.

For each type of animal, market monitors (are expected to) collect price information from five different buyers, while they obtain information on the total volume of exchanges from the relevant market authorities. Market monitors are local government officers with no direct reporting responsibilities to MIT. The Ministry of Industry and Trade, however, provides them with a mobile phone and some air-time, which market monitors use to send a coded text message to MIT, with average prices and total volume of exchanges for the various animals. To incentivise the data collection process, all market monitors are invited by MIT once a year to participate in a major meeting to discuss pressing issues / concerns and identify options for improvement.

Market monitors send price and volume data to MIT every week. The data are first checked and validated. If inconsistencies are revealed, the relevant market monitor is contacted to ensure validity of the information. 'Weekly Summary Livestock Market Information Reports' for cattle, sheep, goats and donkeys are then prepared and disseminated by MIT, with information on average prices and total volume of exchanges from the different markets in the country. Details are given on breed, age, gender and grade of animals and the reports are released every Friday afternoon. A 'Monthly Livestock Market Information Report' is also released, which presents a comparison with previous-month-price and volume levels.

Livestock weekly reports are disseminated through English and Swahili newspapers, such as the Guardian, the Citizen, the Mwananchi and the Majira, either weekly or daily. Data are also disseminated through Radio and TV programmes and market boards in the Community Information Centres. Price and quantity data are publically available through the LINKS website (www.lmlstz.net), with a search query that allows downloading information on selected markets and periods.

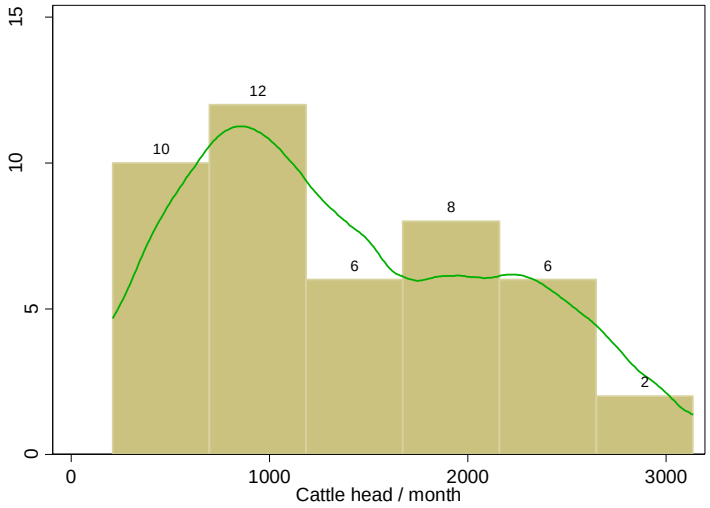
[4] See www.limstz.net for a complete list of LINKS regions and markets. Some background information on LINKS is in Mapunda (2011).

4.2 LINKS, MUKUTA II and LSDP

LINKS dataset provides useful information about market size and trends in prices / volume of exchanges for major live animals, i.e. on trends in business opportunities for livestock keepers. What follows reviews LINKS monthly data available for cattle markets for the period January 2010 to December 2010, as TZNPS data showed that cattle are widely owned by Tanzanian rural households and that beef is the most consumed meat in the country, with its demand anticipated to growth fast in the next coming years.

Out of the 53 markets monitored by LINKS, 45 reported market data for cattle during 2010. Cattle markets record an average volume of almost 1,400 heads of cattle purchased/sold per month and a median volume of about 1,125 heads. The biggest markets, with a volume of over 2,000 heads of cattle purchased/sold per month, are located in the northern regions (Arusha, Kagera, Kilimanjaro, Morogoro, Mwanza and Shyinyanga), which record a high density of cattle per sqkm (from about 10 TLU/sqkm in Arusha region to over 55 TLU/sqkm in Mwanza). The only large market outside of the Northern part of the country is Pugu market in Dar es Salaam, the capital city, where per-capita consumption of beef is the highest Tanzania.

Figure 1. Sizes of cattle markets in Tanzania, 2010



- In 2010, only two breeds of cattle were traded in LINKS markets, including the Tanzanian short-horned Zebu (> 99% of heads sold/purchased) and the Ankole cattle (< 1%). The Tanzania short-horned Zebu is the most common indigenous cattle in the country and comprises a number of strains, such as Iringa Red, Maasai, Mkalama Dun, Singida White, Mbulu, Gogo, Chagga and Pare (Rege and Tawah 1999). Ankole is an indigenous breed largely kept throughout Eastern Africa, including Burundi, Rwanda, Tanzania and Uganda. Both Tanzania short-horned Zebu and Ankole cattle are kept as draught ox, dairy and beef cattle, as well as for by-products such as hides and dung for fuel and manure.
- The Tanzanian grading system for live animals is based on a variety of parameters (e.g. weight, dentition, etc.) and allows differentiating livestock into four uniform groups, from Grade 1 (G1) to Grade 4 (G4). G1 cattle are the best ones, while G4 cattle are the less valuable. Table 5 displays the mean frequency of trade in market days for cattle by gender, age group and grade in the 45 LINKS markets for the period January-December 2010. On average, cattle are traded in most market days (84% of market days). Mature female and

mature males of grade G2 and G3 are the most traded animals. Mature males are used for breeding and beef, while mature females mainly for milk and re-production.

Table 5. Frequency of trade of cattle by gender, age group and grade of animal

	G1	G2	G3	G4	All
Mature female	9.8	48.1	57.2	8.1	30.8
Mature male	16.9	63.1	59.6	5.0	36.2
Mature castrate	1.5	18.5	10.9	0.2	7.8
Immature	5.0	16.3	14.4	0.0	8.9
All	8.3	36.5	35.6	3.3	83.7

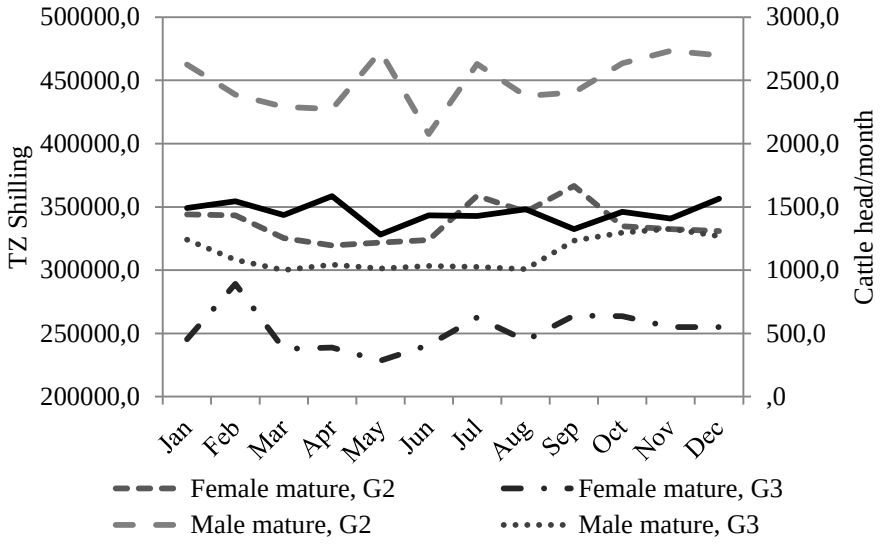
- Prices for live cattle are significantly different for animals belonging to different grades, with price difference between G2 and G3 male / female mature cattle ranging between 25 and 30 percent (table 6).

Table 6. Average prices of live cattle by cattle by gender, age group and grade of animal
Tanzanian Shilling (*US$*)

	G1	G2	G3	G4	Average
Mature female	416,321.6	333,045.9	250,671.2	202,357.3	299,941.5
	(295.4)	*(234.5)*	*(177.9)*	*(143.6)*	*(212.8)*
Mature male	528,065.4	445,411.2	312,739.3	238,544.7	381,190.1
	(374.7)	*(316.1)*	*(221.9)*	*(169.3)*	*(270.5)*
Mature castrate	648,166.7	423,609.9	359,292.4	194,500.0	406,392.2
	(459.9)	*(300.6)*	*(254.9)*	*(138.0)*	*(288.4)*
Immature	287,557.9	174,225.9	163,305.3	na	208,363.0
	(204.0)	*(123.6)*	*(115.9)*	*na*	*(147.9)*

- Trends in volume traded and prices are unclear and LINKS data, at least for 2010, do not provide indications on if/where there are growing market opportunities for cattle keepers. Figure 2 shows average trends in volume (cattle head/month) and prices for G2 and G3 mature male and female cattle in LINKS markets.
- A quick review of price and volume data for the six markets which have reported data for all months in 2010, as well as for Pugu market in Dar es Salaam (data available from January through October 2010), provides some additional insights. First, there is hardly any correlation between volumes traded and prices of the different cattle in the various markets. Second, in all markets there appears to be more variability (as measured by the coefficient of variation) in the volume of cattle traded than price variability. Third, there is more price variability between markets than within markets. Overall, these findings suggest that markets are largely local, with limited inter-regional trade of live animals, and that cattle are considered more as investment rather than a consumption good by farmers, i.e. market price fro live animals reflects the present value of future monetary and non-monetary income stream that livestock are anticipated generate.

Figure 2. Average volume and price trends in Tanzania cattle markets, January-December 2010



A look at LINKS market data for 2010 shows that cattle markets are relatively small and that mature female and mature male cattle of grade G2 and G3 are the most traded animals. The price difference between animals of different grades appears significant, suggesting that investments that help farmers improve the quality of their animals could generate positive returns. As expected, the largest markets are located in the Northern regions and in Dar es Salaam, the capital city. An interesting finding is that trends in price and volume are uncorrelated, at least for 2010, and that there is limited correlation between cattle prices in the different markets. The often high difference in price for the same animals in different markets represents a major business opportunity for livestock keepers as well as for traders. Benefits for cattle keepers can be generated, therefore, if both policies are designed to enhance the grades of the animals farmers sell, as well as to facilitate inter-market trade and trade towards Pugu market in Dar es Salaam (and possibly other major urban centres).

Overall, LINKS data provide critical insights into prioritizing investments for livestock sector development in terms of production and consumption areas. However, neither do they help identify bottlenecks along the livestock value chain nor they provide indication on how to design and formulate livestock sector interventions that benefit livestock producers, as they do not convey information on the (dis)incentives that influence cattle keepers' behaviour.

4. Integrating TZNPS and LINKS

Making joint use of TZNPS and LINKS data could assist policy makers in designing better policies which link farmers to markets. In particular, the two datasets may be used to identify bottlenecks and market imperfections along the value chain: they both provide information on price of live animals but at two different points along the value chain, i.e. at the farm gate (TZNPS) and in market places (LINKS). The agriculture questionnaire of the TZNPS contains in fact the following three questions:

1. Have you sold any livestock alive in the past 12 months?
2. How many have you sold alive in the past 12 months?
3. What was the total value of the sale?

Table 7 compares TZNPS and LINKS average prices for different types of live animals. Note that in the TZNPS dataset live animals are differentiated by gender and age – i.e. mature male cattle (bulls) and mature female cattle (dairy cows) – but not by grade. Figure 3 and 4 display LINKS and TZNPS prices for bulls and dairy cows in 14 and 12 regions respectively. LINKS prices are average annual prices of mature male and mature female cattle sold/purchased in the different livestock markets in the region at hand. TZNPS prices are farm-gate prices reported by individual households living in the selected region (TZNPS households are geo-referenced).

Prices for live animals at the farm-gate and in the market place appear in most cases significantly different, with market prices being up to 220% higher that the price received by households, with the exception for animals of grade 4. The same trend is evident at the level of regions: for instance, in Arusha region, the average difference between farm-gate and market price for bulls is over TzSh 161,000, i.e. US$ 90; in Shingaya, a major cattle producing region, market prices for dairy cows are, on average, 76% higher than farm-gate prices.

Table 7. TZNPS and LINKS prices for live animals

Database	Cattle type	Price per animal		Market price / Farm-gate price	
		Mean	Median	Means	Medians
TZNPS	Cow	230,262	200,000		
LINKS	Mature female G1	415,774	414,625	1.8	2.1
	Mature female G2	333,198	339,277	1.4	1.7
	Mature female G3	250,671	251,300	1.1	1.3
	Mature female G4	202,357	160,000	0.9	0.8
TZNPS	Bull	246,337	233,333		
LINKS	Mature male G1	528,065	513,814	2.1	2.2
	Mature male G2	445,411	425,114	1.8	1.8
	Mature male G3	312,739	307,143	1.3	1.3
	Mature male G4	238,545	210,678	1.0	0.9
TZNPS	Steer	297,000	250,000		
LINKS	Mature castrate G1	648,167	648,167	1.5	1.6
	Mature castrate G2	423,610	417,480	1.0	1.0
	Mature castrate G3	359,292	324,091	0.8	0.8
	Mature castrate G4	194,500	194,500	0.5	0.5

Inefficiencies in the market for live animals appear to exist in Tanzania, as the difference between farm-gate price and market price – recall that data refer to the same animal at different points in the value chain – appears particularly high in most regions. This finding is hardly surprising but, since based on two sources of data which are hardly comparable, should be taken with caution. However, if some formal integration were made between LINKS and TZNPS datasets, not only the same conclusion could have policy relevance but additional inferences could be drawn to design interventions that help farmers better tap into livestock market opportunities.

Figure 3. Farm-gate and market-price for bulls in selected Tanzania regions

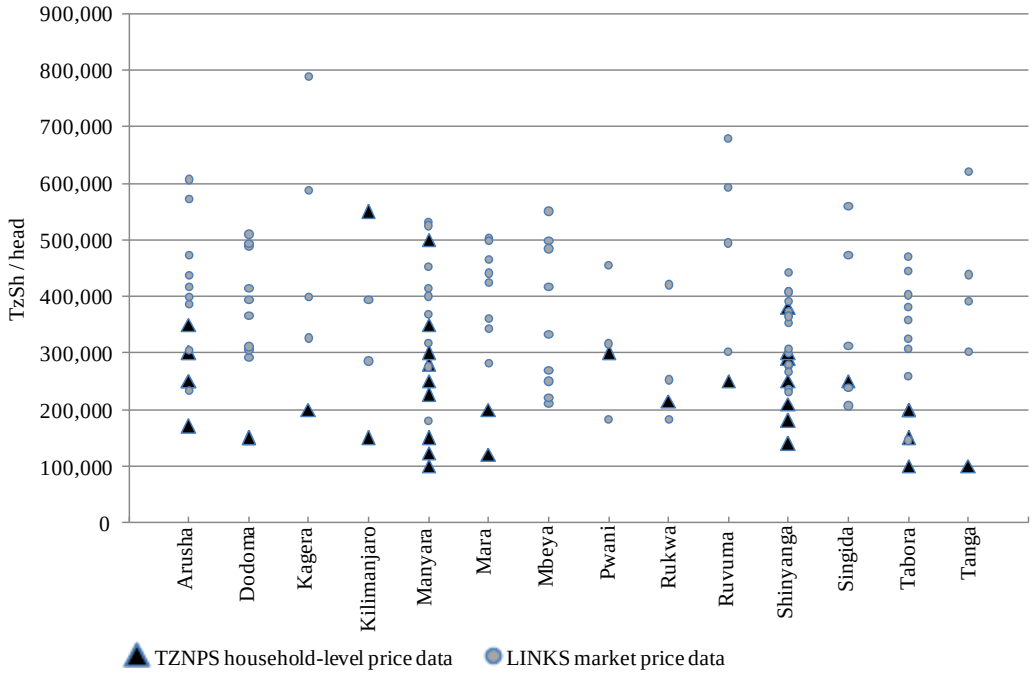
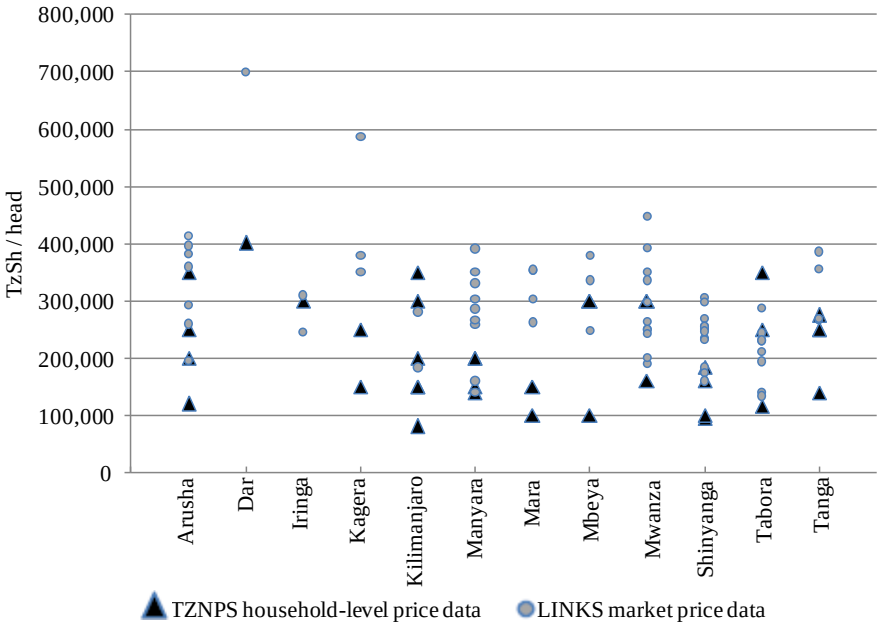


Figure 4. Farm-gate and market-price for dairy cows in selected Tanzania regions



Some possible options to integrate TZNPS and LINKS data systems are as follows:

- Both TZNPS and LINKS data collect price data for live animals, but cattle are differently named or defined in the two datasets. Bulls, cows, steer, heifers, male claves and female calves are found in the TZNPS Agriculture Questionnaire; immature, mature female and male animals of different grades as well as mature castrate and young animals are found in LINKS. A common list of animals is a pre-condition for the joint use of TZNPS and LINKS data.
- Tanzania is one of the few developing countries where a grading system for live animals exists. The price difference between cattle of different grades is noteworthy, and LINKS data

suggests that investments that assist farmers in improving the grade of their animals may generate handsome returns. The TZNPS questionnaires do not include any reference to animal grades: some additional questions on grades would facilitate the joint use of TZNPS and LINKS data.

- The TZNPS Community Questionnaire includes a question on the existence of a primary livestock market, either in the village or in the vicinity, a question on transport cost to the market and a question on the name of the market. The data released by NBS, however, do not include the name of the market, which makes it impossible to identify households selling in LINKS markets. Ensuring that the information on market name is collected and/or that the released TZNPS data include all information which has been collected would facilitate joint analysis of TZNPS and LINKS data.
- Also the TZNPS Agriculture Questionnaire includes a question on livestock market: 'where did you sell most of the cattle that you sold [in the past 12 months]?' Households are entitled to a variety of answers, such as 'relative', 'neighbor', 'market', 'open market', 'cooperative union', etc. It would be useful to ask households the name of the major market in which they sold their live animals. True, the TZNPS households are geo-referenced and one could, on paper, assess in which market households have most likely sold their animals, but it would definitely help have direct information on the name of the market.
- While TZNPS data allow making policy inferences which are representative at national level and at the level of macro-regions, LINKS livestock markets have not been selected having in mind their level of representativeness, though they include all major livestock markets in the country. It would be useful to assess the national and macro-region representativeness of LINKS markets. This would ensure that LINKS could generate statistically reliable annual data, which are needed to jointly use LINKS and TZNPS data and draw policy relevant recommendations both at national level and at the level of macro-regions.
- LINKS collects weekly and monthly data for the total volume of cattle exchanges, while price data are collected by age, gender and grade of the animal. It would be helpful if market authorities provided LINKS market monitors also with detailed information, if available, on the type of cattle traded. There's no need to collect this information on a weekly basis, and monthly or quarterly data should suffice to facilitate comparison / integration with TZNPS data, which are differentiated by type of cattle.
- LINKS market monitors interview at least five buyers to obtain information on market price. The same question asked to sellers, including of whether the seller is a trader or a farmer, would help appreciate transport cost for farmers and margins for traders, two pieces of information which are critical to design interventions that facilitate farmer access to markets. This would also facilitate comparison with TZNPS data, which allow identifying farmers selling to traders / intermediaries and those directly selling their live animals in the marketplace.

Overall, some relatively small changes in both TZNPS and LINKS may help integrate the two data systems and better identify if and where there are bottlenecks along the livestock value chains which prevent farmers from tapping into lucrative market opportunities. The issue is about the feasibility of the proposed changes.

First, TZNPS is a multi-topic survey aimed at measuring welfare / well-being and assessing ex-ante / ex-post selected policy interventions; neither does it have nor it is supposed to have a specific focus on livestock, i.e. additional questions on livestock may generate extra workload on enumerators and analysts which may generate negative externalities on the overall quality of the data. Second, there could be political economy issues in increasing the number of livestock-related questions in the TZNPS questionnaires, as stakeholders from different domains (e.g. gender,

environment, etc.) may then ask that questions be added to respond to their specific needs and concerns. Note also that 2010/11 TZNPS agriculture questionnaire was already expanded to include additional questions on livestock, thanks to a partnership between NBS, the Living Standards Measurement – Integrated Surveys on Agriculture Project of the World Bank and the Livestock Data Innovation in Africa Project of the World Bank, the FAO and the International Livestock Research Institute. Third, LINKS' aim is to provide information on market prices and, whilst MIT is committed to improve LINKS, market monitors are local government officers who already find difficulties in regularly reporting to the Ministry of Industry and Trade, i.e. asking them to collect and report additional information maybe unfeasible. Fourth, if LINKS and TZNPS data were made comparable, a question is about who will make joint use of the two databases. Presumably, only if TZNPS data were processed and market indicators generated and uploaded on the LINKS website, which is user-friendly and targets the general public, there could be some chances that regular policy-oriented rather than sporadic research-oriented analysed be done by combining the two datasets.

5. Conclusions

Linking smallholders to markets is widely viewed as a milestone towards promoting economic growth and poverty reduction, but rarely developing country governments have access to reliable data and statistics to design effective investments which promote a market-driven development of the agricultural sector. This paper focused on livestock sector data in Tanzania and reviewed two major systems of livestock data collection, including the Tanzania National Panel Survey (TZNPS) and the Livestock Knowledge and Information System (LINKS): it showed how their integration would be of value for policy makers and recommended some steps towards their integration.

Both TZNPS and LINKS data provide critical information on market functioning but, on their own, neither is sufficient to design policies which help smallholder access livestock markets. TZNPS data help appreciate household's behaviour, including production and consumption of livestock products, i.e. to identify investment opportunities for livestock sector development. However, *due to the limits of the sample size it is not possible to* [use TZNPS data to] *produce reliable statistics at the regional or district level*' (NBS, 2010b), which are needed to design and implement investments on the ground. It is thus necessary to complement TZNPS data with other sources of data to fully exploit their potential. LINKS collects weekly livestock price and volume data from primary and secondary markets in almost all regions of mainland Tanzania, thereby providing useful information about market size and trends in volume / prices of major live animals, i.e. on trends in business opportunities for livestock keepers. Both TZNPS and LINKS collect information on price of live animals, TZNPS at the farm-gate through interviewing livestock producers and LINKS through interviewing buyers during market days. Ensuring comparability of the price data collected by TZNPS and LINKS would help identify bottlenecks along the supply chain for live animals and draw policy relevant recommendations. This would require some changes in both TZNPS and LINKS, including having a common list of animals, adding some market-related questions in the TZNPS questionnaires and ensuring that LINKS collects information from both buyers and sellers of live animals. Political economy issues and resource constraints, however, could make it difficult to implement those recommendations.

The major lesson out of this paper, in terms of implementing the second pillar of the Global Strategy to Improve Agricultural and Rural Statistics, i.e. integrating different data systems, is however the following: joint analysis of existing datasets is critical to understand if and how it makes sense to integrate different data systems. While the basics of data integration are known – e.g. the development of a master sample frame for agriculture as indicated in the Global Strategy –

it is the details that matter, and those differ from country to country. Institutional changes to integrate different datasets can be best identified when some analyses are done using different sources of data, with the explicit objective to arrive at some practical recommendations for policy makers and private investors. Given scarce resources, it is in fact critical to prioritize integration of those data systems whose joint use can generate information valuable for decision makers to design investments that contribute to economic growth and accelerated poverty reduction.

REFERENCES

Mapunda A.R. (2011) Collection and Use of Livestock Data. LINKS – Tanzania. Presentation given at the 'New Perspective on Livestock Data Workshop', Arusha, Tanzania, 10-11 August. Available at www.africalivestockdata.org.

McDermott J., Staal S.J., Freeman H.A., Herrero M., Van de Steeg J.A. (2010) Sustaining intensification of smallholder livestock systems in the tropics. *Livestock Science*, 130 (1-3): 95-109.

MFEA (2010) *National Strategy for Growth and Reduction of Poverty II. NSGRP II*. Ministry of Finance and Economic Affairs, Dar es Salaam.

MLFD (2010) *The Livestock Data and Information in Tanzania.* Ministry of Livestock and Fisheries Development, Dar es Salaam.

MLFD (2011) *Livestock Sector Development Programme*. Draft. Ministry of Livestock and Fisheries Development, Dar es Salaam.

NBS (2010a) *Tanzania Statistical Master Plan (TSMP) 2009/10 – 2013/14*. National Bureau of Statistics, Dar es Salaam and Office of Chief Government Statistician, Zanzibar.

NBS (2010b) *Basic Information Document. National Panel Survey (NPS, 2008-2009).* National Bureau of Statistics, Dar Es Salaam.

NBS *et al.* (2010) *National Sample Census of Agriculture 2007/08. Preliminary Rerport.* National Bureau of Statistics, Dar es Salaam.

Grosh M.E., Glewwe P. (1995) *A Guide to Living Standards Measurement Study Surveys and Their Data Sets*. LSMS Working Paper No.120. World Bank, Washington D.C.

Pica-Ciamarra U., Baker D., Nsiima L. (2011) Are there market opportunities for livestock producers in Tanzania. Presentation given at the 'New Perspective on Livestock Data Workshop', Arusha, Tanzania, 10-11 August. Available at www.africalivestockdata.org.

Rege J.E.O., Tawah C.L. 1999. The state of African cattle genetic resources II. Geographical distributions, characteristics and uses of present-day breeds and strains. *FAO/UNEP Animal Genetic Resources Information Bulletin*, 26:1-2.

World Bank (2008) *World Development Report 2008: Agriculture for Development*. World Bank, Washington D.C.

World Bank (2011) *Global Strategy to Improve Agricultural and Rural Statistics*. Report No. 56719-GBL. World Bank, Washington D.C.