THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF LIVESTOCK AND FISHERIES DEVELOPMENT

LSMS-ISA
Integrated Surveys on Agriculture

Livestock and livelihoods in rural Tanzania

A descriptive analysis of the 2009 National Panel Survey

Katia Covarrubias, Longin Nsiima and Alberto Zezza

The authors, listed in alphabetical order, are respectively with the Agricultural Development Economics Division (ESA) of the Food and Agricultural Organization (FAO), the Ministry of Livestock and Fisheries Development of Tanzania, and with the Development Research Group (DECRG) of the World Bank. Corresponding author is Zezza: azezza@worldbank.org). The authors are grateful to Derek Baker, Gero Carletto, Luc Christiaensen, Ana Paula de la O, Nancy Morgan and Ugo Pica-Ciamarra for comments on earlier drafts. Exchanges and discussions on data issues with Leigh Anderson, Kathleen Beegle, Kristen Himelein, Jon Kastelic, Amparo Palacios-Lopez, and Waly Wane were extremely useful in completing this work. Raka Banerjee has been of tremendous help in putting the final manuscript together. None of these people, or the institutions the authors are affiliated with, bears any responsibility for the content of the paper which rests solely with the authors.

July 2012

Joint paper of the World Bank, FAO, AU-IBAR, ILRI and the Tanzania Ministry of Livestock and Fisheries Development with support from the Gates Foundation

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report presents an analysis of rural livelihoods in Tanzania, with particular emphasis on the livestock sub-sector, smallholder farmers' living standards, and issues with access to productive assets. The report attempts to answer basic questions such as:

- To what extent is keeping livestock an activity of the relatively better off, and to what extent are poorer households able to engage?
- How does the role of livestock vary with different levels of income and well-being?
- How are livestock holding size and structure associated with differences in welfare, gender, and geography?
- How important are input and output markets for small livestock keepers?
- What form does this market participation take in practice, and what is its extent?
- How important are some of the non-income services of livestock (e.g., manure, draught power) for crop production?

The study is based on data from the Tanzania National Panel Survey (NPS) collected by the National Bureau of Statistics (NBS) from October 2008 to October 2009 as part of the first wave of a nationally representative living standards survey. The NPS was conducted by the NBS with technical assistance and financial support from the World Bank's Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) project (funded by the Bill and Melinda Gates Foundation), as well as the Kingdom of Denmark, the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA). The extensive focus of the survey on agriculture, atypical of previous living standard surveys in Tanzania, offers a wealth of data on the range of agricultural activities relevant for the country. One limitation of the report, driven by the data, is that it covers only farm household operations. Large scale corporate farms are not included in the NPS survey and hence in this study.

❖ *A diverse rural economy, with agriculture as the backbone*

The near totality of rural households in Tanzania has some level of involvement in agricultural activities. Three fifths of rural households earn income from livestock husbandry, while 97 percent cultivate crops and approximately one fifth are employed as agricultural wage laborers. Agricultural activities combined (crop, livestock, and agricultural wage labor) amount to 70 percent of total income for rural households (53 percent from crop production, 13 percent from livestock, and four percent from agricultural wages). Self-employed farming is clearly the mainstay of rural livelihoods, with 53 percent of households deriving 75 percent or more of their income from self-employed farming.

Participation in non-agricultural self-employment is similar to that of other developing countries (Davis et al., 2010), with 34 percent of rural households engaged in these activities. The non-agricultural sector provides a non-negligible 30 percent of total income, seven percent of

which originates from non-agricultural wages, 13 percent from non-agricultural self-employment, and 10 percent from transfers (mostly private transfers from relatives).

- ***Agriculture: A sector of small-holder farmers***

The NPS data yield the picture of a heterogeneous agricultural sector dominated by smallholder farmers. Average land ownership and operations are both at about 1.6 hectares, and less than five percent of rural households own or operate more than five hectares of land. Even in the top land quintile, average land operations are smaller than 4 hectares. Most rural households appear to be engaged in subsistence agriculture. On average, 67 percent of agricultural production is consumed by the household, 30 percent is marketed, and the remainder is used as input or allocated to other uses. Larger farmers tend to market a greater share of their agricultural output when compared to smallholders. Farming households in the top land operated quintile still consume a major part of their output at home, but they sell close to 40 percent of it on the market.

The statistics on agricultural input use and purchases that emerge from the NPS point to a farming sector characterized by an extremely limited use of modern inputs. Only 30 percent of households report using any fertilizers, and 15 percent report the purchase of pesticides. Meanwhile, 58 percent of rural households purchased seeds for agriculture, but just 14 percent purchased improved seed varieties and only 12 percent bought certified improved varieties. Seed use is therefore largely made up of traditional varieties. As expected, the agricultural practices of larger farmers are somewhat more reliant on the use of seeds, fertilizers, and pesticides/herbicides.

- ***Most rural households have some livestock***

About three out of five rural households report some income from livestock activities, earning an average 22 percent of total household income from livestock rearing. Both the share of rural households participating and the income shares from participation in livestock activities increase with welfare, as measured by expenditure quintiles. For the bottom quintile, 49 percent of households participate and livestock contributes to 18 percent of their total household income. At the top 20 percent of the expenditure distribution, the corresponding percentages are 69 percent for participation in livestock activities, and 24 percent for the share of income earned from them.

The NPS data provide an opportunity to look closely the relationship between overall household welfare and livestock ownership in Tanzania. This can yield important indicators on i) the presence and extent of inequality and concentration within the livestock sector, ii) whether there are structural impediments in the access of the poor to livestock ownership, and iii) the extent to which investments in different types of livestock can be a vehicle for poverty reduction.

- ***The poor own relatively more poultry, the rich own more cattle, but average holdings are small for all***

In terms of total livestock ownership, Tanzanian rural households hold on average 2.72 Tropical Livestock Units (TLUs). Rural livestock ownership is dominated by cattle, which contribute 2.24 TLUs, equivalent to 82 percent of total rural livestock ownership. Cattle ownership is however limited to about one third of households. Poultry ownership on the other hand is almost universal, and for the average livestock keeping rural household it is poultry that constitutes the bulk of livestock holdings.

The herds of poorer households are characterized by smaller animals, while wealthier households tend to hold more large livestock. However, all in all the relationship is not striking, which should not be surprising in view of the diversity of rural livelihood. In general, poorer households have broadly comparable levels of ownership to wealthier households. For cows, one can observe a somewhat stronger positive relationship with wealth, with the largest average holding being in the fourth quintile.

- ***Livestock holdings are concentrated in a relatively small group of households***

A substantial share of livestock ownership is concentrated in a relatively small share of the rural population. The top quintile of livestock owners own approximately 81 percent of all livestock. This concentration of ownership is even more striking when compared to the bottom quintile of livestock owners who hold less than one percent of total livestock. Underlying this trend is the composition and size of livestock ownership in these groups, with the bottom 40 percent relying essentially on small numbers of poultry, goats becoming more important in the third and fourth quintiles, and cattle dominating the fifth quintile.

Herd size distribution also varies geographically, with larger holders concentrated in the Northern and Western regions, and smaller holdings prevalent in the Southern and Southern Highlands regions. Interestingly, levels of per capita expenditures do not change significantly across quintiles of livestock ownership, whereas herd size and structure does, with a particularly steep gradient in the top quintile, suggesting that there is a small core of relatively larger livestock owners who are substantially different from the rest. This is confirmed by the fact that households in the top quintile earn about a third of their income from livestock, as opposed to 10-14 percent in the other quintiles.

- ***The use of purchased inputs is scant***

The use of inputs in livestock activities is scarce: only six percent of rural livestock holders hired in labor for work on livestock related activities, and only one fifth purchased fodder for their livestock. The share purchasing fodder ranges from 13 percent for the poorest group of households to 37 percent for the top expenditure quintile of rural households involved in livestock keeping, which could be a reflection of their greater purchasing power, but also of differences in herd composition or livestock rearing systems.

Households also keep livestock for a variety of other goods and services they provide, one being manure. Although the use of organic fertilizer in household agricultural activities is not

widespread, a notable 25 percent of rural households that participate in livestock activities do report using it on their plots, as compared to only 12 percent for households that don't have livestock. That points to potential spillovers of the benefits of livestock to crop production.

❖ ***Livestock diseases are common, access to veterinary services and markets are not***

The control, prevention and cure of animal diseases is an important element in explaining constraints to livestock profitability and growth, as well as possibly the single most important element of public policy towards the sectors. New Castle is the most widely reported disease, affecting 52 percent of all poultry keepers, with peaks of 60 percent in urban areas. Among cattle, Contagious Bovine Pleuropneumonia (CBPP) and East Coast Fever (ECF) are the diseases most often reported by farmers (17 and 15 percent of households respectively), while 23 percent of sheep and goat herders report some cases of Contagious Caprine Pleuropneumonia (CCPP).

The high level of reported disease could be due to the overall low level of vaccination at approximately 29 percent. Poorer households have lower vaccination rates than wealthier households, and they also report slightly lower overall disease rates for livestock. Vaccination rates are much higher than average among households that hold significant numbers of animals, with 40 percent of households in the fourth ownership quintile and 59 percent in the top quintile reporting some animal vaccination in the course of the previous 12 months. Potential problems with barriers to access to vaccination services are suggested by the fact that urban livestock keepers are more likely than rural ones to report having vaccinated any of their livestock. A similar imbalance is noted for the access to vaccination by female- compared to male-headed households.

Access to markets among rural households is limited. Only 10 percent of farm specialized rural households are market oriented (i.e., selling more than 50 percent of their output), and among all rural households, just 37 percent of total agricultural production is marketed, 29 percent being crop sales and only eight percent originating from livestock. Even though the share of livestock in total agricultural sales is limited with respect to crops, livestock is a relatively more market oriented activity, as approximately half of all livestock production is sold. As a result, whereas the value of livestock sales contributes only 7 percent to total agricultural production, it contributes to one quarter of total agricultural sales making it an important source of cash income.

❖ ***Livestock and gender***

Alongside differences in wealth, the livestock sector is also notably divided across gender lines. Sixty-five percent of male-headed households participate in livestock activities, while only 51 percent of female-headed households report participation. When herd structures are compared with respect to the gender of the household head (admittedly a very imperfect indicator of gender control over assets) significant differences are observed in both herd size and composition. Female-headed households manage herds which are on average about two thirds the size of those owned by male-headed households. The difference is most marked when it comes to cattle ownership; it becomes smaller for goats and sheep, and reduces even further for poultry, despite remaining statistically significant. Female-headed households, therefore, tend to have relatively more small animals than

large pack animals compared to the average household. It should be noted that the differences are particularly large in terms of the probability of owning cattle. Once ownership is controlled for, herd size is not large and can actually be larger for female-headed households.

While nearly a quarter of household livestock managers are only women, and fifteen percent are only male, three fifths are joint male-female managers. Women managing livestock earn less from their livestock; they manage considerably lower numbers of the main livestock species in Tanzania, with the exception of poultry, and are significantly less likely to use key inputs such as labor, fodder, and vaccinations. The differential rates of usage of inputs and services do not per se indicate discrimination in access, as they may be equally driven by differences in herd structure, since women are less likely to own cattle which are likely to be more (purchased) input intensive.

Despite these differences, the share of households with only female livestock managers is not completely disadvantaged in terms of accessing markets. Forty percent sold any livestock, a share that is equal to the share selling among the male/joint managers group. It is worth noting that when considering the scale of production, female managers are significantly more commercially oriented, with 37 percent of their total livestock production being sold on market, compared to only 30 percent for households with men involved in livestock management. This outcome highlights that despite the obstacles faced by women in the livestock sector, commercialization of production may not necessarily be affected.

- ***Will the livestock sector be able to satisfy an increasing domestic demand?***

Consumption of livestock products, whether purchased or own produced, contributes 13 percent to total household expenditures, and just over one fifth to the value of total food consumption. Whereas the share of food in total household expenditures decreases with rising wealth, the importance of livestock in total household expenditures and in total food expenditure rises over quintiles. Total rural household food expenditure makes up nearly two thirds of total household expenditure.

The overall level of per capita urban livestock product consumption is approximately twice that of rural households and is sourced almost entirely in purchases, whereas rural households demonstrate a more equal division between the value of produced versus purchased consumption. For meat, poultry and dairy consumption, urban households consume approximately twice the value as rural households, while for eggs, consumption is nearly four times the level of the rural population. The relationship between urban per capita consumption in TZS and wealth quintiles is positive and holds for nearly all products observed.

The analysis of the patterns of consumption of products of animal origin reveals the picture of a sector with much room for expansion. The disparities in livestock product consumption between rural and urban areas and between different income groups suggest that as average incomes in Tanzania increase, the demand for livestock products may expand, offering good opportunities for livestock producers to increase their production in order to serve a growing domestic market. Female-headed households, while somewhat disadvantaged in terms of access to livestock assets,

appear to be in a relatively good position to benefit from such opportunities, as their participation in livestock output markets is on par with, or greater than, that of other households. This growth is also likely to be accompanied by a shift in the composition of the demand towards more meat and dairy products. Poultry will continue to be important, but if current consumption patterns are of any guidance, household preferences will increasingly shift towards other livestock products as incomes increase.

- ***The challenge: Removing constraints to unleash growth in the livestock sector***

A series of factors may constrain households' ability to take advantage of the opportunities offered by a possible growth in livestock demand. In particular, the low level of input use and veterinary services, and the high prevalence of reported animal illness could place restrictions on the extent to which livestock is productive. Further analysis is required to identify the extent to which these constraints may become binding, and to single out possible actions to remedy the situation.

The NPS data offer a rich basis, particularly if integrated with additional data sources, upon which to further the descriptive analysis featured in these pages. The objective of this report has been to use the wealth of information included in the NPS to identify some of the main constraints and opportunities related to growth in the smallholder agricultural sector. It is hoped that others will take this analytical agenda forward, exploiting to its full extent the wealth of information included in the NPS. To that end, the future rounds of longitudinal data that will soon become available from NBS provide an unprecedented opportunity for analysts to further our understanding of the nexus between livestock and livelihoods in rural Tanzania.

1. BACKGROUND

Tanzania's National Strategy for Growth and Reduction of Poverty (NSGRP, also known as MKUKUTA from its Kiswahili title) recognizes that poverty in Tanzania is overwhelmingly rural, as about 87 percent of the population lives in rural areas, where the incidence of poverty is higher. The NSGRP also states that poverty is highest among agricultural households and expresses a concern for the urban-rural disparities in living standards. It is therefore important that the debate on poverty reduction in Tanzania be based on a sound and current understanding of the relationship between living standards in rural areas, agriculture and other sources of income, and access to resources, assets, and markets.

In 2006, the government approved a National Livestock Policy based on the premise that "the Livestock Industry has an important role to play in building a strong national economy and in the process, reducing inequalities among Tanzanians by increasing their incomes and employment opportunities" (URT, 2006). The policy also recognizes that aside from contributing to GDP, the livestock sector has a role to play in i) ensuring food security, ii) providing households with employment, income, and a store of value and investment opportunity, iii) providing draught power and manure for sustainable agriculture, and iv) fulfilling cultural roles.

Tanzania recorded good economic performance in the last decade, with GDP growth rates consistently between 6.0 to 7.8 percent (3.0 to 5.0 percent on a per capita basis). Even in the last years of the decade, despite the global economic recession, growth rates were sustained at respectable rates of 6.0 percent in 2009 and 7.0 in 2010 (or 3.0 and 3.9 percent respectively if the per capita figure is considered) (World Bank, 2011). The agricultural sector annual growth rate was somewhat slower with rates between 3.2 and 5.9 annually. The last two years have been among the worst (3.2 percent in 2009) and the best (5.4 percent in 2010) of the decade according to the available statistics. The agricultural sector accounts for around 28-30 percent of total value added, approximately one fifth of which originates in the livestock subsectors. The crop subsector, the largest component in agriculture, grew 4.5 percent in 2007 and 5.1 percent in 2008. The growth rate in the livestock subsector increased from 2.4 percent in 2007 to 2.6 percent in 2008 (URT, 2009). Government policies towards the sector focused on improving irrigation, rural roads, and infrastructure, as well as increasing efficiency in the use of land resources. Policies also targeted increasing the provision of agricultural services as well as improving access to fertilizers and animal breeding.

However, several observers have pointed with concern to the lack of progress in rural poverty reduction, and have emphasized various constraints that are preventing the existing pockets of agricultural growth from translating into broad-based growth and significant gains in rural poverty reduction. Such constraints include low input use and lack of credit (Sarris et al., 2006), lack of productivity gains in the sub-sectors that matter most to the poor, such as maize (Pauw and Thurlow, 2011), and market imperfections that work against poor smallholder farmers (Mashindano et al., 2011). The increase in world food prices from 2007 to 2008 and the resurgence in food price

levels in 2010 have contributed to increasing concerns regarding household food security, while opening a debate on the ability of the agricultural sector to trigger a supply response to the improved terms of trade for the sector.

This report presents an analysis of rural livelihoods in Tanzania, with particular emphasis on the livestock sub-sector, smallholder farmers' living standards, and issues with access to productive assets. The report attempts to answer basic questions such as:

- To what extent is keeping livestock an activity of the relatively better off, and to what extent are poorer households able to engage?
- How does the role of livestock vary with different levels of income and well-being?
- How are livestock holding size and structure associated with differences in welfare, gender, and geography?
- How important are input and output markets for small livestock keepers?
- What form does this market participation take in practice, and to what extent?
- To what extent do the non-income services of livestock (e.g., manure, draught power) benefit crop production?

The report is organized as follows: after a description of the data in Section 2, in Section 3 we analyze the composition of rural income, household endowment of human capital, and access to infrastructure and assets, in order to gain an understanding of the level of wellbeing in the rural space. A descriptive analysis of the characteristics of small rural livestock owners and their production practices is provided in Section 4, which highlights the heterogeneity of the households engaged in the livestock sector and presents evidence of the sector's importance to rural livelihoods in terms of both income and consumption. Section 5 concludes with a discussion of key results and their implications for policy and further analysis.

2. THE DATA

This study is based on data collected by the Tanzania National Bureau of Statistics (NBS) from October 2008 to October 2009 as part of the first wave of the Tanzania National Panel Survey (NPS), a nationally representative living standards survey. The NPS was conducted by the NBS with technical assistance and financial support from the World Bank's Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) project (funded by the Bill and Melinda Gates Foundation), as well as the Kingdom of Denmark, the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA). The data and full survey documentation are distributed by the NBS and are publicly available.

The extensive focus of the survey on agriculture, atypical of previous living standard surveys in Tanzania, offers a wealth of data on the range of agricultural activities relevant for the country. Data was collected using household, agricultural, and community questionnaires in which information was obtained at the individual, household, plot, and community level. Agricultural production data was collected at the plot and crop level, with considerable detail on the allocation of production and the

use of inputs such as fertilizer, pesticides, seeds, hired labor, and household labor according to activity. Similarly, livestock activities were explored at length in the agricultural questionnaire, with data collected on the ownership of a range of animals, indigenous and improved breeds, transactions in live and slaughtered animals, diseases and vaccinations, and the production and consumption of products obtained from the animals. For all agricultural activities, information was also collected regarding the manager(s) of plots and animals, allowing for the calculation of gender-disaggregated statistics.

The survey is nationally representative at the urban/rural and agro-climatic zone level.1 The final sample consists of 3,265 households, 1,202 of which are urban and 2,063 rural. In this study, we analyze the 2,055 rural and 1,200 urban households for which we have complete data on income and household characteristics. Given the extensive set of information on livestock activities, we also break down our analysis further to look at the 1,499 rural and 225 urban households reporting some involvement in livestock activities.[2]

3. RURAL HOUSEHOLD LIVELIHOODS

3.1. Basic household characteristics

Table 1 reports basic summary statistics for some key characteristics of rural households.[3] Data for urban households and t-tests on the difference in means are also reported in the table, for comparison. These households consist on average of 5.4 members, 2.5 of which are of working age, defined as being from 15 to 60 years old. The average age of rural household heads is 47 years. One fourth of household heads are female and about the same share are single. The educational attainment of heads is at the primary school level: on average, household heads have completed less than five years of schooling and the highest level of attainment among all household members is, on average, under six years.

Access to infrastructure and basic services is also problematic for many rural households. Fewer than five percent of all rural households report having access to an internal flush toilet, electricity, a fixed telephone line, or public/private garbage collection service. Households, however, are not entirely disconnected from public services and infrastructure. The distance to the nearest primary school from the community is 0.15 kilometers, on average. At an average distance of one kilometer, agricultural plots are also not far removed from the household or the nearest road, but they are relatively far from the nearest market, at about seven kilometers.

Urban households are observed to be somewhat smaller at only 4.4 members, but with approximately the same number of working age members in the household. The urban sample is

[1] The NPS is statistically representative of the following seven macro-regions of Tanzania: Central, Northern, Eastern, Southern, Southern Highlands, Western, Lakes, and Zanzibar.

[2] Of these 1,724 households owning any animals, 1,404 households (1,197 rural and 207 urban) reported earning any income from livestock. In the discussion that follows, we will refer to these as 'livestock producers', and to the households owning livestock (the larger group) as 'livestock keepers'.

[3] The survey documentation provides an explanation of the definition of the concept of a household in this survey.

also characterized by having younger household heads, who more often tend to be female and single. Educational attainment, at seven years, is also notably higher, though still limited to an upper primary school level. Access to public services in urban areas is also considerably higher when compared to the rural space; however, it is by no means universal, as more than half of urban households lack access to modern sewage disposal, electricity, running water, and public garbage collection. While government schools are present in the vicinity of most rural as well as urban households, private schools are less accessible among the rural sample when compared to urban areas, reflected in the large distance rural households must traverse in order to reach a private primary school; urban households have private primary schools in greater proximity at 4.33 kilometers.

Table 1. Basic household characteristics

	Urban	Rural	T-test	*N*
Household size	4.42	5.43	***	*3255*
# Household members of working age	2.62	2.52		*3255*
Household head characteristics				
Age	42.28	47.22	***	*3255*
Female	0.28	0.24	**	*3255*
Single	0.38	0.25	***	*3255*
Years of schooling	7.02	4.43	***	*3255*
Highest years of schooling in household	8.31	5.83	***	*3255*
Dwelling characteristics				
Flush toilet	0.15	0.03	***	*3255*
Electricity	0.43	0.03	***	*3255*
Running water	0.15	0.01	***	*3255*
Public garbage collection	0.29	0.00	***	*3255*
Kilometers from dwelling to:				
Nearest government primary school	0.29	0.15	***	*3255*
Nearest private primary school	4.33	23.44	***	*1040*
Agricultural plot	7.02	0.98	***	*2287*
Kilometers from plot to:				
Nearest market	5.96	6.85	***	*2287*
Nearest road	1.57	1.13	***	2287

*Note: Asterisks denote significant differences based on t-tests across urban and rural as follows: * significant at 10%; ** significant at 5%; *** significant at 1%.*

3.2. Income patterns

Key survey results on household participation in income generating activities and the share of income derived from them are reported in Table 2, while Annex 1 describes the basic concepts and methodologies applied for defining income. The data from the NPS confirm the nearly universal involvement in self-employed agriculture reported in previous surveys and in the agricultural Census (URT, 2006). Three fifths of rural households earn income from livestock husbandry, while 97 percent cultivate crops and approximately one fifth are employed as agricultural wage laborers.

Agricultural activities combined (crop, livestock, and agricultural wage labor) amount to 70 percent of total income for rural households, a figure that is driven mostly by independent agricultural work.

Whereas 53 percent of total income comes from crop production and 13 percent from livestock, only four percent originates from agricultural wages.

Table 2. Income composition and participation

	Urban	Rural	T-test
Share in Total Income			
Agricultural (A+B+C)	0.13	0.70	***
A. Agricultural wages	0.02	0.04	***
On farm (B+C)	0.11	0.66	***
B. Crop	0.08	0.53	***
C. Livestock	0.03	0.13	***
Non-agricultural (D+E+F+G)	0.84	0.30	***
Nonfarm (D+E)	0.77	0.20	***
D. Non-agricultural wages	0.35	0.07	***
E. Self-employment	0.42	0.13	***
F. Transfers	0.07	0.10	***
G. Other	0.00	0.00	*
Participation in Income Activities			
Agricultural (A & B & C)	0.44	0.99	***
A. Agricultural wages	0.04	0.22	***
On farm (B & C)	0.43	0.98	***
B. Crop	0.37	0.97	***
C. Livestock	0.22	0.61	***
Non-agricultural (D & E & F & G)	0.92	0.77	***
Nonfarm (D & E)	0.85	0.43	***
D. Non-agricultural wages	0.48	0.15	***
E. Self-employment	0.59	0.34	***
F. Transfers	0.37	0.57	***
G. Other	0.01	0.01	*
Specialization			
Farm specialized household	0.08	0.53	***
Market oriented	0.02	0.10	***
Subsistence	0.06	0.43	***
Labor specialized household	0.74	0.10	***
Migration specialized household	0.03	0.04	
Diversified household	0.15	0.33	***
Number of Households	*1200*	*2055*	

Note: A household is defined as specialized in labor if 75 percent or more of its total income comes from wages and self employment; it is migration specialized if it earns 75 percent or more from transfers; and it is farm specialized if it earns more than 75 percent of total income from on farm activities. Market oriented farm specializers are those selling more than 50 percent of their production, while subsistence oriented farm specializers consume more than 50 percent of their production. Diversified households earn less than 75 percent of total income from any one activity.

Participation in non-agricultural self-employment is similar to that of other developing countries (Davis et al., 2010), with 34 percent of rural households engaged in these activities. The non-agricultural sector provides a non-negligible 30 percent of total income, seven percent of which originates from non-agricultural wages, 13 percent from non-agricultural self-employment, and 10

percent from transfers. These transfers are nearly all incoming transfers originating from children living outside the household.[4]

Self-employed farming is clearly the mainstay of rural livelihoods, with 53 percent of households deriving 75 percent or more of their income from self-employed farming. We define these households as agricultural specializers. Nearly all agricultural specializers consume more than half of their production, identifying their livelihood as subsistence oriented. Exactly one third of rural households hold a diversified portfolio of income, with no single source accounting for more than three quarters of total household income. Another 10 percent of households specialize in off-farm labor activities such as self-employment enterprises or wage labor in or outside agriculture.

The composition of urban income portfolios is markedly different from the rural one. Only 13 percent of total income is sourced in agriculture, while 35 percent is derived from non-agricultural wages and 42 percent from nonfarm self-employment. Whereas the rural population is largely either specialized in farming or holds a diversified income portfolio, nearly three quarters of urban households are specialized in labor activities and only 15 percent have diversified income portfolios.

3.3. Land holdings: a smallholder sector

Data regarding land holdings by rural agricultural households (reported in Table 3) yield the picture of a heterogeneous agricultural sector dominated by smallholder farmers.[5] Most households own or operate agricultural land; only 10 percent of rural households are landless and just six percent report that they do not operate any land. Average land ownership and operations are both at about 1.6 hectares. The distribution of land operated is illustrated in Table 3 and Figure 1, which both show the prevalence of smallholder operations in the rural space. Less than five percent of rural households own or operate more than five hectares of land; even in the top land quintile, average land operations are smaller than 4 hectares.

Table 3. Basic land characteristics

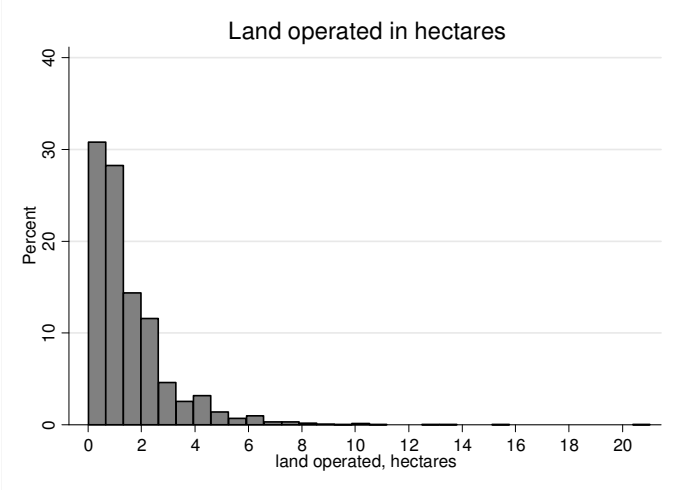
Share of rural landless households	Share of households not operating any land	Average land owned (ha)	Land operated quintiles	Average land operated (ha)
0.10	0.06	1.59	1	0.31
			2	0.69
			3	1.17
			4	1.82
			5	4.06
			Total	1.63

Note: 2,055 rural households.

[4] The NPS collects remittances data specifically in the context of children living away from the household. Total transfers make up 10.4 percent of rural household income. The majority of that share is sourced in remittances from children (10.2 percent of total household income) and the remaining 0.2 percentage points are attributed to public transfer income.

[5] The unit of analysis in the NPS is the household. This report therefore covers farming activities performed by households, but does not deal with the large farm sector. According to the 2002-03 Census there were a total of 1,254 large farms in Tanzania (URT, 2006).

Figure 1. Histogram of the area of land operated by rural households



Most rural households appear to be engaged in subsistence rather than market oriented agriculture. On average, 67 percent of agricultural production is consumed by the household, 30 percent is marketed, and the remainder is used as input or allocated to other uses. Overall, 24 percent of households sell more than half of their production, a share that increases with land operated, while 73 percent of households consume more than half of total agricultural production, a figure that is somewhat inversely related to land size (Table 4).

Larger farmers tend to market a greater share of their agricultural output when compared to smallholders. The households at the bottom of the land distribution appear to be primarily subsistence households as they consume up to 70 percent of their production. Farming households in the top land operated quintile still consume a major part of their output at home (61 percent), but they sell close to 40 percent of it on the market. Meanwhile, only 23 percent of the value of total agricultural production is sold by households in the bottom land operated quintile. Furthermore, one third of the largest farming households sell more than half of their output on the market, which is 14 percentage points more than the corresponding share in the first quintile.

Table 4. Sales and consumption of agricultural production, by quintiles of land operated

Land operated quintiles	Share of agricultural production:		Share of households for which more than half of production is:	
	Sold	Consumed	Sold	Consumed
1	0.23	0.70	0.19	0.74
2	0.27	0.70	0.19	0.78
3	0.28	0.70	0.21	0.77
4	0.34	0.64	0.27	0.71
5	0.37	0.61	0.33	0.65
Total	0.30	0.67	0.24	0.73

Note: 1,882 land operating rural households

The statistics on agricultural input use and purchases that emerge from the NPS point to a farming sector characterized by an extremely limited use of modern inputs, summarized by the share of rural households using or purchasing agricultural inputs in Table 5. Only 30 percent of households report using any fertilizers (chemical or organic); about 14 percent buy them on the market, while the remainder rely on own organic fertilizers. Similarly, only 15 percent report the purchase of pesticides. Meanwhile, 58 percent of rural households purchased seeds for agriculture, but just 14 percent purchased improved seed varieties and only 12 percent bought certified improved varieties. Seed use is therefore largely made up of traditional varieties.

As expected, the agricultural practices of larger farmers are somewhat more reliant on the use of seeds, fertilizers, and pesticides/herbicides. Purchases of chemical fertilizer rise with increasing area of operated land, from 10 percent in the bottom quintile to 14 percent in the largest land group. The use of any kind of fertilizer rises from 23 to 34 percent of rural households over quintiles of land operated. The purchase of improved seeds is not pervasive but it does increase considerably with land operated, confirming the trend towards greater access among larger scale producers. Households in the higher land quintiles are likely to use improved seeds more often (19 percent), while their use is much less common among the smallest holders at nine percent.

Table 5. Share of households using and purchasing inputs, by land operated quintiles

	Land operated quintiles					
	1	2	3	4	5	Total
Fertilizer use	0.23	0.28	0.28	0.35	0.34	0.30
Organic	0.17	0.22	0.20	0.26	0.27	0.22
Chemical	0.10	0.08	0.14	0.14	0.14	0.12
Fertilizer purchase	0.12	0.11	0.15	0.19	0.15	0.14
Organic	0.04	0.04	0.04	0.07	0.05	0.04
Chemical	0.10	0.08	0.14	0.14	0.14	0.12
Pesticide purchase	0.11	0.11	0.13	0.17	0.20	0.15
Seed purchase						
Traditional / Improved	0.48	0.56	0.60	0.62	0.65	0.58
Improved	0.09	0.13	0.14	0.14	0.19	0.14
Certified	0.08	0.11	0.13	0.12	0.18	0.12

Notes: (1) 1,882 land operating rural households; (2) Chemical fertilizer use is equivalent to chemical fertilizer purchase since the survey does not distinguish between the use versus purchase of this input.

Household labor is the one input easily accessed by agricultural households. At 99 percent, nearly all rural households relied on household members for agricultural labor in either season (Table 6). This figure varies minimally across land size. The use of hired labor is limited for livestock activities, but more common for activities related to crop production, with 46 percent of the rural sample contracting agricultural laborers. This share increases with area of land operated from 34 percent in the first land quintile to 60 percent in the fifth for crops and from 1 to 8 percent for livestock, although the relationship is not linear.

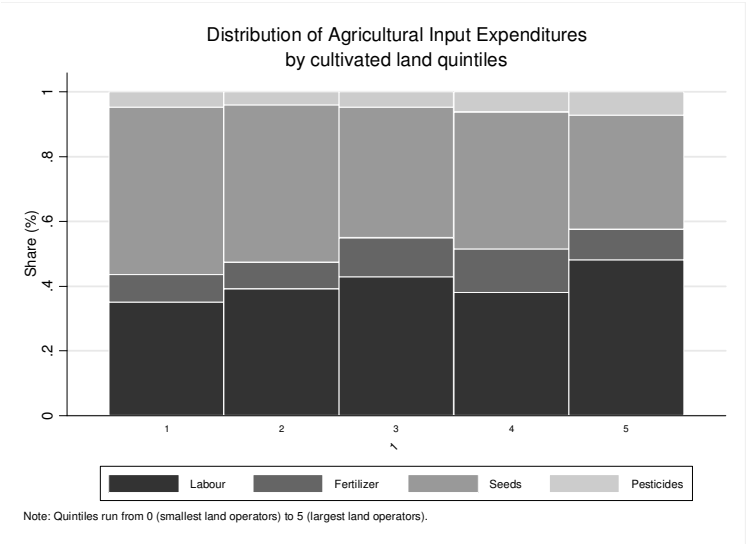
Table 6. Households and hired labor, by quintiles of land operated

	Land operated quintiles					
	1	2	3	4	5	Total
Share of households using household member labor in either season	0.98	0.99	1.00	0.99	1.00	0.99
Share of households hiring in labor for						
Livestock	0.01	0.03	0.03	0.03	0.08	0.04
Crop	0.34	0.41	0.51	0.44	0.60	0.46

Note: 1,882 rural land operating households

Looking at the composition of total input expenditures in Figure 2, we see that hired labor and seed expenditures are the most important cost items across all land operated quintiles, while fertilizer and pesticides make a more marginal contribution. The composition of total expenditure changes as land operated rises. Larger land operators allocate a somewhat greater share of their total input expenditures to labor and a slightly lower share to seeds than smaller producers. Moreover, pesticide and fertilizer cost shares increase slightly with land size.

Figure 2. Distribution of annual agricultural input expenditure, by quintiles of land operated



The high level of labor expenditures relative to other inputs highlights the importance of manpower for agricultural activities, an observation that is consistent with the extremely low level of usage of agricultural tools and mechanization (Table 7). Most households appear to only own hoes; only three percent of rural households own a tractor. About one in five households in the top land quintile (10 percent in total) own an ox plough while almost no households own a mechanical plough. Even larger scale producers are not particularly mechanized, with only eight percent owning a tractor and essentially none reporting any other sort of mechanization. Most agricultural machinery is primarily powered by livestock.

Table 7. Share of households owning agricultural assets, by quintiles of operated land

	Rural Land Operated Quintile					
	1	2	3	4	5	Total
Hoe	0.966	0.990	0.997	0.998	1.000	0.990
Sprayer	0.040	0.056	0.063	0.048	0.148	0.071
Ox plough	0.031	0.034	0.086	0.113	0.213	0.096
Ox seeder	0.027	0.045	0.090	0.130	0.253	0.110
Ox cart	0.000	0.000	0.003	0.000	0.003	0.001
Tractor	0.002	0.006	0.015	0.022	0.078	0.025
Mechanized plough	0.000	0.000	0.004	0.000	0.002	0.001
Mechanized harrow	0.003	0.000	0.007	0.000	0.002	0.002
Thresher	0.000	0.000	0.003	0.000	0.000	0.001
Grinder/Mill	0.003	0.012	0.011	0.003	0.000	0.006
Farm Building	0.008	0.011	0.025	0.016	0.040	0.020
Drum/Geri can	0.039	0.047	0.076	0.090	0.143	0.080
Plough	0.100	0.135	0.118	0.109	0.222	0.137

Note: 1,882 rural land operating households.

4. LIVESTOCK IN LIVELIHOODS

4.1. Participation and income shares

The first question this paper intends to investigate is the role that livestock plays in the livelihoods of Tanzania's households, particularly the rural poor. Fifty-one percent of Tanzanian households are to some extent involved in rearing livestock, according to the NPS data, as described in Table 8. In rural areas, the proportion is higher, with about three out of five households reporting some income or expenditure related to livestock activities and earning an average 22 percent of total household income from livestock rearing.

In urban areas, livestock activities are of lesser importance, with only 22 percent of households participating. Among the livestock rearing urban population, the share of income is a full seven percentage points below the national average at 14 percent.

Both the share of rural households participating and the income shares from participation in livestock activities increase with welfare, as measured by expenditure quintiles (Table 8). For the bottom quintile, 49 percent of households participate and livestock contributes to 18 percent of their total household income. At the top 20 percent of the expenditure distribution, the corresponding percentages are 69 percent for participation in livestock activities, and 24 percent for the share of income earned from them. Rural male-headed households are more likely to participate in livestock rearing than female-headed ones, and when they do they earn a larger percentage of their household income from this activity (23 percent as compared to 19 for female-headed households).

Table 8. Livestock participation and income shares, by rural/urban and rural expenditure quintiles

				Rural Expenditure Quintile					Rural household head	
	Total	Urban	Rural	1	2	3	4	5	Male	Female
Participation in livestock activities	0.51	0.22	0.61	0.49	0.62	0.63	0.63	0.69	0.65	0.51
Share of livestock in total income, livestock participants	0.21	0.14	0.22	0.18	0.19	0.21	0.26	0.24	0.23	0.19
N	*3,255*	*1,200*	*2,055*						*1,610*	*445*
N livestock participants	*1,404*	*207*	*1,197*						*962*	*235*

4.2. Herd characteristics

The evidence on the relationship between overall household welfare and livestock ownership in developing regions is mixed. Pica-Ciamarra et al. (2011b) review the literature and analyze some cross-country data to show how generalizations are not possible and, depending on the country livestock ownership, show positive, negative, or no association with overall welfare as measured by consumption expenditure. They also show that household wealth is a poor predictor of herd composition. While a hierarchy of livestock keeping is sometimes observed (the so-called 'livestock ladder'), with the poor keeping mainly poultry and relatively wealthier households keeping more small and large ruminants, the occurrence of this phenomenon is essentially an empirical question, as factors other than wealth may drive the reliance of households on different types of livestock.

The NPS data provide an opportunity to look closely at how these relationships play out in Tanzania. This can yield important indicators on i) the presence and extent of inequality and concentration within the livestock sector, ii) whether there are structural impediments in the access of the poor to livestock ownership, and iii) the extent to which investments in different types of livestock can be a vehicle for poverty reduction.

Herd size and composition are important indicators for understanding the characteristics of livestock systems. In terms of total livestock ownership, Tanzanian households hold on average 2.53 Tropical Livestock Units (TLUs, Table 96), or 2.72 TLUs when only rural households are considered. Rural livestock ownership is dominated by cattle, which contribute 2.24 TLUs, equivalent to 82 percent of total rural livestock ownership by the shares of means measure, which conveys the distribution of livestock ownership at the level of the rural economy.

For the average livestock keeping rural household, however, it is normally poultry that constitutes the bulk of livestock holdings. This is exemplified by the means of shares measure, which captures herd composition at the household level. This measure reveals that rural household livestock

[6] TLU's allow for the measurement of livestock holdings using internationally agreed upon equivalence scales for different types of livestock. The following conversion factors are used in this paper: 0.5 for bulls, cattle and horses, 0.25 for calves and heifers, 0.1 for sheep and goats, 0.2 for pigs, 0.3 for asses, 0.6 for mules, 0.7 for camels and 0.01 for rabbits and poultry (Chilonda and Otte, 2006).

ownership is concentrated in poultry, which constitutes 48 percent of total TLU ownership, while cattle account for 26 percent of the total holdings. Sheep and goats make up about one fifth of rural household holdings, while other ruminants are marginal in terms of total herd composition. Annex 1 describes in detail the methodology in calculating shares of means and means of shares.

Table 9. Distribution of total livestock ownership

	Total	Cattle	Sheep, Goats	Poultry	Equines	Pigs	*N*
Total	2.53	2.07	0.30	0.09	0.03	0.04	*1724*
Urban	0.88	0.61	0.12	0.10	0.02	0.04	*225*
Rural	2.72	2.24	0.32	0.09	0.03	0.04	*1499*
T-test	***	***	***	ns	ns	ns	*1499*
For rural livestock-keeping households only:							
Share of animal in total TLU ownership							
Shares of means		0.82	0.12	0.04	0.01	0.02	*1499*
Means of shares		0.26	0.21	0.48	0.00	0.04	*1499*

Note: t-test of difference between the two groups is: * significant at 10%; ** significant at 5%; *** significant at 1%, ns: not statistically significant.

Herd composition in terms of animal headcounts is analyzed in Table 10, overall and across rural expenditure quintiles. The importance of smaller ruminants such as goats and chickens is again observed through this angle, particularly when analyzed across expenditure quintiles. Despite some positive correlation between ownership levels and wealth, the relationship between holdings and welfare is not linear, and poorer households have broadly comparable levels of ownership to wealthier households. For cows, one can observe a somewhat stronger positive relationship with wealth, although the trend is also not linear, with the largest average holding being in the fourth quintile. For smaller ruminants like goats and sheep, it is actually the second and third quintiles, respectively, that report the highest average ownership level. These trends, taken together with the general observations on livestock sector participation, provide some additional evidence that the herds of poorer households are characterized by smaller animals, while wealthier households tend to hold more large livestock. However, all in all the relationship is not striking, which should not be surprising in view of the diversity of rural livelihoods.

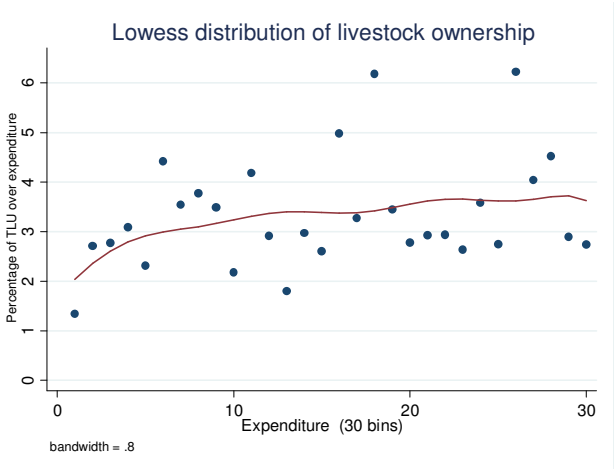
Table 10 also reports in the last column the overall share of households keeping each type of animal. Ownership of smaller animals (e.g., chickens, goats) is relatively common, as expected. Still, cattle ownership is quite widespread among livestock keeping households with one third owning some animal from this category.

Table 10. Livestock headcounts by rural expenditure quintiles (averages conditional on households keeping each species)

	Rural per capita expenditure quintiles						
	1	2	3	4	5	Total	*Share owning any animal*
Cattle							*0.32*
Cows	2.45	3.14	3.26	3.70	3.53	3.27	*0.27*
Bulls	1.44	1.13	0.98	1.00	1.23	1.15	*0.17*
Steers	1.71	1.42	1.27	1.15	1.42	1.38	*0.12*
Heifers	1.00	0.64	1.22	0.95	1.24	1.01	*0.12*
Male calves	1.20	1.16	1.26	1.34	1.38	1.27	*0.16*
Female calves	1.21	1.11	1.44	1.22	1.34	1.26	*0.18*
Goats	5.51	7.49	5.88	5.45	6.95	6.30	*0.41*
Sheep	3.19	5.45	6.61	4.76	6.10	5.33	*0.14*
Chickens	9.25	10.47	10.97	9.77	12.59	10.63	*0.87*
Turkeys	5.03	5.99	4.84	4.00	5.15	5.01	*0.10*
Pigs	2.14	3.44	2.51	2.22	2.82	2.68	*0.08*
Donkeys	3.45	2.73	2.59	2.05	2.43	2.53	*0.04*
N	*262*	*324*	*283*	*320*	*310*	*1499*	*1499*

Figure 3 graphs the share of total livestock owned in TLUs against per capita expenditures. Livestock ownership is certainly more concentrated among the wealthier strata, however the differences are not striking. The conclusions from this distribution support the trends observed in Table 10 that fail to find clear correlations in the relationship between livestock headcounts and overall welfare levels.

Figure 3. Lowess distribution of livestock ownership



Summarizing livestock headcounts according to expenditure quintiles presented one angle of the inequality of livestock ownership, with poorer households owning smaller ruminants to a greater extent and wealthier households more invested in larger livestock. Another way to look at the distributional aspects of livestock ownership is by looking at the concentration in ownership, as illustrated by the share of total livestock held by the top twenty percent of livestock owners, given in Table 11. These figures reveal that a substantial share of livestock ownership is concentrated in a relatively small share of the rural population. The top quintile of livestock owners own approximately 81 percent of all livestock. This concentration of ownership is even more striking when compared to the bottom quintile of livestock owners who hold less than one percent of total livestock.

Table 11. Concentration of rural livestock assets and herd structure based on cumulative distribution of TLU ownership

	Quintiles of livestock ownership					
	1	2	3	4	5	Total
Share of total livestock owned	0.00	0.01	0.02	0.12	0.85	1.00
Share of income from livestock	0.099	0.115	0.114	0.138	0.321	0.16
TLUs: total	0.034	0.105	0.297	1.433	10.996	2.723
TLUs: cattle (cows, calves, bulls, steers)	0.000	0.000	0.009	0.751	9.751	2.236
TLUs: sheep, goats	0.000	0.009	0.138	0.475	0.934	0.325
TLUs: poultry (chicken, turkeys)	0.034	0.095	0.121	0.097	0.113	0.092
TLUs: equines (horses, donkeys)	0.000	0.000	0.001	0.009	0.122	0.028
Number of cows	0.000	0.000	0.000	0.311	4.550	1.035
Number of bulls	0.000	0.000	0.001	0.179	1.530	0.363
Number of steers	0.000	0.000	0.004	0.202	1.855	0.438
Number of heifers	0.000	0.000	0.013	0.102	1.385	0.319
Number of male calves	0.000	0.000	0.005	0.108	1.782	0.403
Number of female calves	0.000	0.000	0.008	0.171	1.705	0.4
Number of goats	0.000	0.082	1.267	4.053	7.150	2.612
Number of sheep	0.000	0.009	0.117	0.69	2.609	0.721
Number of chickens	3.185	11.046	11.502	9.408	11.372	9.274
Number of donkeys	0.000	0.000	0.005	0.029	0.408	0.094
Per capita expenditure (TZ Sh)	27973	29622	29912	28741	31745	29620

Notes: (1) 1,499 rural livestock rearing households; (2) For the bottom quintile, the share is rounded down to zero from 0.002.

Underlying this trend is the composition and size of livestock ownership in these groups, with the bottom 40 percent relying essentially on small numbers of poultry, goats becoming more important in the third and fourth quintiles, and cattle dominating the fifth quintile.7 Interestingly, levels of per

[7] Herd size distribution also varies geographically, with larger holders concentrated in the Northern and Western regions, and smaller holdings prevalent in the Southern and Southern Highlands regions.

capita expenditures do not change significantly across quintiles of livestock ownership, whereas herd size and structure does, with a particularly steep gradient in the top quintile, suggesting that there is a small core of relatively larger livestock owners who are substantially different from the rest. This is confirmed by the fact that households in the top quintile earn about a third of their income from livestock, as opposed to 10-14 percent in the other quintiles.

Taking a look at livestock ownership across the various macro regions of Tanzania, the relative importance of certain animals across such regions becomes clear, as does the relative concentration of livestock ownership nationwide. Table 12 reports average household headcount ownership by macro-regions for the livestock rearing rural and urban population. Most striking is the level of importance of cattle ownership for households in the Western macro-region, where the highest average household level ownership of heads is concentrated for all types of cattle. Although goats and sheep are also owned in considerable quantities relative to other regions, it is actually in the Central and Lakes regions where holdings are largest for these animals. Households in Eastern Tanzania do not own many heads of any animal, apart from poultry, the ownership of which is rather evenly spread throughout the country.

Table 12. Number of animals owned by urban and rural livestock-keeping households, for owners of each species, by macro-region

	Macro-regions									
	Central	Northern	Eastern	Southern	Southern Highlands	Western	Lakes	Zanzibar	Total	*Obs*
Cows	2.63	2.56	1.82	2.08	2.19	4.81	4.40	2.10	3.20	*500*
Bulls	1.13	0.86	0.26	0.54	0.70	2.19	1.08	0.62	1.14	*500*
Steers	1.81	0.55	0.00	0.00	1.17	2.98	1.54	0.02	1.37	*500*
Heifers	0.19	0.84	0.55	0.27	0.46	1.60	1.71	0.56	0.98	*500*
Male calves	1.26	1.03	0.04	0.66	0.88	1.82	1.53	0.64	1.23	*500*
Female calves	1.24	1.18	0.86	0.62	0.84	1.75	1.44	0.53	1.26	*500*
Goats	7.77	7.45	4.64	4.21	5.12	7.19	4.71	3.85	6.30	*618*
Sheep	4.52	5.61	3.00	2.70	3.01	5.09	6.39	--	5.31	*191*
Chickens	12.55	9.29	13.79	10.09	9.39	11.17	9.98	14.40	10.59	*1459*
Turkeys	4.18	5.18	5.65	4.14	7.40	4.77	5.01	4.66	5.09	*166*
Pigs	2.31	3.19	2.62	1.72	2.51	5.86	1.00	10.00	2.63	*130*
Donkeys	3.11	2.56	--	--	1.00	2.99	--	1.00	2.64	*56*

4.3. Access to inputs, credit and extension services

Low levels of access to input use and credit, the incidence of livestock disease, and the poor dissemination and uptake of knowledge on improved management practices are recognized constraints to the development of the Tanzania smallholder crop (Sarris et al., 2006) and livestock sectors (URT, 2006; Njombe and Msanga, 2005).The first wave of the NPS allows an update of the situation with respect to the access by small livestock keepers to basic inputs and services such as extension and vaccination. Future waves of data collection will allow for the monitoring of trends,

while also delving more deeply into the possible causal linkages between access to inputs and services, and the productivity and profitability of animal production.

The use of inputs in livestock activities is scarce: only six percent of rural livestock holders hired in labor for work on livestock related activities (although this percentage goes up to 14 percent for the largest holders), and only one fifth purchased fodder for their livestock as observed in Table 13. The share purchasing fodder ranges from 13 percent for the poorest group of households to 37 percent for the top quintile of rural households involved in livestock keeping. It is noteworthy that the share of households purchasing fodder in the top quintile is about two to three times the share of households that purchased fodder in each of the other quintiles, which could be a reflection of their greater purchasing power, but also of differences in herd composition or livestock rearing systems. It is interesting in this respect that the largest holders are as likely as the average holder to have purchased any fodder.

Aside from being a source of food products, livestock is also kept for a variety of other goods and services it provides, one being manure. The use of own produced organic fertilizer in household agricultural activities is explored in Table 13 for both households that do and do not participate in livestock activities. Although the use of organic fertilizer in household agricultural activities is not widespread, a notable 25 percent of rural households that participate in livestock activities do report using it on their plots. Since only four percent report having purchased any organic fertilizer, the use of it comes largely from household production among those using it in their agriculture. The use of organic fertilizer, whether purchased or produced by the household, is positively related to wealth, ranging from 20 to 32 percent over the five expenditure quintiles, but is much more strongly related to livestock (and cattle) ownership, as it goes up to 47 percent amongst the largest livestock keepers.

Among households that are not involved in livestock activities, only 12 percent report the use of organic fertilizer on their plots, considerably lower than the share for livestock rearing households. However, since only five percent of non-livestock households report having purchased this input, other types of organic fertilizer that are not manure are likely being applied to their plots. These could include compost and worm castings, among other non-animal sources. Regardless of the source of the organic fertilizer, the relationship between usage and wealth is positive, as in the case of livestock producing households.

Table 13. Share of households using inputs for livestock, by rural expenditure quintiles

	Expenditure quintiles - Livestock keepers only						*Quintiles of TLU ownership*								
	1	2	3	4	5	Total	1	2	3	4	5	Non-Livestock Keepers	Livestock-Keepers	Total	T test
Hired-in labour for crop or livestock activities	0.38	0.51	0.46	0.49	0.63	0.50	0.44	0.45	0.48	0.52	0.58	0.30	0.50		***
Livestock	0.01	0.03	0.06	0.03	0.10	0.05	0.01	0.01	0.02	0.04	0.14	0.00	0.05		***
Crop	0.38	0.50	0.44	0.48	0.62	0.48	0.43	0.45	0.47	0.51	0.54	0.30	0.48		***
Holds credit	0.04	0.07	0.06	0.06	0.08	0.06	0.07	0.07	0.07	0.05	0.06	0.06	0.06	0.06	ns
Member of credit/savings group	0.04	0.03	0.06	0.04	0.10	0.06	0.02	0.07	0.07	0.06	0.06	0.03	0.06	0.05	**
Received any extension services	0.22	0.25	0.30	0.22	0.34	0.27	0.17	0.26	0.19	0.28	0.33	0.16	0.27	0.23	***
for crop activities	0.18	0.18	0.23	0.16	0.27	0.21	0.13	0.23	0.17	0.23	0.19	0.14	0.21	0.18	***
for marketing	0.09	0.12	0.11	0.09	0.16	0.12	0.08	0.13	0.08	0.12	0.10	0.06	0.12	0.09	***
for livestock	0.12	0.18	0.21	0.15	0.23	0.18	0.10	0.13	0.09	0.20	0.28	0.06	0.18	0.13	***
livestock disease	0.12	0.18	0.21	0.14	0.22	0.17	0.09	0.12	0.08	0.19	0.27	0.06	0.17	0.13	***
livestock production	0.10	0.12	0.16	0.09	0.20	0.14	0.07	0.09	0.06	0.16	0.21	0.04	0.14	0.10	***
Used fodder	0.13	0.15	0.14	0.19	0.37	0.20	0.12	0.15	0.22	0.30	0.20				
Used organic or chemical fertilizer	0.24	0.29	0.33	0.37	0.42	0.33	0.19	0.24	0.26	0.45	0.50	0.13	0.33	0.28	***
Organic	0.2	0.21	0.24	0.29	0.32	0.25	0.12	0.12	0.16	0.36	0.47	0.08	0.25	0.21	***
Chemical	0.06	0.11	0.13	0.17	0.19	0.13	0.09	0.14	0.13	0.19	0.13	0.05	0.13	0.12	***
	Non liivestock keepers - Expenditure quintiles														
Used organic or chemical fertilizer	0.09	0.16	0.13	0.11	0.17	0.13									
Organic	0.08	0.08	0.08	0.05	0.12	0.08									
Chemical	0.01	0.11	0.07	0.06	0.05	0.05									
	Livestock keepers - Land operated quintiles														
Used organic or chemical fertilizer	0.29	0.33	0.32	0.38	0.35	0.34									
Organic	0.22	0.27	0.23	0.29	0.28	0.26									
Chemical	0.13	0.09	0.17	0.15	0.14	0.14									
	Non livestock keepers - Land operated quintiles														
Used organic or chemical fertilizer	0.12	0.13	0.15	0.19	0.22	0.15									
Organic	0.06	0.09	0.09	0.12	0.16	0.09									
Chemical	0.06	0.05	0.06	0.07	0.12	0.06									

Access to credit is also low among rural livestock producers. Access to credit for rural households in general is extremely limited, and the value of loans received varies little according to land size. Similarly, participation in credit or savings groups is low, at six percent. These figures vary minimally for the livestock producing segment of the rural population. Only six percent of these households reported holding credit and five percent reported membership in a credit or savings group. The shares vary slightly with expenditure quintiles in that wealthier households have somewhat greater access to credit, even if the eight percent in the top quintile of rural livestock producing households that hold credit is still a notably low figure. This disparity is also reflected in the level of access to credit-enabling social capital. Whereas only four percent of the households in the poorest quintile report participating in a credit or savings group, 10 percent of the wealthiest do.

Access to extension services does not prove to be as scarce as credit, but it is not considerably widespread either. Just over one fourth of rural livestock producing households made use of these services, receiving advice on production practices or disease prevention. Access is positively related to wealth, though the dip in the fourth quintile disrupts the linearity of the trend. The trend is definitely more clear when access to extension services for livestock is related to the size of livestock ownership, indicating that households that have larger herds and depend more on livestock for their income are also more likely to use these services, particularly for livestock disease. The percentages are still low, however, with the vast majority of livestock keepers even in this group not reporting any use of the services.

Relating income shares, diseases reported and animal vaccination rates to the receipt of extension reveals some important differences across households that do and do not receive any type of livestock extension (Table 14). Even though the two groups have similar livestock income shares, the share of extension-receiving households that report livestock disease is 12 percentage points higher than for households without extension. Even more notable is that the share of extension-receiving households who used vaccines for any of their livestock is more than twice the rate of vaccination among households that did not receive any extension.

Table 14. Disease, vaccinations, income and expenditures for livestock producing households with and without extension services.

	Without Extension	With Extension	Total	t-test
Share of livestock in total household income	0.21	0.25	0.22	**
Any disease reported for livestock owned	0.58	0.70	0.61	***
Any vaccination reported for livestock owned	0.24	0.51	0.31	***
Per capita expenditure (TZS)	29,839	35,634	31,401	*
Number of rural livestock producing households	*900*	*297*	*1197*	

Note: t-test of difference between the two groups is: * significant at 10%; ** significant at 5%; *** significant at 1%, ns: not statistically significant.

Putting the disease rates together with the vaccination rates raises the question of why differences across groups for each of these variables are so large. While this finding is most likely associated with the fact that households receiving extension may have sought out the services of a veterinarian

due to diseases afflicting their animals, or to the fact that the availability of extension and vaccination services may be correlated, it does point to significant differences between the two groups that should be further explored to confirm whether livestock extension may be having a substantial positive impact in ensuring higher vaccination rates.

Looking closer at the prevalence of livestock disease among rural livestock producers illustrates the widespread vulnerability of all types of livestock to disease. Tables 15 reports the share of households reporting illness and the share reporting each disease, among owners of each type of livestock, while Table 16 reports the rate of owners reporting the illness of each type of livestock. The reported rates of disease are at an average of 60 percent overall, ranging from 48 percent among the smallest to 71 percent among the largest holdings. The most afflicted animal groups are reportedly poultry and cattle, followed by sheep and goats. For cattle, richer households tend to report higher disease rates, while for other animals all wealth groups have broadly similar rates of reporting. Some caution should be exhibited in interpreting these figures, as they do not factor in the share of each household's herd that was affected by disease.

New Castle is the most widely reported disease, affecting 52 percent of all poultry keepers, with peaks of 60 percent in urban areas. Female-headed households report similar incidence rates for this disease as male-headed households, while they report proportionally greater occurrences of diseases among their cattle, sheep, goat, and pig holdings. Among cattle, Contagious Bovine Pleuropneumonia (CBPP) and East Coast Fever (ECF) are the diseases most often reported by farmers (17 and 15 percent of households respectively), while 23 percent of sheep and goat herders report some cases of Contagious Caprine Pleuropneumonia (CCPP) (Table 17).

Table 15. Disease rates: overall and by disease reported, livestock-keeping households

	Houseold location			*Quintiles of TLU ownership*						*Household head gender*		
	Urban	Rural	Total	1	2	3	4	5	Total	Male	Female	Total
Any vaccination reported for livestock owned	0.32	0.28	0.29	0.06	0.13	0.20	0.40	0.59	0.28	0.30	0.23	0.28
Any disease reported for livestock owned	0.65	0.60	0.60	0.48	0.62	0.57	0.60	0.71	0.60	0.60	0.57	0.60
				Rural per capita expenditure quintiles								
Any vaccination reported for livestock owned				0.23	0.25	0.27	0.28	0.38	0.28			
Any disease reported for livestock owned				0.52	0.58	0.63	0.60	0.64	0.60			
At least 1 animal reported ill with:												
Brucellosis	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01
CBPP	0.01	0.06	0.05	0.04	0.07	0.05	0.05	0.09	0.06	0.06	0.07	0.06
Lumpy skin	0.01	0.04	0.04	0.03	0.05	0.04	0.05	0.05	0.04	0.04	0.04	0.04
CCPP	0.04	0.07	0.06	0.07	0.06	0.08	0.05	0.07	0.07	0.07	0.05	0.07
ECF	0.02	0.05	0.05	0.03	0.03	0.05	0.06	0.08	0.05	0.05	0.04	0.05
Rabies	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
FMD	0.01	0.03	0.03	0.02	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03
Anthrax	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00
BQ	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Castle	0.60	0.47	0.48	0.42	0.47	0.49	0.48	0.49	0.47	0.48	0.44	0.47
Small pox	0.02	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.03
Gomboro	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Helminthiosis	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
ASF	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tick borne illness	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00
Typanosomiasis	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01
Foot rot	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00
Mange	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Anaemia	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
N	*225*	*1499*	*1724*	*262*	*324*	*283*	*320*	*310*	*1499*	*1184*	*315*	*1499*

Table 16. Disease rates by species: livestock-keeping households

	Urban	Rural	Total	*N Owners*	*Rural per capita expenditure quintiles*				
					1	2	3	4	5
Any disease reported for:									
Cattle	0.27	0.42	0.41	*500*	0.31	0.38	0.44	0.41	0.51
Sheep, Goats	0.24	0.29	0.29	*651*	0.27	0.25	0.29	0.32	0.31
Pigs	0.27	0.19	0.20	*143*	0.17	0.31	0.15	0.18	0.15
Poultry	0.69	0.56	0.58	*1497*	0.52	0.54	0.59	0.57	0.58
Equines	0.00	0.17	0.17	*56*	0.00	0.32	0.11	0.09	0.16
Any disease reported for:	Male	Female	Total	*N Owners*					
Cattle	0.40	0.51	0.42	*465*					
Sheep, Goats	0.27	0.37	0.29	*605*					
Pigs	0.16	0.28	0.19	*121*					
Poultry	0.57	0.55	0.56	*1303*					
Equines	0.12	0.33	0.17	*55*					

The high level of reported disease could be due to the overall low level of vaccination at approximately 29 percent. Poorer households have lower vaccination rates than wealthier households, and they also report slightly lower overall disease rates for livestock. However, vaccines are not necessarily available nor a necessary treatment for the ailments that households may report when indicating disease among their animals. The relationship could also be endogenous, in that households may vaccinate because they experience disease, even though vaccination should be a preventative measure. Finally, while the observed disparity in access to vaccines may stem from financial and information constraints, a disparity in access to veterinary services may also exist, which could contribute to the slightly lower disease reporting among the poor. Vaccination rates are in fact much higher than average among households that hold significant numbers of animals, with 40 percent of households in the fourth ownership quintile and 59 percent in the top quintile reporting some animal vaccination in the course of the previous 12 months.

Potential problems with barriers to access to vaccination services are suggested by the fact that urban livestock keepers are more likely than rural ones to report having vaccinated any of their livestock. A similar imbalance is noted for the access to vaccination by female- compared to male-headed households.

Table 17. Share of animal groups affected by specific diseases for rural and urban livestock-keepers of each species

	Cattle	Sheep, Goats	Pigs	Rabbits	Poultry	Equines
Brucellosis	0.00	0.01	0.09	n/a	n/a	0.00
CBPP	0.17	n/a	n/a	n/a	n/a	n/a
Lumpy skin	0.11	n/a	n/a	n/a	n/a	n/a
CCPP	n/a	0.23	n/a	n/a	n/a	n/a
ECF	0.15	n/a	n/a	n/a	n/a	n/a
Rabies	0.01	0.01	n/a	0.00	n/a	0.02
FMD	0.06	0.05	0.02	n/a	n/a	n/a
Anthrax	0.01	0.01	0.00	0.00	n/a	0.05
BQ	0.00	0.00	n/a	n/a	n/a	n/a
Newcastle	n/a	n/a	n/a	n/a	0.52	n/a
Small pox	n/a	0.03	n/a	n/a	n/a	n/a
Gumboro	n/a	n/a	n/a	n/a	0.01	n/a

4.4. Commercialization of livestock products

The linkages between smallholder access to improved inputs and technologies and market participation (or lack thereof) have been widely noted in the literature. Barrett (2008) provides an insightful discussion, with convincing evidence related to the crop sector in Eastern and Southern Africa. Market constraints to smallholder development are as important for livestock as they are for crop products (ILRI, 2011), and different forms of interventions to improve market access are part of the policy toolbox of governments and donors throughout Africa. In Tanzania, such constraints are well recognized in livestock policy circles (Njombe and Msanga, 2005; Pica-Ciamarra et al., 2011a) and have led the government to take action both on issues of market infrastructure development (e.g., via the Tanzania Livestock Marketing Project) and of market information systems (e.g., through the Local Indigenous Technical Knowledge System (LINKS) Program).

Access to markets among rural households is limited, as shown in the previous section on rural livelihoods. Only 10 percent of farm specialized rural households are market oriented (i.e., selling more than 50 percent of their output), and among all rural households, just 37 percent of total agricultural production is marketed, 29 percent being crop sales and only eight percent originating from livestock. Even though the share of livestock in total agricultural sales is limited with respect to crops, livestock is a relatively more market oriented activity, as approximately half of all livestock production is sold. As a result, whereas the value of livestock sales contributes only 7 percent to total agricultural production, it contributes to one quarter of total agricultural sales (Table 18).

Taken together with the share of livestock in total income, which stands at 13 percent, this figure indicates that livestock is relatively more important in terms of cash generation for rural households than would be suggested by its share in overall income. Interestingly, the poorest livestock

producing households sell as much as two thirds of their production, while just over one third was sold by the wealthiest households. Although this suggests that the poor are notably more market oriented relative to the scale of their production, it may also be an indication of distress sales of livestock. Unfortunately, the data do not allow for disaggregation by motive of market participation.

Table 18. Marketing of agricultural output, by rural expenditure quintiles

	Rural per capita expenditure quintiles					
	1	2	3	4	5	Total
Share produced in total agricultural production						
Crop	0.88	0.84	0.85	0.79	0.73	0.82
Livestock	0.12	0.16	0.15	0.21	0.27	0.18
Share sold in total agricultural production	0.27	0.30	0.27	0.31	0.29	0.29
Crop	0.23	0.25	0.22	0.25	0.23	0.23
Livestock	0.06	0.06	0.06	0.08	0.08	0.07
Share sold in total agricultural sales						
Crop	0.74	0.76	0.74	0.74	0.71	0.74
Livestock	0.26	0.24	0.26	0.26	0.29	0.26
Share of livestock sold in total crop production	0.24	0.28	0.25	0.29	0.27	0.27
Sold un-processed	0.24	0.28	0.24	0.29	0.27	0.26
Sold processed	0.00	0.01	0.00	0.00	0.00	0.00
Share of livestock sold in total livestock production	0.68	0.55	0.50	0.50	0.38	0.51
Sold un-processed	0.58	0.50	0.43	0.43	0.32	0.44
Sold processed	0.09	0.06	0.07	0.08	0.06	0.07

Note: 2,055 rural households (top rows); 1,197 rural livestock producers (bottom three rows)

Of the two thirds of livestock keeping households engaged in selling, 52 percent sold live animals, four percent sold some butchered livestock, and 21 percent sold livestock products (Table 19). Considering that 82 percent of livestock income earners produced some livestock products, the discrepancy between the two figures shows how most of that production is targeted for household consumption. Accounting for just seven percent of the value of livestock production, product sales are not the most important income generators, even though approximately a quarter of rural households earn some cash from those sales. Again, however, we note a steep gradient in the top quintile of livestock ownership, where the share of households selling livestock products (41 percent) is almost double the sample average, indicating a much stronger commercial orientation, which can also be noted in the share selling live animals (71 percent).

On the other hand, livestock products appear to be important in supplementing household consumption. For example, more than 70 percent of rural households produced eggs, but mostly for

own consumption, as only 11 percent sold any. Similarly, a quarter of rural households participating in livestock produced milk, but only seven percent sold any. This observation is true for all welfare groups, even though a slight increase in the proportion of households selling livestock products as wealth increases can be detected in the data, driven in particular by milk sales.

Table 19. Marketing of livestock output: Livestock keepers by livestock ownership quintiles; livestock producers by rural expenditure quintiles.

	TLU Ownership Quintiles					
	1	2	3	4	5	Total
Sold any livestock	0.34	0.47	0.42	0.54	0.77	0.51
Sold livestock alive	0.38	0.48	0.45	0.51	0.71	0.52
Sold livestock butchered	0.02	0.01	0.04	0.06	0.05	0.04
Sold any livestock product	0.12	0.12	0.14	0.19	0.41	0.21
N (livestock owners)	*312*	*284*	*300*	*299*	*304*	*1499*

	Rural Expenditure Quintiles					
	1	2	3	4	5	Total
Sold any livestock	0.62	0.68	0.66	0.69	0.63	0.66
Sold livestock alive	0.53	0.63	0.56	0.64	0.56	0.58
Sold livestock butchered	0.03	0.03	0.04	0.04	0.05	0.04
Livestock products						
Produced	0.77	0.83	0.82	0.83	0.83	0.82
Sold	0.18	0.23	0.23	0.25	0.26	0.23
Milk						
Produced	0.16	0.26	0.26	0.26	0.31	0.26
Sold	0.03	0.05	0.06	0.06	0.12	0.07
Eggs						
Produced	0.72	0.72	0.73	0.74	0.71	0.73
Sold	0.11	0.09	0.12	0.13	0.10	0.11
Other						
Produced	0.11	0.14	0.11	0.12	0.16	0.13
Sold	0.06	0.10	0.06	0.07	0.08	0.07
N (livestock producers)	*187*	*242*	*230*	*260*	*278*	*1197*

Note: Livestock owners/keepers are defined as those owning at least one animal of any kind; livestock producers as those reporting earning any income from livestock.

Breaking down the share of households that sold any livestock by the type of markets they accessed reveals the use of a large variety of market outlets (Table 20). Sixty-three percent of households reported selling in their same village, while 46 percent reported having sold any type of livestock or product in a neighboring village. The types of markets to which they sold included businesses and business persons such as traders8 (59 percent), formal markets (27 percent), and neighbors (25 percent).

[8] The 'businesses/intermediaries' category includes private businesses and business contacts, but also slaughterhouses, factories, groceries and local merchants.

Table 20. Market types and locations for commercialization of livestock products

	Rural per capita expenditure quintiles					
	1	2	3	4	5	Total
Type of market to which livestock was commercialized						
Market	0.27	0.23	0.24	0.30	0.30	0.27
Neighbors	0.20	0.27	0.24	0.24	0.26	0.25
Family members	0.04	0.06	0.06	0.05	0.04	0.05
Community group	0.00	0.01	0.02	0.02	0.02	0.01
Business/Intermediary	0.51	0.66	0.61	0.60	0.58	0.59
Institution	0.00	0.00	0.01	0.00	0.00	0.00
Other outlet	0.05	0.04	0.04	0.06	0.15	0.07
Location of market at which livestock was commercialized						
Same village	0.65	0.62	0.58	0.66	0.64	0.63
Neighboring village	0.38	0.45	0.50	0.49	0.45	0.46
Another district in the same region	0.04	0.08	0.06	0.06	0.06	0.06
Another region	0.01	0.01	0.01	0.01	0.05	0.02
Across the border	0.00	0.02	0.00	0.00	0.00	0.00
N	*114*	*153*	*140*	*163*	*162*	*732*

4.5. Livestock and gender

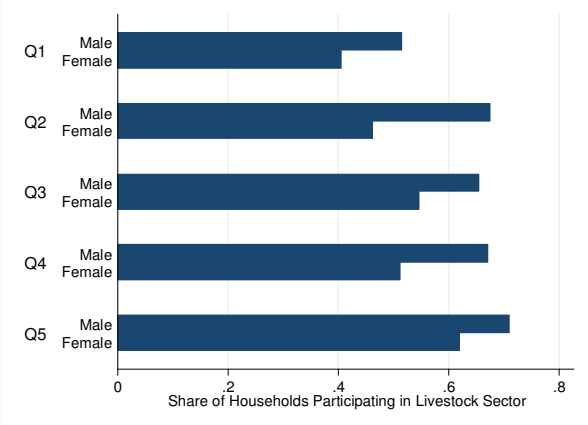
A vast and growing amount of literature exists that documents gender inequalities in nearly all aspects of livelihoods management, from access to education to asset acquisition, wage differentials, and beyond.9 The livestock sector is no exception, in that women are disadvantaged relative to men in terms of herd size, managerial roles, scale of production, and access to industrial value chains (FAO 2011). At the same time, given the role of livestock as an insurance mechanism, a store of wealth, and a potentially sustainable income generating activity (FAO 2009), the livestock sector can serve as an important source of livelihoods, and a potential pathway out of poverty for rural women (IFAD 2011).

In Tanzania, previous research has shown that women tend to own fewer TLU's than men, that they tend to be more likely to own poultry and small ruminants than cattle, and that their livestock market participation is more oriented towards the sale of milk, eggs and chicken, whereas the sale of goats, sheep, and particularly cattle, is dominated by men (Njuki et al., 2011). In the discussion that follows, we review the evidence that the NPS provides on some of these issues. It should be noted that the first round of the NPS has some limitations in terms of the provision of gender-disaggregated livestock data, as aside from the standard information on the gender of household headship, it included only a single question defining the person responsible for keeping the animals.

[9] See Deere and Doss (2006), Peterman et al. (2010) and Quisumbing et al. (2011) for evidence on gender and asset ownership.

However, the survey did not include questions on the control of income, the ownership of the animals, or any further detail on specific aspects of decision-making within the household.

Figure 4: Participation in livestock by household head gender and rural per capita expenditure quintiles



Alongside differences in wealth, the livestock sector is also notably divided across gender lines, with the first division concerning the level of participation in the sector. Sixty-five percent of male-headed households participate in livestock activities, while only 51 percent of female-headed households report participation (Table 29). This difference may be a first indication of the presence of constraints for women to invest in such activities.

As demonstrated in Figure 4, the participation differential across gender extends over wealth levels. Forty percent of the poorest female-headed households earned some income from livestock activities. This share increases with wealth, reaching just over 60 percent in the top quintile. Among male-headed households, participation ranges from 50 percent in the poorest quintile to around 70 percent in the top quintile, with much of the difference explained by a sharp jump between the first and second quintiles, and little difference between the other wealth groups. For female-headed households, the involvement in livestock activities seems to increase more gradually with wealth.

When herd structures are compared with respect to the gender of the household head (Table 21) significant differences are observed in both herd size and composition. Female-headed households manage herds which are on average about two thirds the size of those owned by male-headed households. The difference is most marked when it comes to cattle ownership; it becomes smaller for goats and sheep, and reduces even further for poultry, despite remaining statistically significant. For equines and pigs, the differences between the two groups disappear, but these constitute a relatively minor component of the average herd. Female-headed households, therefore, tend to have relatively more small animals than large pack animals compared to the average household. It should be noted that the differences are particularly large in terms of the probability of owning cattle. Once

ownership is controlled for, herd size is not large and can actually be larger for female-headed households.

Table 21. Livestock ownership in TLUs (top panel) and number of heads, for rural livestock-keeping households, by household head gender

TLUs owned –rural livestock keepers

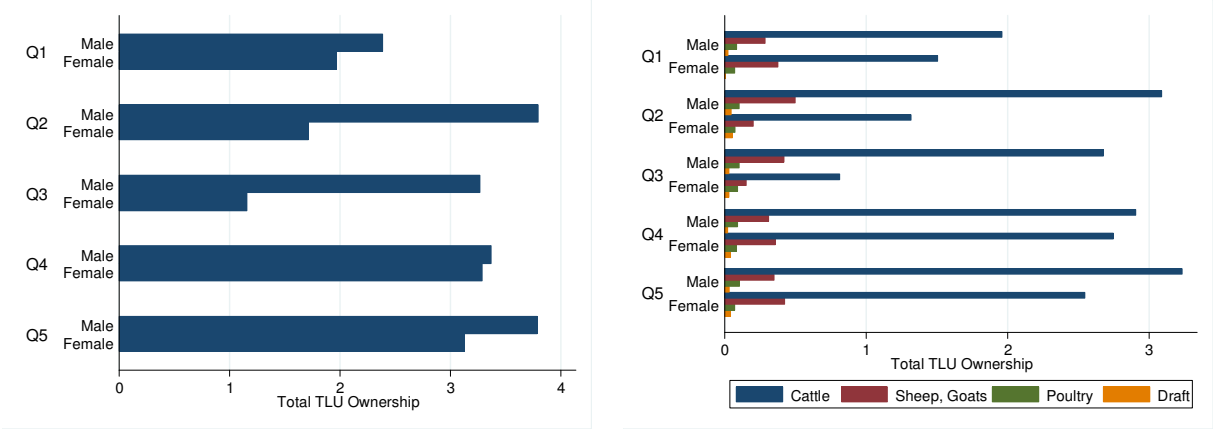
	Male headed	Female headed	Total
Total	2.94	1.95	2.72
Cattle	2.43	1.54	2.24
Sheep, Goats	0.34	0.26	0.32
Poultry	0.10	0.08	0.09
Equines	0.03	0.03	0.03
Pigs, Rabbits	0.04	0.04	0.04
N	*1184*	*315*	*1499*

	Number of animals owned conditional on keeping any, by species			*Share of households owning animals*		
	Male headed	Female headed	Total	Male headed	Female headed	Total
Cattle				0.33	0.20	0.32
Cows	3.25	3.37	3.27	0.27	0.17	0.27
Bulls	1.15	1.12	1.15	0.18	0.08	0.17
Steers	1.42	1.16	1.38	0.13	0.05	0.12
Heifers	0.98	1.14	1.01	0.12	0.07	0.12
Male calves	1.22	1.56	1.27	0.16	0.12	0.16
Female calves	1.28	1.18	1.26	0.19	0.12	0.18
Goats	6.45	5.62	6.3	0.41	0.34	0.41
Sheep	5.27	5.66	5.33	0.14	0.09	0.14
Chickens	11.08	8.92	10.63	0.88	0.85	0.87
Turkeys	5.16	4.32	5.01	0.11	0.08	0.10
Pigs	2.87	2.1	2.68	0.08	0.09	0.08
Donkeys	2.61	2.29	2.53	0.03	0.04	0.04
N	*1184*	*315*	*1499*	*1184*	*315*	*1499*

Differences across gender lines, with female-headed households owning lower levels of TLUs than their counterparts, remain when the analysis is run by wealth level (Figure 5). For the first, fourth and top quintiles, the differences are not tremendous; however, for the second and third quintiles, female-headed households own less than half the level of livestock that male-headed households hold in those same quintiles.

The trends in TLUs owned by gender are more sensitive to the type of animal owned. As observed, male-headed households generally own more livestock across the board, regardless of the type of livestock. However, exceptions to this trend exist, such as with poultry and draft animals, for which ownership levels are roughly equal across the gender of the household head. Moreover, for the ownership of sheep and goats, female-headed households report higher ownership levels than their counterparts in the bottom, fourth, and top quintiles. Despite those exceptions, inequality is most marked in terms of large livestock ownership. Ownership of cattle is higher across the board for male-headed households, the differences often considerably large, such as in the second and third quintiles in which female-headed households own less than half the number of TLUs of cattle than households with male heads. These trends are not necessarily or exclusively a consequence of discrimination, as in part they may be linked to female heads of households preferring to keep livestock that can be supervised around the house, rather than larger pack animals that may require greater labor intensity.

Figure 5. TLU ownership by household head gender and rural per capita expenditure quintiles, rural livestock keeping households



Aside from animal ownership, the NPS data offer the opportunity to look at the organization of livestock management across gender lines. Table 22 indicates that while nearly a quarter of household livestock managers are only women, and fifteen percent are only male, three fifths are joint male-female managers. Therefore, although joint gender management is the most common arrangement, a greater share of households have female-only rather than male-only livestock management. This figure seems to be driven by female-headed households for which 61 percent of livestock is managed only by women, in comparison to the five percent of female-headed households with only male livestock managers. Male-headed households, on the contrary, are approximately equally divided across male-only and female-only livestock managers, at 17 to 18 percent, while two thirds of male-headed households report involvement of both men and women in their herd management. Although these figures seem to communicate a positive message about gender equality in livestock management, they do not reveal the underlying dynamics in the joint male-female management arrangements and may also simply be a representation of the demographic

composition of male- versus female-headed households, the latter of which may have fewer adult male members.

Table 22. Livestock manager gender distribution

	Gender of Head		
	Male	Female	Total
Only male managers	0.18	0.05	0.15
Only female managers	0.17	0.61	0.25
Joint male-female managers	0.66	0.34	0.60

N=1136 households. For 61 households this information was not reported.

As anticipated from the literature, Table 23 reveals that women managing livestock earn less from their livestock, they manage considerably lower numbers of the main livestock species in Tanzania, with the exception of poultry, and they indicate significantly lower usage of key inputs such as labor, fodder, and vaccinations. Although hired labor is not prevalent for livestock in general, the one percent of female managers that hire labor is statistically lower than the four percent of male or joint management households hiring in. Similarly, female livestock managers purchased fodder seven percentage points less often than households with male or joint management. The differential for vaccination rates is even greater, at 20 percentage points. Again, the differential rates of usage of inputs and services does not per se indicate discrimination in access, as it may be equally driven by differences in herd structure, since women are less likely to own cattle which are likely to be more (purchased) input intensive.

Despite these differences, the share of households with only female livestock managers is not completely disadvantaged in terms of accessing markets. Forty percent sold any livestock, a share that is equal to the share selling among the male/joint managers group. The likelihood of selling for female livestock managers is slightly lower than the male managers group for both livestock sold alive and as livestock products; however, no differences are observed for slaughtered livestock sales. Moreover, the difference in value earned from slaughtered livestock sales and sales of milk, eggs and other products across gender lines is not statistically significant. For the value of livestock sold alive, however, the difference is much more pronounced, with female managers earning less than half the value earned by the male/joint managers group.

It is worth noting that when considering the scale of production, female managers are significantly more commercially oriented, with 37 percent of their total livestock production being sold on market, compared to only 30 percent for households with men involved in livestock management. This outcome highlights that despite the obstacles faced by women in the livestock sector, commercialization of production may not necessarily be affected.

Table 23. Livestock figures according to the gender of livestock managers

	Male Only & Joint Male-Female Management	Only Female Managers
Participation in Livestock	0.599**	0.657**
Share Livestock in total income	0.139**	0.112**
Total TLUs	2.505***	0.576***
Cattle	2.082***	0.383***
Sheep, Goats	0.291***	0.098***
Poultry	0.071	0.069
Pigs, Rabbits	0.036*	0.019*
Draft	0.025**	0.009**
Any livestock disease reported	0.569	0.536
Any livestock vaccination reported	0.322***	0.137***
Extension received for livestock	0.133	0.136
Livestock production extension	0.1	0.092
Livestock disease extension	0.127	0.136
Hired in labor for livestock	0.043***	0.011***
Purchased fodder for livestock	0.186***	0.115***
Any livestock sold	0.402	0.403
Livestock sold alive	0.524***	0.415***
Livestock sold slaughtered	0.038	0.026
Livestock products sold	0.214***	0.148***
Value of livestock sold alive (TZS)	35950***	14966***
Value of livestock sold slaughtered (TZS)	2751	682
Value of livestock products sold (TZS)	22085	12022
Milk sales	18621	9869
Egg sales	1704	1260
Other product sales	1758	892
Share of livestock sales in total livestock production	0.299***	0.365***
Live, slaughtered	0.260**	0.311**
Livestock products	0.039*	0.054*
Number of households	*1,610*	*445*

* significant at 10%; ** significant at 5%; *** significant at 1%

Reverting the discussion back to female-headed households, inequality is also observed within the sub-population of rural female-headed households when analyzed by expenditure quintiles (Table 24). Poorer female-headed households report limited access to inputs for livestock production, such as lower vaccination rates, considerably reduced access to extension services, and lower shares of purchasing fodder. They do not however have a more limited commercialization of their livestock. Nearly 70 percent of the poorest quintile of rural livestock producing female-headed households sold livestock or livestock products, on par with the rural average for female-headed households and above the share for male-headed households. Moreover, the poorest strata sold close to 90 percent of their livestock production. Since this outcome seems to be driven by the sale of animals (live/slaughtered) as opposed to the sale of livestock products, and since the share of those sales in total production is considerably lower for the poorest strata than the upper wealth quintiles, the outcome could be suggesting distress sales among poor female-headed households. However, since

we observe the same negative relationship for the share of livestock product sales in total production, and an inverse U trend for the share of households selling any livestock or livestock products, we can instead conclude that for this subpopulation, households are more commercially oriented in their livestock activities.

Although we do not study the demand patterns for female-headed households, the high share of sales in the value of production for the poor communicates that production is not necessarily intended to satisfy household consumption needs. In fact, the relatively high share of female-headed household selling livestock products among the poor provides evidence that livestock could have the potential to serve as a pathway out of poverty for these disadvantaged segments of the rural population.

Table 24. Livestock statistics by household head gender, and by rural expenditure quintiles

			Rural Expenditure Quintile (Female Headed Households Only)				
	Male headed	Female headed	1	2	3	4	5
Participation in Livestock	0.65	0.51	0.41	0.46	0.55	0.51	0.62
Share Livestock in total income	0.15	0.09	0.06	0.07	0.12	0.11	0.11
Only for Livestock Participants:							
Share Livestock in total income	0.22	0.18	0.16	0.15	0.24	0.20	0.16
Total TLUs	3.48	2.41	1.98	1.73	1.21	3.42	3.29
Cattle	2.90	1.93	1.51	1.33	0.85	2.86	2.68
Sheep, Goats	0.39	0.32	0.38	0.21	0.16	0.38	0.45
Poultry	0.10	0.08	0.07	0.08	0.10	0.08	0.08
Pigs, Rabbits	0.05	0.05	0.00	0.06	0.07	0.06	0.04
Draft	0.03	0.04	0.01	0.06	0.03	0.04	0.04
Any livestock disease reported	0.64	0.61	0.59	0.67	0.58	0.64	0.57
Any livestock vaccination reported	0.34	0.28	0.22	0.24	0.18	0.22	0.50
Extension received for livestock	0.19	0.17	0.05	0.15	0.21	0.15	0.27
Livestock production extension	0.14	0.13	0.04	0.09	0.11	0.12	0.24
Livestock disease extension	0.18	0.17	0.05	0.15	0.21	0.15	0.27
Hired in labor for livestock	0.07	0.03	0.00	0.00	0.00	0.04	0.10
Purchased fodder for livestock	0.26	0.28	0.05	0.33	0.25	0.27	0.45
Used organic fertilizer	0.29	0.22	0.24	0.19	0.13	0.32	0.22
Purchased organic fertilizer	0.04	0.03	0.00	0.01	0.02	0.06	0.04
Any livestock sold	0.67	0.69	0.69	0.81	0.74	0.64	0.62
Alive	0.60	0.61	0.50	0.80	0.66	0.57	0.53
Slaughtered	0.04	0.03	0.00	0.04	0.02	0.02	0.08
Products (milk, eggs, other)	0.24	0.24	0.27	0.20	0.25	0.22	0.26
Share of livestock in total food expenditures	0.25	0.22	0.13	0.17	0.19	0.28	0.28
Share of livestock sales in total livestock production	0.51	0.58	0.87	0.73	0.58	0.48	0.36
Live, slaughtered	0.45	0.49	0.68	0.68	0.50	0.40	0.27
Livestock products	0.07	0.09	0.18	0.05	0.08	0.08	0.09
N rural households	*1,559*	*496*	*90*	*96*	*83*	*124*	*103*
N livestock producing households	*962*	*235*	*36*	*43*	*43*	*59*	*54*

4.6. Demand for livestock products

Globally, the growth in demand associated with economic growth and the accompanying changes in dietary composition are among the main drivers in the development of the livestock sector (Delgado et al., 1999; Thornton, 2010). At the household level, livestock can provide producers with direct access to animal source foods, as well as the income necessary to pursue a more diversified diet. Consumers, in urban as well as in rural areas, tend to spend a greater share of their food budget on animal sourced foods as incomes increase. This section explores demand for livestock products in the rural sample of the NPS, and draws comparisons with urban households in order to illustrate differences in consumption preferences across the rural-urban divide.

Table 25A. Levels of livestock product demand urban and rural households, by livestock production status

	Rural Households				*Urban Households*			
	Non-livestock producer	Livestock-producer	Total	T test	Non-livestock producer	Livestock-producer	Total	T test
% Food consumption in total household expenditure	0.60	0.60	0.60		0.46	0.49	0.47	**
% Livestock consumption in total household expenditure	0.09	0.16	0.13	***	0.10	0.13	0.11	***
% Livestock consumption in total food expenditure	0.14	0.25	0.21	***	0.23	0.26	0.23	***
% Livestock home-produced consumption in total food expenditure	0.00	0.13	0.08	***	0.00	0.08	0.02	***
Per capita value of annual livestock product consumption (TZS)	16172	49381	36541	***	70206	77254	71822	
Purchased	*16172*	*18770*	*17766*		*70206*	*50475*	*65681*	***
Home produced	*0*	*30611*	*18775*	***	*0*	*26779*	*6141*	***
N	*556*	*1499*	*2055*		*992*	*206*	*1198*	

Total rural household food expenditure makes up nearly two thirds of total household expenditure. Consumption of livestock products, whether purchased or own produced, contributes 13 percent to total household expenditures, and just over one fifth to the value of total food consumption. Whereas the share of food in total household expenditures decreases with rising wealth, the importance of livestock in total household expenditures and in total food expenditure rises over quintiles.

At an overall level of eight percent, the share of food expenditure coming from own consumption of livestock products also increases with wealth. Taken together with the share of total livestock expenditure in food expenditure, it is evident that wealthier households purchase a greater share of their livestock consumption than poorer households, who produce a greater share of their consumption.

Table 25B. Levels of livestock product demand overall and relative to total household expenditures, by rural expenditure quintiles

	Rural Expenditure Quintile					
	1	2	3	4	5	Total
% Food Expenditure in Total Household Expenditure	0.65	0.63	0.62	0.60	0.51	0.60
% Livestock Consumption in Total Household Expenditure	0.09	0.12	0.13	0.14	0.17	0.13
% Livestock Consumption in Total Food Expenditure	0.14	0.18	0.20	0.24	0.27	0.21
% Livestock Home Produced Consumption in Total Food Expenditure	0.04	0.07	0.07	0.09	0.12	0.08
Per capita Value of Livestock Product Consumption (TZS)	5,515	14,957	22,973	38,693	101,719	36,541
Purchased	*2,746*	*6,096*	*10,786*	*19,277*	*50,503*	*17,766*
Home Produced	*2,769*	*8,861*	*12,187*	*19,416*	*51,216*	*18,775*
Per capita Value of Livestock Product Consumption (TZS)	5,515	14,957	22,973	38,693	101,719	36,541
Meat	*2,076*	*5,358*	*9,751*	*17,756*	*54,619*	*17,783*
(Goat)	*(366)*	*(1,257)*	*(2,424)*	*(5,070)*	*(19,263)*	*(5,629)*
(Beef)	*(1,126)*	*(3,332)*	*(5,628)*	*(9,926)*	*(31,043)*	*(10,138)*
(Pork)	*(584)*	*(768)*	*(1,698)*	*(2,761)*	*(4,314)*	*(2,016*
Poultry	*1,258*	*4,450*	*6,804*	*11,414*	*22,949*	*9,325*
Eggs	*245*	*983*	*936*	*1,636*	*4,317*	*1,614*
Dairy	*1,936*	*4,167*	*5,483*	*7,886*	*19,834*	*7,819*
(Fresh milk)	*(1,237)*	*(2,950)*	*(3,672)*	*(6,143)*	*(13,208)*	*(5,414)*
(Other dairy)	*(474)*	*(679)*	*(1,586)*	*(1,347)*	*(5,907)*	*(1,985)*
(Butter)	*(225)*	*(538)*	*(224)*	*(397)*	*(719)*	*(420)*

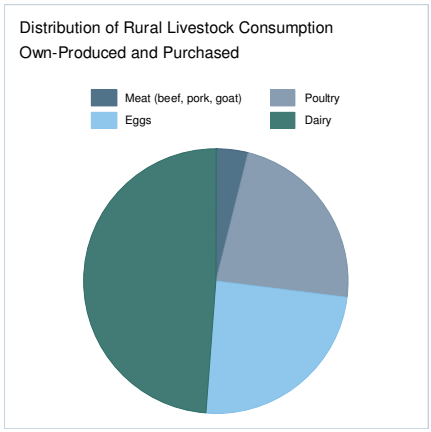
Note: 2,055 rural households

In terms of the value of livestock expenditure per capita, the poorest households report consuming just 5 percent of the value of households in the top quintile. Also noteworthy is the ratio between the bottom and top quintiles for the value of purchased livestock consumption, and also home produced livestock product consumption, which each fall between five and six percent. In other words, for every shilling spent by the poorest households on livestock products, the wealthiest households spent 18 shillings. The value of livestock consumption is therefore strongly and positively correlated with wealth.

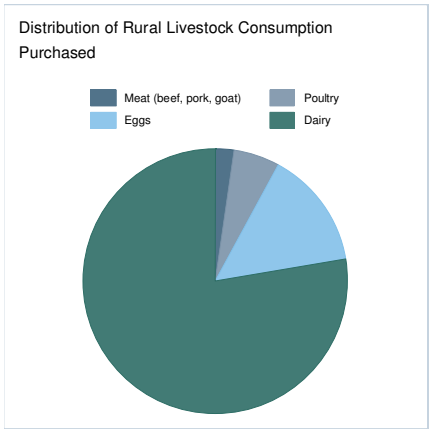
The composition of livestock consumption is given in Figure 9 by four groups of animal products: meat (beef, pork and goat), poultry (chicken, turkeys, wild birds), eggs, and dairy. This grouping is presented for rural and urban consumption overall as well as broken down by purchased versus produced consumption. The pie charts demonstrate that the main source of livestock product consumption in rural areas is dairy, comprising nearly half the value of all consumption, while meat represents the smallest contribution to this consumption. Dairy is mostly purchased, while eggs and poultry are more often home produced.

Urban households convey similar consumption trends, with dairy representing the greatest value of total consumption, followed by poultry and eggs, although urban households consume a greater value of meat products. The value of purchases is of course much smaller in urban than in rural areas. Among purchased products, meat and poultry have greater shares in urban areas, while for own production, urban households record a greater share of dairy and a smaller share of poultry.

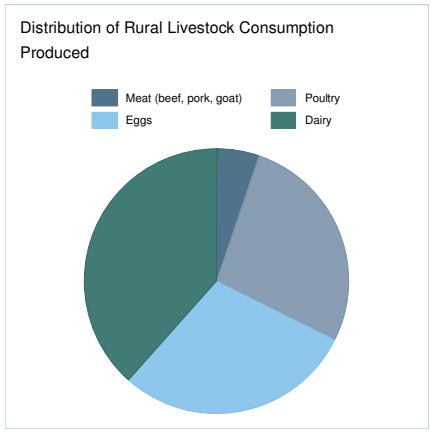
Figure 6. Distribution of per capita livestock consumption, own produced and purchased



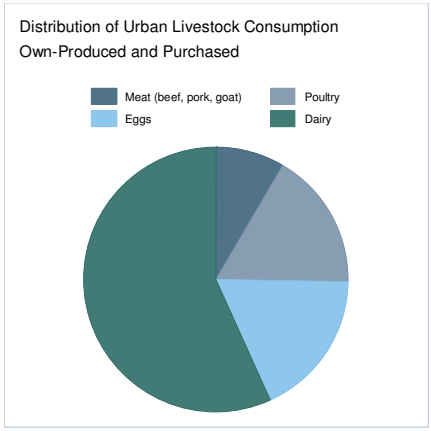
Per capita average: TZS 36,541



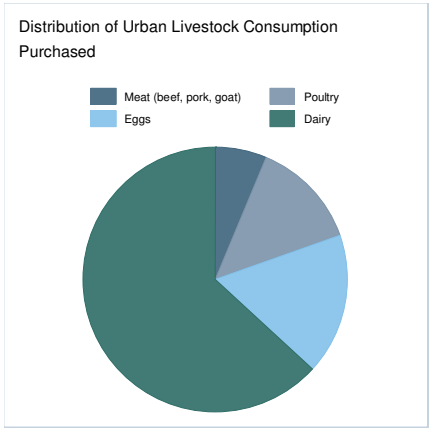
Per capita average: TZS 17,766



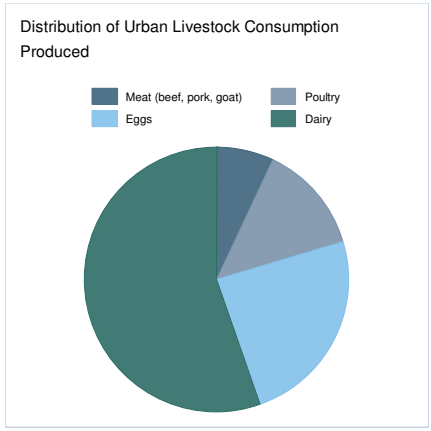
Per capita average: TZS 18,755



Per capita average: TZS 71,822



Per capita average: TZS 65,681



Per capita average: TZS 6,141

The allocation of livestock consumption to different items is similar across rural and urban areas. However, urban preferences differ from those of households in rural areas when measured in terms of the level of consumption of these livestock products. As seen in Table 26, the overall level of per capita urban livestock product consumption is approximately twice that of rural households and is sourced almost entirely in purchases, whereas rural households demonstrate a more equal division between the value of produced versus purchased consumption. For meat, poultry and dairy consumption, urban households consume approximately twice the value as rural households, while for eggs, consumption is nearly four times the level of the rural population. The relationship between urban per capita consumption in TZS and wealth quintiles is positive and holds for nearly all products observed.

Table 26. Levels of urban livestock product demand overall and relative to total household expenditures, by urban expenditure quintiles

	Urban Expenditure Quintile					Urban Total	Rural Total
	1	2	3	4	5		
% Food Expenditure in Total Household Expenditure	0.61	0.56	0.50	0.40	0.28	0.47	0.51
% Livestock Consumption in Total Household Expenditure	0.07	0.12	0.12	0.13	0.10	0.11	0.17
% Livestock Consumption in Total Food Expenditure	0.12	0.20	0.24	0.31	0.30	0.23	0.27
% Livestock Home Produced Consumption in Total Food Expenditure	0.01	0.02	0.03	0.02	0.02	0.02	0.12
Total Per Capita Value (TZS) of Livestock Product Consumption	9,308	37,098	57,755	95,185	168,870	71,822	36,541
Purchased	*7,826*	*31,494*	*49,911*	*89,919*	*157,936*	*65,681*	*17,766*
Home Produced	*1,481*	*5,604*	*7,844*	*5,266*	*10,934*	*6,141*	*18,775*
Total Per Capita Value (TZS) of Livestock Product Consumption	9,308	37,098	57,755	95,185	168,870	71,822	36,541
Meat	*5,726*	*23,030*	*36,454*	*56,513*	*87,393*	*40,909*	*17,783*
(Goat)	*(288)*	*(1,153)*	*(3,418)*	*(4,428)*	*(10,064)*	*(3,758)*	*(5,629)*
(Beef)	*(4,997)*	*(19,916)*	*(32,030)*	*(49,196)*	*(71,584)*	*(34,803)*	*(10,138)*
(Pork)	*(441)*	*(1,961)*	*(1,006)*	*(2,889)*	*(5,745)*	*(2,348)*	*(2,016)*
(Poultry)	*(1,824)*	*(8,396)*	*(13,381)*	*(23,909)*	*(49,734)*	*(18,893)*	*(10,940)*
Eggs	634	2,369	2,535	8,312	19,478	6,437	1,614
Dairy	1,759	5,672	7,920	14,764	31,744	12,021	7,819
(Fresh Milk)	*(1,551)*	*(5,176)*	*(6,736)*	*(11,437)*	*(26,059)*	*(9,909)*	*(5,414)*
(Other Dairy)	*(161)*	*(334)*	*(884)*	*(1,918)*	*(1,867)*	*(1,012)*	*(1,985)*
(Butter)	*(47)*	*(162)*	*(300)*	*(1,409)*	*(3,818)*	*(1,100)*	*(420)*

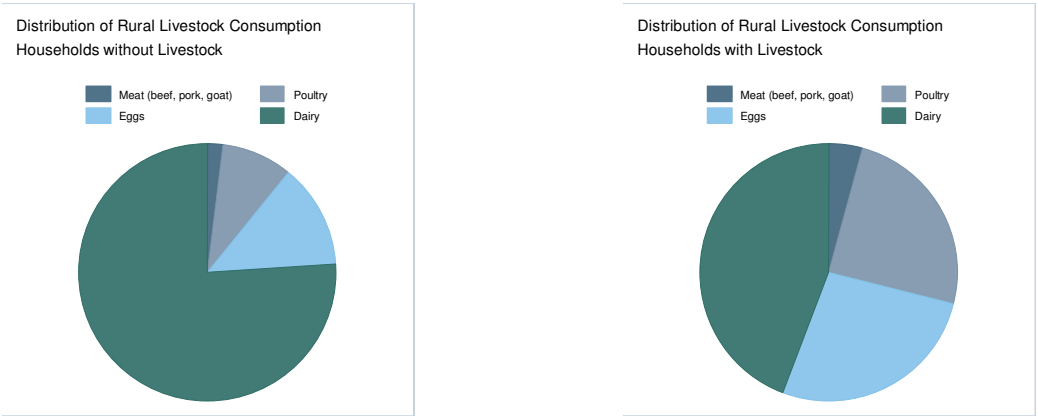
Note: 1,198 urban households

Although urban households are greater livestock consumers when considering the value of total consumption (i.e., purchases, gifts and home production), the share of home produced livestock consumption in total food expenditure is only two percent, a full 10 percentage points below the 12

percent average for rural households. The majority of urban livestock consumption is purchased rather than self-produced, whereas among rural households, home production is relatively more important.

The role of participating in the livestock sector in livestock product consumption is conveyed in Figure 7, which presents the distribution of rural livestock product consumption according to whether households report any livestock income. In per capita terms, consumption of livestock products among livestock producers is nearly three times the level consumed by households not involved in livestock. Rural households that do not participate in livestock production reveal a much greater share of dairy consumption, while more nominal shares for poultry, meat and eggs are observed. Conversely, the 39 percent of households who are involved in the livestock sector report livestock product consumption that is somewhat more balanced across products. Eggs and poultry each contribute to approximately one fourth of the value of total consumption, dairy accounts for more than one third, while the value of meat consumption in total livestock product consumption is about one sixth.

Figure 7. Livestock production consumption among rural households with and without livestock

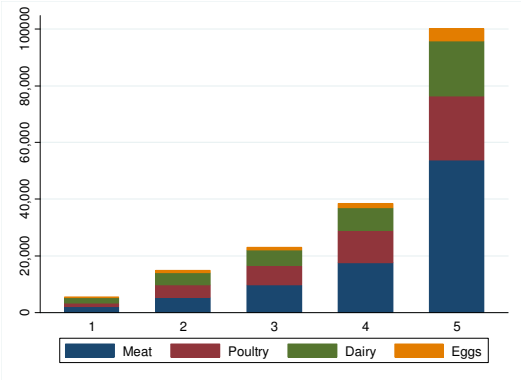


Per capita average: TZS 17,432

Per capita average: TZS 47,750

Annex 2 contains the rural per capita value of consumption in TZS for each product, broken down by expenditure quintiles. Richer households consume much greater levels of livestock products, whether home produced or purchased. The trend over quintiles is conveyed in Figure 8, which presents the level of total per capita home produced and purchased consumption for each expenditure quintile, by type of livestock product. The overall level of expenditures per person increases exponentially with increasing levels of wealth. Households in the bottom quintile spend less than TZS 10,000 per person per year on livestock products, which is less than 10 percent of the TZS 100,000 spent by households in the top expenditure quintile. Expenditures on meat, poultry and dairy increase the most with rising wealth, whereas consumption of eggs records a more limited expansion.

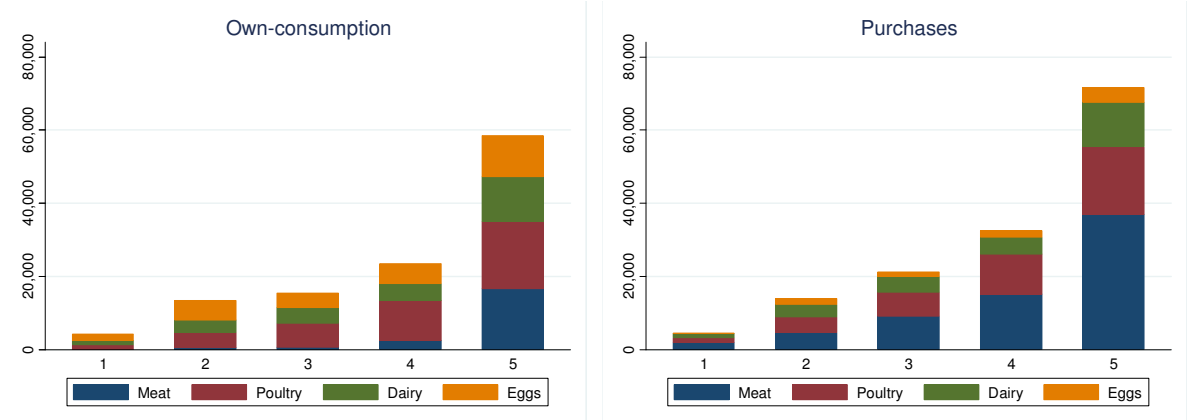
Figure 8. Total rural per capita livestock consumption in TZS, by rural expenditure quintiles



Breaking down per capita consumption levels by quintiles for home produced and purchased consumption reveals additional trends in Figure 9. First, for the bottom quintiles of the expenditure distribution, home produced and purchased production contribute approximately equal amounts to total per capita livestock product consumption. Among households in the third and fifth quintiles, home production levels are greater than purchases.

For specific products, the trends support the findings of Figure 6 in which poultry consumption is mostly sourced in home production and meat consumption in purchases. Among the poor, meat consumption is almost entirely sourced from purchases, and the bulk of home produced livestock products is composed of eggs and poultry.

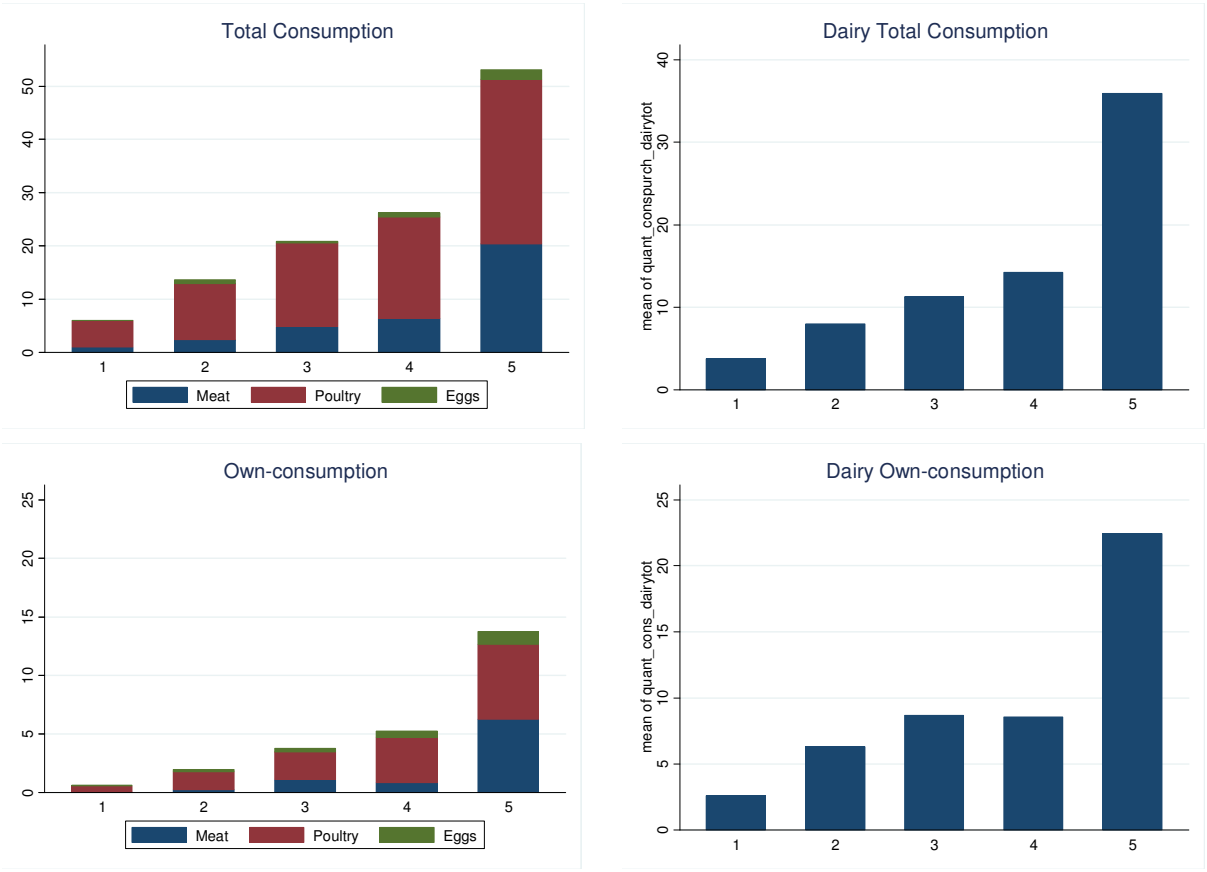
Figure 9. Rural per capita livestock consumption in TZS, by rural expenditure quintiles

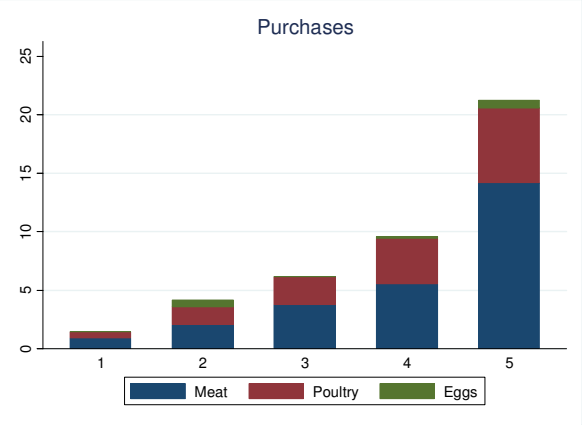


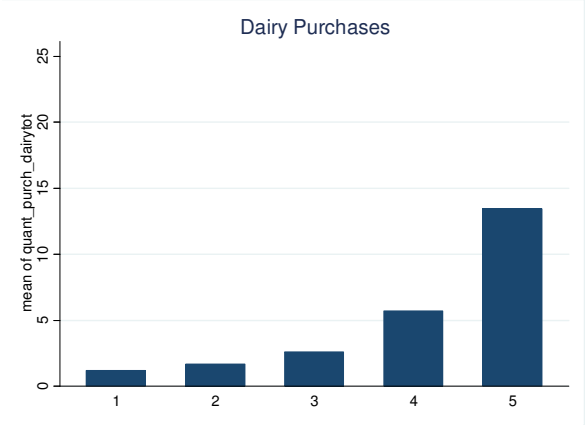
Looking at the same figures in terms of quantities rather than values as in Figure 9 reveals similar trends, as per capita quantities of consumption increase exponentially with wealth. Once again, poultry is shown to be the most important item in rural livestock product consumption, and is primarily sourced in home production. The quantity of meat consumed increases with wealth, but is largely purchased rather than produced. As with consumption in value terms, the quantity in

kilograms of purchases is greater than the quantity consumed from household production for all but the bottom quintile. Conversely, for dairy consumption, graphed separately since it is calculated in liters, the quantity of home produced consumption largely exceeds purchased consumption for all groups, highlighting the ownership of milk producing animals across the wealth spectrum. These results demonstrate that own consumption of livestock products is fundamental to rural household food intake.

Figure 10. Per capita yearly consumption in kilograms (left panel) and liters (right panel), by rural expenditure quintiles (2,055 rural households)







When measuring consumption in quantities per capita, urban households are greater consumers of livestock products in comparison to rural households (Table 27). On the whole, urban areas consume nearly twice as many kilograms of meat per person than rural areas. Whereas rural households consume nearly seven kilograms per person annually, the urban sample reports over 12 kilograms per capita. Similarly, urban consumption of eggs in kilograms exceeds rural levels by nearly three times. Poultry and dairy consumption are approximately equal across groups with no significant differences observed, which is striking if one considers that the value of expenditures is almost double in urban areas (Table 26).

Table 27. Livestock product consumption, by urban/rural

Per capita consumption	Urban	Rural
Meat (kg)	12.35***	6.97***
Poultry (kg)	3.52	3.33
Dairy (ltr)	15.61	14.64
Eggs (kg)	2.62**	0.72**
Number of households	*1,200*	*2,055*

* significant at 10%; ** significant at 5%; *** significant at 1%

5. CONCLUSIONS

The Tanzania National Panel Survey (2008-09) provides an up-to-date snapshot of living standards and livelihoods in the country. This report has utilized the extensive information included in this dataset on income sources, productive activities, access to basic services, market participation, access to assets, and a host of other socioeconomic variables to put together a detailed picture of the role of livestock in rural livelihoods.

In analyzing the different economic activities in which households are involved, and the income they generate, the report confirmed the perception that agriculture forms the backbone of the rural economy. Nearly all rural households participate in crop or livestock activities, earning on average two thirds of total income from the sector. Household participation in non-agricultural sectors is

somewhat more limited but also widespread, with 77 percent of households participating and income accounting for almost one third of the total. Both crop and livestock production are also practiced extensively by urban households, accounting for a combined 11 percent of urban household income.

Despite its importance to rural livelihoods, the family farm sector is dominated by small, largely subsistence-oriented operations, often raising some livestock as well as producing crop products. Land ownership is widespread, with only 10 percent of households identified as landless; however, the average farm size is a mere 1.6 hectares. Subsistence staple crop production dominates the sector, and only about one fourth of agricultural produce is sold on the market, while the rest is consumed within the household.

The limited ownership of assets and access to inputs present important obstacles to improving the living conditions of rural households, particularly of the poor. Ownership of the most basic productive assets is limited and the use of mechanization is rare. Households instead rely heavily on family and hired labor for all agricultural activities. Furthermore, access to financial services such as credit is scant in rural areas, presenting constraints to household investment potential.

This report placed a deliberate emphasis on the characteristics of the livestock sector, which is often overlooked in agricultural sector reports. The role of the sector for poverty reduction can hardly be ignored, as three out of five rural households engage in livestock keeping, earning over 20 percent of their income from livestock, while also benefiting from other livestock uses (e.g., traction, manure) which are not captured in that figure. Households involved in livestock rearing also enjoy a far greater consumption of animal origin products. The NPS offers a wealth of information on the livestock/livelihood linkages of which this report has provided only an initial, descriptive exploration.

In terms of herd structure, large ruminants dominate, accounting for over 80 percent of total livestock holdings when measured in TLUs. When looking at the same picture from a household livelihood perspective, however, the importance of poultry emerges alongside that of cattle, as the average livestock keeping household holds 44 percent of their total livestock ownership in poultry. One issue of concern emerging from the analysis is the high degree of concentration in livestock holdings, with the top 20 percent of livestock keepers holding over 80 percent of livestock assets. This reflects a heterogeneous sector composed largely of small holdings that make limited use of inputs, with a core of relatively large holders who are much more active on both input and output markets, and earn a substantial share of their income from livestock.

While some correlation between the ownership of livestock and welfare levels (as measured by consumption expenditure) is present in the data, this is not very strong. Cattle ownership is less widespread and more clearly linked to wealth. Poultry ownership is ubiquitous, while poor goat herders have flocks of similar size, or larger, than rich ones. The heterogeneity across rural households seems to be driven more by other issues, such as the regional differences in livestock

systems and idiosyncratic household characteristics, such that the larger differences emerge when livestock keepers are classified in terms of the size of their holdings.

In terms of heterogeneity along gender lines, the NPS data confirm expectations. Women are relatively disadvantaged when it comes to livestock ownership, in particular for cattle, especially among poorer households. It should be noted that the gender disaggregation of livestock data in the NPS is rather simple and hence these findings should be interpreted with some caution. Once they do own livestock, women appear to be as market oriented as men, if not more so, due in particular to their role in the marketing of milk and milk products. However, the sale of live animals is much more frequently handled by men.

Taken together, these results point to the fact that potentially dynamic livestock producers are also present among the poor, and include poor rural women. Removing the constraints to increases in productivity and market participation for these households and individuals, thus allowing them to realize the full income generating potential from their livestock resources, is therefore bound to have a payoff in terms of rural poverty reduction. These payoffs can be amplified via the interaction between livestock keeping and crop production through the provision of manure and draught power. These inputs do appear to be used more frequently by mixed crop-livestock producers, in comparison with pure crop producers at comparable income levels. While this additional benefit of livestock keeping is not included in the figures of income shares reported above, it should enter the equation when calculating the full range of benefits of livestock production for rural households.

The analysis of the patterns of consumption of animal origin products reveals the picture of a sector with much room for expansion. The disparities in livestock product consumption between rural and urban areas and between different income groups suggest that as average incomes in Tanzania increase, the demand for livestock products may expand, offering good opportunities for livestock producers to increase their production in order to serve a growing domestic market. Female-headed households, while somewhat disadvantaged in terms of access to livestock assets, appear to be in a relatively good position to benefit from such opportunities, as their participation in livestock output markets is on par with, or greater than, that of other households. This growth is also likely to be accompanied by a shift in the composition of the demand towards more meat and dairy products. Poultry will continue to be important, but if current consumption patterns are of any guidance, household preferences may increasingly shift towards other livestock products as incomes increase.

While the prospects for the livestock sector are promising, the report also highlights a series of factors that may constrain households' ability to take advantage of the opportunities offered by a possible growth in livestock demand. In particular, the low level of input use and veterinary services, and the high prevalence of reported animal illness could place restrictions on the extent to which livestock is productive. Further analysis is required to identify the extent to which these constraints may become binding, and to single out possible actions to remedy the situation.

The NPS data offer a rich basis, particularly if integrated with additional data sources, upon which to further the descriptive analysis featured in these pages. The objective of this report has been to use the wealth of information included in the NPS to identify some of the main constraints and opportunities related to growth in the smallholder agricultural sector. The descriptive analysis within this report also aimed to provide possible starting points for additional analysis that could offer recommendations of direct relevance to the formulation of national agricultural policies and programs. Further analysis of the NPS data and, even more so, the analysis of longitudinal data as future rounds become available, provide and unprecedented opportunity for the national and international community to further our understanding of the nexus between livestock and livelihoods in rural Tanzania.

REFERENCES

Barrett, C. (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy*, 33: 299–317.

Carletto, G., Covarrubias, K., Davis, B., Krausova, M. and Winters, P., 2007. Rural Income Generating Activities Study: Methodological note on the construction of income aggregates. Food and Agriculture Organization of the United Nations. Rome: FAO. Available from: http://www.fao.org/fileadmin/user_upload/riga/pdf/ai197e00.pdf

Chilonda P., and J. Otte. 2006. Indicators to monitor trends in livestock production at national, regional and international levels. *Livestock Research for Rural Development*, 18 (8).

Davis, B., Winters, P., Carletto, G., Covarrubias, K., Quiñones, E. J., Zezza, A., Stamoulis, K., Azzarri, C., and DiGiuseppe, S., 2010. A Cross-Country Comparison of Rural Income Generating Activities. *World Development*, 38(1):48-63.

Deere, C. D. and Doss, C.R., 2006. The Gender Asset Gap: What Do We Know and Why Does It Matter? *Feminist Economics*, 12(1-2), 1-50.

Delgado, C., Rosegrant, M., Steinfeld, H., Ehui, S., and Courbois, C., 1999. Livestock to 2020: The Next Food Revolution, Food, Agriculture, and the Environment Discussion Paper 28, IFPRI, FAO, & ILRI.

Food and Agriculture Organization of the United Nations (FAO), 2009. *Livestock in the Balance. The State of Food and Agriculture*. Rome: FAO.

FAO, 2011. *Women in Agriculture: Closing the gender gap for development*. The State of Food and Agriculture. Rome: FAO.

International Fund for Agriculture and Development (IFAD), 2011. *Rural Poverty Report 2011*. Rome: IFAD.

International Livestock Research Institute (ILRI), 2011. Towards Priority Actions for Market Development for African Farmers: Proceedings of an International Conference. 13-15 May 2009, Nairobi, Kenya. Nairobi, Kenya: AGRA and ILRI.

Mashindano, O., Kayunze, K., da Corta, L., and Maro. F., 2011. Agricultural growth and poverty reduction in Tanzania 2000-2010: where has agriculture worked for the poor and what can we learn from this? Chronic Poverty Research Centre Working Paper No. 208.

Njombe A. P., and Y. N. Msanga. 2005. Livestock and dairy industry development in Tanzania. Mimeo: Department of Livestock production and Marketing Infrastructure Development, Ministry of Livestock Development, Dar-es-Salaam, Tanzania.

Njuki, J., Waithanji, E., Macha, J., Mburu, S., and Kariuki, J., 2011. Gender and livestock value chains in Kenya and Tanzania. Presentation at the Gender and Market Oriented Agriculture (AgriGender 2011) Workshop, Addis Ababa, Ethiopia, 31st January.

Pauw, K. and Thurlow, J., 2011. Agricultural growth, poverty, and nutrition in Tanzania. *Food Policy*. 36: 795-804.

Peterman, A., Behrman, J. and Quisumbing, A., 2010. A Review of Empirical Evidence on Gender Differences in Nonland Agricultural Inputs, Technology, and Services in Developing Countries. International Food Policy Research Institute (IFPRI), Discussion Paper 00975. Washington, D.C.: IFPRI.

Pica-Ciamarra, U., Baker, D., Chassama, J., Fadiga, M., and Nsiima, L., 2011a. Linking Smallholders to Livestock Markets: Combining Market and Household Survey Data in Tanzania. Paper presented at the 4th Meeting of the Wye City Group on Statistics on Rural Development and Agriculture Household Income. Rio de Janeiro, 9-11 November.

Pica-Ciamarra, U., Tasciotti, L., Otte, J., and Zezza, A., 2011b. Livestock Assets, Livestock Income and Rural Households. Cross-Country Evidence from Household Surveys. World Bank, FAO, ILRI.

Quisumbing, A., Kumar, N. and Behrman, J.A., 2011. Do Shocks Affect Men's and Women's Assets Differently? A Review of Literature and new Evidence from Bangladesh and Uganda. IFPRI, Discussion Paper 01113. Washington, D.C. : IFPRI.

Sarris, A., Savastano, S., and Christiaensen, L., 2006. The role of agriculture in reducing poverty in Tanzania: A household perspective from rural Kilimanjaro and Ruvuma. FAO Commodity and Trade Policy Research Working Paper No. 19. Rome: FAO..

Thornton, P. K., 2010. Livestock production: recent trends, future prospects. *Philosophical Transactions of the Royal Society*. 365, 2853-2867.

URT, 2006. *Tanzania Census 2002: Analytical Report, Volume II.* National Bureau of Statistics, Ministry of Planning, Economy and Empowerment, Dar es Salaam.

URT, 2009. Mkukuta Annual Implementation Report 2008/09. Ministry of Finance and Economic Affairs: Success in the midst of turbulence. November.

World Bank, 2011. *World Development Report 2012. Gender Equality and Development*. Washington, DC: The World Bank.

ANNEX 1. METHODOLOGY IN THE ESTIMATION OF INCOME LEVELS AND RELATED VARIABLES

A1.1. Income categories

For this study, seven basic categories of income have been identified for analysis: (1) crop production, (2) livestock production, (3) agricultural wage employment, (4) non-agricultural wage employment, (5) non-agricultural self-employment, (6) transfer income, and (7) other non-labor sources of income.

Although these seven categories form the basis of the analysis, in certain cases they are aggregated into higher level groupings depending on the type of analysis that is conducted. In one grouping, we distinguish between agricultural (crop, livestock, and agricultural wage income) and non-agricultural activities (non-agricultural wage, non-agricultural self-employment, transfer, and other income).

In a second grouping, we refer to crop and livestock income as on-farm activities, non-agricultural wage and self-employment income as non-farm activities, and leave agricultural wage employment, transfer, and other income as separate categories. Finally, we also use the concept of off-farm activities, which includes all non-agricultural activities in addition to agricultural wage labor.

A1.2. Income levels

Income is estimated in accordance with the methodology of the Rural Income Generating Activities (RIGA) project of the Food and Agriculture Organization. Income is annual, net of costs, estimated at the household level, and comprehensive of all possible sources of labor and non-labor earnings. The methodology only considers regular or recurring sources of income and only factors in expenditures that are inputs to the income activity; therefore, windfall gains and investment expenditures are excluded. For a thorough explanation of the RIGA project methodology for estimating income, see Carletto et al (2007). For details on the construction of the income variables based on the Tanzania 2009 NPS, please refer to the survey-specific documentation note, available on request from the authors, or when requesting the data online from the RIGA project at http://www.fao.org/economic/riga/riga-database/riga-request/en/.

Livestock income, which is analyzed in depth in Part 2 of this report, captures earnings from livestock sold alive or slaughtered, livestock product sales, earnings from fisheries, and deduces expenditures related to household livestock production such as fodder and labor. In addition, the household consumption of livestock food items produced from the household's own livestock activities are factored in as an income source.

A1.3 Participation in income activities

Variables to identify household participation in the activities that comprise total income are constructed at the household level. Participation is defined by having non-zero, non-missing income from the source in question.

A1.4 Income shares

Income shares are calculated according to the "means of shares" approach (MS_i) in which the share of income of each activity in total household income is calculated for each household, and then the mean of all household shares is calculated for each income activity. This approach is effective in communicating the diversity of household income portfolios. An alternative approach, "shares of means" (SH_i), calculates income shares from each activity based on the mean level of income for a group of households, generating a picture of the relative importance of different income activities at the economy level, where the overall economy is defined by the universe of the group of households for which the shares are estimated. The formulas for each estimate of income are as follows:

$$SH_i = \frac{\sum_{h=1}^{n} y_{ih}}{\sum_{h=1}^{n} Y_h} \qquad MS_i = \frac{\sum_{h=1}^{n} y_{ih} / Y_h}{n}$$

The income shares presented in this report are estimated as MS, as the interest of this report is to characterize household level income and agricultural activities. These approaches for estimating shares are not limited to income and can be applied to other variables. For example, the shares of each animal type in total herd size is estimated using both approaches to demonstrate the types of animals that are most important to households individually, as well as among all livestock holders.

ANNEX 2. ADDITIONAL DEMAND TABLES

2.1 Annual Per Capita Value (TZS) of Rural Livestock Product Consumption

	Rural Expenditure Quintile					
	1	2	3	4	5	Total
Value of Livestock Product Consumption	**5515**	**14957**	**22973**	**38693**	**101719**	**36541**
Purchased	2746	6096	10786	19277	50503	17766
Own-consumed	2769	8861	12187	19416	51216	18775
Meat: total per capita value of consumption	**2,076**	**5,357**	**9,750**	**17,757**	**54,620**	**17,783**
Purchased	2,016	4,749	9,104	15,243	37,633	13,663
Own-consumed	60	608	647	2,514	16,986	4,120
Goat	**366**	**1257**	**2424**	**5070**	**19263**	**5629**
Purchased	366	840	1847	3429	7095	2699
Own-consumed	0	417	578	1641	12168	2930
Beef	**1126**	**3332**	**5628**	**9926**	**31043**	**10138**
Purchased	1066	3141	5598	9053	26636	9037
Own-consumed	60	191	30	873	4406	1101
Pork	**584**	**768**	**1698**	**2761**	**4314**	**2016**
Purchased	584	768	1659	2761	3902	1927
Own-consumed	0	0	39	0	412	89
Poultry: total per capita value of consumption	**1,503**	**5,433**	**7,740**	**13,050**	**27,266**	**10,940**
Purchased	46	512	514	783	5,475	1,453
Own-consumed	1,457	4,921	7,226	12,268	21,791	9,486
Chickens and Turkeys	**1258**	**4218**	**6408**	**11190**	**22692**	**9104**
Purchased	42	203	194	399	4014	960
Own-consumed	1216	4015	6214	10791	18678	8143
Wild Birds and Insects	**0**	**232**	**396**	**224**	**257**	**222**
Purchased	0	72	95	52	257	95
Own-consumed	0	160	301	172	0	127
Eggs: total per capita value of consumption	**245**	**983**	**936**	**1636**	**4317**	**1614**
Purchased	4	237	225	332	1204	398
Own-consumed	241	746	711	1305	3113	1216
Dairy: total per capita value of consumption	**1,936**	**4,167**	**5,482**	**7,887**	**19,834**	**7,819**
Purchased	685	835	1,168	3,252	7,396	2,651
Own-consumed	1,251	3,331	4,315	4,633	12,438	5,169
Fresh Milk	**1237**	**2950**	**3672**	**6143**	**13208**	**5414**
Purchased	398	568	917	2595	5686	2020
Own-consumed	839	2382	2755	3547	7521	3394
Other Dairy	**474**	**679**	**1586**	**1347**	**5907**	**1985**
Purchased	85	216	232	554	1241	463
Own-consumed	389	462	1354	793	4666	1523
Butter	**225**	**538**	**224**	**397**	**719**	**420**
Purchased	202	51	19	103	469	168

Own-consumed	23	487	206	293	251	252

cont.

cont.

	Rural Expenditure Quintile					
	1	2	3	4	5	Total
Total Livestock	**5515**	**14957**	**22973**	**38693**	**101719**	**36541**
Purchased	2746	6096	10786	19277	50503	17766
Own-consumed	2769	8861	12187	19416	51216	18775
Meat	**2,076**	**5,357**	**9,750**	**17,757**	**54,620**	**17,783**
Purchased	2,016	4,749	9,104	15,243	37,633	13,663
Own-consumed	60	608	647	2,514	16,986	4,120
Goat	**366**	**1257**	**2424**	**5070**	**19263**	**5629**
Purchased	366	840	1847	3429	7095	2699
Own-consumed	0	417	578	1641	12168	2930
Beef	**1126**	**3332**	**5628**	**9926**	**31043**	**10138**
Purchased	1066	3141	5598	9053	26636	9037
Own-consumed	60	191	30	873	4406	1101
Pork	**584**	**768**	**1698**	**2761**	**4314**	**2016**
Purchased	584	768	1659	2761	3902	1927
Own-consumed	0	0	39	0	412	89
Poultry	**1,503**	**5,433**	**7,740**	**13,050**	**27,266**	**10,940**
Purchased	46	512	514	783	5,475	1,453
Own-consumed	1,457	4,921	7,226	12,268	21,791	9,486
Chickens and Turkeys	**1258**	**4218**	**6408**	**11190**	**22692**	**9104**
Purchased	42	203	194	399	4014	960
Own-consumed	1216	4015	6214	10791	18678	8143
Wild Birds and Insects	**0**	**232**	**396**	**224**	**257**	**222**
Purchased	0	72	95	52	257	95
Own-consumed	0	160	301	172	0	127
Eggs	**245**	**983**	**936**	**1636**	**4317**	**1614**
Purchased	4	237	225	332	1204	398
Own-consumed	241	746	711	1305	3113	1216
Dairy	**1,936**	**4,167**	**5,482**	**7,887**	**19,834**	**7,819**
Purchased	685	835	1,168	3,252	7,396	2,651
Own-consumed	1,251	3,331	4,315	4,633	12,438	5,169
Fresh Milk	**1237**	**2950**	**3672**	**6143**	**13208**	**5414**
Purchased	398	568	917	2595	5686	2020
Own-consumed	839	2382	2755	3547	7521	3394
Other Dairy	**474**	**679**	**1586**	**1347**	**5907**	**1985**
Purchased	85	216	232	554	1241	463
Own-consumed	389	462	1354	793	4666	1523
Butter	**225**	**538**	**224**	**397**	**719**	**420**
Purchased	202	51	19	103	469	168
Own-consumed	23	487	206	293	251	252

Annex 2.2 Annual Per Capita Value of Urban Livestock Product Consumption

	Urban Expenditure Quintile					
	1	2	3	4	5	Total
Value of Livestock Product Consumption	**9308**	**37098**	**57755**	**95185**	**168870**	**71822**
Purchased	7826	31494	49911	89919	157936	65681
Own-consumed	1481	5604	7844	5266	10934	6141
Meat	**5,726**	**23,030**	**36,454**	**56,513**	**87,393**	**40,909**
Purchased	5,726	22,145	36,182	56,325	87,393	40,635
Own-consumed	0	885	271	188	0	273
Goat	**288**	**1153**	**3418**	**4428**	**10064**	**3758**
Purchased	288	1153	3418	4428	10064	3758
Own-consumed	0	0	0	0	0	0
Beef	**4997**	**19916**	**32030**	**49196**	**71584**	**34803**
Purchased	4997	19916	32030	49008	71584	34765
Own-consumed	0	0	0	188	0	37
Pork	**441**	**1961**	**1006**	**2889**	**5745**	**2348**
Purchased	441	1076	734	2889	5745	2112
Own-consumed	0	885	271	0	0	236
Poultry	**1,824**	**8,396**	**13,381**	**23,909**	**49,734**	**18,893**
Purchased	512	3,990	6,442	19,812	40,552	13,776
Own-consumed	1,310	4,406	6,939	4,097	9,183	5,117
Chickens and Turkeys	**1176**	**6027**	**10311**	**15200**	**29940**	**12206**
Purchased	176	2183	4551	12392	26317	8808
Own-consumed	999	3844	5760	2808	3623	3398
Wild Birds and Insects	**14**	**0**	**535**	**397**	**316**	**250**
Purchased	14	0	0	397	316	141
Own-consumed	0	0	535	0	0	109
Eggs	**634**	**2369**	**2535**	**8312**	**19478**	**6437**
Purchased	322	1807	1891	7023	13919	4827
Own-consumed	311	562	644	1289	5560	1610
Dairy	**1,759**	**5,672**	**7,920**	**14,764**	**31,744**	**12,021**
Purchased	1,588	5,359	7,287	13,782	29,992	11,270
Own-consumed	194	800	839	1,274	2,003	1,003
Fresh Milk	**1551**	**5176**	**6736**	**11437**	**26059**	**9909**
Purchased	1380	4863	6103	10455	24685	9229
Own-consumed	171	313	633	981	1374	680
Other Dairy	**161**	**334**	**884**	**1918**	**1867**	**1012**
Purchased	161	334	884	1918	1489	941
Own-consumed	0	0	0	0	378	71
Butter	**47**	**162**	**300**	**1409**	**3818**	**1100**
Purchased	47	162	300	1409	3818	1100
Own-consumed	23	487	206	293	251	252