

APMI TANZANIA BASELINE REPORT

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ACRONYMS

3DE	<i>3 Dimensions of Empowerment</i>
5DE	<i>5 Dimensions of Empowerment</i>
APMI	<i>African Poultry Multiplication initiative</i>
A-WEAI	<i>Abbreviated Women's Empowerment in Agriculture Index</i>
BMGF	<i>Bill & Melinda Gates Foundation</i>
DOC	<i>Day Old Chick</i>
DHS	<i>Demographics and Health Survey</i>
GPI	<i>Gender Parity Index</i>
HH	<i>Household</i>
IEDD	<i>Impact Evaluation Design Document</i>
MDD	<i>Minimum Dietary Diversity</i>
MU	<i>Mother Unit</i>
NPS	<i>Net Promoter Score</i>
PAP	<i>Pre-Analysis Plan</i>
PPI	<i>Progress out of Poverty Index</i>
SHF	<i>Smallholder Farmer</i>
WPF	<i>World Poultry Foundation</i>
WTP	<i>Willingness to Pay</i>
HBS	<i>Household Budget Survey</i>

EXECUTIVE SUMMARY

Small-scale poultry farming is a low-input agricultural activity that can supplement a household's income while improving the overall household's diet. Silverlands is a poultry company based in Tanzania which specializes in the sale of chickens, including dual-purpose chickens (Sasso). Compared to indigenous breeds of chickens (local chickens), the Sasso chicken grows faster and lays more eggs over a longer period of time while experiencing lower mortality.

IDinsight is leading an evaluation to assess the productivity of the Sasso breed and the impact of Sasso ownership on income, nutrition, and empowerment of smallholder farmers in Tanzania. The APMI Tanzania baseline report outlines the study design and presents findings from the baseline survey, which establishes a picture of the smallholder farmer sample at baseline and a preliminary understanding of past and present Silverlands customers from the sample. The baseline survey was conducted with 6,057 households¹ in 180 communities across 10 regions of Tanzania. A similar baseline survey was conducted for the APMI project in Nigeria, where IDinsight surveyed 2,248 households across 5 states. In this report we present initial findings for the Tanzania baseline sample (n=6,057) and a specific sample of Silverlands customers (n=197). We also provide a comparison of the baseline results from Tanzania and Nigeria.

KEY FINDINGS FOR THE BASELINE SAMPLE

Flock performance:

- **Most SHFs in our sample are currently engaged in small-scale poultry farming.** Approximately three quarters of households keep chickens, with a mean flock size of 14.7 for local chickens. Of households that own chickens, 99% own local chickens. Only 3% of treatment households currently own Sasso chickens, which is not surprising as we predominantly sampled *prospective* Sasso buyers.
- **Approximately 69% of SHFs had local chickens that laid eggs in the previous seven days.** Households that owned laying local chickens produced an average of 9.9 eggs per week across their total local flock. Eggs produced were primarily hatched (76%); the rest were either consumed (15%) or sold (8%).

Income:

- **The majority of SHF households in the sample are likely living under the \$3.10/day poverty line² (average household size of 4.8).** Most SHFs rely on agricultural-based income and grow a variety of cash crops. Most also own small herds of livestock, such as goats and milking cows.
- **SHFs currently generate a small fraction of their income from local poultry production.** Only 10% of households report that poultry contributes significantly to their household income. In the previous 30 days, approximately 40% of households sold

¹ A household is defined as a group of people who eat from the same pot and answer to the same household head. The average household size for this sample was 4.8 people. The primary respondent is married (76%), divorced (10%) widowed (9%) or never married (6%). For households without a spouse, 64% are female-headed and 21% male-headed. Majority of respondents come from rural communities (64%), followed by peri-urban (20%) and finally urban communities (16%).

² This poverty line is based on poverty levels in Nigeria. See page 18 for more details.

chickens and 7% sold eggs. Accounting for the value of local chickens and eggs consumed, the average monthly profit is TZS 8,520, or \$3.70.³ Increased access to Sasso could increase income by increasing the likelihood of selling poultry products.

Nutrition:

- **Chicken and egg consumption are low among children under 5 and women.** Less than 4% of women and children reported eating eggs or chicken in the previous 24 hours. Consumption of chicken or eggs can increase protein and micronutrient intake for the 54% of women and 66% of children who had not consumed any meat, fish, or poultry in the last 24 hours.
- **The majority of children under 5 and women in our baseline sample do not meet the minimum dietary diversity (MDD) threshold.** Only 19% of children under 5 and 38% of women meet the threshold. About 26% more children and 28% more women would meet the threshold if they consumed either eggs or chicken.

Women's empowerment:

- **The majority of women are empowered, though less empowered than men.** About 86% of households in our sample meet the gender parity index. Men appear slightly more empowered than women across all three domains (income, production, and ownership decisions).
- **Male poultry caretakers are more empowered than female poultry caretakers.** Male poultry caretakers are significantly more empowered than female poultry caretakers in chicken rearing and ownership decisions. However, both caretakers are equally empowered in decisions regarding use of income from poultry. The impact of Sasso ownership on women's role in poultry production will thus depend on the ability to close the gap between men and women in the ownership and rearing domains, where men are more empowered.

KEY FINDINGS FOR THE SILVERLANDS SAMPLE

Income:

- **The majority of Silverlands customer households are likely living under the poverty line of \$3.10/day.** About a third of households in the Central region have a higher likelihood of falling under this poverty level compared to the other zones.

SHF motivation:

- **Most customers are motivated to purchase Sasso for increased productivity reasons.** Customers most commonly buy Sasso to consume and sell chicken and eggs.
- **About a fifth of households purchased Sasso with the intention to hatch eggs.**

³ This value is about 3% of the average salary for those formally employed in our sample. Exchange rate: 1 USD= 2,299.70 Tanzania Shillings (<https://www.xe.com/currencyconverter/convert/?Amount=1&From=USD&To=TZS>; March 18 2020).

Customer satisfaction:

- **The majority of Silverlands customers report being satisfied with Sasso, but the net promoter score is low.** Most Silverlands customers stated they were very interested in purchasing Sasso again in the future, and almost none stated they were very uninterested. The net promoter score for Sasso is only 5.⁴ While slightly higher than -1 as reported by 60 decibels, this score means that the Sasso has slightly more promoters than detractors, indicating room for improvement.
- **The main complaints from Sasso owners was the high cost of Sasso and high consumption of feed.**

KEY COMPARISONS FROM FINDINGS IN TANZANIA AND NIGERIA

Flock performance:

- **In both Tanzania and Nigeria, the majority of sampled households keep poultry, with most of them rearing local chickens.** A higher proportion of households in Tanzania reported their local chickens laid eggs in the last seven days compared to Nigeria. The average eggs produced per household was higher in Tanzania (9.9 vs 7.8), and was likely driven by the slightly larger local flock size in Tanzania (14.7 vs 13.9). The number of eggs per hen was however the same in both countries (n=2.1). Mortality among local chickens was higher in Tanzania compared to Nigeria (34% vs 23%).

Income:

- **The majority of households in both countries live on less than \$3.10 per day, and for a majority of households, poultry contributes minimally to household income.** A slightly higher proportion of households in Nigeria (9%) compared to Tanzania (4%) live above the \$3.10 poverty line.

Nutrition:

- **A higher proportion of women and children under 5 in the Nigeria sample meet the minimum dietary diversity threshold compared to Tanzania.** About 57% of women in the Nigeria sample compared to 38% of women in the Tanzania sample meet the MDD. For children under 5, 28% meet the MDD threshold in the Nigeria sample compared to 19% in the Tanzania sample. The lower MDD observed in Tanzania may be driven partly by lower consumption of meat, poultry, and fish among women and children, but especially for women. 64% of women in Nigeria compared to 46% in Tanzania consumed meat, poultry, or fish in the last 24 hours.

Women's empowerment:

- **Women respondents in Tanzania generally appear more empowered than women respondents in Nigeria.** A higher proportion of households in Tanzania meet the Gender Parity Index compared to Nigeria. About 86% of women in Tanzania have parity with the primary male in their households, compared to 66% in Nigeria. In both countries,

⁴ The Net Promoter Score (NPS) measures satisfaction and loyalty for a product. The score ranges from -100 to 100 and scores above 0 are generally considered "good" as they imply a larger percentage of promoters than detractors.

however, men are more empowered than women in general as well as within the poultry value chain.

KEY RECOMMENDATIONS FOR SILVERLANDS

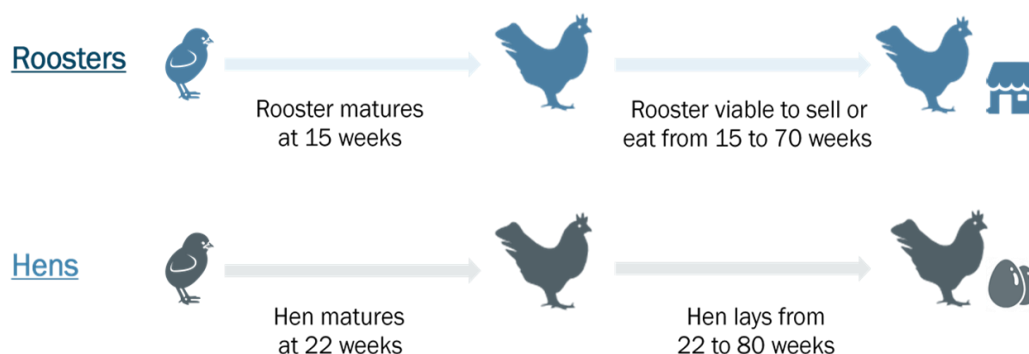
- **Field teams should discourage households from hatching of Sasso eggs and explain why.** A significant proportion (23%) purchased Sasso with the intention of hatching eggs. Hatching Sasso eggs will reduce the quality of the product and consequently any benefits households may see.
- **Sasso buyers should be encouraged to consume eggs and chicken.** Consumption of poultry products is very low in our sample. Furthermore, most home-produced local eggs are used for hatching. Sasso owners should be encouraged to consume poultry products, and sell any surplus, so that they can reap income and nutrition benefits from owning Sasso.
- **SHFs need to be reminded that Sasso can forage like the local chickens.** One big complaint about Sasso from SHFs is that they consume a lot of feed, suggesting that SHFs are purchasing or supplementing feed.
- **Silverlands should encourage SHFs to start with small flock sizes, and increase flock size over time.** Another major complaint was that Sasso are expensive. As SHFs benefit from Sasso, they can use the extra disposable income to increase flock sizes.
- **The NPS for Sasso from baseline can be used as a benchmark to track customer satisfaction.** We encourage Silverlands to focus on customer satisfaction, especially among women who gave a negative NPS score, to build future loyalty for the Sasso product.

INTRODUCTION

BACKGROUND

In most of the developing world, poultry farming plays a key role in rural households (Padhi 2016). Recent studies have shown that chicken rearing can increase household income and improve nutrition, thereby alleviating poverty (Gueye 2000; FAO 2010; Padhi 2016).⁵ With these benefits in mind, the Bill and Melinda Gates Foundation (BMGF) is funding the Africa Poultry Multiplication Initiative (APMI). Under this program, the World Poultry Foundation (WPF) received a multi-year grant to produce and sell low-input dual-purpose chickens to rural households in Tanzania and Nigeria. These chickens are more productive than local breeds: they gain weight more quickly and produce more eggs, yet they exhibit lower rates of mortality while requiring minimal resources for daily upkeep. Figure 1 below shows the maturity timeline of these dual-purpose chickens.

Figure 1: Maturity timeline of dual-purpose chickens



Under APMI, WPF supports three private sector poultry companies to sell approximately 61 million day-old chicks (DOCs) annually to rural households.⁶ In Tanzania the DOCs are distributed by AKM Glitters and Silverlands. These DOCs are sold to “Mother Units” (MUs) who rear the chicks for the first five weeks and ensure they are fed and vaccinated. To ensure that MUs vaccinate and provide adequate care for the DOCs, thereby reducing chick mortality, the companies provide in-person training and support through their Technical Advisors and Gender Specialists. After four to five weeks, MUs sell the chicks to nearby smallholder farmers (SHFs) who rear them until they are ready for sale and/or household consumption.

OBJECTIVE OF THE REPORT

This baseline report presents findings from the baseline data collection for the IDinsight impact evaluation of the Africa Poultry Multiplication Initiative (APMI) in Tanzania. The report focuses on the evaluation of Sasso, a dual-purpose breed distributed by Silverlands.⁷ The purpose of the baseline is to provide a picture of the baseline sample and establish pre-intervention parameters.

⁵ Complete literature review in [Appendix A](#).

⁶ <http://worldpoultryfoundation.org/projects/the-african-poultry-multiplication-initiative-apmi-in-tanzania-and-nigeria/>

⁷ Silverlands, an implementing partner of APMI, was established in 2014 to produce DOCs and poultry feed for commercial and small-scale chicken farmers in Tanzania.

The report also shares insights from current and past Silverlands customers. The data collected will be the basis for our matching study. We aim to match SHFs from our treatment sample, drawn from communities with access to Sasso chickens, with SHFs from our control sample, drawn from communities without access to Sasso. This will ensure a reliable comparison that will allow us to measure the impact of Sasso ownership on the livelihoods of SHFs.

AUDIENCE

This report is meant for distribution to stakeholders of the APMI program. Previous deliverables, the Impact Evaluation Design Document (IEDD) and Pre-Analysis Plan, discuss in detail the objectives, research questions, study design, sampling methods, and technical execution of the analysis. We review these briefly in the report and then focus on the findings of baseline data collection and operational learnings. For reference, a summary of the APMI program and its Theory of Change (ToC) are provided in Appendix C.

EVALUATION DESIGN

RESEARCH QUESTIONS

The aim of this evaluation is to assess the impact of owning Sasso on the lives of smallholder farmers (SHFs) with a particular focus on four domains: flock performance, nutrition, women's empowerment, and income. Table 1 below summarizes the primary and secondary research questions of the evaluation.

Table 1: Primary and secondary research questions for the APMI Tanzania impact evaluation

Category	Primary Question	Secondary Question
Flock Performance	To what extent does owning Sasso chickens affect poultry-related outputs (eggs and meat)?	How do Sasso chickens compare to local chicken varieties on measures of mortality and resources required to care for them (including time)?
Income	How does owning Sasso chickens affect income generated from poultry-related outputs?	What portion of the household income is from poultry production?
Nutrition	Has household consumption of eggs and chicken meat increased as a result of owning Sasso chickens?	To what extent are women's and children's diets more diverse as a result of owning Sasso chickens?
Women's Empowerment	Does owning Sasso chickens impact women's empowerment?	To what extent do women SHFs have more ownership and agency in poultry decisions?

STUDY DESIGN

To assess the impact of owning Sasso, IDinsight will match one-to-one treatment SHFs⁸ to control SHFs who are comparable on a set of baseline characteristics.⁹ These characteristics will be a combination of baseline outcomes and other characteristics expected to predict the propensity to

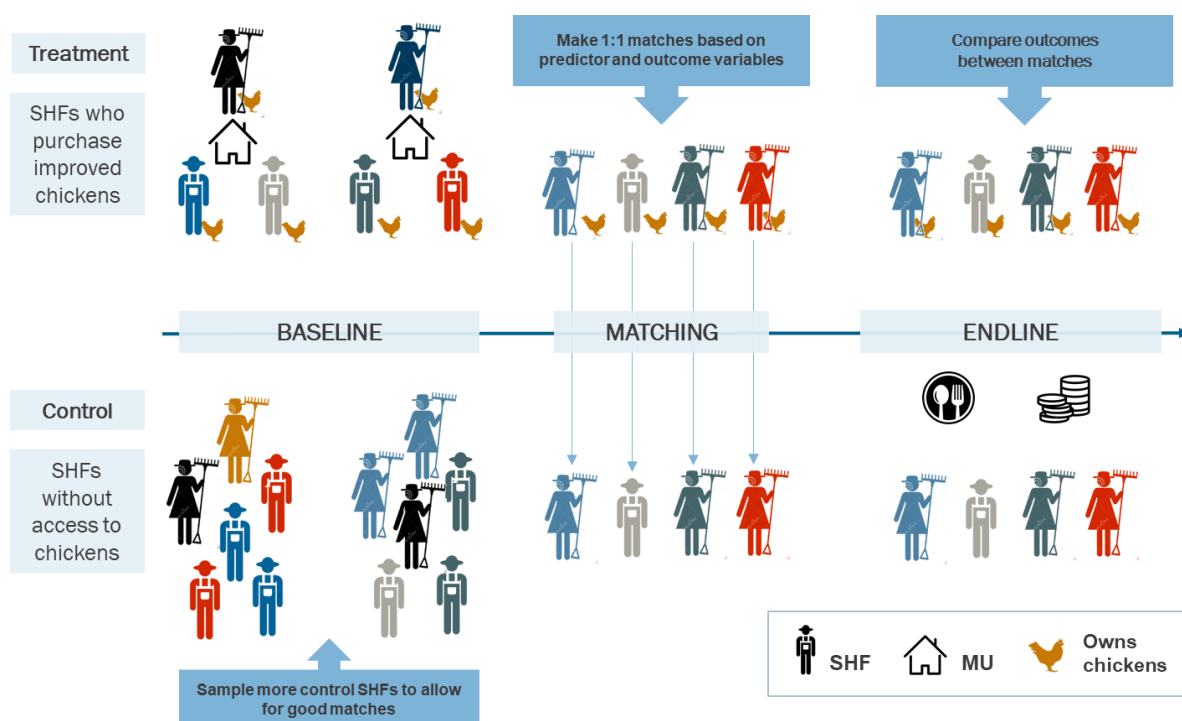
⁸ We define treatment SHF as any SHF confirmed to be a first-time buyer of Sasso chickens.

⁹ Treatment SHFs come from communities that have access to Sasso while control communities come from communities without access to Sasso.

purchase Sasso chickens.¹⁰ At endline, we will compare outcomes of matched treatment and control SHFs to estimate the causal effect of owning Sasso chickens. Figure 2 below illustrates the proposed matching process.

This design assumes that outside the observable characteristics on which we match, there are no other unobservable factors which correlate with both purchasing Sasso chickens and our outcomes of interest.

Figure 2: Individual-level matching approach



STUDY SITE SELECTION

In conjunction with Silverlands, we identified ten study regions that represent diverse geographical zones and are of strategic importance to Silverlands. These regions are: Arusha, Kilimanjaro, Tanga, Ruvuma, Mtwara, Lindi, Dodoma, Morogoro, Njombe, and Mbeya. These study regions are highlighted in blue in figure 3 below.

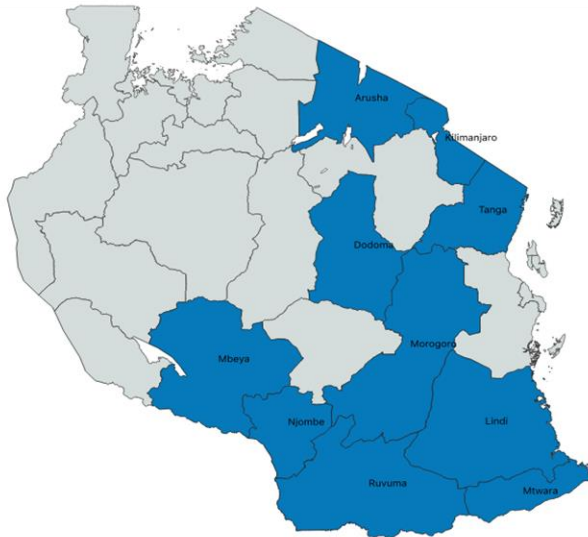
We identified treatment communities based on the natural expansion of Silverlands in these regions. In selecting treatment communities, field teams paid special attention to communities with high demand for Sasso and where we would identify first-time purchasers of Sasso, and to communities within 50km radii of Silverlands distribution centers.¹¹ In total, Silverlands’ field teams identified 110 treatment communities for the study.

¹⁰ We will choose the matching technique that generates the best balance across treatment and control SHFs on baseline outcomes and other covariates predictive of endline outcomes.

¹¹ This is to ensure that treatment SHFs have uninterrupted Sasso supply throughout the evaluation period.

To identify control communities, we randomly selected villages from wards without exposure to Sasso (or Kuroiler, the dual-purpose breed distributed by AKM Glitters), and that were similar to treatment wards.¹² Similarity at ward level was defined by location, population size, population density, and ward type (rural, urban, or mixed).¹³ In total, we selected 70 control communities that are evenly distributed across the 10 regions. For a detailed explanation of the process for identifying treatment and control communities, please refer to the Pre-Analysis Plan.

Figure 3: APMI Tanzania study regions



SAMPLE SELECTION

The treatment sample comprises 4,313 SHFs from 110 communities (~39 SHFs per community). These treatment SHFs were sampled from a list of likely purchasers of Sasso chickens.¹⁴ To establish the treatment sampling frame, we attended Silverlands outreach events and delivered a short eligibility survey to one participant per attending household. This eligibility survey gathered basic identifying information and assessed general willingness to pay (WTP) for a new breed of poultry.¹⁵ Respondents were eligible to join our sampling frame if their stated WTP was close to or above the price for a five-week old Sasso chicken.¹⁶ Of those SHFs with adequate WTP, we randomly selected approximately 40 (plus five replacements) per village¹⁷ to participate in

¹² As we will match across SHFs, balance across treatment and control communities is not strictly necessary. However, as having comparable communities increases the likelihood of finding good SHF matches, we aimed to find control communities that look similar to the treatment communities.

¹³ For some treatment communities we could not find matching control wards. In these cases, we identified the closest control wards or oversampled communities in matching wards that had already been selected.

¹⁴ We also refer to this approach as ‘prospective sampling.’ Some treatment SHFs may actually be Sasso owners (attendants may order Sasso during Silverlands sensitization events) but they need to be first-time buyers of Sasso to be included in our sample.

¹⁵ The survey includes other business-oriented questions so as to not link the research with poultry specifically.

¹⁶ In cases where a large proportion of listed SHFs in a given community reported a lower WTP, we sampled households with WTP close to the price of a five-week chicken. If we did not reach the target of sampled households in that community, we oversampled from other communities with larger numbers of eligible respondents.

¹⁷ One outreach event was conducted per study village/community.

the main household survey and join the baseline sample. The list of treatment SHFs will be shared with Silverlands to facilitate targeted marketing of Sasso to those potential customers.¹⁸

The control sample comprises 1,744 SHFs from 70 communities (~25 SHFs per community). The control SHFs are would-be purchasers of Sasso if given access. We established the control sampling frame by mimicking the process by which Silverlands conducts outreach for Sasso.¹⁹ We held generic community events that encouraged attendance from more enterprising individuals in control communities. We ensured that content delivered at these events would not sway participants' interest in poultry (such that they would seek out the Sasso), or affect their baseline outcomes (e.g. investing more in nutrition).

At these community events, we delivered the same eligibility survey delivered in treatment communities. Respondents with adequate WTP scores were included in the shortlist of eligible respondents as part of our sampling frame. Of the eligible respondents, we randomly selected 25 (plus 5 replacements) for inclusion in the main household survey.²⁰

DATA COLLECTION

INTRODUCTION TO INSTRUMENT

The household survey questionnaire contains two parts: the primary and supplementary survey. The primary survey includes questions on household demographics (education, crop cultivation, and asset ownership); poultry practices (chickens owned, chicken productivity, and egg and chicken sales); poultry-related expenses; attitudes and perceptions towards rearing chickens; household food expenditure; food security (coping strategies); women's decision-making in chicken-related activities; and women and children's dietary recall (individual dietary diversity score and infant and young child feeding practices). The supplemental survey contains a subset of the questions in the primary survey, which are dependent upon the gender of the secondary respondent.

The primary survey was administered to the adult who is the main poultry caretaker in the household (the primary respondent), who may or may not be the head of household. The supplemental survey was administered to an adult of the opposite gender, often the spouse of the poultry caretaker. In the case that the primary caretaker did not have a spouse, the respondent was asked to choose a secondary adult respondent of the opposite gender such as a sibling or older child. In the case that the household did not own any poultry, the adult female, if available, was usually the default primary respondent.

DATA STORAGE AND ANALYSIS

We collected data using SurveyCTO, downloaded the data daily, and saved the data in encrypted servers. We conducted the analyses using STATA. For detailed information on analyses, please refer to the Pre-Analysis Plan shared on February 24, 2020.

¹⁸ Silverlands already conducts targeted marketing via messaging when Mother Units have chickens ready for sale.

¹⁹ We ensured that control communities did not have any known AKMG presence

²⁰ Sampling is conducted in two stages. In the first stage, we classify SHFs based on their WTP for a 5-week old Sasso chicken. Respondents are eligible if they are willing to pay (slightly less than or above) the usual price for such a chicken. In stage two of the sampling process, we draw a random sample of SHFs stratified by SHFs having children in the relevant age group in their household. In communities where less than 30 eligible SHFs have been identified in step one, all SHFs will be sampled.

FINDINGS

INTRODUCTION TO THE SAMPLES

The baseline report discusses findings from two samples:

Baseline sample: This sample comprises all households that were eligible to be included in the impact evaluation. Out of the 6,174 households interviewed, 6,057 were eligible to be included in our baseline sample. To arrive at this number, we excluded:

- All households that previously owned Sasso²¹
- All households that previously owned Kuroiler or currently own Kuroiler²²
- Control households that currently own Sasso
- Treatment households with productive Sasso, i.e. households whose Sasso currently lay eggs or households who have sold Sasso chickens²³

We will draw from this baseline sample to match treatment and control respondents for the endline survey.

The A-WEAI sub-sample comprises households that have two adult respondents, both of whom were interviewed during the baseline survey. In total, the A-WEAI sub-sample contains 4,619 households, and will be used to compute empowerment scores.

Silverlands sample: This sample includes current and past owners of Sasso. In total 197 households currently or previously owned Sasso. This sample will not be used for the impact evaluation, but was used to generate preliminary insights about Silverlands customer experiences.

Each sample above is further classified into zones that mirror the geographical locations of the study regions, and also that roughly correspond to agro-ecological zones. The South zone comprises regions from the southern highlands and the southeastern coast: Njombe, Ruvuma, Mbeya, Lindi, and Mtwara. The North zone comprises regions from the northern highlands and northeastern coast: Arusha, Kilimanjaro, and Tanga. The Central zone comprises regions from the central semi-arid zone: Dodoma and Morogoro.

Table 2 below provides a detailed breakdown of the two samples. The majority of the baseline sample (n=3,200; 53%) comes from the South zone, followed by North zone (n=1,658; 27%) and finally the Central zone (n=1,199; 20%). For the Silverlands sample, the majority of households are found in the South zone (n=154; 78%), followed by North zone (n=24; 12%) and finally the Central zone (n=19; 10%). The distribution of households across zones reflects the number of regions that form each zone: five for the South, three for the North, and two for the Central zones.

²¹ This is to ensure none of our treatment households have seen the benefits of Sasso at baseline. We also want to ensure that control households have not previously owned Sasso, as this would increase the likelihood of them purchasing Sasso in the future.

²² We exclude Kuroiler, a dual-purpose bird distributed by AKMG, as it possesses similar qualities as Sasso.

²³ The data collection process was designed to ensure the baseline sample had these ineligible respondents excluded (see IEDD), however extra precautions were taken to drop any SHFs that met these conditions following the end of baseline data collection.

Table 2: APMI Tanzania samples

<i>Sample</i>	Total	South	North	Central
Baseline Sample Size	6,057	3,200	1,658	1,199
<i>Control</i>	1,744	889	514	341
<i>Confirmed buyers</i>	129	105	14	10
<i>Prospective buyers</i>	4,184	2,206	1,130	848
Excluded Sample	117	66	26	25
<i>Past Sasso owners (treatment and control)</i>	32	25	2	5
<i>Control SHFs that own Sasso</i>	6	3	2	1
<i>Treatment SHFs with productive Sasso</i>	26	18	6	2
<i>SHFs that own/owned Kuroiler</i>	58	23	6	2
Silverlands Sample Size	197	154	24	19
<i>Confirmed buyers that currently own Sasso</i>	166	130	22	14
<i>Past owners of Sasso</i>	32	25	2	5

BASELINE SAMPLE FINDINGS

DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

The average household size in the baseline sample is 4.8 people, which is slightly lower than the average Tanzanian household size of 5 members reported in the 2011/2012 Household and Budget Survey (HBS).²⁴ Households in the South appear to have slightly fewer members than either in the North or the Central zones, as shown in Table 3 below.

Table 3: Household demographics by zone

Indicator	Total	South	North	Central
Average household size (includes respondent)	4.8	4.6	5.0	5.0
% of respondents that are female	80.3%	77.4%	82.3%	85.3%
% of households with children under 5	40.9 %	41.2%	39.4%	42.5%
Average age of respondent	42.2	41.9	43.3	41.4

Statistics are about the primary respondent unless reported otherwise. Sample sizes: Total=6,057; South=3,200; North=1,658; Central=1,199.

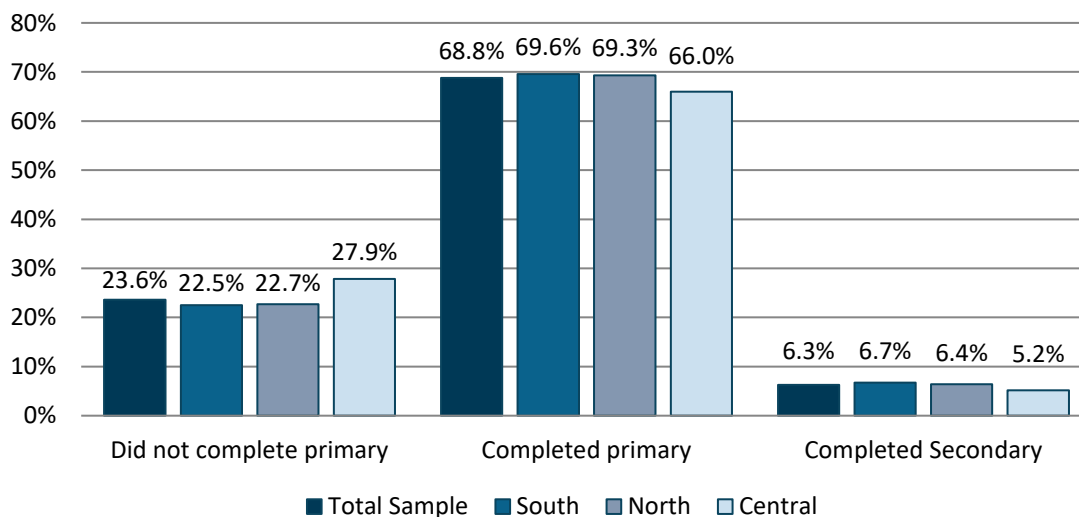
²⁴ [Tanzania Mainland Household and Budget Survey 2011-2012.](#)

A large proportion of primary respondents interviewed were female (80%). The primary respondent is defined as the main caretaker of chickens if the household owns chickens, or an adult female for households without chickens. Excluding households without chickens, about 80% of the main poultry caretakers in our sample are female. This large proportion of women already involved in poultry provides an opportunity for Sasso ownership to potentially improve the position of women in the household due to increased incomes from Sasso sales. As shown in Table 3, the percentage of female primary respondents varies across zones, with the largest proportion in the Central zone and lowest in the South zone. Sasso sensitizations should continue to encourage more women to consider poultry keeping as a potential source of income.

Approximately 41% of households in our baseline sample have children under 5. This proportion is lower than the 50% we assumed in our sample size calculations. Despite this lower than expected proportion, we are not concerned about reaching the required sample size of households with children under 5; we will reach the endline target sample size even if only 20% of the current households with children purchase Sasso by endline.²⁵

The majority of the primary respondents (69%) have completed primary school. About a quarter have either not completed primary school or do not have formal schooling, as shown in Figure 4. Educational attainment does not vary much across zones but seems to correlate with the gender of the primary respondent: women generally have lower educational attainment than men.²⁶ Consequently, in the Central zone, where the largest proportion of primary respondents are female (85%), we observe the largest proportion of respondents who have not completed primary education compared to the other zones.

Figure 4: Primary respondent's highest level of education



Sample sizes: Total=6,057; South=3,200; North=1,658; and Central=1,199.

²⁵ In the Ethiochicken project, we observed that only about 20% of households purchased chickens by endline. We expect this proportion of purchasers to be higher in Tanzania given Silverlands is committed to targeted marketing of Sasso to potential customers in treatment communities.

²⁶ Please see Appendix A for a breakdown of the education of the main respondent by gender.

Income and labor

Table 4 below summarizes how households earn income. Households predominantly derive their livelihoods from cash crop farming²⁷ (58%), livestock rearing (42%), and/or non-farm businesses (43%). At 68%, the South zone has the largest proportion of households practicing cash crop farming, while the North has the least at 37%. These findings are not surprising as the southern highlands receive plenty of rain and are conducive for crop farming. Animal keeping is mainly practiced in the North due to the slightly more arid conditions. In fact, we observe the highest proportion of livestock ownership in the North zone with 57% of households reporting keeping other livestock besides chickens. The North zone is also a tourist hub and home to entrepreneurial communities, which might explain why almost half (~49%) of households are involved in non-farm businesses.

A smaller proportion of households (~24%) participate in formal employment. For these households, the average monthly salary was TZS 287,235 (median=TZS 150,000), which is higher than the average Tanzanian wage reported in the DHS.²⁸ Across zones, there is variation in wages, especially in the Central zone where on average households earn about 30% less than households in the other zones. The Central zone may therefore benefit from emphasizing the potential impact of Sasso on household incomes during Silverlands' Sasso sensitizations.

Table 4: Income demographics

Indicator	Total Sample	South	North	Central
% of respondents formally employed	23.8%	26.0%	21.6%	20.9%
Average monthly income of employed respondents (TZS) in last 6 months	287,235	303,966	308,074	204,688
% of respondents that participate in cash crop farming	57.7%	66.7%	37.1%	62.0%
% of respondents that participate in non-farm businesses	43.0%	40.4%	48.5%	42.3%
% of respondent that own other livestock besides chickens	42.5%	38.3%	57.0%	33.9%

Outcomes have been calculated for the full baseline sample (n=6,057). Monthly income has been calculated for those with wages (n=1,353).

We also collected information on households' socioeconomic status using the Progress Out of Poverty Index (PPI).²⁹ Based on asset ownership and other characteristics, the PPI assigns each household a score that corresponds to the likelihood of that household living below the national poverty line of \$3.10/day. It is important to note that we administered the PPI questionnaire for Nigeria in both Nigeria and Tanzania. We used the same PPI questionnaire in order to facilitate a direct comparison of poverty levels across potential APMI customers between the two countries.

²⁷ Cash crops farming includes cultivation of both classical cash crops and classical food crops as long as the intent of cultivation is to sell.

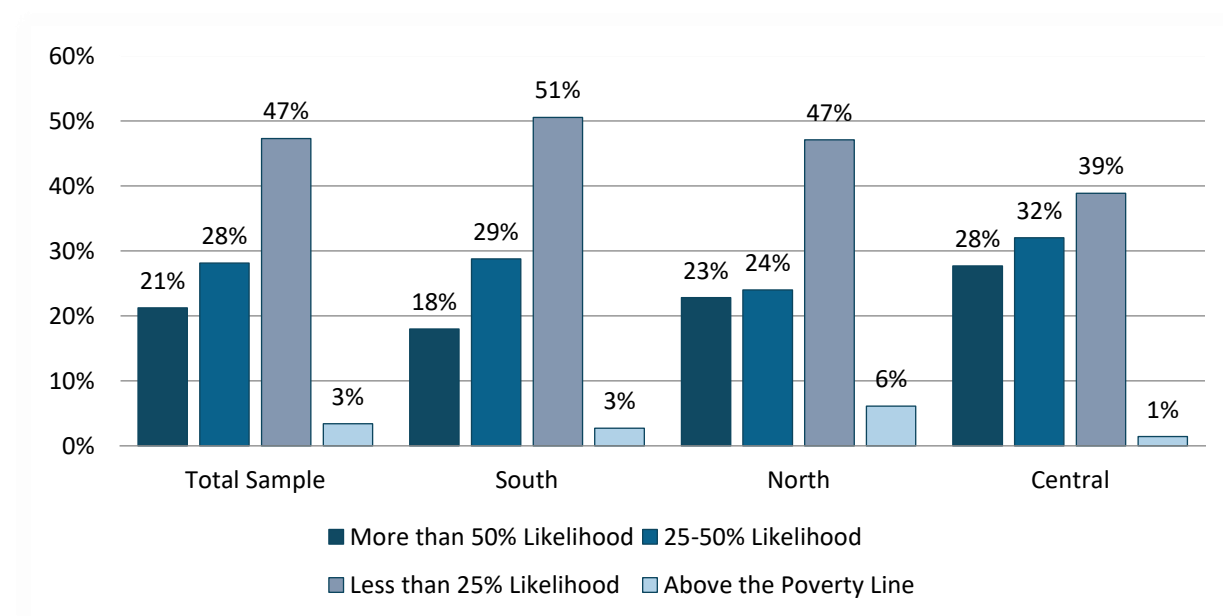
²⁸ The annual per capita income for Tanzania in 2015 was TZS 1,918,928. Dividing this value by 12 months translates to TZS 160,000 monthly per capita income.

²⁹ Please see appendix D of the Pre-Analysis Plan for how PPI was calculated and the indicators used for the calculation.

Use of the Nigerian PPI also means that scores presented in Figure 5 below are benchmarked against the Nigerian (rather than the Tanzanian) poverty line.³⁰

The majority of households in our baseline sample (~97%) have a positive likelihood of living under the \$3.10/day poverty line, as seen in Figure 5 below. The positive likelihood of living in poverty varies across zones, with the highest proportion observed in the Central zone, where about a quarter of the households have more than a 50% likelihood of living under the poverty line. This is the same zone in which the average monthly income is 30% less than that reported in the North and South. Differing levels of disposable income across the regions might have implications for SHFs’ willingness to buy Sasso. Further, differing disposable income would also affect SHFs’ willingness to become a Mother Unit given the significant up-front investment.

Figure 5: Likelihood of households living under the \$3.10/day poverty line



Sample sizes: Total=6,057; South=3,200; North=1,658; and Central=1,199.

Land ownership and agriculture

About 87% of all households in our baseline sample own land used for agricultural activities, which is similar to the average proportion observed in the nationally representative HBS survey.³¹ The average land size owned in our sample is 3.9 acres, which is lower than in the HBS survey and could be due to the proximity of many of our treatment households to urban areas.³²

As noted previously, about 58% of households practice cash crop farming. The main cash crops grown are maize and cashew nuts, as shown in Figure 6 below. The primary cash crop varies across zones, reflecting the different agro-ecological conditions: maize is popular in the North,

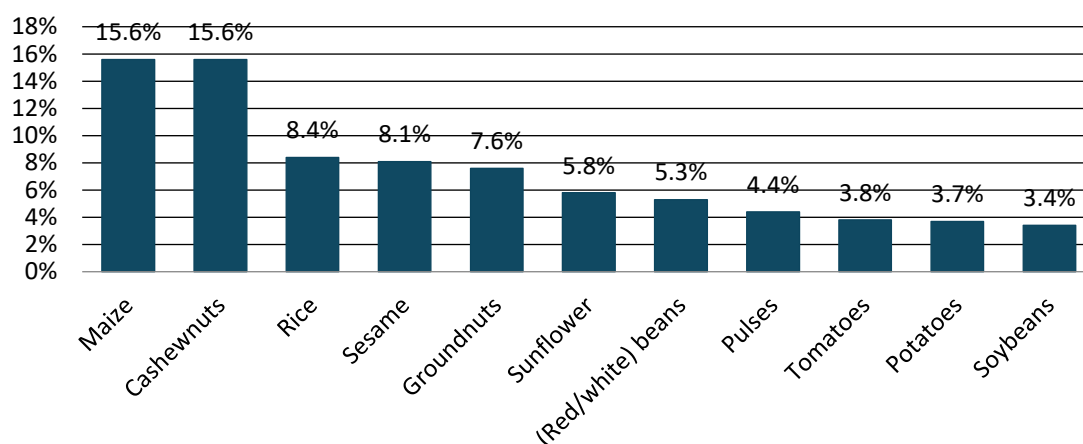
³⁰ This is because some indicators used to compute the PPI differ across the two country questionnaires. Our proposed evaluation design is not affected, as our matching algorithm is based on comparing SHFs with *similar* PPI scores.

³¹ During the 2012 HBS survey, 87.7% of land owned was used for agricultural purposes, with an average land size of 5.2 acres.

³² About 10% of the baseline respondents do not own any agricultural land, the majority (75%) of whom are from treatment communities.

cashew nuts in the South, and groundnuts in the Central zone.³³ As most households rely on agriculture for their livelihoods, targeting distribution of Sasso chicks around harvest season may lead to higher sales, as households have more disposable income at that time.

Figure 6: Primary cash crops grown



Total sample=3,492.

Livestock ownership

Besides chickens, goats and milking cows are the most commonly owned livestock, at 49% and 39% respectively. Table 5 below summarizes the types of livestock owned by sampled households and the average herd sizes. The highest ownership of milking cows and goats is observed in the North zone.³⁴ Except for sheep, similar proportions of male-headed households and female-headed households own the other livestock types.³⁵

Table 5: Types of livestock owned by households

Livestock type	% of households who own	Mean herd size
Goats	49.6%	7.8
Milking Cows	38.8%	4.9
Pigs	21.5%	3.7
Poultry (other than chicken) ³⁶	15.8%	8.7
Sheep	10.7%	12.1
Bulls	7.8%	2.8
Oxen	7.3%	3.4
Rabbits	4.6%	8.9
Donkeys	1.9%	2.6

Sample sizes: Total=2,572; South=1,224; North=942 and Central=406. Mean herd size is calculated for households that have at least one of that type of livestock.

³³ Please see Appendix A for breakdown of cash crops per region.

³⁴ Please see Appendix A for a breakdown of ownership across zones.

³⁵ Female/male-headed households are defined as households where the primary respondent is female/male, is not married and claims to be household head. Female-headed households are more likely to own sheep compared to male-headed households. Please see Table 26 for this breakdown of ownership.

³⁶ This includes guinea fowl, turkey, and duck.

Chicken ownership

Roughly 72% of respondents report they currently own chickens. This percentage rises to 80% when considering ownership in the last six months. Among households who currently own chickens, the vast majority (99%) own local chickens;³⁷ just three percent of SHFs report they currently own Sasso (n=129). We expected the proportion of Sasso owners to be low at baseline as our treatment sample is comprised of predominantly prospective buyers of Sasso in communities where Silverlands has only recently started marketing.

Table 6: Breeds of chickens owned

Poultry type	% of households owning breed	Mean flock size
Overall³⁸	72.0%	15.4
Local chicken (n=4,353)	99.3%	14.7
Layer chicken (n=31)	0.7%	62.9
Broiler chicken (n=15)	0.3%	34.0
Sasso chicken (n=129)	2.9%	11.8
Other chicken breeds(n=27)	0.6%	10.4

Percentage has been calculated for all households that own chickens (n=4,385). Mean flock size is calculated for households that have at least one of that type of poultry.

The average flock size per household with chickens is 15.4 chickens. Respondents who reported keeping broilers and layers also reported having the highest flock sizes, at 34.0 and 62.9 chickens, respectively. These large numbers are not surprising given the commercial nature of broiler and layer rearing. The average flock size of local and Sasso chickens is 14.7 and 11.8, respectively. We expect the average number of Sasso chickens owned to increase over time as SHFs see the benefits of rearing these chickens. Overall these numbers are encouraging, as sufficient flock sizes are essential to SHFs achieving the expected gains in income, nutrition, and empowerment.³⁹

Households that own Sasso and local breeds report a mixed age composition in their flocks, as shown in Table 7. The average Sasso flock is composed of 2.3 chicks, 8.0 growers, and 1.4 mature birds, while the average local flock has 4.8 chicks, 3.9 growers, and 6.1 mature birds.⁴⁰ As we exclude Sasso owners with productive birds from our baseline sample, it is unsurprising that the average Sasso flock has mainly chicks and growers. Furthermore, most of the Sassos are recent purchases and would not have had time to mature. Households keep more female than male growers and mature birds.

Table 7: Chicken age breakdown

Breed	Chicks	Growers		Mature	
		Cocks	Hens	Cocks	Hens
Local	4.8	1.6	2.4	1.5	4.5
Sasso	2.3	4.0	4.0	0.2	1.3

Mean flock size is calculated for households that had that breed. For local owners n=4,353; for Sasso owners n=129. Sasso were included in the sample if they have not laid any eggs.

³⁷ The proportion of SHFs that reported owning local chickens is similar across zones. Refer to Appendix A for a detailed breakdown across zones.

³⁸ Only 3.8% of poultry keepers pursue mixed poultry strategies. Most owners of commercial breeds (82%; n=37) also own local chickens.

³⁹ We will track flock size over time as part of monitoring exercises.

⁴⁰ Chicks are younger than 6 weeks, growers between 6 weeks to 4 months, and mature birds older than 4 months.

CHICKEN PRODUCTIVITY

Here we report the productivity of the local chickens, as we excluded SHFs with productive Sasso from our baseline sample. We also exclude layers, broilers, and other breeds from the calculations. To measure chicken productivity, we focus on SHFs who own local mature hens⁴¹ and reported that their chickens have laid at least one egg in the last 7 days.⁴²

Greater than half (69%) of SHFs with whose local chickens have begun laying eggs reported their chickens laid eggs in the last 7 days. The highest proportion was found in the Central zone, where 77% reported their chickens laid eggs in the last 7 days. On average, 9.9 eggs were produced per household in the last 7 days. This average ranges from 9.1 eggs in the South to 11.2 eggs in the North. Each mature hen produced on average 2.1 eggs in the last 7 days.⁴³ This average number of eggs per hen is similar across zones, as shown in Table 8 below.

Table 8: Local chicken productivity

Indicator	Total Sample	South	North	Central
% of HHs with local chickens producing eggs	69.4%	70.0%	65.7%	77.0%
Average weekly local egg production per HH	9.9 (8.8)	9.1 (7.5)	11.2 (10.8)	9.8 (8.1)
Average weekly egg production per local chicken	2.1 (1.7)	2.0 (1.6)	2.2 (1.6)	2.3 (1.9)

Standard deviations are reported in parentheses under averages. Sample sizes: Total=1,481; South=785; North=491; and Central= 205.

Looking at egg production and gender, we do not find any correlation between the gender of primary poultry caretaker and egg production. Appendix A-III investigates links between egg production, gender, and chick care practices.

Figure 7 below shows how the eggs produced by the local chickens in the previous seven days were used. A large proportion of these home-produced local eggs (76%; n=7.5) was hatched, while a smaller proportion (15%; n=1.5) was consumed by the household. Households in the

⁴¹ The average layer chicken begins to produce chickens at 5 months. As the age range of mature chickens in our sample was 4 months or older, we calculated productivity by dividing total egg production by number of mature hens. <http://www.fao.org/3/Y4628E/y4628e03.htm>

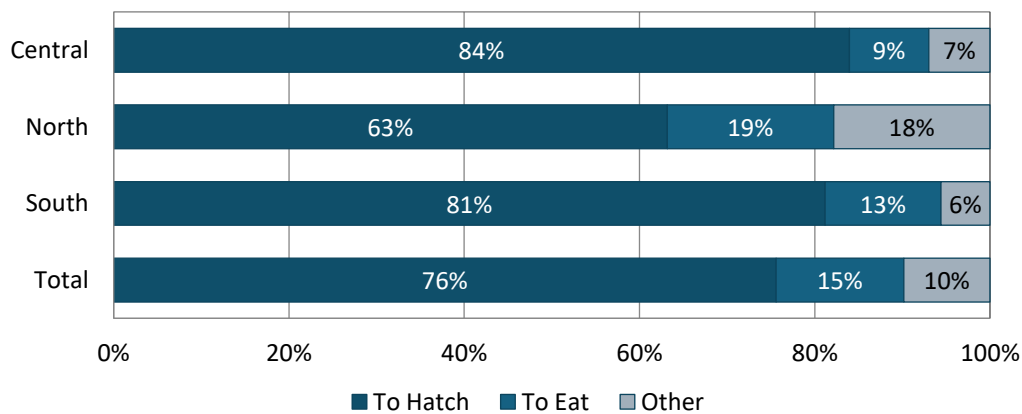
⁴² Average egg numbers for local chickens seem consistent with indigenous bird egg production as documented in the literature: Pym, Robert & Alders, Robyn. (2016). "Helping smallholders to improve poultry production." 10.19103/AS.2016.0010.25; Applegate, T. (Ed.). (2017). "Achieving sustainable production of poultry meat." Volume 1. London: Burleigh Dodds Science Publishing. As such, we believe the average values reported are likely reflective of the true numbers of eggs produced. Given concerns around recall of egg production potentially being subject to measurement error, we may explore alternative methods for measuring egg production for endline, such as a daily diary. At this point, though, we have no reason to believe that SHFs are systematically under or over-estimating the number of eggs produced, thus leading to unbiased *impact* estimates at endline.

⁴³ Eggs produced per week by a mature local hen = total weekly local eggs/total mature female local chickens. Note that this weekly production estimate only includes households with productive flocks (hens over 22 weeks in age). Further, it should not be extrapolated to estimate the yearly egg production per bird through simple multiplication, because it is a snapshot in time that encompasses the average age of birds in the baseline sample and the state of their clutches during baseline data collection.

North zone were more likely to consume and less likely to hatch eggs compared to other zones. For example, 84% of households in the Central zone hatched eggs compared to 63% in the North. Looking at consumption, only 9% of households in the Central zone ate the home-produced eggs compared to 19% in the North zone.

Very few of the home-produced eggs were sold or used for other purposes such as gifts, except in the North (18%), where most of these eggs were sold. Although the trends in usage described are for local eggs, Sasso marketing events should continue to discourage households from hatching Sasso eggs as this would make the breed lose its unique qualities. Field teams should however encourage attendees to consume home-produced Sasso eggs and sell any surplus, so that households may reap the nutrition and income benefits of Sasso ownership.

Figure 7: Uses of home-produced local eggs.

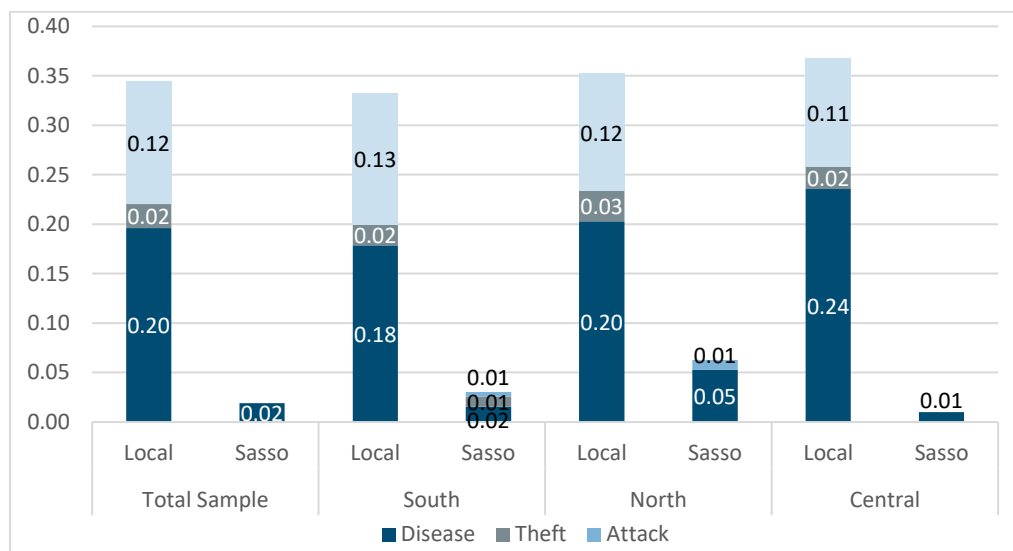


Sample sizes: Total=1472; South=783; North=488; Central=201.

Figure 8 below shows the proportions of local and Sasso chickens lost to different causes. We calculated mortality by dividing the total number of chickens lost to various causes in the last 6 months by the largest flock size owned in the same time period. The combined mortality rate for local and Sasso chickens is approximately 34%. This high mortality rate is mainly driven by the high mortality reported for local chickens, because our baseline sample includes only 129 owners of Sasso and 4,352 owners of local chickens. The mortality rate among Sasso chickens is 3%. The low mortality rate among Sasso could be a product of a smaller number of Sasso owners, farmers taking better care of their Sassos, or low susceptibility of the breed to diseases. The mortality rate among local chickens is caused mainly by diseases, followed by attack by wild animals and to a small extent theft. Diseases also play a key role in Sasso mortality but to a smaller extent. Diseases not only lead to high mortality rates that can discourage households from keeping chickens, but may also force them to replenish their flocks by hatching more eggs. Previous studies have reported high prevalence of diseases in poultry in Tanzania, especially Newcastle disease.⁴⁴ Given that Sasso are vaccinated against disease, mortality rate should be low for Sasso households. However, as diseases correlate with poor chicken housing conditions, field teams should continue emphasizing the importance of rearing chickens in hygienic conditions.

⁴⁴ Yongolo, M., Machangu, A., & Minga, U. (2002). Newcastle disease and infectious bursal disease among free-range village chickens in Tanzania. Veterinary Investigation Centre, Department of Veterinary Microbiology and Parasitology, Sokoine University of Agriculture.

Figure 8: Causes of chicken mortality



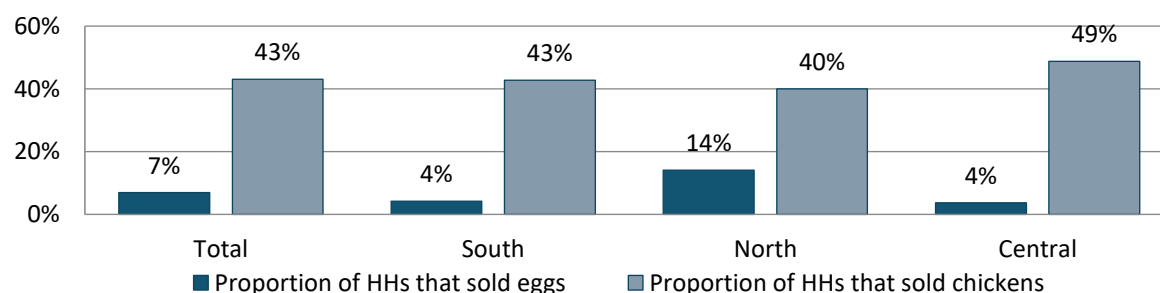
Sample sizes for local chicken mortality: Total=4,336; South =2,286; North =1,258; Central=792. Sample sizes for Sasso chicken mortality: Total=129; South =105; North=14; Central=10.

POULTRY INCOME AND EXPENDITURE

Chicken ownership has the potential to increase household income through the sale of eggs or chickens. At baseline, only 10% of SHFs reported that poultry contributed significantly to their income pool. Although this proportion is small, as more SHFs rear Sasso and see its benefits, poultry’s contribution to household income might increase over time. Field teams should continue emphasizing the potential of Sasso to increase household incomes via increased egg and chicken sales, as Sassos produce more eggs and grow faster.

Figure 9 shows the proportions of households with local chickens that sold local eggs and local chickens in the last 30 days. Roughly 7% of households with local chickens sold eggs in the last thirty days. This proportion varies across zones, from 4% in the South to 14% in the North. The average price per egg was TZS 315 (median TZS 300). About 43% of households sold chickens in the last 30 days, with the largest proportion observed in the Central zone, at 49%. The main reasons cited for selling chickens are to liquidate assets to pay for specific expenses, e.g. school fees (64%; n=1,187), and as a regular source of income for the household (38%; n=704). The average price per chicken was TZS 9,923 (median TZS 10,000).

Figure 9: Proportion of households that sell eggs and chickens



Sold Eggs sample sizes: Total=4,347; South=2,296; North=1,258; Central=793. Sold Chicken sample sizes: Total=4,349; South=2,293; North=1,262; Central=794.

As poultry contributes minimally to household income in our sample, it is not surprising that the average monthly revenue from the sale of local chickens or eggs is only about TZS 6,463 (~\$2.81) as shown in Table 9 below. The average revenue from sales is similar across all zones. We also calculated the value of chicken consumption for households that consumed chickens or eggs in the last 30 days. The value of chicken consumption is similar across zones; the average is TZS 17,274 (~\$7.51) and median is TZS 12,568 (~\$5.47).⁴⁵

Table 9: Average monthly chicken expenditure and income (Tanzanian Shillings)

Indicator	Total Sample	South	North	Central
Average monthly revenue from local chickens	6,463	6,459	6,655	6166
	Median: 0	Median: 0	Median: 0	Median:0
	(17,378)	(17,266)	(19,732)	(13,215)
Value of local consumption	17,274	17,656	16,125	18,115
	Median: 12,568	Median: 13,852	Median: 10,272	Median: 10,272
	(15,737)	(15,395)	(13,643)	(20,236)
Average monthly local chicken expenditure	5,568	4,178	8,461	4,893
	Median: 1,333	Median: 833	Median: 4,500	Median: 1,333
	(10,698)	(9,675)	(12,342)	(9,705)
Estimated local profit⁴⁶	8,520	10,509	5,515	7,538
	Median: 2,568	Median: 4,500	Median: 0	Median: 1,969
	(23,584)	(25,542)	(24,544)	(21,542)

Standard deviations are in parentheses below medians. Sample sizes for expenditure, income, and profit: Total=4351; South=2,237; North=1,281; Central=816. Sample sizes for value of local chickens consumed: Total=1,901, Southwest=1,064, North=558; Central=279.

Table 10 provides a breakdown of expenses incurred in keeping chickens. Households with local chickens spent about TZS 5,568 (~\$2.42) in chicken expenses in the previous 30 days. The most common expenditures are for feed and vaccines, while the costliest are feed and chicken transport. On average, households in the North spend more on feed and transport than the other zones.

⁴⁵ We calculate expenditure and revenue for SHFs that own only local chickens to account for the potential differences in expenditure across breeds. For averages for all SHFs, including those that only own other breeds and those that own local chickens and other breeds, see Appendix A.

⁴⁶ Approximately 27% of households made a loss from chicken rearing, i.e. local profit<0.

Table 10: Average monthly local chicken expenditures in Tanzania Shillings

Indicator	Total Sample	South	North	Central
Average monthly feed expenditure⁴⁷	4,907	3,560	7,642	4,272
	(10,037)	(9,170)	(11,477)	(8,961)
	42.8%	31.4%	62.2%	44.6%
Average monthly chicken transport expenditure	5,387	5,616	6,004	3,400
	(6,400)	(4,430)	(6,733)	(3,064)
	1.2%	0.6%	2.1%	1.3%
Average monthly vaccine expenditure	1,353	1,329	1,318	1,488
	(1,447)	(1,337)	(1,388)	(1,827)
	42.4%	42.9%	43.3%	39.7%
Average monthly vet expenditure	1,307	1,197	1,534	1,032
	(1,687)	(1,255)	(2,161)	(1,365)
	5.3%	4.7%	7.2%	4.3%
Average monthly infrastructure expenditure	4,865	4,973	2,313	10,583
	(6,952)	(6,571)	(2,738)	(15,458)
	0.9%	1.3%	0.6%	0.4%

Standard deviations are in parentheses below averages. Percentage of households that incur the expense are under standard deviations and have been calculated for all households that only own local chickens (n=4,353). Means have been calculated for households that incur the particular expenditure.

The above chicken expenditures comprise expenses incurred for all chickens owned by a household. When these expenses are disaggregated by breeds, the estimated profit per local chicken per month is TZS 8,520 (~\$3.70).⁴⁸

NUTRITION

We calculated dietary diversity scores for all female respondents and children under 5 as a measure of baseline nutrition levels.⁴⁹ The Minimum Dietary Diversity Score⁵⁰ is a proxy indicator of nutrient adequacy of household members' diets. Scores were calculated by counting the number of food groups that each individual reported consuming over the past 24 hours.⁵¹ Women

⁴⁷ Households in the North mostly buy mixed unpackaged feed that costs about TZS 12,800 while households on the South and Central zones mostly buy grains like maize and rice for an average cost of TZS 10,400. The difference in cost of these two feed products is significant ($p=0.0003$)

⁴⁸ Due to monthly chicken expenditure encompassing all chickens, estimated local chicken expenditure was calculated by taking the proportion of local chickens in SHFs flocks and multiplying this figure by the total expenses. This estimated expenditure was then subtracted from local chicken revenue to calculate an estimated profit. We calculated individual SHF-level profit and average across SHFs.

⁴⁹ The score was calculated for one child under 5: the oldest child between 6 months and 2 years old, or the youngest child between 2 and 5 years old if the former was not available.

⁵⁰ <http://www.fao.org/3/a-i1983e.pdf>.

⁵¹ Adult respondents receive a score of 1 if they have consumed at least 5 food groups out of 10, and 0 otherwise. The minimum dietary diversity for children between 6 months and 2 years of age is 4 food groups out of 7, and for children between 2-5 years of age it is 5 food groups out of 9.

were asked to recall the food eaten by themselves and by one child under 5(6-59 months), if available, over the past 24 hours.⁵²

As shown in Table 11, about 38% of women in our sample meet the minimum dietary diversity (MDD) threshold. An even smaller proportion (19%) of children under 5 meets the threshold. The proportion of women and children meeting MDD varies across zones, with the largest proportion in the North and the smallest in the Central zone. Only 7% of children under 5 in the Central zone meet the MDD compared to 25% in the North zone. About 28% of women in the Central zone meet MDD compared to 51% in the North zone. As reported previously, the Central zone has the lowest income from employment compared to other zones: households in the Central zone make about 30% less compared to the other zones. Furthermore, 99% of households in the Central zone have a high likelihood of falling under the \$3.10 poverty level. These two factors as well as lower levels of educational attainment compared to other zones may be leading to the low levels of dietary diversity observed in the Central zone.

The consumption of eggs and chicken meat by women and children is relatively low across all zones: about 2% reported they ate chicken and about 4% reported they ate eggs in the last 24 hours.⁵³ For about 28% of women and 26% of children who missed the MDD by one food group, consumption of chicken or eggs would sufficiently diversify their diet to meet the MDD bar, raising the proportion meeting MDD to 65% and 48% respectively. As such, increasing consumption of eggs and poultry can ultimately help achieve the goal of improving nutrition.

Table 11: Dietary Diversity

Indicator	Total Sample	South	North	Central
% of women that meet MDD	37.5%	34.3%	50.6%	28.0%
% of children u5 that meet MDD	19.0%	20.8%	24.9%	6.9%
% of women that consumed chicken	2.2%	2.6%	1.8%	1.6%
% of children u5 that consumed chicken	1.6%	2.4%	0.5%	1.0%
% of women that consumed eggs	3.6%	4.3%	3.6%	1.7%
% of children u5 that consumed eggs	3.7%	3.7%	4.9%	2.0%

Sample sizes for women: Total=5,645; South=2,969; North=1,549; Central=1,127. Sample sizes for children under 5: Total=2,480; South=1,317; North=654; Central=509.

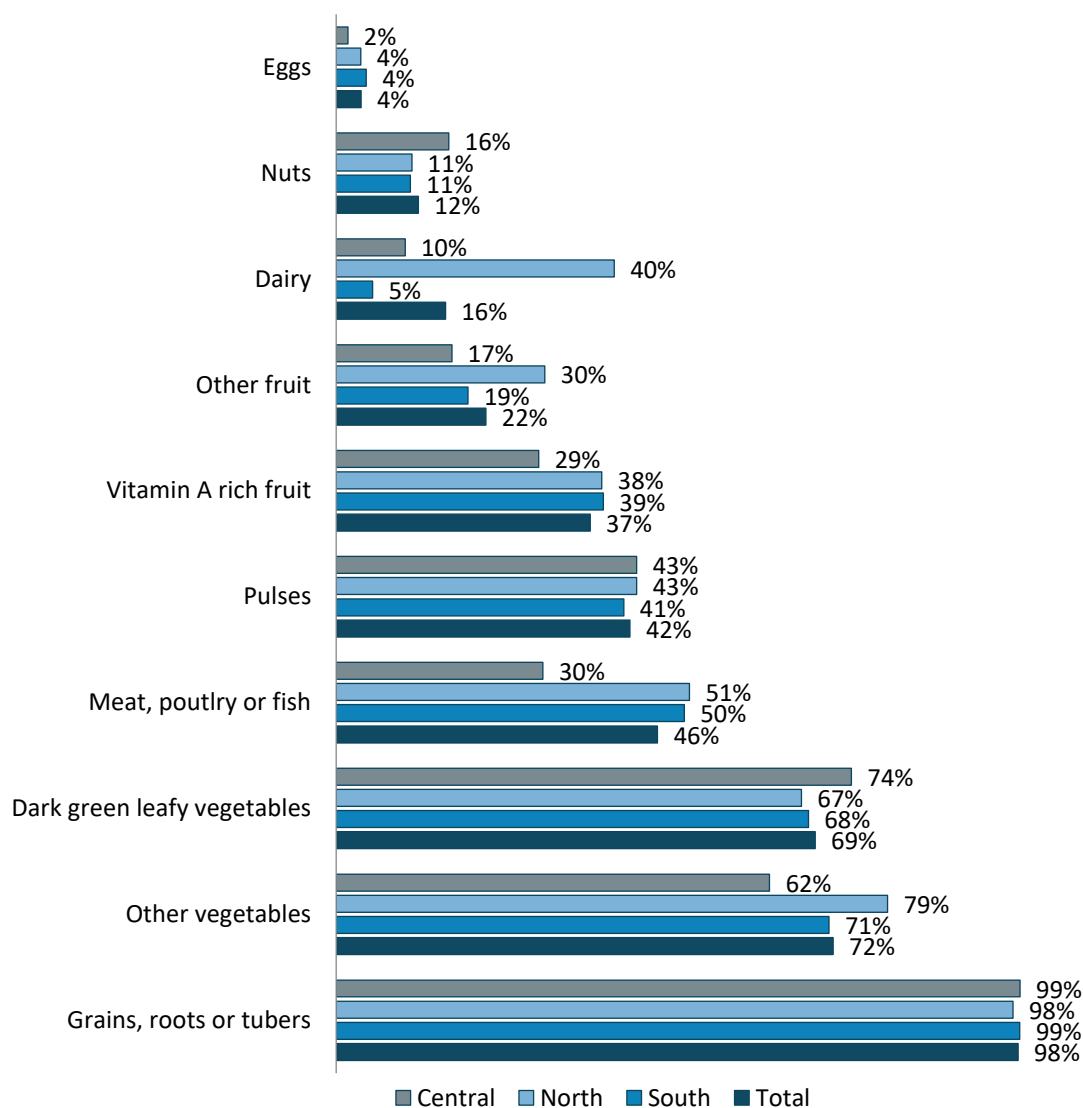
Figures 10 and 11 below show the proportion of food groups consumed by women and children. These food groups were used to compute the minimum dietary diversity scores. As can be seen in Figure 10, grains, roots, or tubers was the most consumed food group, with 98% of women reporting they consumed this food group in the past 24 hours. The least consumed food group was eggs, at 4%. The main sources of protein for women were meat, poultry, or fish (~45%). Dairy is the most important source of protein for women in the North, with about 40% of women reporting having consumed dairy in the last 24 hours. The contribution of dairy is not surprising given the large number of animal keepers in the North zone. 40% of women in the South zone report consuming fish in the previous 24 hours, making fish the most important source of protein in the South. The South zone boasts many lakes, with two regions bordering the Indian ocean. In

⁵² Within a given household - if available - one child younger than five was interviewed. We interviewed the oldest child between 6 and 24 months, whenever available, and the youngest child between 25 and 59 months otherwise.

⁵³ Households that consumed eggs in the last 7 days ate on average 6.2 eggs in the last week, 3.8 of which were home-produced and the 2.3 store-bought. Most of home-produced eggs came from local chickens.

the Central zone both fish and milk are key sources of protein, with 18% of women reporting having consumed them in the last 24 hours.

Figure 10: Food groups consumed by women

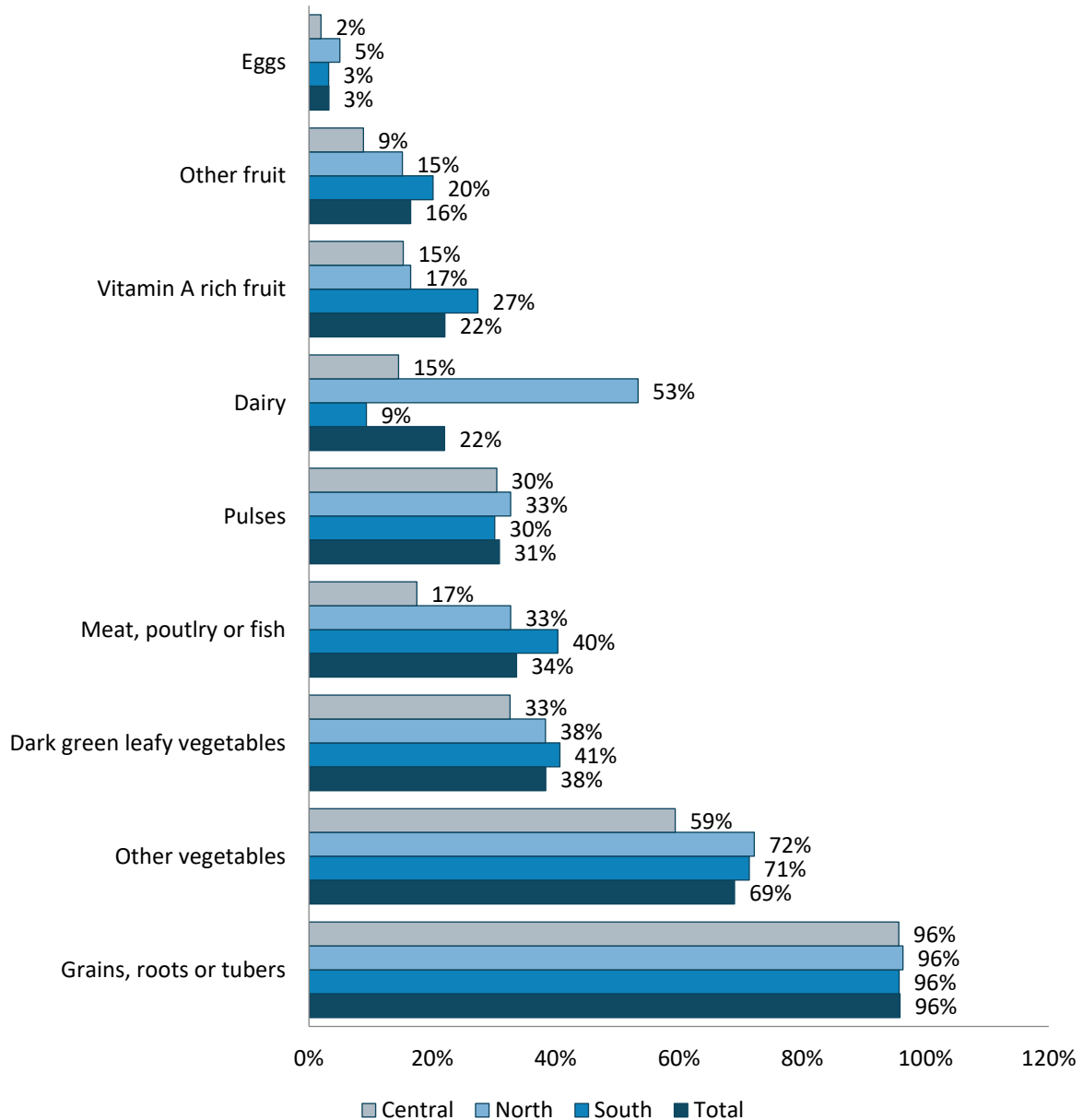


Sample sizes: Total=5,645; South: 2,969; North:1,549; Central:1,127.

Children under 5 also consume grains, roots, and tubers in large proportions (96%), and consume eggs in low proportions (3%). As with women, meat, poultry, or fish constitute an important source of protein for children under 5 across all zones. In the North, dairy is the most consumed protein source for children under 5. However, 74% of children that do not meet MDD were reported to not have eaten any meat, fish, or poultry in the last 24 hours. This highlights the potential to increase protein intake by increasing poultry consumption, which could lead to an improvement in child nutrition. Figure 11 below summarizes the food groups consumed by children across zones. In Appendix A, we provide a breakdown of the nutrition for children 6-23 months and 24-59 months.

To summarize, a large proportion of women and children in our sample do not meet the MDD. As chicken and egg consumption is generally low in these groups, their consumption would allow more women and children to meet the minimum dietary diversity. As noted, about 26% more children and 28% more women could meet the MDD threshold if they consumed eggs or chicken. Silverlands could therefore continue to encourage households to consume Sasso products, as they have the potential to significantly impact nutrition.

Figure 11: Food groups consumed by children under 5



Sample sizes: Total=2,480; South=1,317; North=654; Central=509.

WOMEN'S EMPOWERMENT

We adapted the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI) as a measure of women's empowerment for use in our study. The original A-WEAI involves 5 dimensions and 6 sub-indicators, which comprise the weighted Five Dimensions of Empowerment (5DE)⁵⁴ composite score and the Gender Parity Index (GPI). In our adapted A-WEAI, we focus on three dimensions of the 5DE that are most relevant to context of the APMI study: (1) input in productive decisions, (2) ownership of assets, and (3) control over use of income.

We utilized these three indicators to generate (a) a modified empowerment score which we term the 3DE,⁵⁵ and (b) a Gender Parity Index (GPI) which captures the extent to which women and men within a household have similar levels of empowerment.⁵⁶ We consider a respondent empowered if his or her involvement in various decisions reaches a specified threshold when the three domains are aggregated,⁵⁷ and a household is said to have gender parity if a woman has an equal or higher score than the primary male in the household.⁵⁸

Approximately 86% of women in our sample are empowered. This is slightly lower than the proportion of men empowered (88%), as shown in Table 12. About 86% of women have gender parity with the main adult male in their household. This implies that 86% of women in our sample have a similar level of input into decisions as their spouses. The high levels of women empowerment observed in Tanzania are not entirely surprising: Tanager's research report⁵⁹ noted that while men were responsible for making most decisions, they tended to ascribe more decision-making power to women than women themselves. The GPI we report is also on par with that reported in the neighboring region: the pilot of A-WEAI in Uganda found a GPI of 89%, which is similar to what we observe for Tanzania.⁶⁰ Furthermore, about 81% of households in Southwest Nigeria that were interviewed at baseline met gender parity.⁶¹

There is no variation across zones in terms of proportions of women empowered, proportions of men empowered, or households meeting gender parity.

⁵⁴ We prioritized these 3 domains in consultation with our external experts and the advisory committee. In addition to these 3 domains listed for 3DE, the 5 domains in 5DE include: time, which refers to the allocation of time for primary productive and domestic tasks; and leadership, which aims to capture the individual's potential for leadership and influence in his or her community.

⁵⁵ The WEAI builds on research to develop indicators of agency and empowerment that propose the aforementioned domain-specific measures of empowerment obtained using questions that can be fielded in individual or household surveys.

⁵⁶ Gender parity is measured in binary terms at the household-level. GPI reflects the percentage of women who are equally or more empowered as the men in their households. In households where women have the same or higher 3DE score (between 0 and 1), we record a GPI score of 1, and 0 if not. Therefore, a woman can be empowered but not have gender parity and vice versa.

⁵⁷ A respondent is empowered if he or she has an aggregated score of 0.75 out of 1 from the three domains.

⁵⁸ In the 5DE, a woman is said to be empowered if she has an aggregated score of 0.8 out of 1 from the five domains. In addition, IFPRI calculates disempowerment (1-empowerment) and discusses their respondents from the vantage point of disempowerment. We discuss our results from the angle of empowerment.

⁵⁹ Gender and Nutrition Desk Research (Tanzania), August 2018.

⁶⁰ https://www.ifpri.org/sites/default/files/a-weai_instructional_guide_final.pdf

⁶¹ Although Northern Nigeria was included in the baseline survey, we have excluded it from comparison to Tanzania as it is culturally unique i.e. more conservative and more polygamous.

Table 12: Women Empowerment and Gender Parity scores

Indicator	Total Sample	South	North	Central
Proportion of women empowered (3DE)	85.5%	86.7%	84.3%	84.9%
Proportion of men empowered (3DE)	88.0%	89.8%	85.5%	86.7%
Proportion of HHs that meet gender parity (GPI)	86.3%	86.5%	86.6%	85.1%

Proportion calculated for households that have two respondents, and that were interviewed during the baseline survey. Sample sizes: Total=4,619; South=2,443; North=1,279; Central=897.

Table 13 shows the domain-wise empowerment scores across gender and region. The three domains are:

- **Production:** this domain captures levels of input in decisions involving agricultural activities such as cash crop farming and livestock rearing. An individual is empowered in production if they have at least some input in two decisions regarding agricultural activities.
- **Income:** this domain captures sole or joint decisions on the use of income in a household such as on health and school expenditures. An individual is empowered in income decisions if they have at least some input in one decision of how to utilize income.
- **Ownership:** this domain captures sole or joint ownership of household assets such as vehicles and televisions. An individual is empowered in ownership if they own at least one large asset solely or jointly.

Table 13: Empowerment levels across 3DE domains

	Total Sample	South	North	Central
Production(women)	87.3%	88.0%	86.7%	86.0%
Production (men)	89.6%	91.0%	87.4%	88.8%
Income decisions (women)	97.4%	97.8%	97.0%	97.1%
Income decisions (men)	98.9%	99.1%	98.5%	98.8%
Ownership (women)	93.6%	94.2%	95.0%	90.3%
Ownership (men)	95.8%	96.8%	95.9%	93.1%

Empowerment for each domain is only calculated for households that participate in the domain.

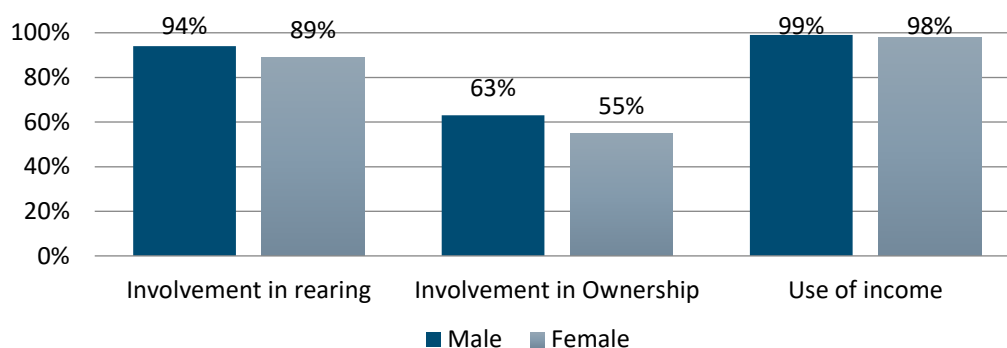
Men appear somewhat more empowered than women across all three domains and across all three zones, as shown in Table 13 above. The proportion of women empowered across all zones does not vary except in the Central zone where a slightly smaller proportion of women is empowered in ownership compared to the other zones. Both men and women are most empowered when it comes to income decisions, e.g. how household income is spent on health and education. Women and men are both least empowered in productive decisions, at 87% and 90% respectively. This means that on average, fewer respondents, especially women, have input in decisions regarding agricultural activities such as when to harvest or what livestock to rear, compared to the other domains. Tanager similarly found that men are responsible for most productive decisions, especially in agriculture. Consequently, the production domain has the highest potential for increasing women's empowerment through poultry rearing, and could be a focus area for Silverlands sensitization efforts about women's role in the poultry value chain.

Women’s empowerment in poultry

To explore women’s empowerment in the context of poultry rearing in more depth, we constructed a Women and Poultry Ownership Score (WPO) for any respondent that rears chickens. This score is a standardized index composed of three domains: the caretaker’s involvement in poultry rearing, ownership of poultry, and use of income from poultry. For each of the three domains, we asked the primary caretaker of poultry several questions similar in nature to the questions asked as part of the A-WEAI modules.⁶² Analogously, we consider the poultry caretaker empowered in a domain if he or she meets a minimum level of achievement with regards to involvement in the decisions of that domain.⁶³

Figure 12 illustrates the proportion of poultry caretakers empowered across the three domains. We compare the proportions across poultry caretakers’ gender, emphasizing that these comparisons are *between* different smallholder households.⁶⁴ In Figure 12, we do not provide a breakdown across zones as the trends are similar. Female and male poultry caretakers are equally empowered in decisions regarding use of income from poultry, at approximately 98%. Men are significantly more empowered than women, however, in decisions regarding rearing of chickens and decisions regarding involvement in ownership ($p < 0.001$).^{65,66}

Figure 12: Proportions of women and men empowered by domain



Sample sizes (Male/Female): Involvement in rearing=809/3292; Involvement in ownership=825/3084; Use of income =461/1516.

⁶² Involvement in poultry rearing focuses on respondents’ involvement in decision making around extension support, chicken housing, and sourcing of feed. Ownership focuses on respondents’ involvement in making decisions regarding buying, selling, and consuming chickens and eggs. Use of income focuses on respondents’ input in decisions around the use of income generated from selling chickens or eggs. If a respondents’ household is not involved in any of the activities in a particular dimension, their score in that domain is treated as missing.

⁶³ Achievement within a domain is defined in a comparable way to achievement in the A-WEAI modules. Poultry rearing consists of three decisions and we require the respondent to be involved in making at least one decision. Ownership consists of five decisions and we require involvement in two (see more below). Use of income consists of three decisions and we require input into at least one. For more details on the minimum levels of achievement required, please refer to the Pre-Analysis Plan.

⁶⁴ Comparisons *between* household are in contrast to comparisons *within* households for the adapted A-WEAI.

⁶⁵ For general ownership, we look at ownership of households’ assets e.g. small and large durables, while for poultry ownership we consider respondent’s input into decisions regarding the use of poultry. General production considers decisions for all agricultural activities—cash crop, food crop and livestock farming. Poultry is only a small part of productive decisions.

⁶⁶ Male poultry caretakers have significantly larger flock sizes than female caretakers. To determine whether the empowerment gap in rearing and ownership is driven by flock size, we conduct a logistic regression of empowerment in rearing/ownership against gender and flock size. The odds of being empowered in ownership (and not rearing) increases significantly with flock size ($p < 0.0005$). After controlling for flock size, we find that the gender of poultry caretaker being female decreases the odds of being empowered in ownership and rearing decisions ($p < 0.005$).

We aggregate the three domains into a comprehensive, standardized women poultry ownership (WPO) score, in which higher scores indicate that the caretaker is more empowered.⁶⁷

Table 14 shows the average empowerment scores of the full sample: male and female caretakers. Male caretakers appear more empowered than female caretakers. Given the domain-specific results, this finding is not surprising.

Looking at empowerment along the poultry value chain, we observe that the vast majority of primary poultry caretakers of either gender appear empowered across different dimensions, potentially leaving little room for further improvements overall. Therefore, a key goal is not to create any sources of disempowerment through the introduction of improved birds. There may be room to close the gender gap in rearing and ownership involvement through Sasso ownership, however, as most of the poultry caretakers in our sample are female.

Table 14: Poultry Ownership Score by gender of primary caretaker

	Mean	Sample size
Full sample	0.00	4,350
Male primary poultry caretaker	0.16	882
Female primary poultry caretaker	-0.04	3,468

SILVERLANDS SAMPLE FINDINGS

This section presents the customer profile of past and present Sasso customers. As 65% of the Silverlands sample is included in the baseline sample, we do not make comparisons across these samples.

Demographics

Table 15 below summarizes the demographic characteristics of the Silverlands sample. The average household size is 3.7 people, which is smaller than that observed in the general Tanzanian population (n=5). About 75% of the primary respondents, who are caretakers of Sasso chickens, are female. About a quarter of primary respondents are employed, with an average monthly salary of TZS 305,530. Approximately 10% of primary respondents have not completed primary school. The Central zone has a higher proportion of primary respondents that have not completed primary education (21.1%) compared to other zones (11.6% in the South and 4.2% in the North).

⁶⁷ We are using an inverse-variance weighting algorithm that attempts to explain as much of the joint variance in the sub-domains as possible. This results in an index with mean of 0 and standard deviation of 1. We conduct the aggregation for the full sample of respondents to be able to make meaningful comparisons across the gender of poultry caretakers. See the Pre-Analysis Plan for more details.

Table 15: Demographics of Silverlands sample

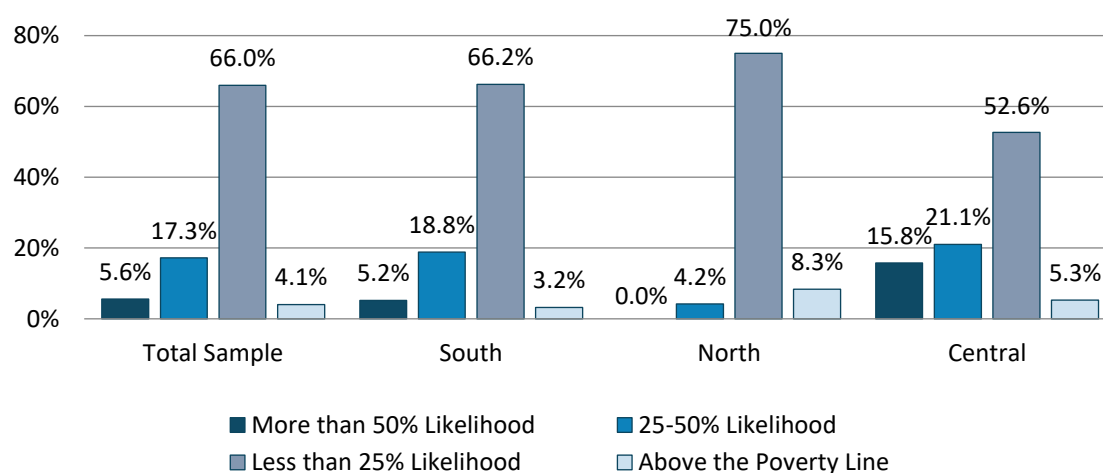
Indicator	Total Sample	South	North	Central
Average household size	3.7	3.6	4.5	3.6
Proportion of primary respondents that are female	75.1%	75.3%	70.8%	78.9%
Proportion of households with children under 5	39.1%	38.3%	41.7%	42.1%
Average age of primary respondent	43.5	43.3	44.1	44.3
% of primary respondents formally employed	25.9%	27.9%	20.8%	15.8%
Average monthly income of respondents with wages (in TZS)	300,530	317,109	209,800	258,333
% of primary respondents that did not complete primary education	11.7%	11.6%	4.2%	21.1%
Progress Out of Poverty Index (PPI) score	61.9	61.9	65.6	57.1

Averages and proportions have been calculated for all households (n=197). Average income has only been calculated for households employed.

As with the baseline sample, socioeconomic status was collected using the Progress Out of Poverty Index (PPI). Table 15 shows that the average PPI score for Silverlands customers was 61.9, corresponding to a 96% likelihood of living below the \$3.10/day Nigerian poverty line.

Figure 13 below shows that poverty levels vary across zones: in the Central zone, 16% of households have a more than 50% likelihood of living below the poverty line, while other zones have less than 5%.

Figure 13: Progress out of Poverty Index (PPI)



Sample sizes: Total=197; South=154; North=24; and Central=19.

Sasso productivity

Our sample size for this section is small (n=197). Consequently, numbers reported in this section have high variability, as can be seen in the standard deviations in parentheses. The numbers presented below may not be representative of the larger Silverlands customer base. Nevertheless, these numbers give a snapshot of what Sasso customers currently report. The average flock size for this sample is 14.5 Sasso chickens per household (standard deviation=34). About 7% of these households report their Sassos are currently laying eggs. On average, a mature Sasso hen laid approximately 3.8 eggs (standard deviation=2.4) in the last 7 days prior to the survey, and households received a total of ~22 eggs (standard deviation=20.1) per week from their Sasso flock.

Table 16: Sasso Egg Production

Indicator	Total Sample	South	North	Central
Average Sasso flock size	14.5 (34.0)	12.0 (28.4)	35.4 (60.0)	4.3 (4.4)
% of HHs with Sasso chickens producing eggs	7.3%	5.3%	20.8%	5.9%
Average weekly egg production per HH	22.5 (20.1)	15.3 (10.3)	23.7 (19.8)	70.0
Average weekly egg production per Sasso	3.8 (2.4)	3.9 (2.5)	2.4 (1.3)	7

Standard deviations are in parentheses under averages. Sample size for Sasso-owning households: Total=197; Sample size for egg averages: Total=11.

Figures for average flock size and weekly egg production vary widely between zones, but this is expected due to the small sample size; these patterns may change given a larger and more representative sample of Silverlands customers.

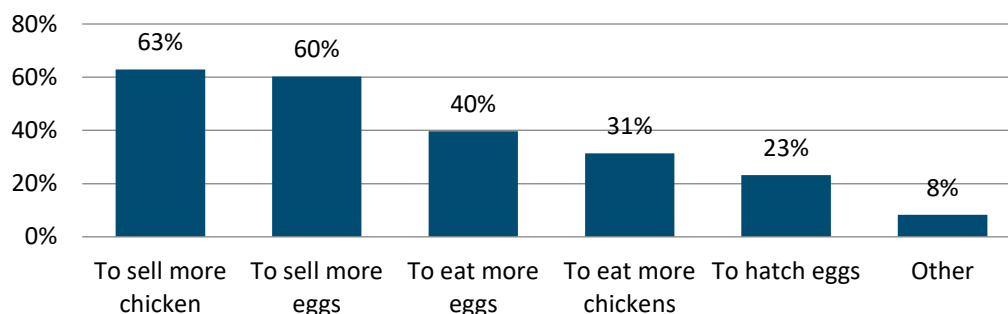
Perception of Sasso

We also aimed to gauge SHFs' perceptions of the Sasso for those who own the birds or have owned them in the past. Households were asked questions on what and who influenced them to buy the Sasso, as well as what they liked or disliked about the Sasso in comparison to local chickens.

When we asked respondents what influenced their purchase of Sasso, the majority reported they intended to sell the chickens (63%) and eggs (60%). A moderate proportion purchased Sasso to consume eggs (40%) or chicken (31%). These results are encouraging and indicate that households are aware of Sasso's potential to improve both incomes and nutrition.

About 23% of Sasso owners bought Sasso in order to hatch the eggs: this high proportion is concerning as hatching would reduce the quality of the Sasso product. Silverlands fields teams should therefore continue to discourage Sasso owners from hatching Sasso eggs, and explain why.

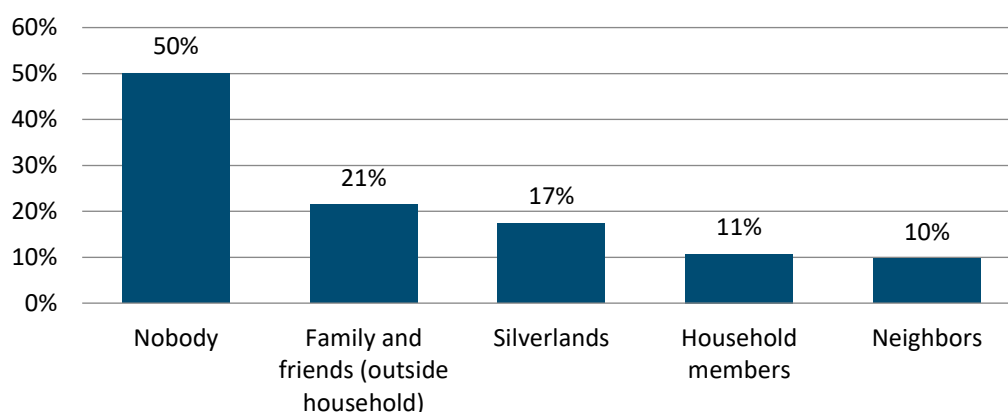
Figure 14: Reasons for purchasing Sasso



Respondents could select more than one choice. Sample size=194.

We also asked respondents who influenced their decision to purchase Sasso. As shown in Figure 15, about half of respondents decided to purchase on their own, without any external influence. Family and friends outside the household, and Silverlands remain important influences to purchase Sasso, at 21% and 17% respectively. As most of our treatment households are prospective buyers of Sasso, continued marketing of Sasso may improve uptake, thus increasing the proportion of Sasso purchasers by endline.

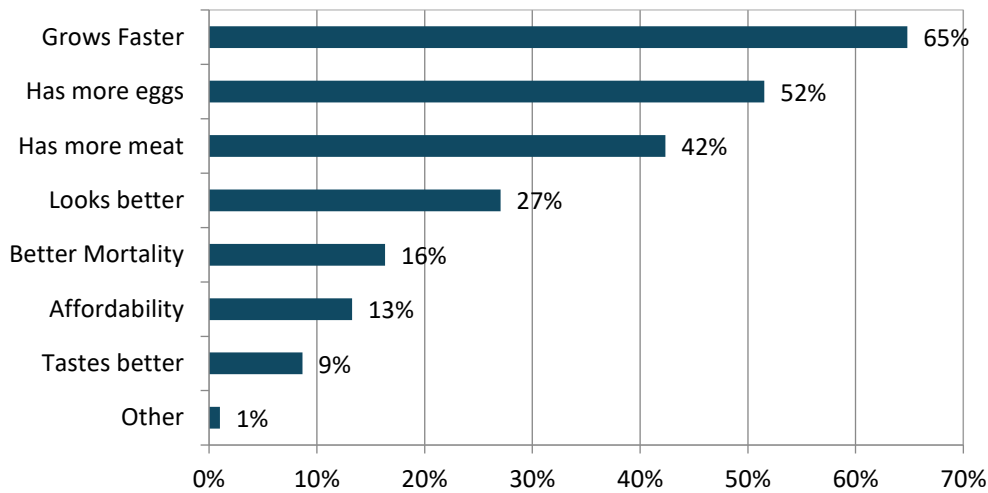
Figure 15: Who influenced you to purchase Sasso?



The percentages do not add up to 100% as respondents could choose more than one answer, unless they indicated nobody. Sample size=197.

Figure 16 below summarizes what customers like about Sasso compared to the local chicken. A large proportion of households like Sasso because of its productivity: it grows quickly (65%), produces more eggs (52%), and has more meat (42%). This finding is not surprising given the many households who cited selling eggs and chickens as their main motivation for keeping Sasso. A small proportion reported liking Sasso's taste (9%) and affordability (13%).

Figure 16: What SHFs like about Sasso

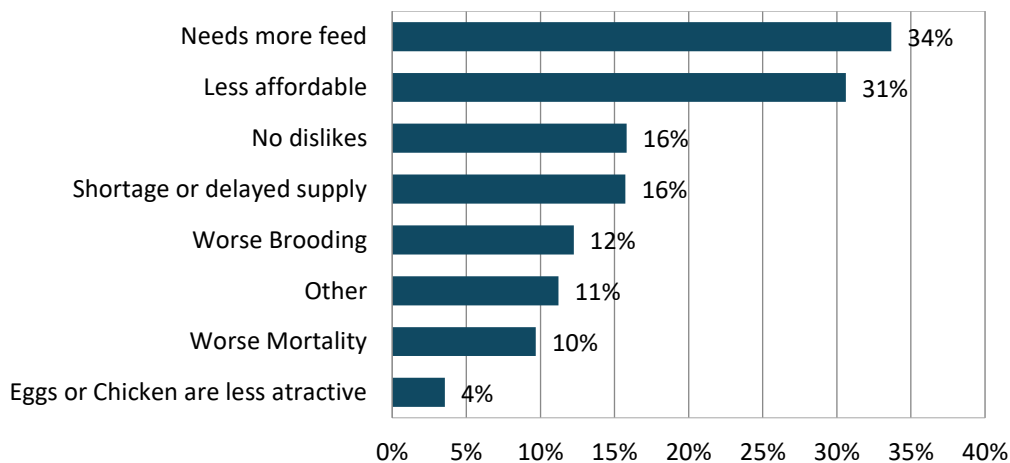


Respondents could select more than one choice. Sample size=197.

Figure 17 below summarize the reasons respondents dislike the Sasso. A major reason cited is that Sasso requires more feed than the local chicken (34%), which indicates that households continue to buy feed for Sassos. Silverlands should therefore remind attendees of sensitization events that an advantage of Sasso is that it forages like the local chicken and should not incur extra feeding costs.

Besides feed, an equally large proportion of respondents perceive Sasso to be expensive (31%). About 16% of the respondents reported that they dislike the shortage or delay in the supply of the Sasso birds. While this challenge is not shared by a majority of customers, and so does not highlight a critical challenge, an understanding of possible supply bottlenecks could be worth further exploration for Silverlands. Although only 12% cite poor brooding, this proportion further confirms that customers may already be hatching Sasso eggs, which is concerning. A small proportion (10%) cite mortality as a dislike, though we did not find Sasso mortality higher than expected in the findings presented above. Nevertheless, we will monitor this dynamic going forward.

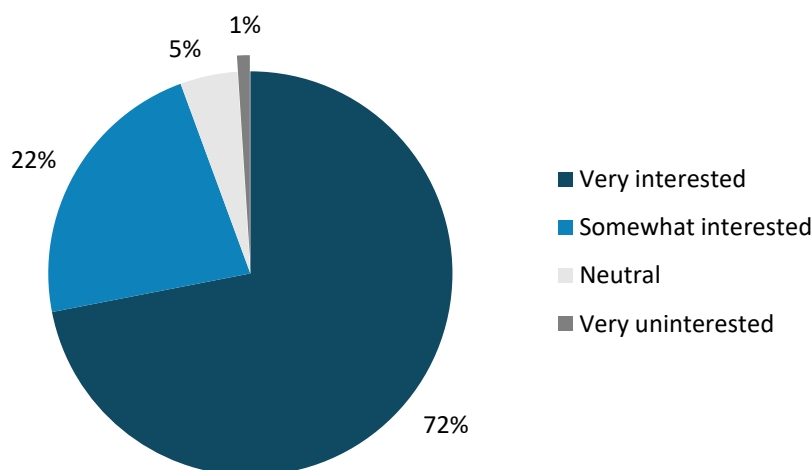
Figure 17: What SHFs dislike about Sasso



Sample size=197.

We also asked respondents how interested they would be in purchasing Sasso in the future, as shown in Figure 18. In general, respondents are satisfied with Sasso: over 90% are interested in purchasing Sasso in the future, with 72% very interested. Only a very small proportion (1%) are very uninterested in purchasing Sasso.

Figure 18: Interest in buying Sasso in the future



Sample size=197.

Net Promoter Score

We also computed the net promoter score (NPS) for Sasso from past and current Silverlands' Sasso customers. The NPS measures satisfaction and loyalty for a product.⁶⁸ The score ranges from -100 to 100 and scores above 0 are generally considered "good" as they imply a larger percentage of promoters than detractors. The East Africa NPS benchmark for businesses of similar model as Silverlands is 49.

The NPS for Sasso chicken is 5.⁶⁹ This score implies that the Sasso has 5% more promoters than detractors, and therefore can be interpreted as a good score. In their Producer Insights report, 60 Decibels calculated an NPS of -1 for Sasso.⁷⁰

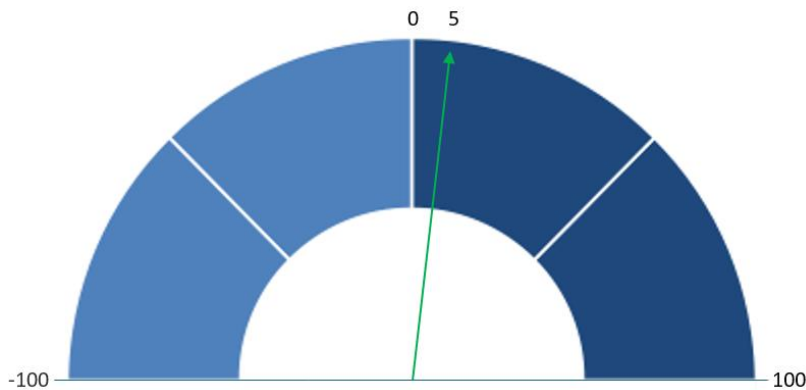
The NPS of 5 can be used as a benchmark to help Silverlands measure changes in customer satisfaction over time. As our Silverlands sample is composed of predominantly first-time purchasers of Sasso (65%), we expect the NPS to increase as SHFs reap the benefits of Sasso ownership.

⁶⁸ The NPS is measured by asking respondents how likely they are to promote a product on a scale of 1-10 (with 10 as most likely). The percentage of detractors (scorers of 1-6) is then subtracted from the percentage of promoters (scorers of 9-10). Therefore, the score ranges from negative 100 (all detractors) to positive 100 (all promoters).

⁶⁹ This value varies by gender. NPS score from female poultry caretakers was -4 (n=148) compared to 33 (n=49) for male poultry care-takers. Given the relatively small sample sizes of customers at baseline, we look forward to revisiting the NPS broken down by gender during our monitoring exercise.

⁷⁰ 60 Decibels' score is based on phone interviews with 172 producers in September 2019. Our score is based on a similar sample size (n=197) spread across the ten regions, and interviewed during November 2019-January 2020.

Figure 19: Net promoter score



Sample size=197.

COMPARING BASELINE RESULTS FROM NIGERIA AND TANZANIA

IDinsight conducted a similar survey for the APMI project in Nigeria from July to August 2019. This section compares baseline results from the two countries in order to inform targeted approaches that will ensure APMI achieves its goal of improving livelihoods in both countries. This section will be shared with APMI stakeholders only.

Demographic characteristics

The average household size in Nigeria is larger than in Tanzania, as shown in Table 17. Each household in Nigeria comprises 6.8 individuals compared to 4.8 individuals in Tanzania. Looking at the primary respondent, females comprise a larger proportion in Tanzania compared to Nigeria (80% vs 60%). As most of the primary respondents are the primary caretakers of poultry, women therefore comprise a large proportion of the primary poultry caretakers in Tanzania compared to Nigeria. In the latter, efforts might focus on encouraging more women to get involved in poultry rearing.

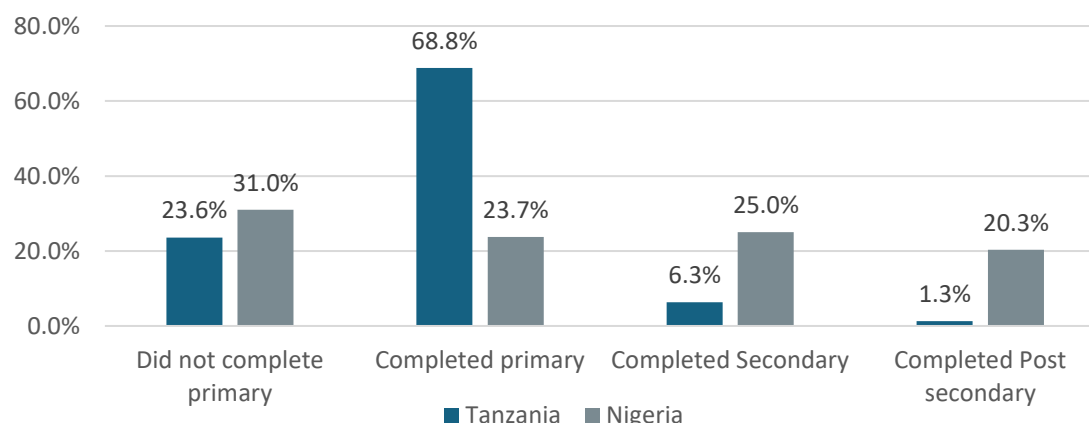
Table 17: Key differences between Tanzania and Nigeria

	Tanzania	Nigeria
Household size	4.8	6.8
% respondents that are female	80%	60%
% HHs with chickens	72%	84%

Tanzania baseline sample=6,057; Nigeria baseline sample=2,246.

Figure 20 below compares educational attainment of the primary respondent in Nigeria and Tanzania. A larger proportion of primary respondents in Tanzania have completed primary education, but a higher proportion in Nigeria have completed secondary and tertiary education.

Figure 20: Education level of primary respondent



Sample sizes: Tanzania=6,057; Nigeria= 2,246.

Flock performance

The majority of households in both Nigeria and Tanzania keep chickens, but a slightly higher proportion in Nigeria keep chickens compared to Tanzania (84% vs 72%).

Table 18 below compares the frequency of different chicken breeds owned in the Nigeria and Tanzania samples, with flock sizes in parentheses. While local chicken breeds are popular in both contexts, a higher proportion of households in Nigeria own other breeds besides the local chicken. For example, 20.3% of households in Nigeria own broilers, compared to 0.3% in Tanzania. A higher proportion of households in Nigeria also own dual-purpose birds (Sasso or Noiler) compared to Tanzania.

The average flock size in Nigeria is slightly larger than the average flock size in Tanzania, driven mainly by higher ownership of commercial breeds in Nigeria. However, the dual-purpose flock size is larger in Tanzania: on average, households own 11.8 Sassos in Tanzania compared to 8.7 Noilers in Nigeria. The local chicken flock sizes are similar across countries.

Table 18: Poultry ownership and mean flock size in Tanzania and Nigeria

Poultry type	Tanzania	Nigeria
Overall	72.0% (15.4)	84.0% (18.0)
Local chicken	99.3% (14.7)	89.8% (13.9)
Layer chicken	0.7% (62.9)	2.6% (72.8)
Broiler chicken	0.3% (34.0)	20.3% (15.3)
Sasso/Noiler	2.9% (11.8)	14.9% (8.7)
Other chicken breeds	0.6% (10.4)	6.5% (7.4)

Percentage has been calculated for all households that own chickens (Tanzania=4,385; Nigeria=1,868). Mean flock size is calculated for households that have at least one of that type of poultry.

Among households whose local chickens have started laying eggs, a higher proportion in Tanzania reported their local chickens laid eggs in the previous 7 days compared to Nigeria (69% vs 46%). The number of eggs produced per household is higher in Tanzania than Nigeria (9.9 vs 7.8), which is consistent with Tanzania's slightly larger local flock size. The number of eggs per mature local hen, though, remains similar in both countries, as shown in Table 19 below.

Table 19: Local chicken productivity in Tanzania and Nigeria

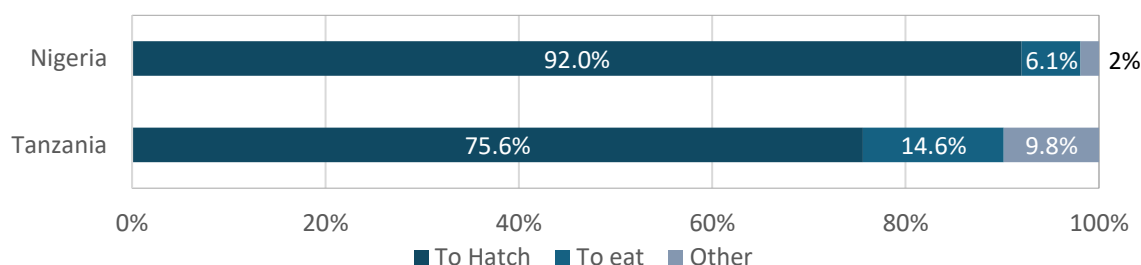
Indicator	Tanzania	Nigeria
% of HHs with local chickens producing eggs	69.4%	45.9%
Average weekly local egg production per HH	9.9 (8.8)	7.8 (6.7)
Average weekly egg production per local chicken⁷¹	2.1 (1.7)	2.1 (1.5)

Standard deviations are reported in parentheses under averages. Sample sizes: Tanzania=1,481; Nigeria=1,139.

The number of eggs produced by local hens does not vary across the poultry caretaker’s gender for both Nigeria and Tanzania.

Figure 21 compares how home-produced local eggs are used across both countries. Although most eggs are hatched in both countries, a higher proportion of households hatch local eggs in Nigeria compared to Tanzania. It appears a higher proportion of households in Tanzania consume or sell the home-produced eggs. If these observations hold for improved breeds, Nigeria may benefit more from emphasizing consumption and sale of eggs from improved breeds.

Figure 21: Uses of home-produced local eggs in Nigeria and Tanzania

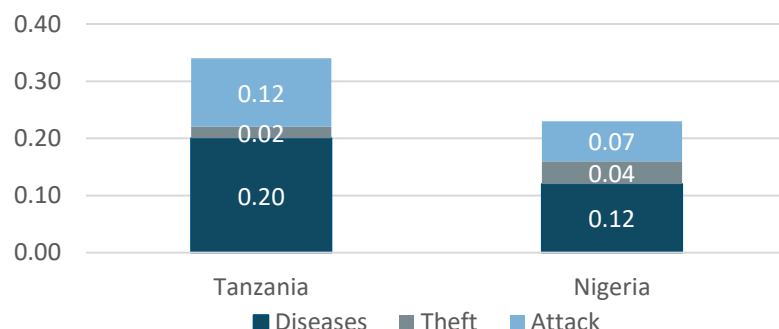


Sample sizes: Tanzania=1,472; Nigeria=522.

We observed a higher mortality rate among local chickens in Tanzania than in Nigeria: in the last six months 34% of chickens were lost in Tanzania, compared to 23% in Nigeria. The mortality rate in both countries is driven mainly by diseases, especially in Tanzania. Figure 22 compares the causes of mortality for local chickens across both countries.

⁷¹ As stated in Table 8, note that this weekly production estimate only includes households with productive flocks (hens over 22 weeks in age). Further, it should not be extrapolated to estimate the yearly egg production per bird through simple multiplication, because it is a snapshot in time that encompasses the average age of birds in the baseline sample and the state of their clutches during baseline data collection.

Figure 22: Causes of mortality for local chickens



Sample sizes for local chicken mortality: Tanzania=4, 336; Nigeria=1,663.

Income

Nearly half of households in Tanzania and nearly three quarters in Nigeria rely on cash crop farming or livestock rearing for their livelihoods. As shown on Table 20, only about a fifth of respondents in both countries are formally employed, earning a monthly salary of approximately \$125.00 in Tanzania and \$88.00 in Nigeria.

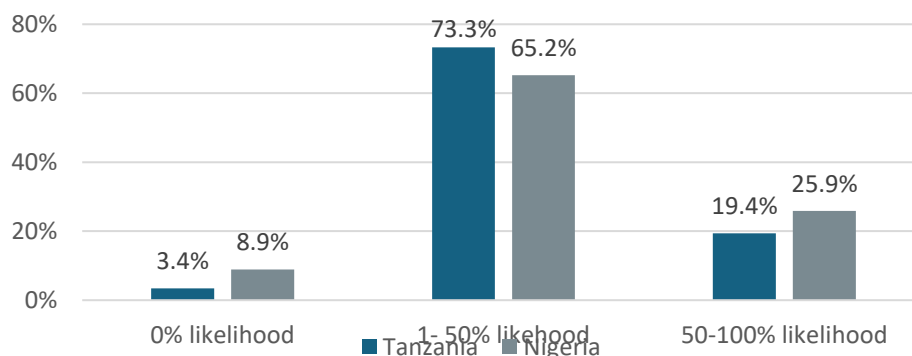
Table 20: Sources of livelihoods in Nigeria and Tanzania

Indicator	Tanzania	Nigeria
% of respondents formally employed	23.8%	21.5%
Average monthly income of employed respondents in last 6 months	\$124.90	\$87.60
% of respondents that participate in cash crop farming	57.7%	79.0%
% of respondents that participate in non-farm businesses	43.0%	71.2%
% of respondents that own other livestock besides chickens	42.5%	79.6%

All outcomes have been calculated for the full baseline sample (Tanzania=6,057; Nigeria=2,246), except monthly income, which has been calculated for only those who are formally employed (Tanzania=1,353; Nigeria=440).

Looking at poverty, a similar proportion of households in both countries is likely to fall below the \$3.10/day poverty line, as shown in Figure 23.

Figure 23: PPI for Nigeria and Tanzania



Sample sizes: Tanzania=6,057; Nigeria=2,246.

Poultry's contribution to household income in both Nigeria and Tanzania is minimal: only 10% of households in Tanzania report that poultry contributes significantly to their household income, compared to 14.5% in Nigeria. In the last 30 days, about 40% of households sold chickens in Tanzania and Nigeria. However, a higher proportion sold eggs in Tanzania compared to Nigeria (7% vs 2.5%).

The average monthly profit from the sale of local eggs and local chickens in both countries was low, but slightly higher in Tanzania than Nigeria (\$3.70 vs \$2.20). Table 21 summarizes the monthly chicken expenditure and income for both countries.

Table 21: Average monthly chicken expenditure and income (in USD)⁷²

Indicator	Tanzania	Nigeria
Average monthly income from local chickens	2.81 Median: 0 (7.56)	1.34 Median: 0 (3.56)
Value of local consumption	7.51 Median: 5.46 (6.84)	8.37 Median: 6.67 (7.36)
Average monthly local chicken expenditure	2.51 Median: 0.51 (5.19)	1.73 Median: 0.28 (4.69)
Estimated local profit	3.70 Median: 1.12 (10.25)	2.22 Median: 0 (6.74)

Standard deviations are in parentheses below medians.

Breaking down chicken expenses, we observe that a higher proportion of households spend money on feed and vaccines in both countries. However, in terms of costs, households spend the most on feed and chicken transport expenditure in both countries. On average, households in Nigeria spend slightly more than households in Tanzania on feed, transport, and vet costs. Households in Tanzania on the other hand spend slightly more on vaccines and infrastructure, as shown in Table 22 below.

⁷² We calculate expenditure and revenue for SHFs that own only local chickens to account for the potential differences in expenditure across breeds. Averages for all SHFs that own chickens regardless of breed composition can be found in Appendix A.

Table 22: Monthly expenses in Tanzania and Nigeria (USD)

Indicator	Tanzania	Nigeria
Average monthly feed expenditure	2.31	3.08
	(4.92)	(3.41)
	42.8%	42.5%
Average monthly chicken transport expenditure	2.51	3.97
	(2.78)	(10.8)
	1.2%	4.2%
Average monthly vaccine expenditure	0.63	0.46
	(0.72)	(0.83)
	42.4%	24.2%
Average monthly vet expenditure	0.63	0.75
	(0.86)	(1.33)
	5.3%	7.9%
Average monthly infrastructure expenditure	2.27	1.23
	(3.07)	(1.23)
	0.9%	1.2%

Standard deviations are in parentheses below averages. Percentage of households that incur the expense are under standard deviations and have been calculated for all households that only own local chickens (Nigeria=1,868; Tanzania=4,353). Means have been calculated for households that incur the particular expenditure.

Nutrition

Table 23 compares dietary diversity in both countries. A lower proportion of women in Tanzania meets the MDD threshold compared to Nigeria (38% vs 57%). Similarly, a lower proportion of children under 5 in Tanzania meets the MDD threshold compared to Nigeria (19% vs 28%).

As shown in the table, chicken consumption is comparatively low in both Tanzania and Nigeria. However, the proportion of women and children consuming eggs is higher in Nigeria. In both countries, promotional campaigns aimed at improving consumption of these foods could have large impacts. For example, for about a quarter of women who missed the MDD by one food group, consuming eggs or poultry would add sufficient diversity to their diet to meet the MDD bar. For children, 17.5% in Nigeria and 26.1% in Tanzania would meet the MDD bar if they added eggs or chicken to their diet.

Table 23: Dietary diversity in Tanzania and Nigeria

Indicator	Tanzania	Nigeria
% of women that meet MDD	37.5%	57.1%
% of children u5 that meet MDD	19.0%	27.8%
% of women that consumed chicken	2.2%	3.0%
% of children u5 that consumed chicken	1.6%	2.7%
% of women that consumed eggs	3.6%	10.7%
% of children u5 that consumed eggs	3.7%	9.6%
% women that would meet MDD if consumed eggs or chicken	27.8	26.7%
% children u5 that would meet MDD if consumed eggs or chicken	26.1%	17.5%

Sample sizes, women: Tanzania=5,645; Nigeria=2,136. Sample sizes, children under 5: Tanzania=2,480; Nigeria=1,191.

Grains, tubers, and roots were the most consumed food group in both countries. Meat, poultry, and fish remain the most important source of protein in both countries as well. The least consumed food group differed: vitamin A-rich foods in Nigeria and eggs in Tanzania. In addition to increasing consumption of poultry products in both countries, consumption of vitamin A-rich vegetables or fruit in Nigeria may further improve dietary diversity.

Women's empowerment

In general, women in Tanzania appear more empowered than women in Nigeria (86% vs 69%), although men are more empowered than women, with similar proportions of men empowered in both countries. In the poultry value chain, men in both countries are more empowered than women.

A higher proportion of households in Tanzania meet the gender parity index compared to Nigeria, meaning only 66% of women in Nigeria enjoy gender parity with the primary male in the household, compared to 86% in Tanzania.⁷³

Table 24: Women empowerment in Tanzania and Nigeria

Indicator	Tanzania	Nigeria
Proportion of Women Empowered (3DE)	85.5%	69.3%
Proportion of Men Empowered (3DE)	88.0%	86.2%
Proportion of HHs that meet Gender Parity (GPI)	86.3%	65.8%

Sample sizes: Tanzania=4,619; Nigeria=1,936.

⁷³ The proportion of households meeting gender parity in Tanzania is however just slightly higher than households meeting gender parity in Southwest Nigeria (86.3% vs 80.7%). North Nigeria is more conservative and has a lower proportion of households with gender parity at 50.4%.

RECOMMENDATIONS FOR SILVERLANDS

Most of home-produced local eggs (76%) are used for hatching. Field teams should encourage Sasso customers to consume home-produced Sasso eggs and sell any surplus, so that households may reap the nutrition and income benefits of Sasso ownership

A significant proportion of households (23%) purchased Sasso with the intention of hatching eggs. Silverlands field teams should continue discouraging households from hatching Sasso eggs as this would make the breed lose its unique qualities.

A major complain of Silverlands customers was that Sasso chickens consume a lot feed. Silverlands could remind households that Sasso can forage, and therefore households need not spend a lot of money on feed.

Another big complain from Sasso customers was that Sasso chickens are expensive. Silverlands can encourage households to start with smaller flock sizes and increase flock size over time as they get more money from Sasso sales.

Although the NPS for Sasso is currently low, Silverlands can use the score as a benchmark to track changes in customer satisfaction over time.

CONCLUSION

This report presents a summary of the socio-demographic characteristics and baseline levels of outcome indicators (flock performance, income, nutrition, and women's empowerment) in our study population. Key findings across these four outcome indicators are summarized below.

Income: In general, SHFs in our study sample are poor and rely predominantly on agriculture as a primary source of income. Access to Sasso chickens could impact SHF income through the increased sale of poultry products due to increased poultry outputs. As most SHFs rely on agricultural income, especially cash crops, Silverlands could encourage MUs to sell even smaller flock sizes during periods of low liquidity to ensure people can afford to purchase Sasso.

Flock performance: The report does not include findings on Sasso productivity as all Sasso chickens owned by SHFs in the sample are young. However, we share findings on local chicken productivity to understand the benchmark to which Sasso productivity will be compared. We find that about 69% of households with local chickens reported their chickens laid eggs in the previous 7 days, producing on average of 9.9 eggs. The majority of these households planned to hatch their local eggs. The overall mortality was high, driven by high mortality among local chickens (34%). Looking at gender and egg production, we do not find any evidence that gender is correlated with egg production.

Nutrition: Over 60% of women and 80% of children in our sample do not meet the minimum dietary diversity (MDD) threshold. Furthermore, poultry consumption in these groups is very low, with less than 4% reporting any consumption of chickens and eggs in the last 24 hours. If children and women missing the MDD threshold by one food group were to eat eggs or chicken, 26% more children and 28% more women would meet the MDD threshold. This highlights the potential impact that increased access to poultry products through Sasso ownership could have on nutrition for both women and children.

Women's empowerment: The majority of women in our sample are considered empowered, but less so than men in productive decisions, use of income, and asset ownership. In the poultry value chain, we find that male poultry caretakers are more empowered than female ones, especially in their involvement in rearing and ownership of chickens. As most of the primary poultry caretakers in our sample are women, Sasso ownership may help improve women's input in rearing and ownership decisions, especially over time as Sasso sales improve household income.

We also provide a snapshot of **Silverlands' current customer base** in the report. The majority of respondents report they will likely purchase Sasso in the future: only 1% report being very uninterested, which is promising. We found a net promoter score of 5 for Sasso, which indicates slightly more promoters than detractors, and can be used as a benchmark to measure changes in customer satisfaction over time. Customers reported liking the Sasso because of its productivity: it grows quickly, produces more eggs, and has more meat. The main complaints from farmers are that Sossos are expensive and consume a lot of feed. Silverlands could educate households on how to raise Sasso so they do not incur extra costs from feed. Furthermore, Silverlands could encourage households to start with smaller flock sizes, as this may be more affordable, and increase flock size as household incomes increase.

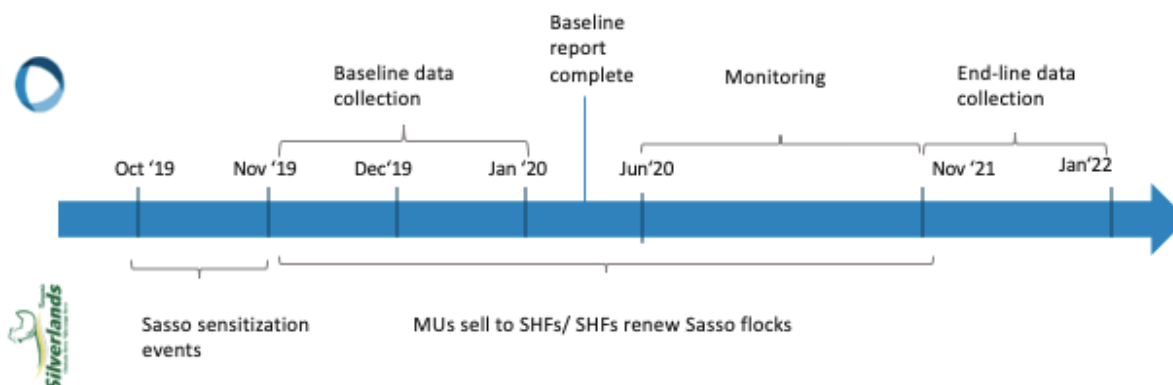
Silverlands field teams should also continue discouraging SHFs from hatching Sasso eggs, as about 23% reported hatching as a motivation for purchasing Sasso. Hatching Sasso eggs may reduce the quality of the product and hence impact flock performance.

Finally, we **compare results from Tanzania and Nigeria** baseline surveys. Compared to Nigeria, a higher proportion of Tanzanian households with local chickens reported their chickens laid eggs in the last 7 days. The number of eggs laid per households was also higher in Tanzania compared to Nigeria. Looking at nutrition, a higher proportion of women and children meet the minimum dietary diversity in Nigeria compared to Tanzania. On empowerment, women in Tanzania are more empowered than women in Nigeria. However, men are more empowered than women in both countries, in general and in the poultry value chain.

NEXT STEPS

Monitoring: IDinsight is developing a monitoring protocol in collaboration with Silverlands. This protocol will outline the various monitoring activities IDinsight will conduct between now and endline data collection to ensure that control communities do not receive access to Sasso, and prospective buyers in treatment communities are converted to actual buyers with continuous access to Sasso. IDinsight plans to commence monitoring activities in approximately June 2020, depending on how the COVID-19 pandemic unfolds in Tanzania. Initial monitoring activities will be conducted remotely, primarily in the form of phone surveys.

Figure 24: APMI Tanzania timeline



Matching: Following confirmation that prospective buyers have purchased Sasso, we will match treatment SHFs with control SHFs based on various baseline characteristics.⁷⁴

Comparisons between prospective and converted buyers: As more prospective buyers become actual buyers, we will begin to compare differences between actual buyers, and those prospective buyers who do not purchase Sasso, to help us better predict who will buy.

Endline: We aim to commence endline data collection near the end of 2021.⁷⁵

⁷⁴ See the Pre-Analysis Plan for more details on the matching procedure.

⁷⁵ This timeline could change due to disruptions related to COVID-19 or stakeholder suggestions to conduct endline at the same time of the year as the baseline.

APPENDIX A: SUPPLEMENTAL FINDINGS

APPENDIX A-I: DEMOGRAPHICS

In the main report, we reported the types of livestock owned by the entire baseline sample. Table 25 summarizes the types of livestock owned by our sample by zone. Goats are the most common across all three zones, owned by 41% of SHFs in the South, 62% in the North, and 47% in the Central zone. The second most popular livestock owned are pigs in the South, milking cows in the North, and other poultry (e.g. turkey, duck) in the Central zone, as shown in bold.

Table 25: Livestock owned by zone

Livestock	Total	South	North	Central
Non-chicken poultry	15.8%	13.6%	12.2%	30.7%
Goats	49.6%	40.9%	61.8%	47.3%
Sheep	10.7%	1.8%	23.4%	7.9%
Donkeys	2.0%	0.2%	3.9%	2.2%
Milking Cows	38.8%	27.1%	58.7%	27.8%
Bulls	7.8%	6.2%	10.2%	7.1%
Oxen	7.3%	9.3%	2.8%	11.8%
Rabbits	4.6%	5.8%	2.8%	5.4%
Pigs	21.5%	32.4%	7.6%	20.9%
Other	2.3%	4.1%	0.4%	0.7%

Sample sizes: Total=2,572; South=1,224; North=945; Central=406.

While in the survey we ask about household's livestock ownership as shown above, we disaggregate this ownership further by whether the household is female-headed or male-headed. We define male or female-headed households as households where the primary respondent is the main household head and is not married (divorced, widowed, or never married). Table 26 summarizes ownership for these two types of households. Except for sheep, the proportions of male-headed and female-headed households that own the various types of livestock are similar. Female-headed households are more likely to own sheep compared to male-headed households ($p=0.04$), though note that these sample sizes are very small.

Table 26: Livestock ownership in male-headed and female-headed households

Livestock	Female-headed	Male-headed
Non-chicken poultry	16.4% (n=51)	10.5% (n=9)
Goats	49.5% (n=154)	47.7% (n=41)
Sheep	9.0% (n=28)	2.3% (n=2)
Donkeys	2.6% (n=8)	0% (n=0)
Milking Cows	28.6%(n=89)	25.6% (n=22)
Bulls	5.5% (n=17)	3.5% (n=3)
Oxen	3.5%(n=11)	5.8% (n=5)
Rabbits	6.8% (n=21)	3.5% (n=3)
Pigs	23.5%(n=73)	20.9% (n=18)
Other	1.6%(n=5)	1.2%(n=1)

Sample sizes: Female-headed= 311; male-headed=86.

We previously provided a table of cash crops grown by our baseline sample. In Table 27 we provide a breakdown of cash crops grown by zone. The most popular cash crop varies across zones: in the South, most households cultivate cashew nuts; in the North most households cultivate maize; and in the Central zone most households cultivate groundnuts and sunflowers. As the primary cash crops in these zones have different harvest seasons, the optimal distribution of Sasso chicks should coincide with when the main cash crop has been harvested and households have more disposable income.

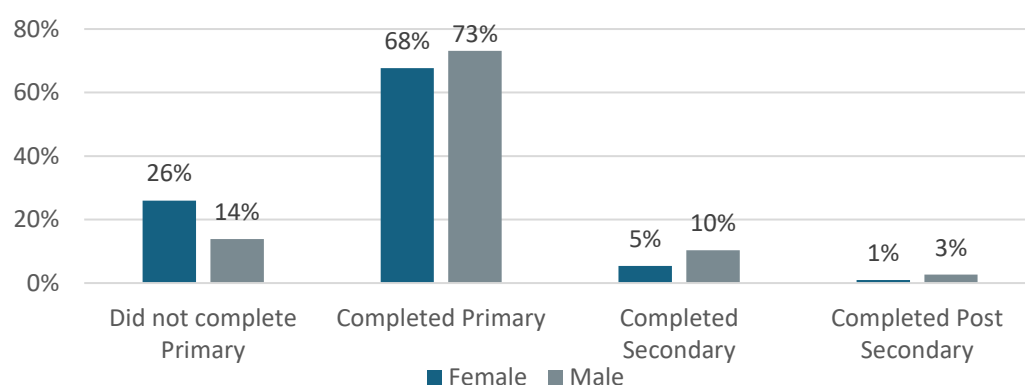
Table 27: Primary cash crops by zone

Crop	Total	South	North	Central
Cassava	2.6%	2%	7%	1%
Rice	8.4%	8%	10%	8%
Maize	15.6%	14%	26%	13%
Soybeans	3.4%	5%	2%	0%
Yams	1.9%	2%	2%	0%
Groundnuts	7.6%	3%	2%	25%
Pulses	4.4%	4%	3%	6%
(Red/white) beans	5.3%	7%	4%	3%
Sunflowers	5.8%	1%	2%	22%
Cashew nuts	15.6%	25%	0%	0%
Sesame	8.1%	11%	0%	5%
Tomatoes	3.8%	2%	6%	6%
Potatoes	3.2%	5%	2%	0%

Sample sizes: Total=3,492; South=2,133; North=616; Central=743. Proportions have been rounded up to the nearest 1%; percentages above that are 0% were less than 0.5% and were therefore rounded down.

As reported previously, the majority of our primary respondents have completed primary education. Figure 25 below shows the breakdown of the main respondent's education by gender. A larger proportion of men have completed higher levels of education compared to women. For example, the proportion of men who completed secondary school is almost twice as high as the proportion of women. Lower levels of education among women, who are the majority of the poultry caretakers in our sample, may affect chick management practices and therefore the perceived productivity of Sasso.

Figure 25: Gender breakdown of main respondent's education



Total sample size=6,057.

APPENDIX A-II: CHICKEN OWNERSHIP

In the main report, we summarized breeds owned across the entire sample, and provided a breakdown of chicken ages. In this section we look at breed ownership and chicken ages broken down across zones. We also show proportions of households reporting non-laying periods for local hens.

Table 28 below shows the types of chicken breeds owned by households in the different zones, including the proportion of households that own these chickens. Among the three zones, the North has the highest proportion of chicken owners (77%) while the Central zone has the lowest proportion (66%). The North zone is a bustling economic region, which might drive demand for chicken products. The Central zone on the other hand has the highest of proportion of households with a greater than 50% likelihood of living under \$3.10/day. Of all the zones, the Central zone also records the lowest monthly salary made by households, which is about 30% less than what is earned in other zones.

In terms of breed ownership, the vast majority of households (~99%) in all zones own the local breed, with the flock size varying minimally across zones. About 5% of households own Sasso in the South, and about 1% in the North and Central zones. The Sasso flock size ranges from 3 in the Central zone to a high of 35 in the North zone. This high Sasso flock size in the North is especially encouraging for Silverlands.⁷⁶ As Sasso is rated by Sasso households as preferable to local chickens, we hope that over time a majority of treatment households will replace their local stock with Sasso.

Table 28: Proportion of breeds and size of flocks owned per zone

Breed	Total Sample		South		North		Central	
	% Own	Avg. if own	% Own	Avg. if own	% Own	Avg. if own	% Own	Avg. if own
Any	72.0%	15.4	72.2%	15.9	77.1%	15.4	66.4%	15.1
Local	99.3%	14.7	99.4%	15.3	98.8%	14.4	99.7%	13.7
Sasso	2.9%	11.8	4.5%	9.5	1.1%	35.4	1.3%	3
Broiler	0.3%	34.0	0.4%	11.6	0.4%	61.2	0.1%	100
Layer	0.7%	62.9	0.4%	52.4	1.3%	25.1	0.5%	250
Other	0.6%	10.4	0.6%	5.3	0.9%	17.4	0.3%	1.5

Sample sizes: Total=4,375; South=2,311; North=1,269; Central=795.

Table 29 below provides a further breakdown of breed ownership in female-headed and male-headed households (where the primary respondent does not have a spouse). Ownership of specific breeds is similar across female-headed and male-headed households, though note that the sample sizes are very small.

⁷⁶ Given the small number of households owning Sasso in the North (n=14), this flock size may not be representative of Sasso flock sizes in the North.

Table 29: Breed ownership for male-headed and female-headed households

Breed	Female-headed		Male-headed	
	% Own	Avg. if own	% Own	Avg. if own
Any	63.8%	12.5 (n=607)	46.7%	15.0 (n=147)
Local	99.5%	11.8 (n=604)	100%	14.6 (n=145)
Sasso	3.3%	3.1 (n=20)	1.3%	1.5 (n=2)
Broiler	0.2%	30.0 (n=1)	0.0%	0.0 (n=0)
Layer	0.7%	83.0 (n=4)	0.7%	3.0 (n=1)
Other	0.8%	5.6 (n=5)	0.7%	50.0 (n=1)

Sample sizes: Female-headed=952; Male-headed=315. The numbers used for calculation of the averages are in parentheses.

Investigating the local and Sasso breeds further, we find that households have a variety of age groups among these breeds. Local chicken owners in general have more chicks and mature chickens and fewer growers. Sasso owners on the other hand mostly have chicks and growers, which is reflective of our Sasso purchasers being first-time buyers.

Table 30: Distribution of ages for local and Sasso chickens

		Breed	Total	South	North	Central
Chicks		Local	4.8	4.7	4.6	5.0
		Sasso	2.3	1.4	10.7	0.0
Growers	Cocks	Local	1.6	1.8	1.5	1.3
		Sasso	4.0	2.2	19.7	0.7
	Hens	Local	2.4	2.6	1.9	2.3
		Sasso	4.0	4.2	4.4	1.7
Mature	Cocks	Local	1.5	1.6	1.5	1.3
		Sasso	0.2	0.2	0.1	0.3
	Hens	Local	4.5	4.6	4.9	4.0
		Sasso	1.3	1.5	0.5	0.3

Sample sizes: Total (Local)=4,337; South=2,287; North=1,258; Central=792. Total (Sasso)=129; South=105; North=14; Central=10.

In general, households that own chickens have more hens than cocks. This trend is observed in all zones and with both breeds, except in the North where Sasso owners have more cocks than hens. When we consider local chickens that are currently productive, a small proportion have stopped laying eggs for a period exceeding five consecutive days (~6%). This proportion varies across zones, with about 1% in the Central zone and up to 10% in the North zone.

Table 31: Proportion of households whose local chickens have stopped laying eggs for more than 5 consecutive days

	Total	South	North	Central
Local chicken stopped laying eggs for >5 consecutive days	6.1%	4.8%	10.4%	1.0%

Sample size: Total=1,456; South=777; North=479; Central=200.

APPENDIX A-III: DIFFERENCES IN EGG PRODUCTION AND CHICK CARE BY CARETAKER GENDER

In the main text, we reported egg production for local chickens regardless of the poultry caretaker's gender. In this section, we investigate whether there is a difference in egg production depending on the gender of the primary caretaker of poultry. We also explore chick care and management practices disaggregated by caretaker's gender. Any observed differences might inform gender-tailored messaging around topics of poultry management.

Gender and egg production

First, we start by comparing the average number of eggs produced by local chickens in the last 7 days for male and female poultry caretakers.⁷⁷ We conduct this means comparison for the full sample, as well as at the zone level.

We find evidence that the gender of the poultry caretaker is correlated with egg production. Local chickens of female poultry caretakers produce an average of 1.7 fewer eggs per week than those of male poultry caretakers. This difference is statistically significant at 5%.

The correlation of gender and egg production varies across zones: female poultry caretakers in the South produce significantly fewer eggs (1.8, p-value <0.01) compared to male poultry caretakers. In the Central and North zones, female poultry caretakers produce 0.2 more eggs and 2.7 fewer eggs respectively compared to male caretakers, but these differences are not statistically significant.

In a next step, we explore whether the observed difference in egg production for smallholders in the South region are driven by gender or other reasons, such as differences in chick care practices. To assess this difference, we conduct multivariate regression analysis that, in addition to caretaker gender, controls for variables such as expenses (feed, vet, vaccines), time spent on chicken activities (time feeding, time cleaning coops) and number of mature female hens.⁷⁸ Table 32 below summarizes the findings from the regression of egg production against gender and chick care and management practices.

When we condition on chick care, expenses, and number of hens, we observe that the estimated difference in egg production across caretaker gender is no longer statistically significant.

⁷⁷ This mean comparison is implemented through regression analysis: the outcome is regressed on a dummy variable "gender" (1 if female, 0 if male) and standard errors are clustered at the village level to account for the sampling design.

⁷⁸ Expense variables are defined to take value 1 if the SHF reports spending on the expense, 0 if the SHF does not report spending on the expense. Time variables take value 1 if the SHF reports spending more than 30 minutes on the activity, 0 if the SHF reports spending less than 30 minutes on the activity. In addition, the time intervals for feeding chickens is per week and for cleaning coops is per day.

Spending on vaccines is positively associated with egg production: households that spend money on vaccines for local chickens produce on average 0.7 eggs more than households that do not spend on vaccines ($p < 0.1$). This association seems plausible as vaccines keep diseases, which affect egg production, at bay. The added advantage from using vaccines is especially notable in the North, where households that spend on vaccines produce 1.5 eggs more than households that do not spend on vaccines.

Egg productivity is also positively correlated with number of mature hens, which is unsurprising: keeping other factors constant, each additional hen produces an extra 0.7 eggs. This difference is statistically significant at the 1% level.

Table 32: Egg production regression

Variables	(1) Full Sample	(2) Full Sample Control s	(3) South	(4) South Controls	(5) North	(6) North Controls	(7) Central	(8) Central Controls
Female caretaker	-1.672** (0.687)	-0.517 (0.509)	1.846*** (0.701)	-1.717 (0.601)	-2.746 (1.829)	-1.527 (1.143)	0.239 (1.337)	0.574 (1.263)
Spent on feed		0.673 (0.445)		0.445 (0.449)		0.328 (1.013)		0.407 (1.184)
Spent on vet		1.223 (1.140)		1.623 (1.291)		0.249 (2.318)		-0.0589 (2.569)
Spent on vaccines		0.694* (0.388)		0.597 (0.470)		1.512* (0.777)		0.560 (1.164)
Time feeding chickens		1.494 (1.143)		0.992 (1.491)		2.260 (1.865)		-2.096 (2.953)
Time cleaning coops		-0.547 (0.537)		0.427 (0.791)		-1.574* (0.786)		-2.264 (1.953)
Number of mature hens		0.677*** (0.103)		0.519*** (0.0756)		0.840*** (0.176)		0.696*** (0.154)
Constant	11.20** (0.622)	4.991*** (0.664)	10.52*** (0.655)	5.688*** (0.688)	13.43*** (1.627)	5.503*** (1.213)	9.561*** (1.127)	4.685*** (1.232)
Observations	1,473	1,473	783	783	489	489	201	201
R-squared	0.006	0.053	0.011	0.046	0.009	0.059	0.000	0.0071

Standard errors (clustered at the community level) are included in parentheses. P-value is indicated using stars: * < .1; ** < 0.05; *** < 0.01.

In Table 33 below we explore the gender and chick care practices that may be associated with egg production. We also summarize local flock size and number of mature local hens by gender. A higher proportion of male poultry caretakers compared to females appear to spend on vaccines, vet and feed expenses in general. However, these differences are not statistically significant. Similar proportions of male and female poultry caretakers seem to spend time on chicken activities. Only spending on vaccinations is positively associated with egg production. This finding might suggest a potential to improve egg production by promoting spending on vaccinations, especially to female primary poultry caretakers. Male poultry caretakers on average have more local chickens and local hens compared to female poultry care takers. These findings are for local chickens, but similar patterns might be observed for Sasso.

Table 33: Factors associated with differences in egg production by gender⁷⁹

Indicator	Full Sample		South		North		Central	
	Women	Men	Women	Men	Women	Men	Women	Men
Vaccines	71%	75%	70%	77%	69%	72%	77%	72%
Feed expense	45%	48%	32%	40%	63%	71%	47%	42%
Vet expenses	14%	17%	11%	18%	17%	16%	14%	14%
Infrastructure expenses ⁸⁰	2%	4%	3%	6%	1%	2%	1%	2%
Feed time	6%	6%	4%	3%	11%	11%	3%	6%
Cleaning time	19%	19%	15%	15%	29%	30%	8%	17%
Local flock size	14.1	17.1	14.6	17.4	14.0	16.1	13.0	17.5
Local mature hens	4.4	5.2	4.4	5.2	4.7	5.7	3.8	4.7

The average for local flock size and local mature hens is calculated for households with local chickens (n=4,353). The sample size for vaccines is 2,575.

APPENDIX A-IV: POULTRY INCOME

Poultry's contribution to income

In the main text, we reported that about 40% of households sold local chickens in the last 30 days, earning an average profit of \$3.70 from poultry sales. In this section we present respondents' perceptions of the role of poultry in household income, location of sale of chickens, and expenses and profit from all chicken breeds.

Table 34 below summarizes household perceptions of the contribution of poultry to household income. For households that own chickens (n=4,385), the most common perception (~29%) is that poultry contributes minimally to household income. About a sixth of households report that poultry contributes somewhat to their income. For about 13% of households, poultry contributes moderately to their income, and for another 10% poultry contributes significantly to household income. It is encouraging to note that there are no households for which poultry does not contribute to the household income.

Table 34: Poultry contribution to total HH income

	Total	South	North	Central
Significantly (>50% of total HH income)	10.0%	10.5%	10.1%	8.3%
Moderately (25% to 50% of total HH income)	13.4%	14.1%	12.6%	12.7%
Somewhat (10% to 25% of HH income)	17.5%	17.5%	17.2%	17.7%
Minimally (<10% of total HH income)	29.3%	26.2%	33.0%	32.4%
None (0%)	0.0%	0.0%	0.0%	0.0%

Sample sizes: Total=4,385; South=2,302; North=1,264; Central=786.

⁷⁹ Only the amount spent on feed and vaccines varied significantly by the gender of primary poultry caretaker (p<0.005). Male poultry caretakers on average spend more than female poultry caretakers.

⁸⁰ A significantly higher proportion of male than female poultry caretakers spends on infrastructure.

Sale location for chickens and eggs

Households that sell chickens and eggs generally sell them in their own communities (80% for chickens and 70% for eggs). This high proportion of households selling in their own communities is encouraging as it reduces transportations costs incurred in sales. A potential downside of marketing in their own communities is a likelihood of flooding the market should large numbers of SHFs sell in the same community. Surplus of chickens and eggs in the local market is something to be aware of, as poultry incomes would be impacted if households are unable to sell or sell their chickens for low prices.

Table 35: Location where local chickens and eggs are sold

Location	Total Sample	South	North	Central
% that sold chicken in local market (Local)	24.2%	18.3%	39.0%	39.2%
% that sold chicken in own community (Local)	80.3%	85.0%	70.1%	70.3%
% that sold chicken elsewhere (Local)	0.2%	0.0%	0.2%	0.2%
% that sold eggs in local market (Local)	35.8%	25%	43.7%	23.1%
% sold eggs in own community (Local)	70.4%	78.8%	64.9%	76.9%

Sample sizes for sold chickens: Total=1,865; South=980; North=498; Central=387. Sample sizes for sold eggs: Total=257; South=80; North=151; Central=26.

Chicken income and expenditures for all breeds

In the main text, we provide income and expenditure values for local chickens. Tables 36 and 37 also summarize the average monthly income and expenditure for all chickens, regardless of breed composition. The average monthly income from local chickens as shown below is TZS 6,463, and does not vary much across zones.⁸¹

⁸¹ We report revenue and value of consumption for local chickens only as we excluded productive Sasso from our baseline sample and did collect egg and chicken sale for commercial birds.

Table 36: Average monthly chicken expenditures and income

Indicator	Total Sample	South	North	Central
Average monthly revenue from local chickens	6,463	6,459	6,655	6,166
	Median: 0	Median: 0	Median: 0	Median:0
	(17,378)	(17,266)	(19,732)	(13,215)
Value of local consumption⁸²	17,274	17,656	16,125	18,115
	Median: 12,568	Median: 13,852	Median: 10,272	Median: 10,272
	(15,737)	(15,395)	(13,643)	(20,236)
Average monthly chicken expenditure	5,762	4,299	8,761	5,184
	Median: 1,167	Median: 500	Median: 4,000	Median: 1,000
	(11,940)	(10,712)	(13,776)	(11,255)
Estimated chicken profit	8,027	10,123	4,793	7,141
	Median: 2,333	Median: 4,301	Median: 0	Median: 1,750
	(24,061)	(23,932)	(25,240)	(21,816)

Standard deviations are in parentheses below medians. Sample sizes for expenditure, revenue, and profit: Total=4,385; South=2,340; North=1,293; Central=816. Sample sizes for value of local chickens consumed: Total=1,901; South=1,064; North=558; Central=279.

Table 37 below shows the common expenditures households paid for in the last month. The figures are in Tanzanian shillings. Transporting chickens and eggs to the market was the highest expense for SHFs, followed by feed for chickens and finally coop improvements.

⁸² This is the monetary amount of local chickens and eggs consumed by households (in the last 30 days) valued at the average price of eggs and chickens received by those who report to have sold

Table 37: Monthly chicken expenses in Tanzania shillings

Indicator	Total Sample	South	North	Central
Average monthly feed expenditure⁸³	5,309	3,905	8,166	4,604
	(11,309)	(10,292)	(13,000)	(10,195)
	Median: 0	Median: 0	Median: 4,000	Median: 0
	42.8%	31.4%	62.2%	44.6%
Average monthly chicken transport expenditure	5,782	5,878	6,615	3,400
	(6,400)	(4,261)	(7,971)	(3,064)
	Median: 4,000	Median: 4,000	Median: 5,000	Median: 3,000
	1.2%	0.6%	2.1%	1.3%
Average monthly vaccine expenditure	1,440	1,393	1,416	1,629
	(1,657)	(1,487)	(1,598)	(2,175)
	Median: 1,000	Median: 1,000	Median: 1,000	Median: 1,000
	42.4%	42.9%	43.3%	39.7%
Average monthly vet expenditure	1,445	1,255	1,590	1,666
	(1,974)	(1,261)	(2,151)	(3,115)
	Median: 833	Median: 875	Median: 833	Median: 833
	5.3%	4.7%	7.2%	4.3%
Average monthly infrastructure expenditure	5,220	5,458	2,312	10,583
	(7,063)	(6,719)	(2,738)	(15,458)
	Median: 2,500	Median: 3,333	Median: 1,167	Median: 3,333
	0.9%	1.3%	0.6%	0.4%

Standard deviations are in parentheses below averages. Percentage of households that incur the expense are under standard deviations and have been calculated for all households that only own chickens (n=4,385). Means have been calculated for households that incur the particular expenditure.

When expenses are disaggregated by chicken breed, and value of consumption accounted for, households with local chickens made, on average, a profit of TZS 8,520 (~\$3.70) per month.⁸⁴

APPENDIX A-V: DIETARY DIVERSITY

To further understand dietary diversity for children under 5 years, we investigated the minimum dietary diversity (MDD) of children aged 6-23 months and 2-5 years. The low MDD for children under 5 is mostly driven by lower proportion of children under 2 meeting the MDD: only 14% of

⁸³ Only median feed expenses vary significantly across zones (p<0.005).

⁸⁴ Due to monthly chicken expenditure encompassing all chickens, estimated local chicken expenditure was calculated by taking the proportion of local chickens in SHFs' flock size and multiplying this figure with the total expenses. This estimated expenditure was then subtracted from local chicken revenue to calculate an estimated profit.

children under 2 meet the MDD threshold compared to 22% of children. The proportion under 2 meeting the MDD is lower than the 26% reported by DHS. This may be due to the majority of children under 2 (85%) having been breastfed the previous day.

Table 38: Minimum dietary diversity for children 6 months - 5 years

Indicator	Total Sample	South	North	Central
Children 6-23 months MDD	14.1%	13.4%	22.3%	4.7%
Children 6-23 months still breastfeeding	84.5%	81.1%	86.5%	90.4%
Children 2-5 years MDD	22.4%	26.1%	26.7%	8.2%

Sample sizes for children 6-23 months: Total=1,007; South=551; North=265; Central=191. Sample sizes for children 2-5 years: Total=1,473; Southwest=766; North=389; Central=318.

As seen in Table 39, similar to the findings for women, the food group most consumed by children 6-23 months is grains, roots, or tubers, and the least consumed food group is eggs. Meat, poultry, or fish appears to be the most important source of protein for children 6-23 months.

Table 39: Food groups consumed by infants 6-24 months

Food Group	Total	South	North	Central
Grains, roots or tubers	94.4%	94.4%	95.1%	93.7%
Pulses	27.6%	29.6%	27.2%	22.5%
Green, leafy vegetables	28.8%	32.3%	24.2%	25.1%
Meat, poultry or fish	28.0%	33.0%	28.3%	13.1%
Dairy	24.6%	12.0%	55.1%	18.8%
Eggs	3.5%	3.4%	4.5%	2.1%
Vitamin A-rich fruit	9.7%	7.6%	16.6%	6.3%
Other fruit	23.2%	30.9%	15.5%	12.0%

Sample sizes: Total = 1,007; South=551; North=265; Central=191.

The most consumed food group for children 2-5 years old is grains, roots, and tubers (97%). The least consumed food group for this age group is eggs, at 3.9%. Meat, poultry, or fish is the most consumed protein source for children aged 2-5 years, as shown in Table 40 below.

Table 40: Food groups consumed by children 2-5 years

Food Group	Total Sample	South	North	Central
Grains, roots or tubers	96.9%	96.7%	97.2%	96.9%
Pulses	33.1%	30.5%	36.5%	35.2%
Green, leafy vegetables	45.0%	46.7%	48.1%	37.1%
Other vegetables	11.9%	12.4%	14.9%	6.9%
Meat, poultry or fish	37.5%	45.7%	35.7%	20.1%
Dairy	20.2%	7.4%	52.2%	11.9%
Eggs	3.8%	3.9%	5.1%	1.9%
Vitamin A rich fruit	30.5%	41.6%	16.5%	20.7%
Other vegetables	69.0%	71.4%	72.2%	59.4%
Other fruit	11.9%	12.4%	14.9%	6.9%

Sample sizes: Total = 1,473; South=766; North=389; Central=318.

Table 41 summarizes the average amount of money that households spend on food across the different food groups, and the proportion of households that spend money on each food group. Households spend the most amount of money on grains (TZS 8,161), which forms part of the most consumed food group, followed by baby food (e.g. formula, milk powder, etc.).

Table 41: Household expenditures on food (in TZS)

Food Group	% of HHs	Total Sample	South	North	Central
Total Food	95.7%	14,561 Median: 10,760 (13,045)	13,039 Median: 9,256 (12,250)	17,809 Median: 14,005 (14,034)	13,897 Median: 10,336 (12,819)
Grains	62.1%	8,161 Median: 5,000 (7,980)	8,392 Median: 5,000 (8,575)	8,216 Median: 5,500 (7,235)	7,509 Median: 5,000 (7,551)
Baby Food	1.2%	6,094 Median: 3,250 (7,325)	6,788 Median: 3,500 (7,770)	6,446 Median: 3,000 (8,366)	3,829 Median: 2,750 (2,869)
Tubers and Roots	37.3%	3,363 Median: 2,500 (2,822)	3,464 Median: 2,400 (2,990)	3,558 Median: 3,000 (2,664)	2,981 Median: 2,000 (2,716)
Meat	77.3%	2,942 Median: 2,103 (2,891)	2,848 Median: 2,336 (2,640)	3,445 Median: 2,336 (3,282)	2,404 Median: 1,402 (2,825)
Beverages	31.4%	2,909 Median: 2,000 (2,578)	3,025 Median: 2,000 (2,711)	2,847 Median: 2,000 (2,469)	2,692 Median: 2,000 (2,362)
Dairy	25.8%	3,285 Median: 2,400 (2,727)	3,068 Median: 2,000 (2,613)	3,540 Median: 3,000 (2,803)	3,084 Median: 2,000 (2,698)
Other Foods	2.0%	4,117 Median: 2,804 (4,343)	3,606 Median: 1,752 (5,061)	4,903 Median: 4,673 (3,808)	342 Median: 280 (196)
Vegetables	64.2%	2,309 Median: 1,500 (2,339)	2,191 Median: 1,500 (2,284)	2,592 Median: 2,000 (2,542)	2,178 Median: 1,500 (2,123)
Fruits	43.1%	2,350 Median: 2,000 (2,195)	2,276 Median: 2,000 (2,100)	2,578 Median: 2,000 (2,378)	2,153 Median: 1,500 (2,055)
Legumes	54.0%	1,579 Median: 1,121 (1,748)	1,432 Median: 935 (1,662)	1,760 Median: 1,168 (1,870)	1,612 Median: 1,168 (1,724)
Seeds	5.9%	1,439 Median: 701 (1,521)	1,486 Median: 935 (1,658)	1,498 Median: 935 (1,346)	1,297 Median: 701 (1,611)

Averages for each food group were calculated for SHFs that reported to spend money on the food group. The standard deviations are in parenthesis.

Table 42 below summarizes the share of their food budget that households spend on various food groups. These values are calculated for households that reported purchasing the respective food group.

Table 42: Food groups as share of food expenditure

Food group	% of household food budget
Grains	45.1% (n=3,759)
Meat	25.7% (n=4,683)
Baby food	25.3% (n=72)
Other food	22.5% (n=119)
Tubers	22.3% (n= 2,260)
Vegetables	19.8% (n=3,890)
Dairy	19.4% (n=1,563)
Beverages	18.4% (n=1,904)
Fruit	15.8% (n=2,610)
Legumes	14.1% (n=3,268)
Seeds	12.2% (n=358)

Share of food budget for each food group was calculated for households that reported spending money on that food group. Consequently, the proportions do not add up to 100%.

APPENDIX B: DATA QUALITY

To ensure high quality data, a series of data checks and activities were conducted daily throughout data collection. These included, but were not limited to:

High Frequency Checks: daily checks on all data were conducted to monitor enumerator performance in areas such as:

- Survey duration
- Number of surveys completed per day
- Number of duplicate households per enumerator

These checks were used to monitor enumerator performance, to check issues such as whether they were completing an adequate number of surveys per day or whether their surveys were too short.

Logical Checks: daily checks on all data were conducted in order to ensure that answers inputted by enumerators were logically sound. For example, ensuring that nieces or husbands were the correct gender, and ensuring that children were not recorded as having eaten eggs in a household with no children. These checks were also used to monitor enumerator performance.

Back-checks: 10-15% of the surveyed SHFs were randomly selected for a back-check survey to ensure that data was not falsified. Back-check surveys consisted of a subset of questions from the original survey which had answers that were not expected to change over time. The primary purpose of the back-checks was to incentivize enumerators to do their work properly, but a secondary purpose was to check the validity of responses (i.e. whether the same question to the same respondent yields the same response twice).

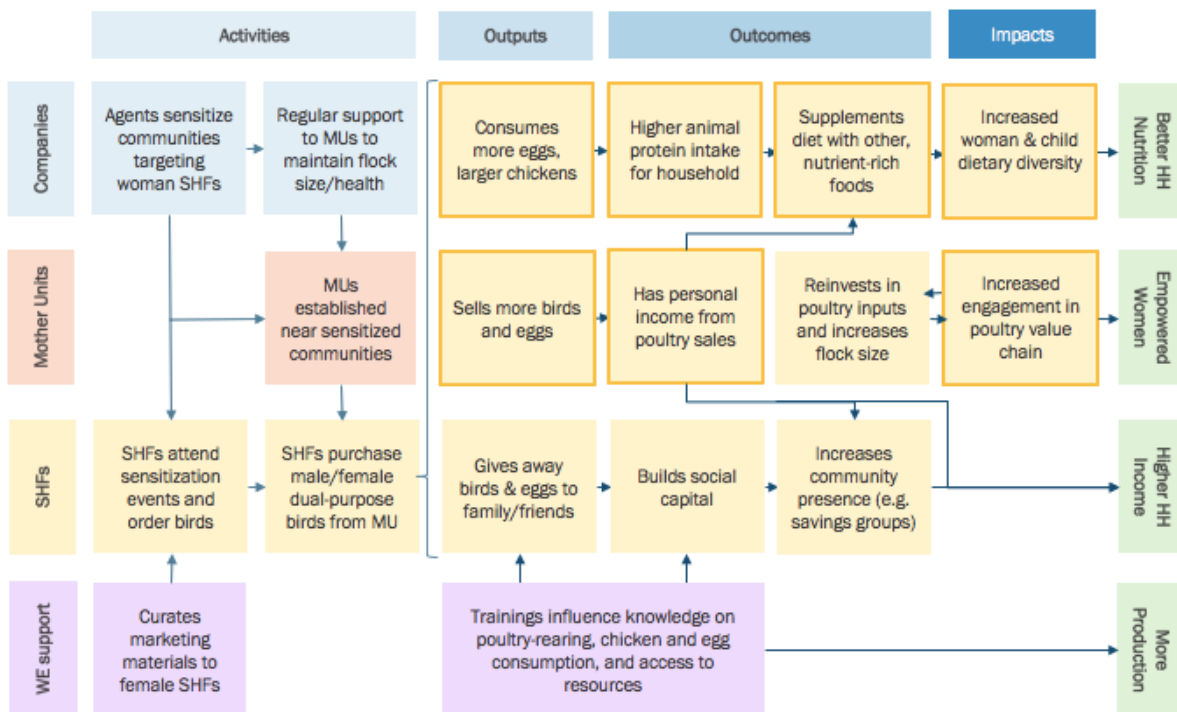
Spot Checks: daily spot checks were conducted by field managers and supervisors, in which they sat in on interviews to monitor enumerator performance, identify persistent trouble areas, and provide feedback to enumerators to ensure high quality work.

APPENDIX C: THEORY OF CHANGE

The figure below maps the Theory of Change (TOC), the expected pathways to impact for the APMI program. Highlighted in the diagram are the roles of various stakeholders, pathways, and assumptions necessary for the program to lead to improved outcomes, as well as key indicators by which to measure program success.

The TOC begins when a company establishes Mother Units (MUs) in communities to sell Sasso chickens to smallholder farmers (SHFs). Sasso chickens allow SHFs to sell, consume, or gift more meat and eggs than would be possible with local chickens. SHFs can use their additional income from sales to increase spending on nutrient-rich foods for themselves and their children; the extra consumption of chicken and eggs also increases the share of protein and micronutrients in their families' diets. As SHFs accrue benefits from chickens, they then increase the size of their flocks and multiply their outcomes. Over time, these channels lead to measurable impacts in household income, female decision-making, and women and children's nutrition.⁸⁵

Figure 26: Theory of Change for the APMI Evaluation



⁸⁵ While Sasso chickens will not be exclusively sold to female SHFs, we assume based on field observations and relevant literature that the majority of purchasers will be women. This will lead to particular impacts from poultry on women's nutrition and economic empowerment.