



Africa Poultry Multiplication Initiative Baseline Report: Nigeria

January 27th, 2020

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ACRONYMS

3DE	<i>3 Dimensions of Empowerment</i>
5DE	<i>5 Dimensions of Empowerment</i>
AFSH	<i>Amo Farm Sieberer Hatchery Limited</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>
LGA	<i>Local Government Area</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>Small Holder Farmer</i>
WPF	<i>World Poultry Foundation</i>
WTP	<i>Willingness to Pay</i>

EXECUTIVE SUMMARY

Small-scale poultry farming is a low-input agricultural activity that can supplement a households' income while promoting increased protein consumption. Amo Farm Sieberer Hatchery Limited (AFSH) is a poultry company based in Nigeria which specializes in the sale of chickens, including dual purpose chickens (Noiler). In comparison to indigenous breeds of chickens (local chickens), the Noiler chicken grows larger and lays more eggs over a longer period of time.

IDinsight is leading an evaluation to assess the productivity of the Noiler breed and the impact of the Noiler on income, nutrition and empowerment of smallholder farmers in Nigeria. The APMI Nigeria 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 AFSH customers from the sample. The baseline was conducted with 2391 households in 87 communities across five states in the south-western and northern regions of Nigeria. We present initial findings for both the baseline sample and a specific sample of AFSH customers.

Key findings for the baseline sample of smallholder farmers (SHF) include:

Flock Performance¹:

- **Most SHFs are currently engaging in small scale poultry farming.** The mean flock size is 18 including commercial chickens (broilers and layers), and 11 excluding these commercial birds. Of households that own chickens, 90% own local chickens. Only 27% of treatment households currently own Noiler chickens. This lower percentage is due to the fact that the majority of Mother Units in treatment communities were not established at the time of baseline data collection.
- **Approximately half of SHFs had local chickens that laid eggs in the previous seven days.** Households that owned local chickens produced an average of 7.8 eggs per week across their total local flock. Eggs produced are primarily hatched; few eggs are consumed or sold.
- **Noiler chickens have an overall lower rate of mortality compared to that of local chickens.** Noiler chickens are less susceptible to loss from attack though mortality rates from disease across Noiler and local chickens are similar.

Income:

- **The majority of SHF households in the sample are likely living under the \$3.10/day² poverty line (average household size of 6.8).** Northern households are poorer than southwest households. 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 sheep. Rearing of dual-purpose breeds could have a positive impact on SHF livelihood and those of their household members.
- **SHFs currently generate a small fraction of their income from local poultry production.** Approximately one-third of households sold chickens and only 3% sold eggs in the previous month. However, when considering the value of local chickens and eggs consumed, the average monthly profit is ₦ 799 or \$2.22. Increased access to poultry products could increase income through increasing the likelihood of selling the poultry products.

¹ Due to the design of the study, those SHFs who own Noilers have not yet produced eggs. However, these findings provide a snapshot of the productivity of the local chicken which will be compared to that of the Noiler at endline to assess how Noiler ownership affects poultry related outputs.

² <https://www.povertyindex.org/country/nigeria>

Nutrition:

- **Approximately half of the women interviewed and only a quarter of children under 5 meet the minimum dietary diversity (MDD) threshold.** A quarter of women and a quarter of children missed the MDD by one food group; consuming eggs or poultry would add sufficient diversity to their diet to meet the MDD bar.
- **Poultry products are some of the least frequently consumed foods by households.** Fewer than 15% of households reported to have eaten eggs or chicken in the last 24 hours, which may be due to the relative cost of chicken versus other meat products. Increasing poultry consumption can also increase protein intake for the 36% of women and 61 % of children who had not consumed any meat, fish or poultry in the last 24 hours.

Empowerment:

- **A majority of women are empowered, though less empowered than men.** Fewer women in the north are empowered than those in the southwest. On average, women are likely to have input into decisions but not at the same level as that of the primary male in their household. Women are generally more empowered with regards to income decisions and least empowered with regards to productivity decisions. This highlights an opportunity for APMI to decrease the empowerment gap between men and women through encouraging women to engage in poultry rearing and consequently engage in more productivity decisions.
- **A vast majority of primary poultry care-takers of both genders appear empowered across different dimensions of poultry rearing.** While male and female care-takers in the south-western region appear equally empowered, male poultry care-takers in the northern regions are more empowered than their female counterparts. The impact evaluation will assess APMI's potential to close this empowerment gap in the poultry value chain in the northern states.

Key findings for current AFSH customers in the sample (SHFs that currently own Noilers or owned them in the past) include:

- **The majority of AFSH customer households are likely living under the poverty line of \$3.10/day,** and northern households are poorer than south-western households.
- **Most customers are motivated to purchase the Noiler for increased productivity reasons.** Customers are more likely to buy the Noiler to consume more chicken and eggs, and sell more chicken; they are less likely to buy the Noiler to hatch eggs or test a new breed. This could be due to AFSH marketing events that advocate consumption of Noiler poultry products and discourage egg hatching.
- **The majority of AFSH customers are satisfied with the Noiler.** Most AFSH customers stated that they were very interested in purchasing the Noiler again in the future, and almost none stated that they were very uninterested. This encouraging finding suggests that increased productivity benefits from Noiler ownership may manifest for the SHF sample. In addition, this level of customer satisfaction is encouraging as it shows SHFs in treatment communities are likely to continue to purchase the Noiler, and continual access is likely important for improved livelihoods.
- **The Noiler also has a Net Promoter Score of 31 which is interpreted as a good score.** This means that the Noiler has more promoters than detractors. This score can be used as a benchmark to help AFSH measure changes in customer satisfaction.

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).³ With these benefits in mind, the Bill and Melinda Gates Foundation (BMGF) is funding the Africa Poultry Multiplication Initiative (APMI). Under this program, World Poultry Foundation (WPF) received a multi-year grant to produce and sell low-input dual-purpose chickens to rural households in 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 only requiring minimal resources for daily upkeep. Under APMI, WPF supports three private sector poultry companies to deliver approximately 61 million-day old chicks (DOCs) annually to rural households.⁴ APMI is a sustainable long-term initiative that is business based and profit oriented.

Objective of report

The Baseline Report presents findings from the baseline data collection for the IDinsight impact evaluation of the Africa Poultry Multiplication Initiative (APMI). The report focuses on the evaluation of the APMI program in Nigeria. The purpose of the baseline is to give us a picture of the baseline sample and establish pre-intervention parameters. In addition, the report shares some insights from current and past Amo Farm Sieberer Hatchery Limited (AFSH) customers in order to provide AFSH with a snapshot of their customers. The data collected will be the basis for our matching study. We will match treatment SHFs to control SHFs across this baseline data to ensure comparable treatment and control groups.

Audience

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

Amo Farm's Model

Amo Farm Sieberer Hatchery Limited (AFSH), Nigeria, was established in 1987 to produce high-quality DOCs and poultry feed. AFSH first introduced the dual-purpose Noiler program in 2016-2017. AFSH is the primary APMI implementer in Nigeria.

AFSH sells these DOCs to “Mother Units” (MUs) or “Brooder Units”. The APMI MU model is designed by WPF to reduce the chick mortality risk for SHFs and to provide intermediating MUs who act as poultry businesses with economic opportunities. Over four years, WPF aims to establish approximately 3,000 MUs in the two countries and impact over 2 million households. These MUs rear the chicks for the first five weeks and ensure they are fed and vaccinated. To ensure that MUs can provide adequate care to the DOCs, thereby reducing chick mortality, the companies provide in-

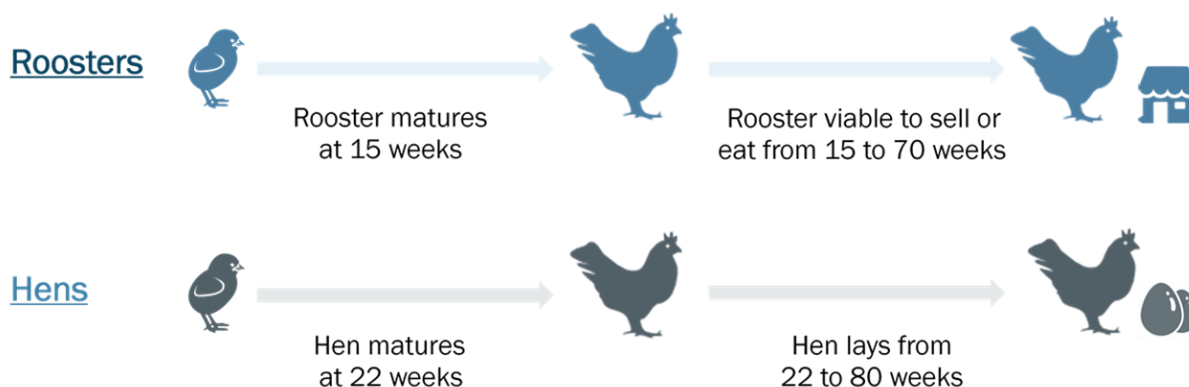
³ Complete literature review can be found in the Evaluation Design for the Africa Poultry Multiplication Initiative (APMI)

⁴<http://worldpoultryfoundation.org/projects/the-african-poultry-multiplication-initiative-apmi-in-tanzania-and-nigeria/>

person training and support through their Technical Advisors and Gender Specialists. This support includes ensuring that all the chicks receive the necessary vaccinations.

After four to five weeks, MUs sell Noiler chicks to nearby SHFs who rear them for sale and/or for household consumption. These chickens have certain characteristics: at 12-13 weeks, but under 15-17 weeks, the cocks weigh between two to three kilograms on average and are usually sold or consumed. The hens begin to lay eggs when they are five to six months old and can lay almost 160-170 eggs/year.

Figure 1: Noiler maturity timeline



Impact evaluation objectives

The purpose of the IDinsight study is to assess the impact of owning these dual-purpose chickens on SHFs’ lives, with particular focus on flock performance, income, nutrition and women’s empowerment.⁵ Table 1 outlines the primary and secondary research questions of the study.

Table 1: Primary and Secondary Questions

Category	Primary Question	Secondary Question
Flock Performance	To what extent does owning Noiler chickens affect poultry related outputs (eggs and meat)?	How do Noiler chicken breeds compare to local chicken varieties on measures of mortality and resources required to care for them (including time)?
Income	How does owning Noiler 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 Noiler chicken varieties?	To what extent are women’s and children’s diets more diverse as a result of owning dual purpose birds?
Women’s Empowerment	Does owning chickens impact women’s empowerment?	To what extent do women SHFs have more ownership and agency in poultry decisions?

⁵ For more information on the impact evaluation objectives, please refer to the Evaluation Design for the Africa Poultry Multiplication Initiative (APMI).

STUDY DESIGN

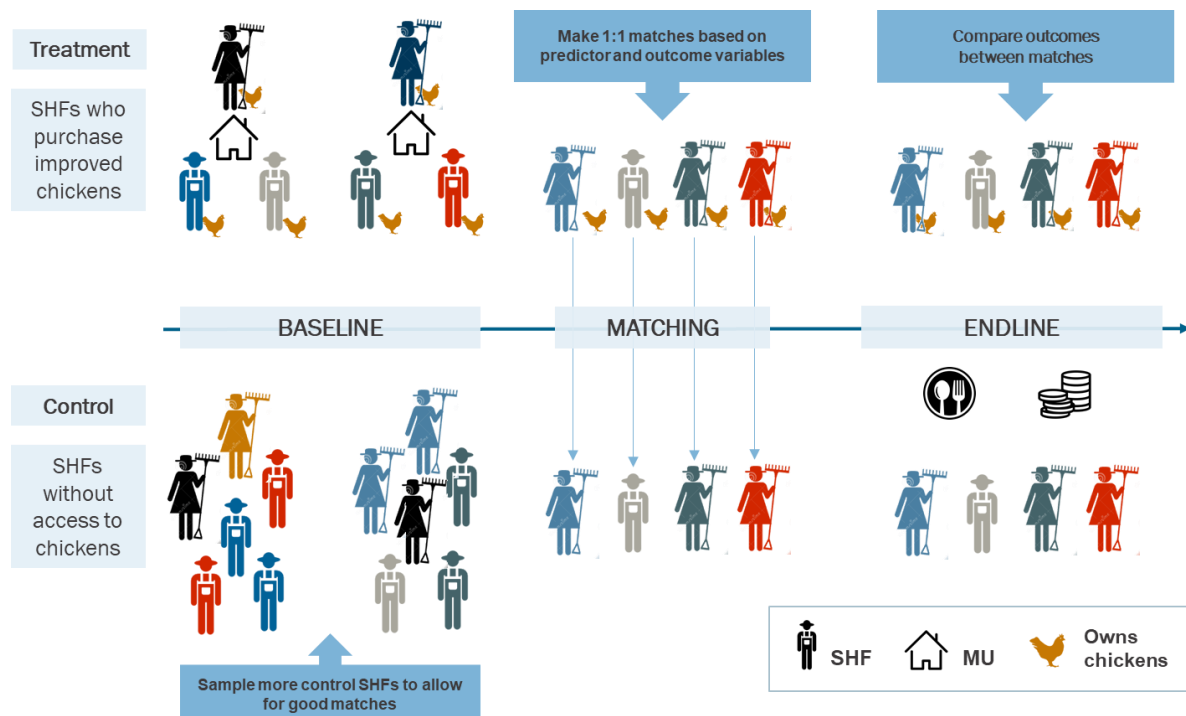
Overview

The APMI impact evaluation leverages AFSH’s natural expansion plans to compare outcomes of interest between Noiler buyers and would-be-buyers (see Sampling).⁶ Communities were allocated to treatment status or control status; treatment communities are those that were given access to the Noiler chicken, and control communities were similar communities that did not have access to the Noiler chicken.

To establish a counterfactual, IDinsight will match one-to-one treatment SHFs to control SHFs who are comparable on a set of baseline characteristics. The baseline characteristics will be a combination of baseline outcomes and other characteristics that are predictive of endline outcomes. At endline, we will compare outcomes of these matched treatment and control SHFs to estimate the causal effect of owning Noilers.

This design assumes that outside the observable characteristics on which we match, there are no other unobservable factors which correlate to both purchasing a Noiler and to our outcomes of interest. We mitigate this possibility by identifying from the outset control SHFs who would be likely to purchase Noilers (more on sampling details below). Figure 2 summarizes the process that will be used to match SHFs.

Figure 2: Process for matching SHFs

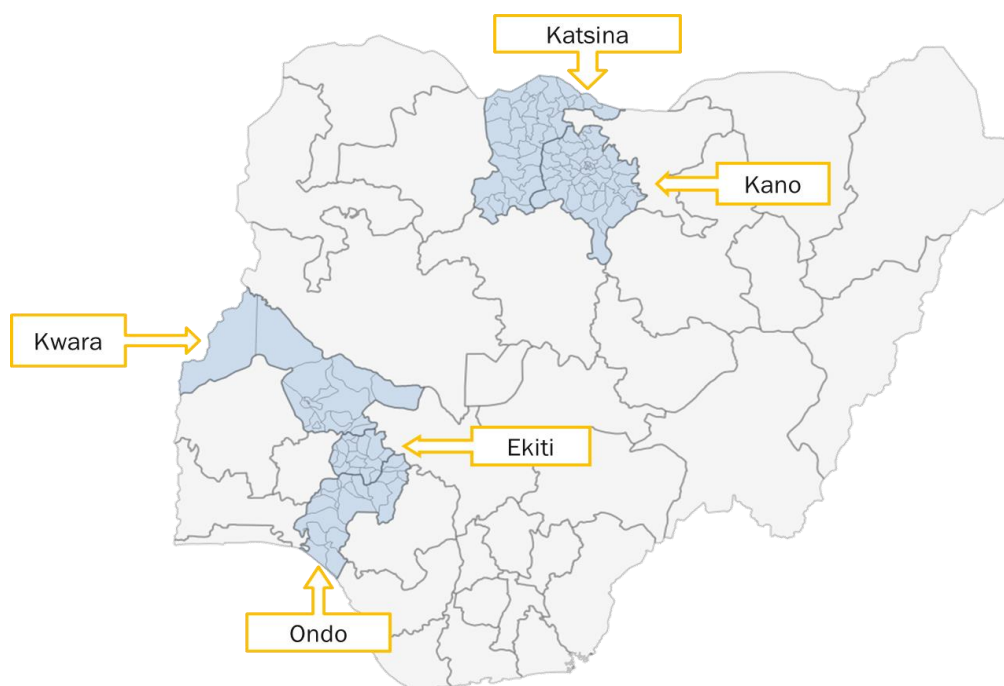


⁶ For more information on the study design, please refer to the Evaluation Design for the Africa Poultry Multiplication Initiative (APMI)

Location selection

We identified five states for the focus of this research: Kano and Katsina in Northern Nigeria and Ondo, Ekiti, and Kwara in southwest Nigeria.⁷ We selected particular study sites in coordination with AFSH, based on their natural expansion across Nigeria. Our iterative selection process with AFSH produced an initial list of viable⁸ communities. Initially, we randomly allocated half of communities within each Local Governmental Area (LGA) to treatment (receive access to Noiler) and control (do not receive access to Noiler). However, owing to the slow expansion of MUs and the need to replace some communities (see more detail in Appendix B) the selection of treatment communities evolved into a natural selection: treatment communities started to be dictated by ASFH field agents based on where they were able to establish MUs. Control communities were either maintained to match the characteristics of the selected treatment communities, or new ones were identified to better match characteristics of the new treatment communities.⁹ Examples of these characteristics included but were not limited to area and population size, access to health facilities, and access to financial facilities

Figure 3: States included in study



⁷ For more information on location selection, please refer to the APMI pre-analysis plan (PAP).

⁸ Treatment communities that AFSH does not yet have a presence in to find first-time buyers; and control communities that AFSH does not, and will not have a presence in until after the conclusion of the study.

⁹ 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 replacement treatment communities.

SAMPLING PROCEDURE

The treatment sample consists of 973 SHFs from 42 communities (approximately 20 SHFs per village). IDinsight conducted two sampling procedures in order to establish the treatment sample:

- **Actual Noiler Buyers:** IDinsight attained sales records from AFSH for MUs who had recently sold their first flock to customers. From these sales records, we randomly sampled 20 SHFs per MU to be surveyed within a ten-week period from the day of Noiler purchase.¹⁰
- **Prospective Sampling:** In the cases that MUs were not established by the time of data collection in a given region, we sampled SHFs who are likely to purchase Noilers. In this scenario, we attended official AFSH outreach events in communities and delivered a 3-4-minute eligibility survey to one participant per household. The eligibility survey gathered basic identifying information and assessed general willingness to pay (WTP) for a new breed of poultry. Respondents were eligible if their willingness to pay was at or above the price for a five-week old dual-purpose chicken. Of those SHFs with adequate WTP, we randomly selected approximately 30 (plus five replacements) to participate in the main household survey and join the baseline sample. The lists of these SHFs have been shared with AFSH in order to target marketing in these communities to maximize Noiler take-up.

Control sample

The control sample consists of 1,273 SHFs from 43 communities (approximately 30 SHFs per village). We aimed to establish a control sample of SHFs who would be likely to purchase Noilers, if given access. Our approach in control communities was to mimic the process by which AFSH conducts outreach for Noilers. However, we did not include content that would sway participants' interest in poultry (such that they would seek out the Noiler) or affect their baseline outcomes (e.g. investing more in nutrition). As such, we held generic community events that encouraged attendance from more enterprising individuals but avoided content directly relating to nutrition and poultry.¹¹

At community events, we delivered the same eligibility survey as for prospective treatment sampling, noted above. Respondents with adequate WTP scores were included in the short-list of eligible respondents as a part of our sampling frame. Of those, 30 respondents (plus five replacements) were randomly selected for inclusion in the main household survey.

¹⁰ IDinsight wanted to ensure that the confirmed buyers of the Noilers were not experiencing any treatment effects.

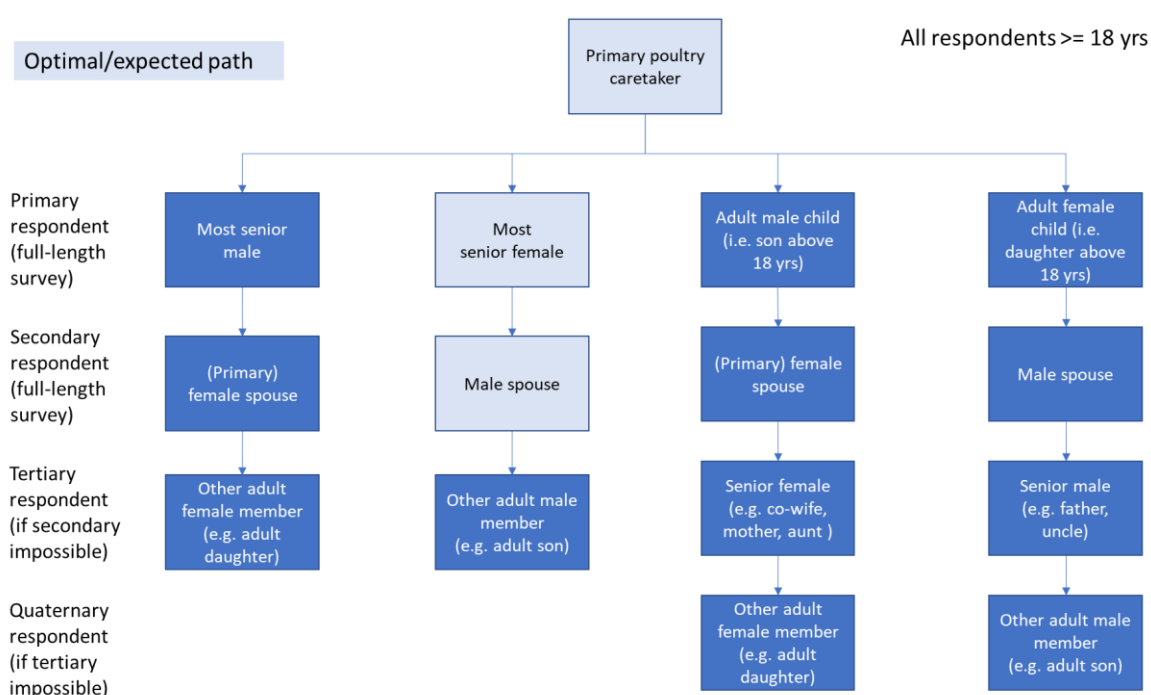
¹¹ The content of the presentation revolved around how to start a new business, how to be a good service provider, and what makes a good business.

DATA COLLECTION

Survey instrument

At baseline, we surveyed households for an average duration of 90 minutes. The survey was comprised of two main parts; **the primary survey** (45-60 mins) and **the supplemental survey** (15-50 minutes). The primary survey was administered to the adult primary caretaker of poultry within a household; the supplemental survey was administered to an adult member of the opposite gender, usually the spouse of the caretaker. In the case that the primary caretaker did not have a spouse, the respondent was asked to choose an adult secondary respondent of the opposite gender such as a sibling or older child. In addition, in the case that the household did not own any poultry, the adult female, if available, was usually the primary respondent by default.

Figure 4: Survey Respondent Decision Tree



The primary survey included questions on household demographics (education, crop cultivation, asset ownership); poultry practices (chickens owned, chicken productivity, 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).

Data storage and analysis

The supplemental survey was comprised of a subset of the questions in the primary survey, which were dependent upon the gender of the secondary respondent. Data was collected on SurveyCTO and backed up daily onto IDinsight computers and an encrypted cloud server.

Data analysis was conducted using STATA. For more information on the methodology and indicators used, please refer to the APMI Pre-Analysis Plan (PAP) shared on **September 19, 2019**.

FINDINGS

Introduction to samples

The baseline report discusses findings from two samples. These samples are:

1. **Baseline sample** – This sample comprises of all households that are eligible to be included in the impact evaluation. The sample includes:
 - Control SHFs
 - Confirmed first time buyers of the Noiler
 - Prospective AFSH SHFs

In order to ensure that SHFs' outcomes at baseline are reflective of not having exposure to the Noiler, the sample excludes:¹²

- Control SHFs that reported that they own any Noiler chickens¹³
 - Confirmed buyers that reported to have productive Noiler chickens¹⁴
 - Confirmed buyers that reported to have sold Noiler chickens or eggs
 - Confirmed buyers that reported to have eaten Noiler chicken or eggs
 - SHFs that confirmed to have owned Noiler chickens in the past
2. **AFSH sample** – This sample includes all customers of AFSH. The sample is made up of:
 - Confirmed past of present buyers of Noiler chickens¹⁵
 - SHFs that may not currently own Noiler chickens, but reported to have consumed Noiler chickens or eggs¹⁶

¹² 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. A total of 145 SHFs were dropped owing to these exclusions.

¹³ We found 5 control SHFs across 4 communities that owned Noiler birds. Given the very low number and spread of these SHFs, we do not foresee a contamination risk in control communities. Anecdotally, we have heard on the ground that these SHFs likely received Noilers as gifts from family members in other states. We will continue to monitor this.

¹⁴ Productive Noilers are Noilers that have started laying eggs,

¹⁵ Confirmed buyers that are first time buyers are part of both the AFSH and baseline sample.

¹⁶ The assumption is that these SHFs have owned noilers in the past.

Table 2 summarizes these two samples' sizes. The baseline sample is comprised of 2,248 households; the majority of households (1,283) are from the south-western states in Nigeria and 965 of the households are from the northern states. The AFSH sample includes 407 households: 331 households from the south-western states and 76 of the households from the northern states. Households from northern states make up the lowest percentage of the AFSH sample size as the majority of the baseline sample from this region is predominantly prospective buyers, given the slow spread of MUs.

Table 2: Sample sizes

Sample	Total	Southwest	Northern
Baseline Sample Size	2248	1283	965
<i>Control</i>	1273	766	507
<i>Confirmed buyers</i>	262	210	52
<i>Prospective</i>	711	305	406
Excluded Sample¹⁷	145	121	24
<i>Control SHFs with Noiler</i>	5	5	0
<i>SHFs with productive Noiler</i>	36	34	2
<i>SHFs that sold Noiler eggs/chicken</i>	45	37	8
<i>SHFs that ate Noiler eggs/chicken</i>	62	58	4
<i>SHFs that owned Noilers in the past</i>	45	30	15
AFSH Sample Size	407	331	76
<i>Confirmed buyers that currently own Noilers</i>	361	300	61
<i>Report to have consumed Noiler chicken/eggs</i>	46	31	15

¹⁷ Note that the subcategories under the excluded sample do not total 145 as they are not mutually exclusive.
 APMI Nigeria Baseline Report

BASELINE SAMPLE FINDINGS

Household Demographics

Table 3 highlights key demographics of the baseline SHF sample. The average household size is 6.8 members which is slightly larger than the average rural Nigerian household.¹⁸ Larger households are more predominantly found in the northern states. This is explained by a greater number of polygamous households in the northern states.¹⁹ More than half (61%) of the primary respondents are female and approximately half²⁰ (52%) of the households have a female as the primary poultry caretaker. Approximately half (53%) of households have children under five. A greater proportion of households in northern states have children under 5 as northern household sizes are larger than those in the southwest. This underscores the potential for access to Noiler to have large impacts on children’s nutrition outcomes, particularly in northern states.²¹

Table 3: Household demographics

Indicator	Total Sample	Southwest	North
Average household size (including respondent)	6.8	5.0	9.2
% of respondents that are female	61.0%	61.4%	60.4%
% of households with child under 5	53.1%	38.9%	72.1%
Average age of respondent	40.7	42.7	37.9

Statistics are about the primary respondent unless reported otherwise.
 Sample sizes: Total = 2,246, Southwest=1,281, North=965

¹⁸ The average Nigerian household is 5 according to 2018 Nigeria Demographics and Health Survey (DHS). <https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf>

¹⁹ Larger households may be due to 35% of households in the northern states being polygamous while only 20% of households in the southwest states are polygamous.

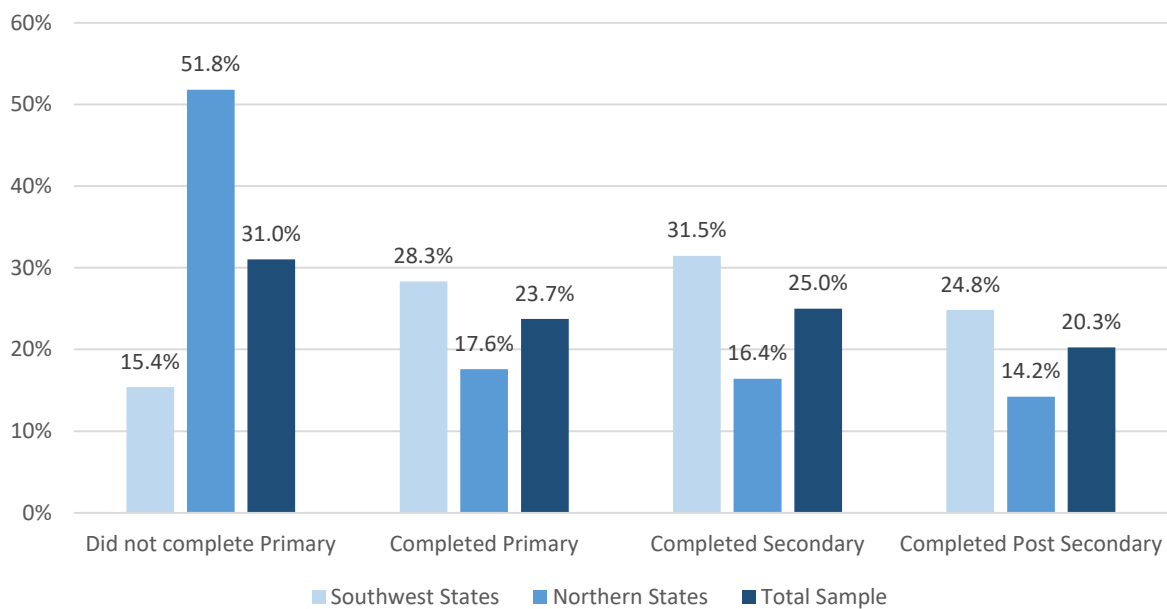
²⁰ Not all primary respondents are poultry caretakers as some households do not own chickens.

²¹ This number matches well with our assumption in the sample size calculations for which we assumed that 50% of households would have a child aged below five. The proportion is partly expected because of our sampling procedure, in which we ensured – whenever possible - to survey roughly 50% of respondents with children in that age range. For more information, refer to the impact evaluation design document and the pre-analysis plan.

As seen in Figure 5, there are varying levels of education across the sample: roughly one-third (31.0%) of the primary respondents have not completed primary school while a quarter (25.0%) have completed secondary school and 20.3% have a post-secondary degree. The variation is partly explained by gender differences in the sample: 64.3% of men have completed secondary or post-secondary education and only 33% of women have completed secondary or post-secondary education. Our sample is more educated than the average resident in rural Nigeria: Demographics and Health Survey (DHS) found that 66.1% of the females and 56.6% of the males in rural Nigeria had not finished primary school. Furthermore, DHS found that only 3% of females and 6% of males in rural Nigeria had any post-secondary education. Higher SHF education levels may be an asset for the program if SHFs manage poultry rearing as small-scale businesses.

Respondents in northern states on average are less educated than those in southwest states: there is a greater proportion of respondents from northern states (51.8%) who did not complete primary school and only 16.4% have completed secondary school. Low levels of education could be a barrier that limits impact down the line if SHFs are not provided with business support.

Figure 5: Primary respondent's highest level of education



Sample sizes: Total = 2,246, Southwest=1,281, North=965

A vast majority of the SHFs are self-employed. As seen in Table 4, the majority of SHFs earn livings from agricultural work such as cash crop farming (79.0%) and livestock farming (79.6%),²² as well as non-farm business ventures. Almost three-quarters (71.2%) of SHFs report that they participate in business ventures outside of farming. The most common business venture is retail: 72.3% of the respondents that participate in non-farm business have retail businesses.

Overall, less SHFs are formally employed. Approximately a third of the households (35.9%) had one or more respondents formally employed in the last 6 months. Only one-fifth (21.5%) of primary respondents themselves were formally employed, and approximately a quarter (24.4%) of the secondary respondents were formally employed in the last 6 months. For those that are employed, the average monthly income is ₦ 31,550 or approximately \$87.60 per month.

Table 4: Income demographics

Indicator	Total Sample	Southwest	North
% of respondents formally employed	21.5%	19.8%	23.7%
Average monthly income of employed respondents (Naira) in last 6 months	31,550	30,843	32,653
% of respondents that participate in cash crop farming	79.0%	90.6%	58.3%
% of respondents that participate in livestock farming	79.6%	74.9%	85.9%
% of respondents that participate in non-farm business	71.2%	62.5%	82.9%

All outcomes have been calculated for the full baseline sample (n=2,246), except monthly income that has been calculated for only those who are formally employed (n=440).

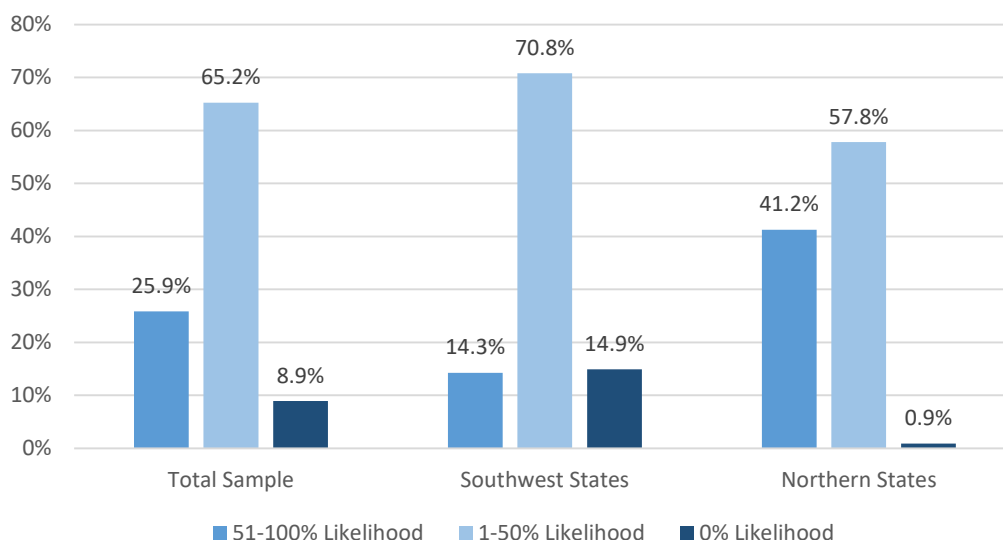
²² See more on cash crop farming and livestock in Land ownership & Agriculture section.

To further understand household wealth, we collected information on households’ socioeconomic status using the Progress Out of Poverty Index (PPI). The PPI assigns a score to a household based on household asset ownership and other household characteristics. The final aggregated score corresponds to the likelihood that a household is below the poverty line of \$3.10/day.

The majority of households in our baseline sample (91.9%²³) have a positive likelihood of living under the \$3.10 poverty line as seen in Figure 6. As with other indicators, poverty levels also differ between the northern and southwestern states: 41.2% of households have a higher than 50% likelihood in northern states of living under the poverty line compared to 14.3% in southwest states. Differing levels of disposable income across the regions might have implications for SHFs’ willingness to become MUs as becoming MU requires a significant up-front investment. This dynamic may also explain why AFSH faced relatively more delays setting up MUs in northern states.²⁴

In summary, SHFs are poorer and more readily rely on informal income sources than the average rural Nigerian. This highlights the potential for Noiler access to have positive impacts on income through increased poultry productivity.

Figure 6: Proportion of households below the \$3.10 poverty line



Sample sizes: Total=2,246, Southwest=1281, North=965

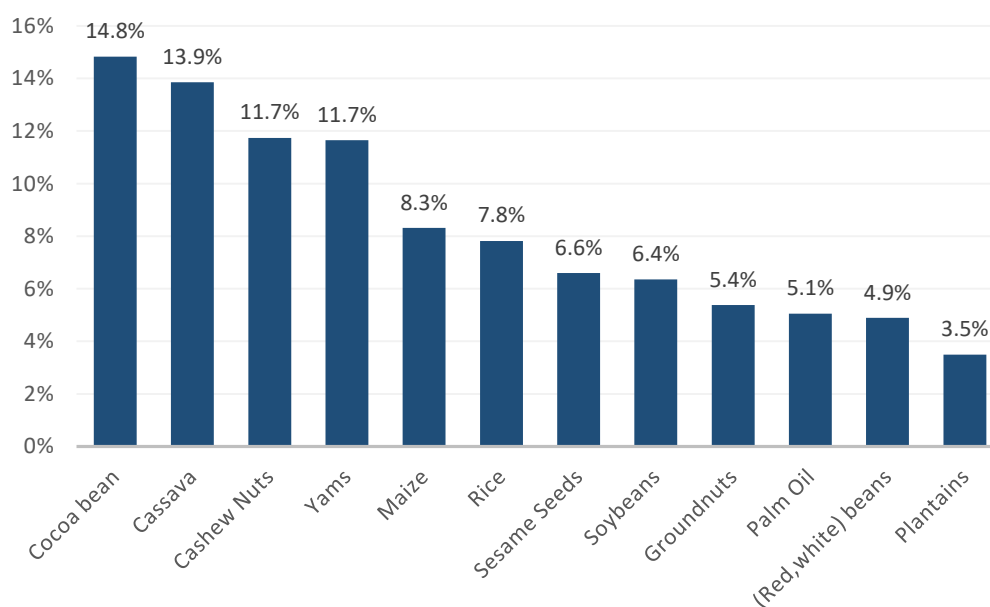
²³ This figure is calculated by adding the percentage of respondents in the 1-50% (65.2%) likelihood range with the respondents in the 51-100% likelihood range (25.9%)

²⁴ At the time baseline data collection was completed, there were 13 MUs in southwest states and 7 MUs in northern states.

Land Ownership & Agriculture

A majority of households (68%) own land, which is a smaller proportion compared to the average rural Nigerian household.²⁵ Households who own agricultural land own an average of 0.26 acres of land. Almost all SHFs (79%) report that they participate in cash crop farming. As seen in Figure 7, SHFs grow a variety of primary cash crops, with cocoa beans and cassava being slightly more common.²⁶ Geography does influence the primary crop grown: southwest states grow primarily cassava and cocoa beans while northern states also commonly grow rice and sesame seeds.²⁷ Given the likely variable nature of SHF income, it might be worth exploring timing Noiler chick distributions along with harvests to ensure SHFs have sufficient liquidity. Furthermore, as most SHFs participate in cash crop farming, AFSH could consider promoting the use of Noiler feces as fertilizer to further influence SHFs to purchase the birds.

Figure 7: Primary cash crops grown



Sample size: n= 1,227

Other crops are not reported, but have a lower share

²⁵ DHS (2018) finds that 75.5% of rural households in Nigeria own agricultural land.

²⁶ Cash crops are crops planted primarily for sale in markets.

²⁷ See Appendix A for primary crops by region.

The majority (75%²⁸) of SHFs own livestock other than chickens which – as expected given AFSH’s targeted beneficiary - is a greater proportion compared to that of other rural Nigeria households.²⁹ Apart from chickens, SHFs most predominantly own goats. Almost one-fifth (17%) of SHFs own poultry other than chicken, and 9% own both chicken and other poultry. Other livestock such as cows and pigs are far less common.

Table 5: Livestock ownership

Livestock	Total Sample	Average herd size
Goats	86.1%	5.6
Sheep	42.0%	4.8
Poultry (other than chicken) ³⁰	17.0%	13.7
Oxen	4.7%	2.4
Milking Cows	3.5%	7.1
Pigs	2.8%	12.2
Bulls	2.1%	3.4
Rabbits	1.7%	9.1
Horses	0.3%	1.0
Donkeys	0.2%	1.5

Percentage has been calculated for all households that own chickens (n=1,868). Mean livestock size is calculated for households that have at least one of that type of livestock.

Chicken Ownership

The majority (84%) of SHFs own chickens. As seen in Table 6, most households (90%) that own chickens own local chickens. Poultry ownership distribution is similar across the northern and southwest states.³¹ At the time of our baseline study, only 15% of households currently own Noilers. This lower proportion is expected given the delays in establishing MUs in the majority of our study communities.

Table 6: Poultry ownership and mean flock size

Poultry type	% of households who own breed	Mean flock size
Local chicken	89.8%	13.9
Layer chicken	2.6%	72.8
Broiler chicken	20.3%	15.3
Noiler chicken	14.9%	8.7
Cockerel chicken	6.5%	7.4

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

The average total flock size for those that own poultry is 18 chickens. For reference, IDinsight’s baseline study for Ethiochicken found that the mean flock size for those who owned poultry was approximately eight chickens. This relatively higher mean flock size and overall high proportion of poultry owners is encouraging for AFSH’s expansion into these communities.

Digging into these poultry statistics further, we analyzed our sample across different chicken breeds. For households that own local chickens, layers, broilers, Noilers or cockerel, the respective average flock size is approximately 14, 73, 15, 9 and 7 birds, respectively. Large numbers of layer and broilers

²⁸ This percentage includes SHFs that own chickens as well as those that do not own chickens.

²⁹ DHS (2018) finds that 56% of rural households in Nigeria owned livestock, including chickens.

³⁰ This includes guinea fowl, turkey and duck.

³¹ See Appendix A for poultry ownership and mean flock size by region.

is to be expected given the commercial nature of these breeds. The lower number of Noilers is also unsurprising given households are first-time buyers of this breed.

As seen in Table 7, SHFs who own Noiler birds, on average have 2.5 chicks, 5.3 growers and 1.1 mature birds. Given the design of the study which excludes Noiler owners with productive birds, the majority of Noiler birds observed in our sample are chicks or growers. The average local chicken flock of respondents who own local chickens is composed of 5 chicks, 4 growers, and 4.9 mature birds.³² SHFs seem to have a mixture of age regardless of the two breeds. Furthermore, for SHFs that own growers and mature birds, they have a greater proportion of female birds.

Table 7: Chicken age breakdown

Breed	Chicks	Growers		Mature	
		Cocks	Hens	Cocks	Hens
Local	5.0	1.8	2.2	1.4	3.5
Noiler	2.5	3.1	2.2	0.6	0.5

Mean flock size is calculated for households that had that breed. Local owners n=1,663 and Noiler owners n=262. Noilers were included in the sample if they have not laid any eggs.

³² Chicks are defined as birds younger than 6 weeks, growers between 6 weeks-4 months and mature are older than 4 months. Average flock sizes for breeds do not total 13.9 because some SHFs did not know the ages of their birds.

Chicken Productivity

To measure chicken productivity, we focus on SHFs who own local mature hens³³ and report that their chickens have laid at least one egg in the last 7 days.³⁴ Note that this section focuses exclusively on local chickens because Noiler chickens are – by design – not yet producing any eggs at the time of our baseline survey.

Almost half (45.9%) of the SHFs rearing local chickens report their local chickens to have laid eggs in the past 7 days. On average, SHFs produced 7.8 eggs per week, with an average of 2.1 eggs per mature hen. These local egg production trends are similar across regions.

Table 8: Local chicken productivity

Indicator	Total Sample	Southwest	North
% of HHs with local chickens producing eggs	45.9%	47.0%	44.5%
Average weekly local egg production per HH	7.8 (6.7)	8.5 (7.2)	7.0 (6.1)
Average weekly egg production per local chicken	2.1 (1.5)	2.2 (1.5)	2.0 (1.5)

Standard deviations are reported in parentheses under averages.

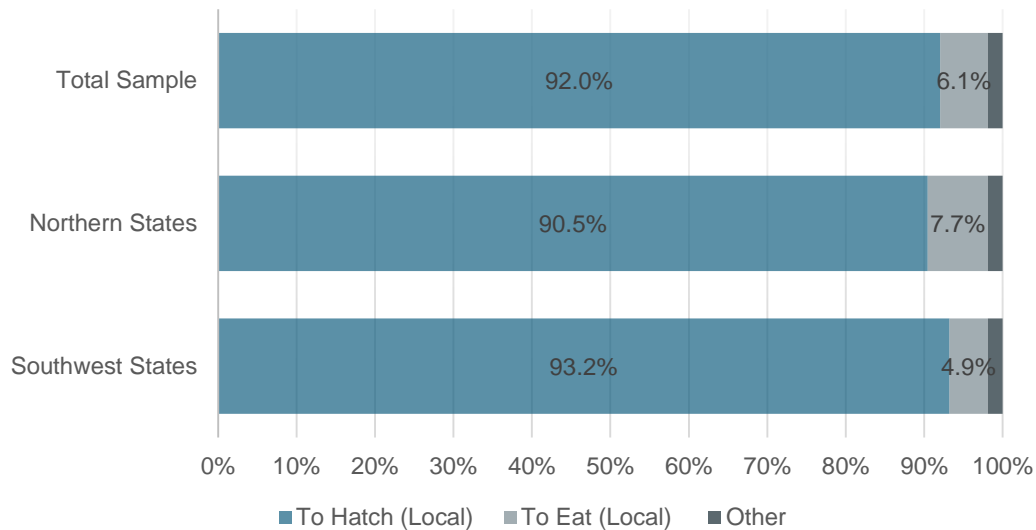
Sample sizes: Total=1,139, Southwest=640, North=499

³³ 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>

³⁴ Average egg numbers for local chickens seem consistent with indigenous bird egg production as documented in the literature. (Ricke, Stephen. "Helping smallholders to improve poultry production Robert Pym, University of Queensland, Australia; and Robyn Alders, University of Sydney, Australia." Achieving sustainable production of poultry meat Volume 1. Burleigh Dodds Science Publishing, 2017. 463-494.) 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 might 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.

Figure 8 shows how eggs from local chickens were used in the past seven days. Households reported hatching the majority of local eggs (92%), hatching an average of 7.2 eggs per week. The next most common use of eggs was for household consumption, though only 6% of eggs produced in the last week were consumed. A slightly higher proportion of households in the northern states (7.7%) reported consuming eggs than in the southwest (4.9%), but the difference is not statistically significant. Very few of the produced eggs were sold or used for other purposes such as gifts or breakage.

Figure 8: Egg use in percentage

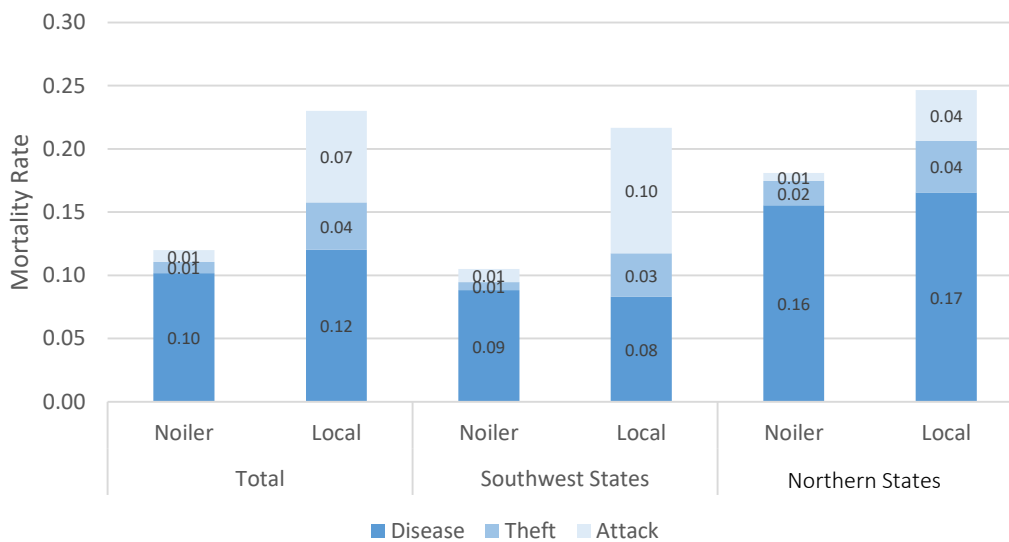


Sample sizes: Total=522, Southwest=300, North=222

Figure 9 shows rates of poultry loss from different causes across local and Noiler chickens. Of those SHFs who own Noilers, overall flock loss is 13% over the past six months: out of 100 birds, 13 birds were lost in the previous six months. This rate compares favorably to the local bird mortality rate of 23% over the same time period. The difference in mortality rates is primarily driven by Noiler chickens having a lower mortality rate from attack by other animals, which could be due to a more resilient nature of the chickens or because SHFs protect their Noiler chickens better. Noiler chickens are also marginally less susceptible to theft. Mortality rates due to disease for the Noiler is slightly higher than the expected 5% and is on par with that of the local chicken: Noiler mortality rates were 10% on average in our sample. This may be explained by Noiler bird being much younger per the study design. There is evidence that supports that the highest mortality rate due to disease in chickens is observed when they are young.³⁵ Further investigation by AFSH with their field officers may be helpful in helping us explore these findings in more depth.

Causes of mortality differ by region. In northern states, both Noiler and local chickens are more likely to die from disease. In southwest states, local chickens are more likely to die from attack from other animals.

Figure 9: Reasons for bird loss



Sample sizes local chicken mortality: Total=1,663, Southwest =911, North =752

Sample sizes Noiler chicken mortality: Total=281, Southwest=229, North=52

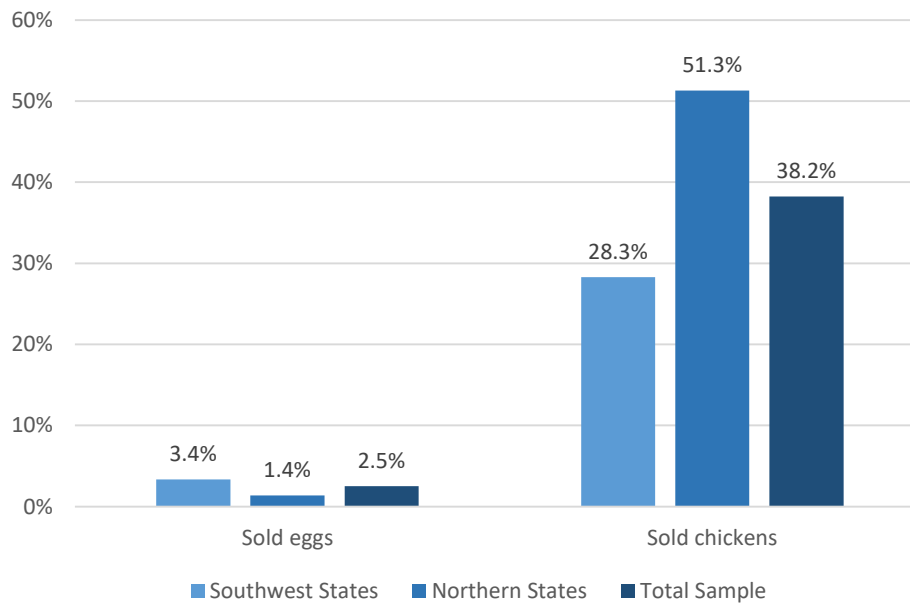
³⁵ <https://bmcvetres.biomedcentral.com/articles/10.1186/s12917-019-1949-y>

Poultry Income & Expenditure

As seen in Figure 10, of households with local chickens, only 2.5% sold eggs and 38.2% sold chickens in the last thirty days. A larger proportion of households in the northern states (51.3%) sold chickens than in southwest states (28.3%).

Households sold an average of three local chickens in the past thirty days, principally at their local market (70.6%) and within their local community (37.5%), such as to neighbors. The average price for a chicken sold was ₦ 950, and the median price was ₦ 800.

Figure 10: Households who sold local eggs and chickens in past 30 days



Sold Eggs sample sizes: Total=519, Southwest=302, North =221

Sold Chicken sample sizes: Total=1,781, Southwest=1,019, North=762

On average, households generate ₦ 482 or \$1.35 per month (\$16.20/year) from selling local chickens or eggs. This small amount aligns with the perception of how much poultry currently contributes to income: only 14.3% of households state that poultry contributes a significant amount (more than 50%) to their income.³⁶ Increased access to poultry products through improved productivity could increase income through increasing the likelihood of selling poultry products.

Households eat a majority of their local chickens as opposed to selling them. On average, respondents sold 3 of their chickens and consumed 3.4 of their chickens over the past 30 days.³⁷ Using the sale prices noted above, the average value of local chickens and eggs consumed per household over the past 30 days is ₦ 3,013 or \$8.37.³⁸ Households that own only local chickens spend on average ₦ 621 or \$1.73 per month on chicken-related expenses.

Table 9: Average monthly chicken expenditure and income (in Naira)³⁹

Indicator	Total Sample	Southwest	North
Average monthly income from local chickens	482 Median: 0 (1279)	461 Median: 0 (1500)	509 Median: 108 (909)
Value of local consumption	3013 Median: 2400 (2648)	2835 Median:1656 (2736)	3127 Median: 2400 (2587)
Average monthly local chicken expenditure	621 Median: 100 (1688)	801 Median: 400 (1298)	451 Median: 0 (1974)
Estimated local profit	799 Median: 0 (2788)	269 Median: -33 (2638)	1299 Median: 467 (2836)

Standard deviations are in parentheses below medians

Sample sizes for expenditure, income & profit: Total=1,213, Southwest=590, North=623

Sample sizes for value of local chickens consumed: Total=544, Southwest=212, North=332

³⁶ However, 2.6% of SHFs have layers and 20.3% have broilers, though we do not capture income generated from these breeds. In addition, more on perceptions of income can be found in Appendix A.

³⁷ This means that there is an outflow in chickens, but not necessarily a reduction in flock size as SHFs may have bought more chickens.

³⁸ This value is calculating by taking the product of the average number of local chickens consumed and the median price achieved by SHFs across the sample.

³⁹ We calculate expenditure and income 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,

As seen in Table 10, the majority of this spending goes towards chicken feed and transport. The most common expenses are chicken feed and vaccinations, though a smaller amount is spent on vaccinations on average. When considering chickens sold and consumed and chicken expenditure, households earn an estimated ₦ 799 or \$2.22 per month in profit on average.⁴⁰

Table 10: Monthly local chicken expenses over the past 30 days (Naira)

Indicator	Total Sample	Southwest	North
Average Monthly Feed Expenditure	1108	1100	1130
	(1227)	(1120)	(1275)
	42.5%	63.6%	22.3%
Average Monthly Chicken Transport Expenditure	1428	1171	1726
	(3896)	(2146)	(5299)
	4.2%	4.7%	3.9%
Average Monthly Vaccine Expenditure	164	155	169
	(298)	(209)	(335)
	24.2%	16.3%	31.8%
Average Monthly Vet Expenditure	269	281	266
	(477)	(283)	(525)
	7.9%	3.9%	11.7%
Average Monthly Infrastructure Expenditure	442	608	252
	(443)	(493)	(303)
	1.2%	1.4%	1.1%

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=1,868).

Means have been calculated for households that incur the particular expenditure.

⁴⁰ 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 income to calculate an estimated profit.

Dietary Diversity

We calculated dietary diversity scores for all female respondents and children under 5 as a measure of baseline nutrition levels.⁴¹ The Minimum Dietary Diversity Score⁴² estimates the micronutrient adequacy of household members' diets. Scores were calculated by counting the number of food groups that each individual reports to have consumed over the past 24 hours.⁴³ Women were asked to recall the food eaten by themselves and children under 5 (6-59 months), if available, over the past twenty four hours.

As seen in Table 11, just over half (57.1%) of women in the sample meet the woman minimum dietary diversity (MDD) threshold, which is on par with the proportion of women in the average rural Nigerian households.⁴⁴ Trends are similar across regions: 53.7% women meet the threshold in the southwest states and 61.4% meet the threshold in the northern states. Looking closely at chicken consumption, most women had not consumed chicken or eggs recently: only 3.0% of female respondents had consumed chicken and 10.7% had consumed eggs within the last 24 hours, which is similar to egg consumption of the average rural Nigerian household.⁴⁵

Table 11: Dietary Diversity

Indicator	Total Sample	Southwest	North
% of Women that meet Minimum Dietary Diversity	57.1%	53.7%	61.4%
% of Women that consumed chicken	3.0%	2.4%	3.8%
% of Women that consumed eggs	10.7%	11.9%	9.4%
% of children u5 that meet Minimum Dietary Diversity	27.8%	30.3%	26.0%
% of children u5 that consumed chicken	2.7%	1.6%	3.4%
% of children u5 that consumed eggs	9.6%	12.1%	7.8%

Sample sizes women: Total=2,136, Southwest =1,178, North=958

Sample sizes children under 5: Total=1,191, Southwest=495, North=696

A smaller proportion of children under 5 meet the minimum dietary diversity. Approximately one-quarter (27.8%) of children under 5 meet the MDD.⁴⁶ Findings are similar across regions: 30.3% percent of the children under 5 in the southwest states meet the MDD and 26.0% of children under 5 in the northern states meet MDD. Furthermore, few children had consumed eggs or chicken: only 2.7% of children under 5 were reported to have eaten chicken and only 9.6% had consumed eggs in the last 24 hours. Low levels of average chicken flock-sizes for the large households in the sample may be the reason for the low consumptions of chicken and eggs, though this would depend on the frequency of households to replenish their flocks.

Given most households report hatching any eggs produced, these low percentages for egg consumption are not surprising. Given the low starting point, though, promotional campaigns aimed at improving consumption of these foods could have large impacts. For example, for 26.7% of women and 17.5% of children who missed the MDD by one food group, consuming eggs or poultry would add

⁴¹ The score was calculated for one child under 5: the oldest child in 6 months to 2 year age range or the youngest child in the 2 years to 5 years age range if the former was not available.

⁴² <http://www.fao.org/3/a-i1983e.pdf>

⁴³ 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 is 5 food groups out of 9.

⁴⁴ DHS (2018) finds that 51% of women in rural Nigeria meet MDD.

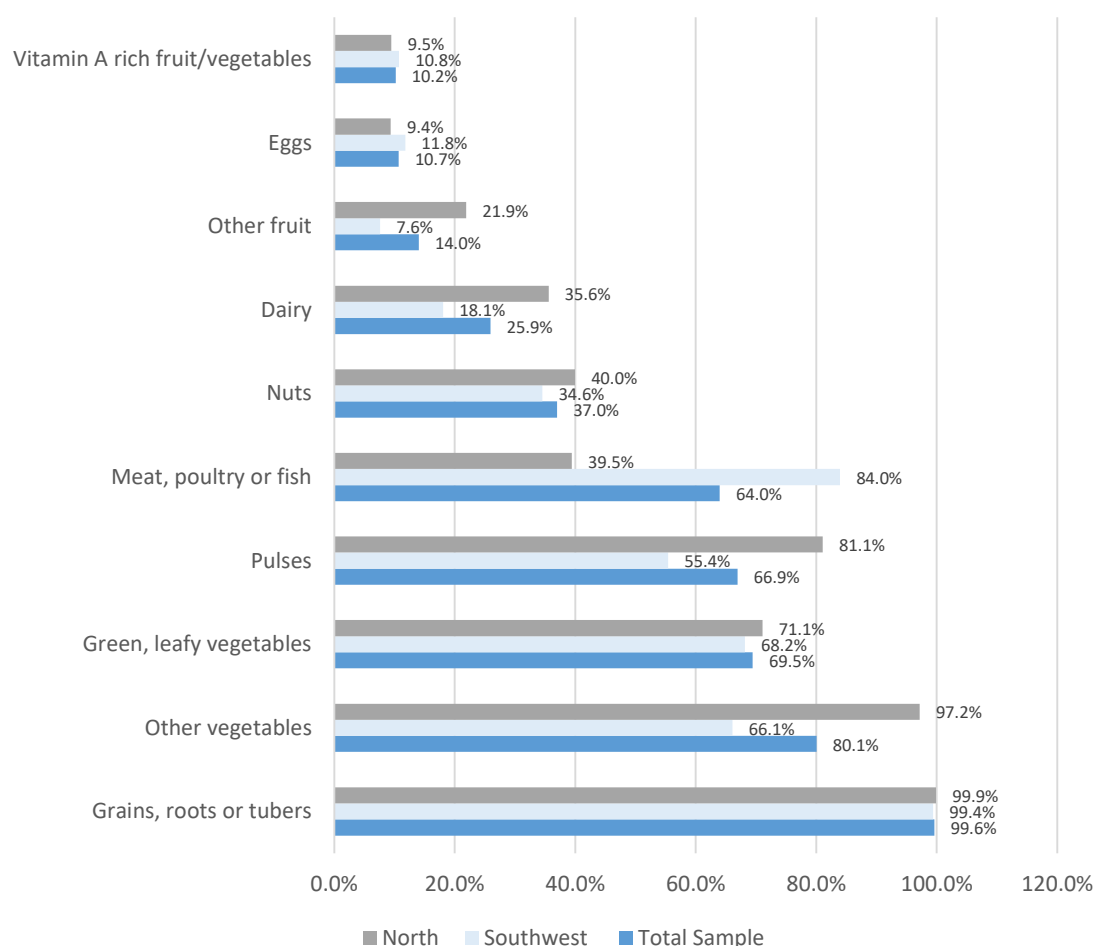
⁴⁵ DHS (2018) finds that only 10.9% of women in rural Nigeria reported to have eaten eggs in a 24-hour recall period. DHS does not report 24-hour recall of chicken alone.

⁴⁶ We do not compare our findings to DHS as DHS calculates MDD for only children under 2 and has a threshold of 5 foods. See more in Appendix A.

sufficient diversity to their diet to meet the MDD bar.⁴⁷ As such, increasing consumption of eggs and poultry can ultimately help achieve the goal of improving nutrition.

Figure 11 illustrates the different food groups consumed by women in the past 24 hours.⁴⁸ The most popular food reported to have been consumed by both women were grains, roots and tubers (99.6%); almost all women reported to have consumed the food group in the last 24 hours.⁴⁹ The second most popular food group was other vegetables (such as tomatoes, onions and eggplants); where 80.1% of women reported to have consumed. The most popular foods are also the food groups that households, on average, spend the most money on.⁵⁰

Figure 11: Food groups consumed by women in last 24 hours



Sample sizes: Total=2,136, Southwest=1,178, North=958

Women more commonly receive protein from fish and meat other than poultry: over half (61%⁵¹) of women reported to have consumed these food groups.⁵² More women in the southwest reported to

⁴⁷ Percentage of women and children under 5 that missed the MDD by one food group, and are not consuming eggs or chicken.

⁴⁸ The table shows a lower percentage of respondents that ate chicken compared to the graph because meat, poultry and fish were grouped into one food group.

⁴⁹ Similarly, DHS found that 98.4% of women in rural Nigeria consumed grains, roots or tubers.

⁵⁰ Refer to Appendix A for detailed household breakdown in food spending.

⁵¹ Percentage of women that only consumed chicken subtracted from those that consumed meat, poultry or fish.

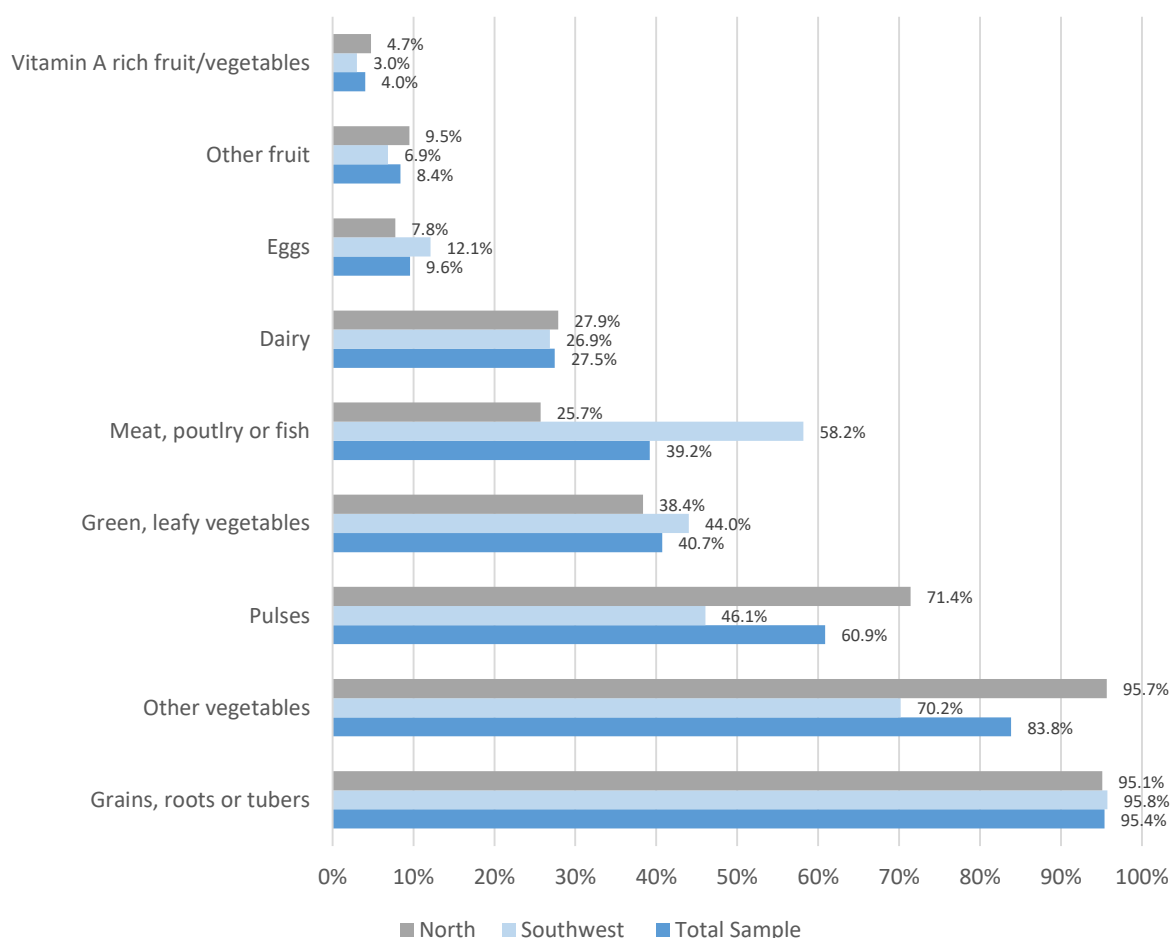
⁵² Percentage is calculated by % of women that ate meat, fish and poultry - % of women that ate chicken = % of women that only ate fish and meat other than poultry.

have consumed fish and meat other than poultry (81.6%) compared to women in the northern states (35.7%). This may be owing to women in northern states coming from poorer households than the women in the southwest. However, there is still potential to increase protein intake for women through increasing poultry consumption as 36% of women in our sample had not consumed any meat, fish or poultry in the last 24 hours.

The least popular food for women is vitamin A rich fruit: only 10.2% of women stated that they had consumed them in the last 24 hours. Technical experts state that consumption patterns of Vitamin A rich fruit are dependent on the time of year, as some of these fruits are seasonal. The second least popular food was eggs, though by a small margin: as highlighted above only 10.8% of women consumed eggs in the past 24 hours.

As shown in Figure 12, the trends in consumption for children under 5 are similar to those for women. Almost all children consumed grains, roots or tuber in the last 24 hours. The second most consumed food is other vegetables such as tomatoes, onions and eggplants. In addition, the least consumed foods are vitamin A rich vegetables or fruit and eggs.

Figure 12: Food groups consumed by children under 5 in last 24 hours



Sample sizes: Total=1,191, Southwest=495, North=696

As with women, children under 5 more commonly receive protein from fish and meat other than poultry (36.5%⁵³). And similarly, more children under 5 in the southwest states (56.6%) were reported to have consumed fish and meat other than poultry compared to children under 5 in northern states

⁵³ Percentage of children under 5 that only consumed chicken subtracted from the percentage of children under 5 that reported to have consumed meat, poultry or fish,

(22.3%). However, 89% of children that do not meet MDD did not report to have eaten any meat, fish or poultry. This highlights the potential to increase protein intake for consumption through increasing poultry consumption which could lead to an improvement in child nutrition.

In addition to increasing consumption of poultry products, these findings suggest there is potential to improve dietary diversity through increasing consumption of vitamin A rich vegetables or fruit. For example, consuming vitamin A rich vegetables or fruit would allow 24.7% of women and 27.7% of children under 5 to meet the minimum dietary diversity threshold.⁵⁴

⁵⁴ This refers to the percentage of women and children under 5 that missed the MDD by one food group, and are not consuming vitamin a rich fruit.

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)⁵⁵ 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
3. Control over use of income

We utilized these three indicators to generate (a) a modified empowerment score which we term the 3DE⁵⁶, and (b) a Gender Parity Index (GPI) which captures the extent to which women and men within a household have similar levels of empowerment.⁵⁷ We consider a respondent empowered if his or her involvement in various decisions reaches a specified threshold when the three domains are aggregated⁵⁸, 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.⁵⁹

We find that more than two-thirds (69.3%) of female respondents are empowered. As seen in Table 12, however, a lower proportion of female respondents are empowered when compared to the proportion of empowered male respondents (86.2%). While men have similar empowerment levels across the regions, a higher proportion of women in the southwest states are empowered (78%) than the proportion of women in the north (60.2%).

Table 12: Women Empowerment and Gender Parity scores

Indicator	Total Sample	Southwest	North
Proportion of Women Empowered (3DE)	69.3%	78.0%	60.2%
Proportion of Men Empowered (3DE)	86.2%	86.4%	86.0%
Proportion of HHs that meet Gender Parity (GPI)	65.8%	80.7%	50.4%

Sample sizes: Total=1,936, Southwest=983, North =953

On average, the proportion of households that have gender parity is similar to the proportion of households that have empowered women; 65.8% of women have gender parity with the primary male in their household. In other words, these women have a similar level of input into decisions as their spouses. However, in northern states, more households have empowered women than have gender

⁵⁵ 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 to primary productive and domestic tasks; and leadership, which aims to capture the individual’s potential for leadership and influence in his or her community.

⁵⁶ 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.

⁵⁷ 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.

⁵⁸ A respondent is empowered if he or she has an aggregated score of 0.75 out of 1 from the three domains.

⁵⁹ 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.

parity. This finding implies that women are more likely to report having input into decisions, but not to the same extent as the primary male in their households.

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

- **Productivity** - This domain captures levels of input in decisions involving agricultural activities such as cash crop farming and livestock rearing. An individual is empowered in productivity 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 assets in a household 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

3DE Domains	Total Sample	Southwest	North
Productivity (Women)	70.9%	80.1%	61.5%
Income Decisions (Women)	95.9%	95.4%	96.3%
Ownership (Women)	82.4%	95.1%	69.4%
Productivity (Men)	88.4%	89.0%	87.8%
Income Decisions (Men)	96.6%	94.5%	98.7%
Ownership (Men)	95.2%	96.6%	93.7%

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

Men are more empowered than women across all three of these domains, except in southwest states where men are almost as equally empowered as women in income decisions. This is not surprising as women are empowered in this domain if they have at least some input into an income decision; women are likely to have input into decisions on food expenditure and health, as seen in the data.

Both men and women, though especially women, are least empowered in the productivity domain, though 88.4% of men are empowered in this domain. This means that on average, fewer respondents, especially women, make decisions regarding agricultural activities such as when to harvest or what livestock to rear. More women in the southwest states are empowered in productivity decisions (80.1%) than women in the northern states (61.5%). Due to this, the productivity domain has the highest potential of increasing women empowerment through poultry rearing. For the north, the ability to empower women in this domain will much depend on how open men are to engage women more in decision making with regards to production decisions and whether women perceive a change in their involvement. One way to encourage men in northern states to support empowering women may be to garner the support of community leaders that have influence on their people.⁶⁰

Both women and men are most empowered in the income decisions domain: all genders in all regions have at least 94.5% of respondents empowered in income decisions. This means that most respondents have input in various decisions concerning the use of income, such as spending on education and on health care.

The ownership domain has the largest gap in empowerment across genders in the north. There is a 24.3% difference in proportion of men empowered than the proportion of women empowered in the northern states. In addition, there is a large difference between women’s empowerment in ownership

⁶⁰ The idea to engage community leaders was suggested by one of the field managers of the firm that managed the baseline data collection.

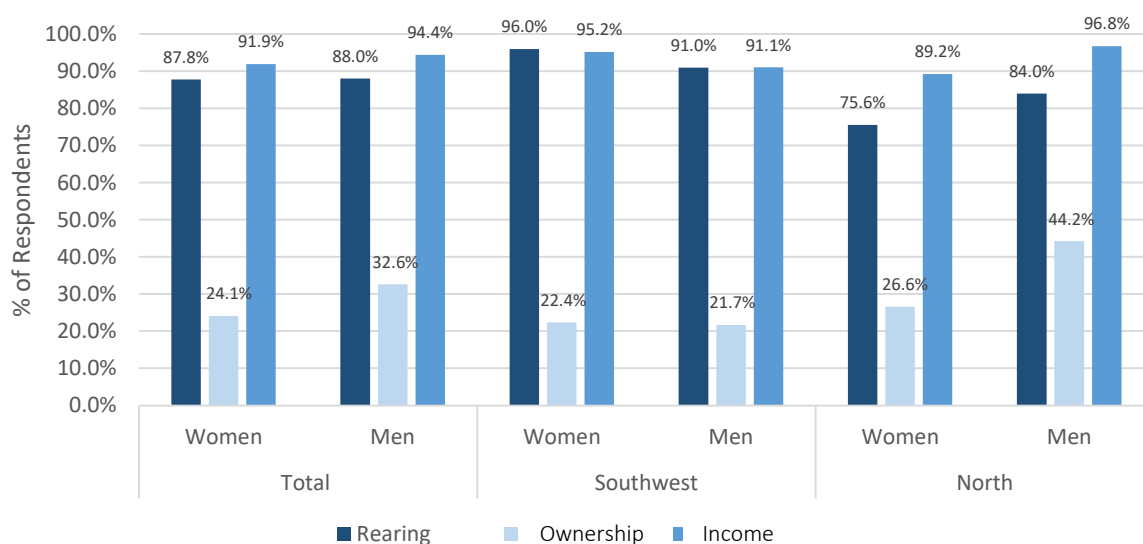
across regions: 95.1% of women in the southwest and only 69.4% of women in the north are empowered in this domain. This means that fewer women in the north feel that they at least jointly own a large asset (e.g. refrigerator, television) in their households. Increased income through chicken rearing may be a possible channel for increasing women’s ownership of assets in northern states, though it is yet to be seen whether women will be able to maintain possession of their income.

Women’s Empowerment in the Poultry Value Chain

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 care-taker’s *involvement in poultry rearing*, *ownership of poultry*, and *use of income from poultry*. For each of the three domains, we asked the primary care-taker of poultry several questions similar in nature to the questions asked as a part of the A-WEIA modules.⁶¹ Analogously, we consider the poultry care-taker empowered in a domain if he or she meets a minimum level of achievement with regards to their involvement in the decisions of that domain.⁶²

Figure 13 illustrates the proportion of poultry care-takers empowered across the three domains. We compare the proportions across poultry care-takers’ gender and region, emphasizing that these comparisons are *between* different small-holder households.⁶³

Figure 13: Percentage of men and women empowered by dimension



Sample sizes; Total =1,829, Southwest=1057, North=772
Empowerment for each domain is only calculated for respondents that participate in the domain.

We observe that the proportion of male and female care-takers empowered with regards to their involvement in rearing poultry and using the resulting income are fairly similar at around 90%. In the

⁶¹ 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 regard 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.

⁶² Achievement within a domain is defined in a comparable way to achievement the A-WEIA 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 into 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.

⁶³ Comparisons *between* household are in contrast to comparisons *within* households for the adapted A-WEIA.

southwest region, we observe that the vast majority of both female and male poultry care-takers (>90%) appear empowered with regards to their involvement in poultry rearing and the use of income from poultry. In fact, the proportion of female care-takers empowered in these two domains appears slightly larger than the proportion of male care-takers empowered in these domains. In the northern region, in contrast, we observe that male poultry care-takers appear more empowered than female care-takers across these domains. This trend of males being more empowered in northern regions is similar to the trend we find across the A-WEIA dimensions. That said, the proportion of female care-takers in the northern region empowered with respect to use of income is fairly high.

Looking at *ownership* decisions, we observe that about one third of male poultry care-takers (32%) is considered empowered, while only about one fourth of female care-takers (24%) is considered empowered. Similar to the two domains above, we observe that levels of empowerment across gender of the poultry care-taker are on par (at about 22%) in the southwestern region. In contrast, male poultry care-takers in the northern region (44%) appear more empowered than female care-takers (26%).

The apparently large difference in the proportion of care-takers empowered with regards to *ownership* in comparison to the other two domains may be explained by a minor coding error in the skip pattern of the baseline survey. While this error makes it more difficult for a respondent to be considered empowered in this domain at baseline⁶⁴, we anticipate no implications for the rigor of the evaluation design. First, we have corrected the skip pattern for data collection in Tanzania and any follow-up data collection. Second, our evaluation design is based on comparing outcomes of SHFs with similar baseline scores, and given that all respondents are affected in the same way, this error is unlikely to introduce bias.

We aggregate the three domains into a comprehensive, standardized women poultry ownership (WPO) score, in which higher values of the score indicate that the caretaker is more empowered.⁶⁵ Table 14 shows the average empowerment scores of the full sample, male caretakers and female takers. Male care-takers appear slightly more empowered than female care-takers. Given the domain specific results and regional differences between northern and southwestern states, this finding is not surprising.

Table 14: Poultry Ownership Score by primary caretaker gender

	Mean	Sample Size
Full sample	0.00	1,829
Male primary poultry caretaker	0.04	687
Female primary poultry caretaker	-0.03	1,142

⁶⁴ The error in the skip pattern caused one of the five decisions in this domain, involvement in consumption decisions, to be only asked of a small subset of poultry care takers: the about 4% who report to have sold eggs in the past six months. A vast majority of respondents to this particular question report being involved in consumption decision. The ownership domain is composed of five decisions and we consider a respondent as empowered if she participates in at least two decisions with some input. The low proportion of respondents selling eggs along with the error in the skip pattern effectively reduce the number of relevant decisions to three for the majority of respondents. As a consequence, it is relatively more difficult to be considered empowered in the ownership domain.

⁶⁵ 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 0 and standard deviation of 1. We conduct the aggregation for the full sample of respondents to be able to make meaningful comparisons across poultry care-takers gender. See Pre Analysis Plan for more details.

Looking at empowerment along the poultry value chain, we observe that vast majority of primary poultry care-takers of either gender appear empowered across different dimensions, potentially leaving little room for further improvements overall. Looking at differences across regions we observe female care-takers in the southwest appear more empowered than their male counterparts, while female care-takers in the north appear less empowered. The impact evaluation will assess APMI's potential to close this empowerment gap in the poultry value chain in the northern states.

AMO FARM SIEBERER HATCHERY (AFSH) SAMPLE FINDINGS

This section discusses the characteristics of past and present AFSH customers. These findings are shared to develop a preliminary understanding of the AFSH customer profile in the SHF sample. In this section, we report demographics of the AFSH sample and the perception that customers have of the Noiler chicken. Note that 65% of the AFSH sample is included in the baseline sample, and thus we do not make comparisons across the AFSH sample and baseline sample.

Demographics

Table 15 highlights key demographics of the AFSH SHF sample. The average household size is 5.7 members. More than half (54.3%) of the primary respondents are female and just over half of households have children under five. A greater proportion of northern households have a child under 5 (76.3%), which might be due to northern households having a larger average household size (9.3) than the southwest (4.8).

Approximately one-third (31.4%) of primary respondents are formally employed. For those that are employed, the average monthly income is ₦ 46,954 or approximately \$130 per month. There are varying levels of education across the regions: over half (59.2%) did not complete primary education in the northern states and only 4.8% of the respondents in the southwest did not complete primary education.

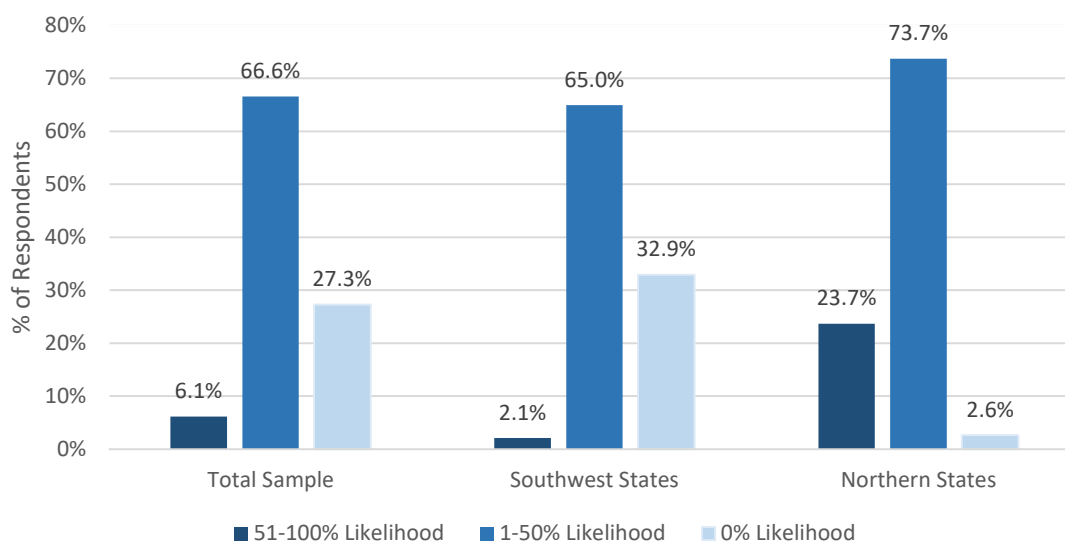
Table 15: AFSH Sample Demographics

Indicator	Total Sample	Southwest	North
Average household size	5.7	4.8	9.3
Proportion of primary respondents that are female	54.3%	57.1%	42.1%
Proportion of households with child under 5	45.9%	39.0%	76.3%
Average age of primary respondent	41.1	42.7	34.5
% of primary respondents formally employed	31.4%	32.3%	27.6%
Average monthly income of respondents with wages (in Naira)	46,954	48,557	31,885
% of primary respondents that did not complete primary education	15.0%	4.8%	59.2%
PPI Score	68.3	72.5	49.8

Averages and proportions have been calculated for all households (n=407). Average income has only been calculated for households employed.

As with the baseline sample, information on the AFSH sample households’ socioeconomic status was collected using the Progress Out of Poverty Index (PPI). As seen in Table 15, AFSH customer households’ average PPI score was 68.3, corresponding to a 7.8% likelihood of living below the \$3.10 poverty line. Figure 14 shows that poverty levels differ between the northern and southwest states: Only 2.6% of AFSH customer households in the north have a likelihood of living above the poverty line compared to 32.9% of the households in the southwest.

Figure 14: Progress out of Poverty Index (PPI)



Likelihoods refer to a household’s likelihood to be living under the poverty line of 3.10 USD/day. Sample sizes: Total=407, Southwest=331, North=76

Noiler Productivity

The average current Noiler flock size is 10.6. Of these SHFs that own Noilers, a small fraction (6.6%) report their Noiler chickens to have laid eggs in the past 7 days.⁶⁶ On average, households that own Noiler chickens produced 13.9 eggs per week, with an average of 4.6 eggs per mature hen. Note that this sample may not be representative given the small sample size, however, these findings are shared in order to give a preliminary sense of the productivity of the Noiler.

Table 16: Noiler Egg Production

Indicator	Total Sample	Southwest	North
Average Noiler flock size	10.6 (19.0)	10.8 (17.9)	10.0 (23.8)
% of HHs with Noiler chickens producing eggs	6.6%	7.9%	1.3%
Average weekly egg production per HH	13.9 (11.5)	14.1 (11.6)	8 (.)
Average weekly egg production per Noiler	4.6 (1.6)	4.6 (1.6)	2.7 (.)

Standard deviations are in parentheses under averages. Sample sizes: Total=27, Southwest=26, North=1

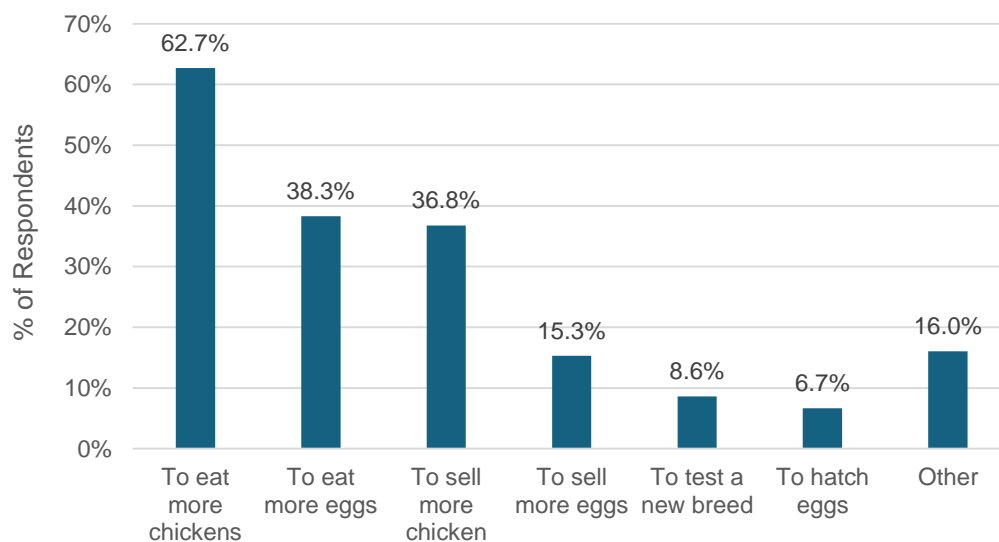
⁶⁶ These SHFs with productive Noilers are not included in the baseline sample, APMI Nigeria Baseline Report

Perception of the Noiler

We also aimed to gauge SHFs' perceptions of the Noiler 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 Noiler, as well as what they liked or disliked about the Noiler in comparison to local chickens.

As shown in Figure 15, a majority of the respondents (62.7%) reported that they bought the Noiler in order to eat more chickens, and slightly more than one-third (38.3%) reported to have bought the Noiler in order to eat more eggs. Thirty-six percent and 15.3% reported to have bought the Noiler in order to sell more chickens and to sell more eggs, respectively. These results highlight that SHFs are motivated to purchase due to the increased productivity potential of the Noiler, both for their own consumption and for generating more poultry income. Only 6.7% of respondents stated that their reason for purchasing the Noiler was to hatch eggs. This may be because SHFs have been convinced by AFSH to not hatch eggs at marketing events.

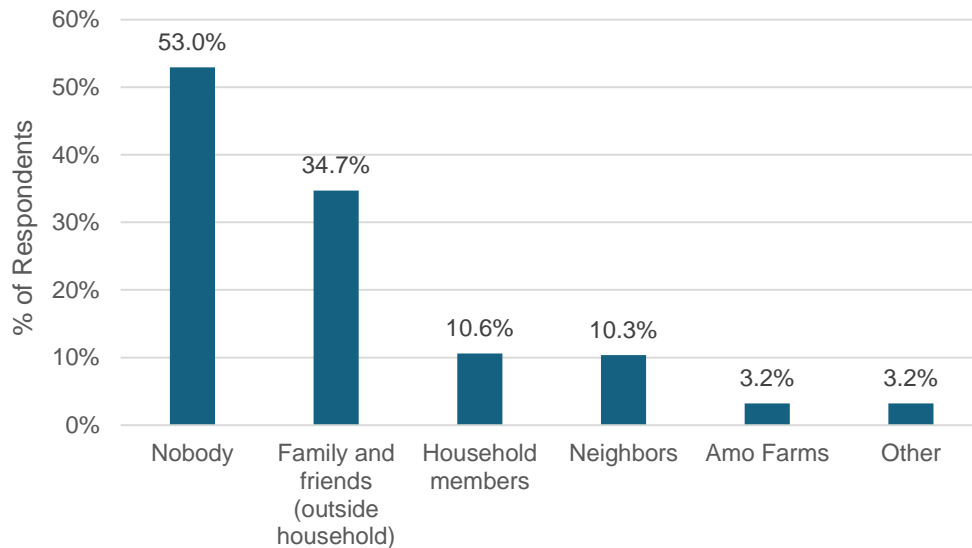
Figure 15: Reasons for deciding to buy the Noiler



Respondents could select more than one choice.
Sample size: 407

Respondents were asked who influenced them the most to purchase the Noiler, having heard of the breed from AFSH through marketing events. As seen in Figure 16, approximately half of the respondents (53.0%) decided on their own to purchase the Noiler. Of the 47% of respondents who were influenced by others, 34.7% stated that family and friends (outside of the household) persuaded them to purchase the Noiler, and 10.6% and 10.3% reported to have been influenced by household members and neighbours, respectively. Only 3.2% of respondents reported to have been influenced by AFSH. Hearing about the Noiler from family or friends and AFSH marketing events seem to be important for influencing SHFs to purchase the Noiler.

Figure 16: Who influenced SHFs to purchase the Noiler

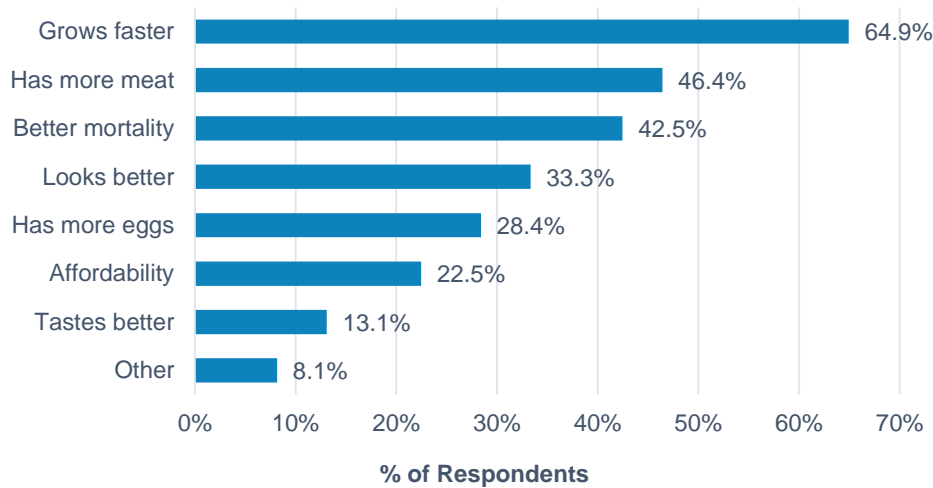


Percentages do not total to 100% as respondents could select more than one option, except respondents that selected "Nobody".

Sample size: 407

Figure 17 and 18 summarize the characteristics that the respondents like and dislike about the Noiler chicken compared to those of the local chicken. The most popular quality reported was that the Noiler grows faster than the local chicken (64.9%). The second and third most popular qualities reported were that the Noiler has more meat (46.4%) and that the dual-purpose chickens die less often than the local chicken (42.5%). These preferences again highlight that SHFs are most excited about increased productivity of the Noiler. Fewer respondents reported the Noiler to be more affordable (22.5%) and tasted better than the local chicken (13.1%).

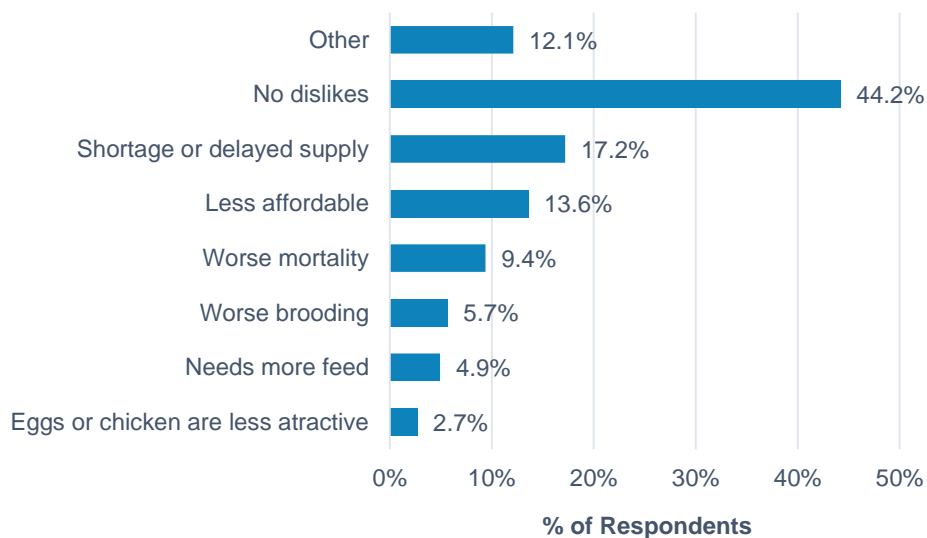
Figure 17: Favourite Noiler characteristics compared to those of the local chicken



Sample size: 407

Forty-four percent of the AFSH sample stated that there are no aspects of the local chicken they prefer over the Noiler. However, the most common dislike was regarding supply challenges: 17.2% of the respondents stated that they dislike the shortage or delay in the supply of the Noiler birds. While this is not majority of the AFSH customers and so does not highlight a critical challenge, an understanding of possible supply bottlenecks could be worth further exploration for Amo. Additionally, 13.6% of the SHFs claimed that the Noiler was less affordable than the local chicken.

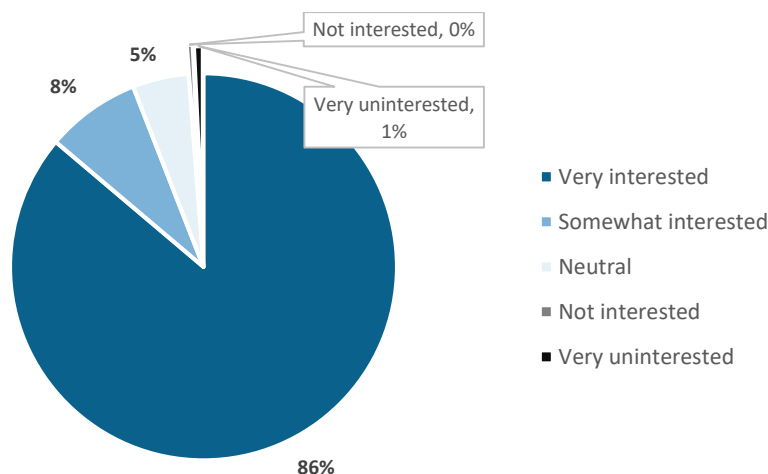
Figure 18: Disliked Noiler characteristics compared to those of the local chicken



Sample size: 407

Respondents were also asked how interested they were in purchasing Noiler chickens in the future. Figure 19 shows that a large majority (86%) of the respondents are very interested in purchasing Noiler in the future. Very few respondents reported that they were not interested or very uninterested. Overall, most respondents are satisfied with the Noiler chicken.

Figure 19: Interest in buying the Noiler in the future



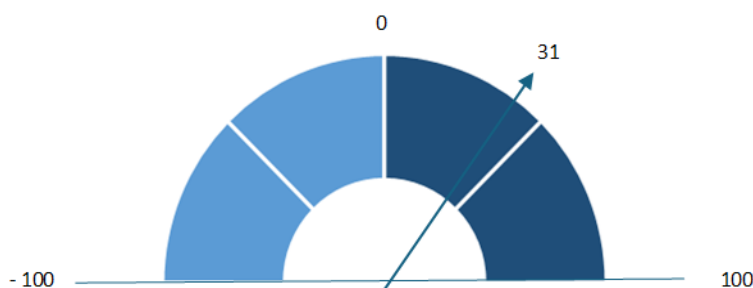
Sample size: 407

Net promoter score

Given the interest in the results shared with 60 Decibels, we calculated the Net Promoter Score (NPS) for the Noiler chicken. The net promoter score is used to measure satisfaction and loyalty for a product.⁶⁷ A score above 0 is considered to be good as this implies a larger percentage of promoters than detractors.

The NPS for Noiler chicken is 31. This implies that the Noiler has 31% more promoters than detractors, and therefore can be interpreted as a good score. This score can be used as a benchmark to help AFSH measure changes in customer satisfaction. In their Amo Farms Adoption Diagnosis report, 60 Decibels calculated an NPS of 69 for the Noiler, which is considered excellent. The difference in scores could be due to the different types of customers interviewed: 60 Decibels possibly interviewed a mix of repeat and first-time purchasers of Noilers, our sample pre-dominantly comprises first-time buyers.⁶⁸

Figure 20: Net Promoter Score



Sample size: 407

⁶⁷ 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).

⁶⁸ The two studies exhibit further differences in geographic focus, sampling procedure and sample size, all possibly contributing to the observed difference in results.

CONCLUSION

The findings in the baseline study provide a snapshot of the smallholder farmers in the study as well as a preliminary understanding of current AFSH customers from the sample. The report highlights insights across the four dimensions of interest:

- **Flock performance** – The report does not include findings on Noiler productivity as all SHFs own young chickens that are not yet producing eggs. However, we share findings on local chicken productivity to understand the benchmark to which the Noiler chicken productivity will be compared.
- **Nutrition** - We found that almost half of the women and approximately three-quarters of the children in our sample do not meet the minimum dietary diversity threshold. In addition, fewer than 15% of both groups consume poultry products. This highlights the potential impact that increased access to poultry products through Noiler ownership could have on nutrition for both women and children. There is also high potential to increase the proportion of women and children that meet the minimum dietary diversity through promotion of the consumption of vitamin A rich fruit or vegetables.
- **Income** – Overall, SHFs are poorer and more readily rely on informal income sources than the average rural Nigerian. In addition, SHFs generate less than \$2 a month from poultry income. Access to the Noiler could have impacts on SHF income through increased sale of poultry products from increased poultry outputs. As most SHFs rely on agricultural income, especially cash crops, AFSH could consider exploring timing Noiler chick distributions along with harvests to ensure SHFs have sufficient liquidity.
- **Women’s Empowerment** - Fewer women are empowered than men, and the women that are empowered are likely to have a lower level of empowerment than the primary male members of their households. In addition, the majority of women are least empowered with regards to making decisions in productivity. This means that fewer women are making decisions regarding livestock rearing or crop farming, such as what crops to farm or which livestock to sell and when. This suggests that involvement in poultry rearing may have potential to increase women’s empowerment, especially because almost two-thirds of poultry caretakers in the sample are women. Increasing women’s empowerment in this domain in northern states will depend on how open communities are to empowering women. One way to encourage men in northern states to support empowering women may be to garner the support of community leaders that have influence.

Furthermore, findings from AFSH customer sample highlight that customers are satisfied with the Noiler, as less than 2% stated disinterest in purchasing the Noiler in the future. This level of customer satisfaction is encouraging as it shows SHFs in treatment communities are likely to continue to purchase the Noiler, and continual access is likely important for improved livelihoods. The NPS score of 31, which signifies that a majority of SHFs promote the Noiler, can be used as a benchmark to help AFSH measure changes in customer satisfaction. Furthermore, this level of satisfaction also means that customers are likely to tell friends and family about the Noiler, which could increase sales.

Next Steps

We have outlined next steps for the APMI Nigeria impact evaluation below:

- **Monitoring** – IDinsight is developing a monitoring protocol in collaboration with AFSH. This protocol will outline the various monitoring activities to ensure that control communities do not receive access to the Noiler, prospective buyers are converted to actual buyers in treatment communities, and treatment communities have regular access to the Noiler. IDinsight will commence monitoring activities in January 2020.

- **Matching** – Following confirmation that prospective buyers have purchased Noiler, we will match treatment SHFs with control SHFs based on various baseline characteristics.⁶⁹
- **Comparisons between prospective buyers and converted prospective buyers** – As more prospective buyers become actual buyers, we will begin to compare differences across these converted buyers and prospective buyers who do not take up the Noiler at all in order to help us better predict buyers.
- **Endline** – Endline data collection will commence in 2021.

⁶⁹ See Pre Analysis Plan for more details on the matching procedure.

APPENDIX A: SUPPLEMENTAL FINDINGS

Appendix A-I: Demographics

Table 17 summarizes the livestock owned by SHFs in the sample. SHFs in the north and southwest predominantly own goats, as over 80% of all SHFs own goats in both regions. Sheep are significantly more popularly owned in the north than in the southwest: approximately three-quarters of SHFs in the north report to own sheep and only 13.7% in the south report to own sheep.

Table 17: Livestock owned by region

Livestock	Southwest	North
Goats	90.0%	82.4%
Poultry other than chicken	13.7%	20.2%
Sheep	9.8%	72.7%
Other Livestock	6.4%	0.1%
Pigs	5.6%	0.0%
Milking Cows	1.2%	5.8%
Rabbits	1.1%	2.1%
Bulls	0.7%	3.3%
Donkeys	0.0%	0.3%
Oxen	0.0%	9.1%
Horses	0.0%	0.6%

Sample sizes: Total=1684, Southwest =816, North =868

Table 18 shows the cash crops owned by SHFs across both regions. There are differences in crop popularity across regions: the most popular cash crops in the southwest are cocoa beans and cassava, while in the north, the most popular cash crops are sesame seeds, soybeans and rice.

Table 18: Primary cash crops by region

Crop	Southwest	North
Cocoa bean	19.8%	2.7%
Cassava	19.1%	1.2%
Sesame Seeds	0.0%	19.8%
Soybeans	0.8%	17.4%
Rice	2.9%	17.4%
Cashew Nuts	16.7%	0.0%
Yams	16.5%	0.0%
Maize	9.1%	5.6%
Palm Oil	7.2%	0.0%
Plantains	5.0%	0.0%
Bananas	2.2%	0.0%
Pulses	0.5%	0.0%
Groundnuts	0.2%	15.7%
Millet	0.1%	5.6%
(Red, white) beans	0.0%	14.7%

Sample sizes: Total=1274, Southwest =865, North =409

Appendix A-II: Chicken Ownership

Table 19 summarizes the average flock sizes owned by SHFs in the northern and southwest states. Of SHFs who own chickens, those in the southwest have larger flocks on average than those in the north. This might be explained by the relatively lower income levels of SHF households in the northern states.

Table 19: Average flock size by region

Flock	Southwest		North	
	% Own	Avg. if own	% Own	Avg. if own
Total	84.2%	24.0	81.8%	17.4
Local	71.1%	14.3	76.2%	13.5
Noiler	15.6%	10.8	5.4%	10.0
Broiler	21.1%	17.0	10.6%	19.7
Layer	2.8%	76.5	1.1%	59.1
Cockerel	9.4%	8.7	0%	0.0
Other	8.0%	7.9	0.002%	3.0

Sample sizes: Total=1868, Southwest =1079, North =789.

Table 4 illustrates the average composition of local and Noiler flocks by region. We observe that SHFs in both the southwest and the north, on average, own more mature hens than cocks for both the Noiler and local chickens.

Table 20: Flock Size by Age

	Breed	Chicks	Growers		Mature	
			Cocks	Hens	Cocks	Hens
Southwest	Local	5.2	1.1	3.3	1.3	3.8
	Noiler	2.6	0.5	3.4	0.1	2.3
North	Local	4.7	1.5	3.3	0.7	3.5
	Noiler	2.2	0.2	2.3	0.01	1.2

Averages for each flock size were calculated for SHFs that own the breed.

Table 21 shows the proportion of SHFs that stated that their chickens stopped laying for at least 5 consecutive days. Of SHFs that reported their local hens to have laid eggs, most report chickens laying eggs relatively consistently; fewer than 2% of SHFs in the sample stated that their local chickens had stopped laying eggs for more than 5 consecutive days.

Table 21: Proportion of SHFs with local hens that stopped laying eggs for more than 5 consecutive days

	Total	Southwest	North
Yes	1.5%	1.3%	1.8%
No	98.5%	98.7%	98.2%

Sample sizes: Total=520, Southwest =298, North =222

Appendix AIII: Differences in Egg Production and Chick Practices Across Caretaker Gender

To summarize the findings in this section: *we do not find evidence to suggest that there are differences in local egg production across genders at this stage. That said, we do find that spending on vets and vaccines is correlated with higher levels of egg production. The results also suggest that a lower proportion of women spend on vets and vaccines than the proportion of men. Owing to this finding, stakeholders might explore promoting spending on these two expenses to women in particular, which could ultimately lead to increased local egg production.⁷⁰ IDinsight will also continue to look into these dynamics at future stages of data collection.*

In this section, we investigate whether there is a difference in egg production across primary caretakers' gender. We also explore chick care and management practices disaggregated by caretaker gender. Any observed differences might inform gender-tailored messaging around topics of poultry management.

To assess these hypotheses, we start by comparing the average number of eggs produced by local chickens in the last seven days for male and female poultry care-takers.⁷¹ We conduct this means comparison for the full sample, as well as at the regional level. Column 1 of *Table 22* summarizes the results for the full sample, while columns 3 and 5 provide the regional level results.

We observe that local chicken flocks of male poultry care-takers, on average, produce 8.42 eggs in the last seven days.⁷² In comparison, flocks of female care-takers, on average, produce 1.05 eggs less than their male counterparts.⁷³ Testing whether this estimated difference in egg production is statistically significant from zero, **we cannot reject the hypothesis that overall egg production differs by gender.**

Looking at egg production by a region, though, we did find that flocks of **female care-takers in the Southwestern region, on average, produce ~1.8 eggs fewer than flocks of their male counterparts.** This difference is statistically significant at the 10% level. In contrast, we find that flocks of female care-takers in the North, on average, produce 0.2 eggs less than flocks of male care-takers, a difference that does not allow us to reject similar levels of egg production.

In a next step, we explore whether the observed difference in egg production for smallholders in the Southwestern region are driven by gender or other reasons, such as differences in chick-care practices. To assess this, we conduct multiple regression analysis that – in addition to care-taker gender – controls for variables such as expenses (feed, vet, vaccines) and time spent on chicken activities (time feeding, time cleaning coops).⁷⁴

Conditioning on these chick care and expenses characteristics, in column 4 of *Table 1*, we observe that the estimated difference in egg production across caretaker gender reduces slightly to 1.46 eggs in the last week. Testing whether this estimated difference in egg production – conditional on chick care

⁷⁰ These findings only consider egg production of local chickens. Given that Noiler chicken are vaccinated by mother units, it is unclear that results extrapolate to this chicken variety.

⁷¹ This mean comparison is implemented through regression analysis: the dummy variable gender (1 if female, 0 if male) is regressed on the outcome and standard errors are clustered at the village level to account for the sampling design.

⁷² The average number of eggs produced by male care-takers equals the coefficient of the “constant”.

⁷³ The coefficient for *Female Care-taker* provides an estimate of the difference in egg production between male and female care-takers.

⁷⁴ 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.

and expenditure variables - is statistically significant from zero, **we cannot reject the hypothesis that overall egg production differs by caretaker gender.**⁷⁵

Though there are no differences in egg production across genders, we do see that there are differences in egg production across primary poultry caretakers that spend on vets and those that do not. Similarly, we also observed differences across primary caretakers that spend on vaccines and those that do not. **We find that primary poultry caretakers that spend on vets, on average, produce 2.71 more eggs than those who do not. In addition, we also find that primary poultry caretakers that spend on vaccines, on average, produce 1.09 more eggs than those who do not.** These differences are statistically significant at the 10% level.⁷⁶

Table 22: Egg Production Regression Analysis

Variables	(1) Full Sample	(2) Full Sample Controls	(3) Southwest	(4) Southwest Controls	(5) North	(6) North Controls
Female Care-taker	-1.047 (0.644)	-0.653 (0.670)	-1.787* (0.956)	-1.460 (0.968)	-0.208 (0.654)	0.313 (0.641)
Spent on feed		-0.398 (0.668)		-0.707 (0.870)		-1.002 (1.082)
Spent on vet		2.713* (1.497)		4.439* (2.540)		1.617 (1.629)
Spent on vaccines		1.089* (0.588)		1.337* (0.731)		1.288 (0.958)
Time feeding chickens		-0.250 (0.962)		-0.225 (1.363)		-0.225 (1.217)
Time cleaning coops		1.050 (0.785)		0.747 (1.287)		0.915 (0.718)
Constant	8.422*** (0.555)	7.067*** (0.667)	9.488*** (0.773)	8.409*** (1.055)	7.110*** (0.673)	5.964*** (0.629)
Observations	522	522	300	300	222	222
R-squared	0.006	0.041	0.015	0.070	0.000	0.031

Standard errors (clustered at the community level) are included in parentheses.

P-value is indicated using stars: * < .1; ** < 0.05; *** < 0.01

Given the differences in egg production by spending patterns, we further explore gender differences across these chick care practices. Specifically, we look at the proportion of primary poultry caretakers that reported to have spent on chick care, and those that spent more than 30 minutes on a particular chicken rearing related activity. Table 23 shows that the proportion of men that report to spend on vaccines and vets is higher than of women across both the full and regional samples. These

⁷⁵ We fail to reject this hypothesis for the full sample and the northern region as well.

⁷⁶ While we do find statistically significant coefficients, this does not imply a causal relationship of spending on vets or vaccines and egg production. There might be other unobserved characteristics – such as caretakers’ wealth or their experience with poultry – that drive both their egg production and propensity to spend on vets/vaccines.

findings might suggest potential to improve egg production by promoting spending on vets and vaccinations, especially to female primary poultry caretakers.

Table 23: Gender differences in chicken expenses and time spent on chicken activities

Indicator	Full Sample		Southwest		North	
	Women	Men	Women	Men	Women	Men
Feed	57.9%	51.6%	72.3%	63.4%	36.9%	37.0%
Vet	9.7%	15.3%	8.5%	11.4%	11.5%	20.0%
Vaccine	31.4%	46.6%	29.9%	39.0%	33.6%	56.0%
Feed	44.2%	45.7%	63.3%	63.4%	13.4%	24.0%
Clean coop	58.5%	64.6%	68.4%	72.4%	44.3%	55.0%
Observations	299	223	177	123	122	100

Sample sizes: Total sample 522, Southwest 300, North 222

Appendix A-IV: Poultry Income

As shown in Table 24, there is diversity in perception of the contribution to income from poultry products among SHFs. Over a third of SHFs (40.2%) state that poultry income either contributes minimally to household income, or not at all. A minority (14.3%) of SHFs reports that poultry contributes significantly to their household income. SHFs in northern states on average perceive that poultry contributes more to their income than SHFs in southwest states.

Table 24: Poultry income contribution to total HH income

	Total	Southwest	North
Significantly (>50% of total HH income)	14.3%	11.0%	16.9%
Moderately (25% to 50% of total HH income)	23.2%	16.5%	28.5%
Somewhat (10% to 25% of HH income)	22.3%	20.9%	23.5%
Minimally (<10% of total HH income)	32.3%	43.7%	23.2%
None (0%)	7.9%	7.9%	7.8%

Sample sizes: Total=573, Southwest =254, North =319

Table 25 shows that the local market is the most popular place that poultry products are sold, as more than two-thirds of SHFs (70.5%) stated to have sold chicken there, and two-thirds (60%) sold eggs there.

Table 25: Chicken and egg sell location

Location	Total Sample	Southwest	North
% that sold chicken in Local Market (Local)	70.5%	75.6%	66.8%
% that sold chicken in own Community (Local)	37.5%	30.0%	43.0%
% that sold chicken in Other (Local)	3.1%	3.9%	2.6%
% that sold eggs in Local Market (Local)	60.0%	50.0%	100.0%
% sold eggs in own Community (Local)	50.0%	50.0%	50.0%

Sample sizes sold chicken: Total=674, Southwest =283, North =391

Sample sizes sold eggs: Total=10, Southwest =8, North =2

Tables 26 & 27 summarize average monthly expenditure on chickens for farmers, regardless of the chicken breed composition. As seen, on average, households generate ₦482 or \$1.35 per month from selling local chickens or eggs. The average value of local chickens and eggs consumed per household

over the past 30 days is ₦ 3013.⁷⁷ Households spend on average ₦ 1,832 or USD 5.08 per month on chicken-related expenses.

Table 26: Average monthly chicken expenditure and income (in Naira)

Indicator	Total Sample	Southwest	North
Average monthly income from local chickens	482	461	509
	Median: 0	Median: 0	Median: 108
	(1279)	(1500)	(909)
Value of local consumption	3013	2835	3127
	Median: 2400	Median:1656	Median: 2400
	(2648)	(2736)	(2587)
Average monthly chicken expenditure	1832	2437	1003
	Median: 400	Median: 800	Median: 33
	(4399)	(5059)	(3102)
Estimated local profit	479	-87	1222
	Median: 0	Median: 0	Median: 400
	(2934)	(2723)	(3037)

Standard deviations are in parentheses below medians

Sample sizes for expenditure, income & profit: Total=1865, Southwest=1078, North=767

Sample sizes for value of local chickens consumed: Total=544, Southwest=212, North=332

⁷⁷ This value is calculating by taking the product of the average number of local chickens consumed and the median price achieved by SHFs across the sample.

As seen in Table 27, the most common expenses are chicken feed and vaccinations, though a smaller amount is spent on vaccinations on average. When considering chickens sold and consumed and chicken expenditure, households earn an estimated ₦ 479 or USD \$1.32 per month in profit on average.⁷⁸

Table 27: Monthly chicken expenses over the past 30 days (Naira)

Indicator	Total Sample	Southwest	North
Average Monthly Feed Expenditure	2983	3196	2346
	(5078)	(5443)	(3729)
	54%	70%	32%
Average Monthly Chicken Transport Expenditure	1492	1341	1662
	(3367)	(2273)	(4308)
	4.5%	4.1%	5.0%
Average Monthly Vaccine Expenditure	272	298	244
	(524)	(578)	(458)
	33.4%	30.1%	38.2%
Average Monthly Vet Expenditure	418	513	353
	(746)	(905)	(612)
	8.8%	6.2%	12.5%
Average Monthly Infrastructure Expenditure	1186	1034	1435
	(1578)	(1250)	(2024)
	2.0%	2.4%	2.0%

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 own chickens (n=1,868).

Means have been calculated for households that incur the particular expenditure.

Appendix A-V: Dietary Diversity

We broke down the dietary diversity for the children under 5 age group that is reported in the main text into that of two separate age groups of 6-23 months and 2-5 years. As seen in Table 28, more children between the ages of 2-5 years meet the MDD threshold than those between 6-23 months. This is likely due to majority of the children under 2 still being breastfed.⁷⁹

⁷⁸ 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 income to calculate an estimated profit.

⁷⁹ According to DHS, after the first 6 months, breast milk alone is no longer sufficient to meet the nutritional needs of an infant. After 6 months, appropriate complementary foods should be introduced while breastfeeding is continued until age 2 or older. However, children that are still being breastfed are more likely to consume a lower selection of foods than those who are not.

Table 28: Children under 5 minimum dietary diversity

Indicator	Total Sample	Southwest	North
Child 6-23 months MDD	19.6%	23.4%	17.5%
Child 6-23 months still breastfeeding	81.5%	77.6%	83.8%
Child 2-5 years MDD	35.6%	35.5%	35.8%

Sample sizes children 6-23 months: Total=586, Southwest =214, North =372

Sample sizes children 2-5 years: Total=606, Southwest =282, North =324

As seen in Table 29, similar to the finding with women, the most consumed food group in children 6-23 months is grains, roots or tubers. However, the least consumed food group in this age range is fruits other than those rich in vitamin A.

Table 29: Child Dietary Diversity (6-23 months)

Food Group	Total	Southwest	Northern
Grains, roots or tubers	91.3%	91.6%	91.1%
Pulses	55.5%	38.8%	65.1%
Green, leafy vegetables	32.3%	30.4%	33.3%
Other vegetables	29.5%	27.6%	30.6%
Meat, poultry or fish	28.7%	40.7%	21.8%
Dairy	23.9%	29.9%	20.4%
Eggs	8.6%	16.3%	4.4%
Vitamin A rich fruit/vegetables	4.1%	1.4%	5.6%
Other fruit	3.9%	5.1%	3.2%

Sample sizes: Total=586, Southwest =214, North =372

As seen in Table 30, the most consumed food group for children aged 2-5 is grains, roots, or tubers and the least popular is vitamin A rich fruit or vegetables.

Table 30: Child Dietary Diversity (2-5 years)

Food Group	Total Sample	Southwest	North
Grains, roots or tubers	99.3%	98.9%	99.7%
Other vegetables	83.8%	70.2%	95.7%
Pulses	66.0%	51.4%	78.7%
Green, leafy vegetables	51.7%	56.7%	47.2%
Meat, poultry or fish	49.3%	71.3%	30.2%
Dairy	30.9%	24.5%	36.4%
Eggs	13.9%	14.2%	13.6%
Other fruit	12.7%	8.2%	16.7%
Vitamin A rich fruit/vegetables	4.0%	4.3%	3.7%

Sample sizes: Total=606, Southwest =282, North =324

Table 31 summarizes the average amount households in the sample spend on food across different food groups, and the proportion of households that spend money on the particular food group. For those SHFs that purchased a given food group in the last month, the food groups that SHFs spend the most money on are grains (₦2,631), baby food (₦1,809) and roots and tubers (₦1,565). Overall, food expense trends are similar to trends of most commonly consumed foods.

Table 31: Food spending (in Naira) per month

Food Group	% of HHs	Total Sample	Southwest	North
Total Food	98.2%	4821	5436	5087
Grains	81.9%	2,631	2,245	3,119
Baby Food	2.3%	1,809	2,033	1,273
Tubers and Roots	43.0%	1,565	2,233	1,020
Meat	88.0%	861	978	701
Beverages	40.0%	618	609	635
Dairy	49.4%	596	564	626
Other Foods	11.1%	579	584	432
Vegetable	65.6%	501	324	688
Fruit	48.7%	499	465	526
Legume	77.1%	408	417	394
Seeds	17.6%	210	195	353

Averages for each food group were calculated for SHFs that reported to spend money on the food group.

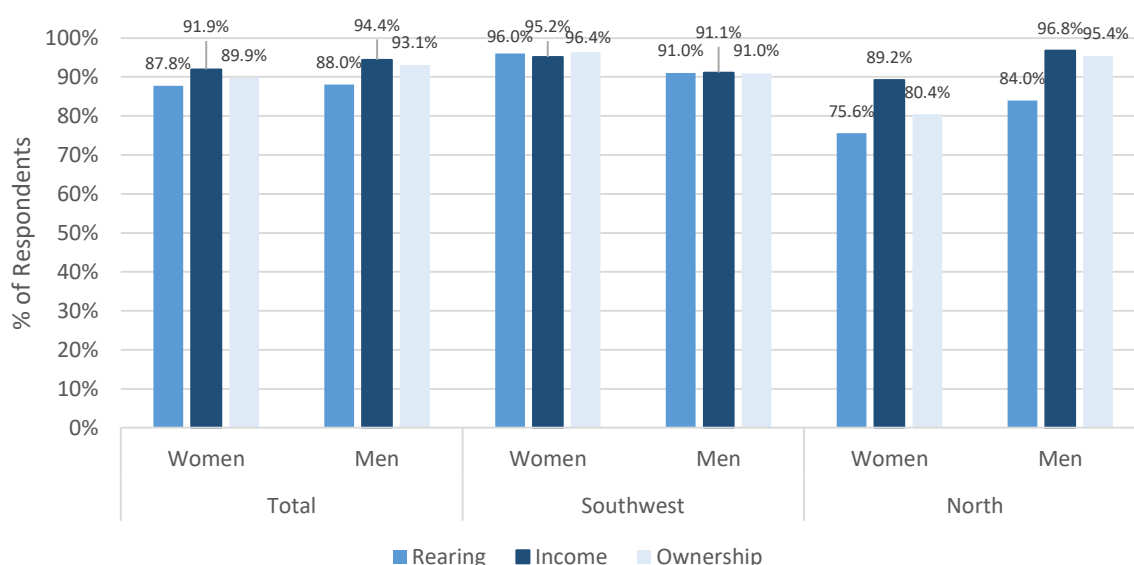
Appendix A-VI: Women Empowerment in Poultry

In the main text, we report on the proportion of primary chicken care-takers empowered in three different dimensions of the household poultry value chain. We find the vast proportion of care-takers to be empowered in two out of the three domains. As explained in the main text, a minor coding error in the skip pattern of the baseline survey makes it more difficult to be considered empowered in the third domain that is focused on ownership. Overall, we anticipate no implications for the rigor of the evaluation design.

To provide a further robustness check, Figure 21 illustrates the proportion of primary chicken care-takers considered empowered per domain using an adjusted empowerment threshold for the ownership domain. We adjusted the threshold in the ownership domain to consider a care-taker empowered if she had some input in one decision out of five, rather than two out of five. With this threshold adjustment, we find that ownership empowerment scores are similar to the scores of the other two domains. Moreover, this adjustment seems to further smoothen the minor differences between male and female care-takers reported in the main text. We still observe differences with respect to involvement in ownership decision among poultry care-takers in the North. The proportion of care-takers empowered in the domains of rearing chickens and use of income remain unaffected. With this adjustment, we see that majority of respondents are empowered in ownership across all regions (>80%).

We prefer to not report these adjusted scores in the main analysis for several reasons. First, from a conceptual point of view, we still believe that the threshold of being involved in two decisions is a reasonable level of achievement in this domain.⁸⁰ Second, from an analytical point of view, adapting the threshold would affect the aggregation into the overall poultry empowerment index.

Figure 21: Women’s empowerment in poultry domains with adjusted score



Averages for each domain were reported for SHFs that participated in the domain.

⁸⁰ This is because the five decisions capture a care-takers involvement in the three main domains of purchasing, selling, and consuming chickens.

APPENDIX B: REPLACING COMMUNITIES & SHARING PROSPECTIVE CLIENT LISTS

Appendix B-I: Replacing Communities

During the baseline data collection process, we needed to replace 24 communities from the original list with new communities. Communities were replaced for two primary reasons:

- **Insecurity** – Due to reported incidents of increased levels of attacks and kidnappings, and so communities were replaced in order to prioritize safety for the field teams.
- **Low likelihood of Mother Unit set up** – As the selection of communities was in coordination with AFSH agents, the agents were able to determine the likelihood of setting up MUs in communities. Communities that were highly unlikely to set up an MU were replaced with communities in the same state that exhibited similar characteristics, but exhibited a higher likelihood for a Mother Unit to be set up.

The number of communities replaced for each state is summarized in the table below.

Table 32: Reasons for replacing communities

	Ekiti	Kwara	Ondo	Kano	Katsina	Total
Low likelihood of MU set up	5	1	5	5	2	18
Insecurity	0	0	0	0	6	6
Total	5	1	5	5	8	24

In order to retain comparability between treatment and control communities, we chose replacement communities that were similar in terms of characteristics such as, but not limited to: population size, access to health care and access to financial services.⁸¹ We also ensured that these replacements were in the same state and local government area as the communities they were compared to. Replacing communities was best undertaken in coordination with AFSH agents and the local survey firm as they were the most familiar with the surrounding communities. As such, the agents and field managers were able to provide valuable insights on communities that were similar in size and demographics to communities we needed to replace. After coordinating with the agents, the IDinsight team then sent mobilizers to potential replacement communities to scope the areas in order to determine if they were viable replacements. This strategy allowed us to find similar communities to replace the older communities in an accelerated time, mitigating potential delays in data collection.

Appendix B-II: Sharing prospective client lists

The IDinsight team also coordinated with AFSH to share lists of prospective clients with Mother Units. Sharing the list of registered SHFs from community events in the communities with potential Mother Units helped persuade some SHFs to become an MU knowing that they would already have a list of customers once established. In addition to this, sharing lists also increased Noiler purchases as was

⁸¹ 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 replacement treatment communities.

observed in some communities where after the MU was set up, some of the prospective buyers became actual buyers.

This insight suggests a possible way to strengthen the MU model: **AFSH may wish to start registering attendees formally during sensitizations and provide these names to MUs to help with sales or to mitigate perceived financial risk of SHFs for becoming an MU.** In addition, this increases the likelihood that prospective buyers will become actual Noiler buyers, as MUs are better able to target customers.

APPENDIX C: 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 the data was 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 a day or their surveys were too short.

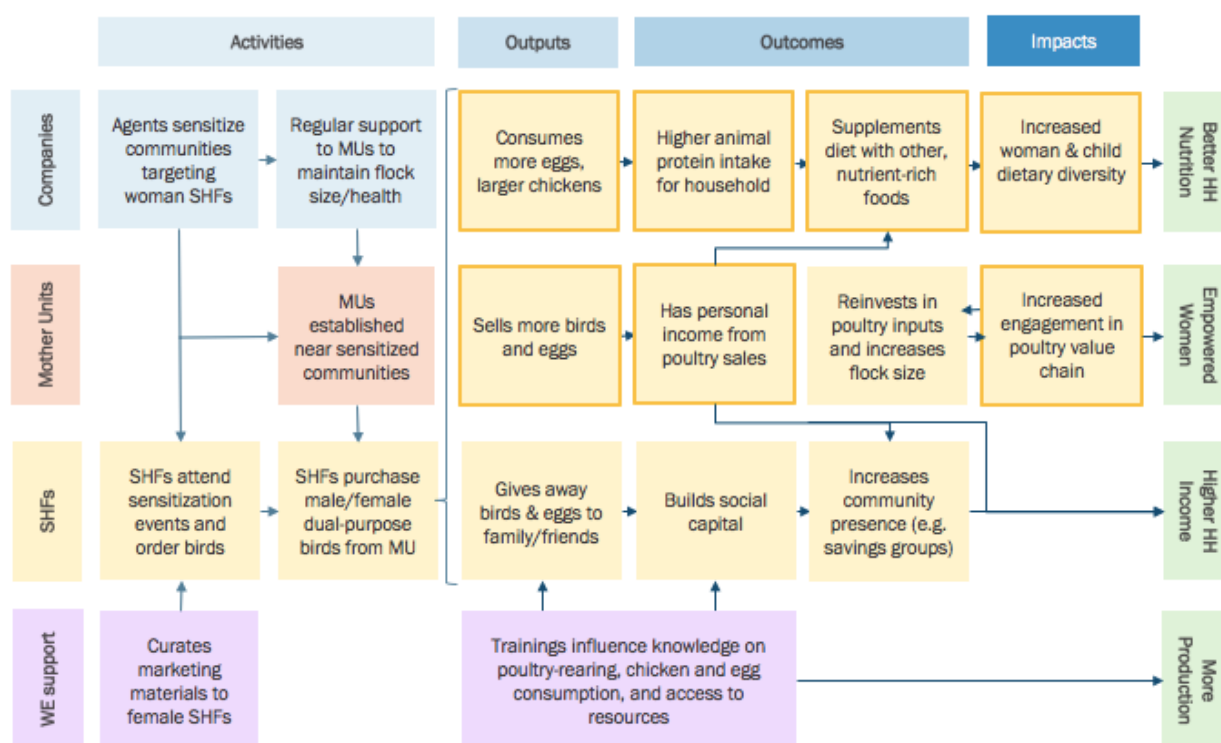
- **Logical Checks** – Daily checks on all the data were conducted in order to ensure that answers imputed by enumerators were logically sound. For example, ensuring that nieces or husbands were the correct gender, and ensuring that children were not recorded as having eaten eggs in a household with no children. These checks were also used to monitor enumerator performance, especially where enumerators were not paying close attention to responses.
- **Back-checks** – 10-15% of the surveyed farmers 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 is to check the validity of questions (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.

APPENDIX D: 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 distribute Noiler chickens to smallholder farmers (SHFs). Noiler 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 also increases the share of protein 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.⁸²

Figure 22: Theory of Change of the APMI Evaluation



⁸² While Noiler 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.