Baseline Survey Report

Raising the Incomes of Smallholder Farmers in the Central Highlands of Angola:

A Model Project for Improving Agricultural Value Chains in Post-Conflict Nations

ProRenda Project

Report to World Vision

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ACRONYMS

DEFF	Design Effect
FO	Farmer organization
MINAGRI	Ministry of Agriculture
MSU	Michigan State University
NGO	Non-governmental organization
SL	Significance Level
TLU	Tropical Livestock Unit
WV	World Vision

1. Introduction

When Angolan leaders signed the ceasefire agreement in 2002, the agricultural sector was functioning poorly and unable to meet the needs of rural and urban populations, in spite of rich natural resources, especially land appropriate for agricultural production. Farmers faced major constraints to obtain information and inputs, and markets for surplus production functioned poorly, with high transport costs (Allen et al. 2003). In spite of these problems, the agricultural sector was and is still seen as key to helping solve Angola's unemployment and poverty problems. In 2008, World Vision sought support to develop a Value Chain program in the Planalto Region of Angola over a period of five years and received funding from the Bill and Melinda Gates Foundation for the ProRenda project. The Angolan context for the project as well as project objectives are described in greater detail below.

To put this report into context, a key component of the project was to develop systems for impact evaluation of program activities based on current research methods and empirical approaches. This report provides a summary of the baseline survey results, as well as the survey design and implementation activities undertaken in 2008/2009. The key objective of the baseline is to establish baseline levels of selected indicators, which can then be used as the program develops, and afterwards to understand the impacts and learn the lessons for such work in Angola and elsewhere.

The report has the following structure. This brief introduction is followed by a background chapter on Angolan context and project objectives. It is followed by Chapter 3 with an overview of the baseline survey design. The remaining chapters present survey results and recommendations. Chapter 4 details community level information, and Chapter 5 presents characteristics of the households. Wealth of the household and analysis of gross margins from sales of key crops are found in Chapters 6 and 7. Potato, bean and onion production analysis are found in Chapters 8, 9 and 10, respectively. Chapter 11 looks at fertilizer and other input use across the crops, and Chapter 12 evaluates marketing strategies. Livestock assets are included in Chapter 13, with household welfare and consumption issues addressed in Chapter 14. Education of children is summarized in Chapter 15. Chapter 16 provides a summary of key findings and Chapter 17 summarizes the usefulness of the baseline for impact evaluation.

2. Background on Angola and the ProRenda Project[1]

After the most recent cease-fire agreement was signed, Angola has been at peace for more than six years. The oil sector has provided resources to the economy to generate improvements in employment and in macroeconomic conditions, especially noticeable in urban areas, with massive infrastructural investments and changing markets. Rural populations have seen less of the benefits and rural poverty remains deep, resulting in continued rural to urban migration. To stem the flow of people to urban areas, where services are overwhelmed and unemployment is on the rise, a dynamic rural economy is critical. Many factors indicate that the stable situation in the country will continue in the long term as the economy is rebuilt and progress continues. However investments in the agricultural sector and complementary services in rural areas will be needed to boost rural incomes and retain labor in those areas.

Enhancements in crop marketing can play a key role in developing incentives for agricultural investments. The ProRenda project focuses on the production and marketing of high-value agricultural crops with potential to improve the incomes of smallholder farmers by

[1] This section relies heavily on the World Vision ProRenda Project (WV 2008) document submitted to the Bill and Melinda Gates Foundation.

substituting for imported produce. The project team has selected the following key commodities: Irish potatoes, dry beans, bulb onions and carrots. As indicated in the project document (World Vision, 2007), Irish potatoes, dry beans, and bulb onions are crops with high potential to generate rapid income growth for rural producers. All of these crops are already grown by some farmers in the region. Key to realizing the potential, however, are the complementary investments in grading, storage, and packaging. Both inputs and transport costs are high, thus the focus needs to be on relatively high value (per weight or volume) commodities to place them profitably in distant urban markets, and to effectively compete with imports. Maize is another crop in region, but with its low value per weight, it was not targeted as a key commodity for ProRenda[2].

Value chain maps[3] prepared for the target crops showed two main marketing channels, one based on the formal sector (with supermarkets and catering companies) and one based on public markets relying more on the informal sector traders. It is estimated that the informal retail sector represents about 80 percent of the total market share for these commodities (World Vision 2008). Smallholder farmers are generally thought to sell their crops to itinerant traders in local markets, but there is a need to determine their current marketing options and strategies.

South Africa supplies most of the imported potatoes, onions and carrots. Recent data suggest that there is an increasing demand for potatoes in urban areas as a result of urbanization, increasing household incomes and population growth data.[4] Local production is unable to meet current demand for potatoes, and with high import prices, there appears to be ample scope to expand domestic production and marketing of potatoes. For beans, there is a deficit in domestic production, with limited imports to satisfy demand. However, the quality of the imported beans does not always meet Angolan demand, leaving a price premium for traditional, high-quality local bean varieties. Markets targeted by the selected value chains are expected to grow at a rate of at least 15 percent a year, based on population projections and growth of gross national product (excluding the oil and diamond sectors) (World Vision 2008).

Angola has excellent agricultural land in the Planalto region and there are up to three agricultural seasons per year, with farmers taking advantage of lowlands, slopes and highlands for a diversified production system. The key problem that this project addresses is competitiveness of domestic production. The project is designed to enable Angolan farmers to compete more effectively in Angolan markets against imports by improving productivity of land and labor in production and enhancing efficiency in marketing.

The ProRenda project will evaluate the entire value chain for the selected crops to understand the potential for interventions to remove constraints and increasing efficiencies in the key segments of the value chain. Based on that, the project will focus on key constraints and opportunities common to all of the targeted value chains. For example, it will focus interventions to improve market information (wholesale/retail constraint), to enhance understanding of formal, high-value market quality requirements (processing/assembly/transport constraint), to improve crop yields and soil fertility (production constraint), to establish formal sector supply contracts (wholesale/retail opportunity), to enable producer-based processing and grading for "added value" to market standards (processing/assembly/transport opportunity), and to encourage adoption of improved production technologies (production opportunity)[5]. If the constraints can be addressed, Angola has excellent agricultural growth potential due to its natural resource base,

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[2] See the ProRenda Grant Proposal for details.

[3] See Appendix J of the ProRenda Grant Proposal.

[4] See Table 2 of the ProRenda Grant Proposal.

[5] For a list of additional key constraints and opportunities, see Table 8 of the ProRenda Grant Proposal.

the overall economic growth rate, efforts on poverty reduction, and establishment of peace with national unity[6].

In brief, World Vision ProRenda seeks to ensure that "smallholder farming families in the central highlands of Angola will increase their incomes from potatoes and other high-value crops by establishing and maintaining competitive value chains through (1) improved marketing of produce for major urban markets, (2) improved organization of farmer associations to operate as a business, and (3) increase yields, quality, and the regularity of production" (World Vision 2008)[7]. The goal is to reach 100,000 smallholder-farming families in Angola's central highlands, increasing their annual income from potatoes and other high-value crops. Based on the program of activities, ProRenda will affect a minimum of 27,000 smallholder families, (22,000 primary beneficiaries in directly-assisted villages and 5,000 of secondary beneficiaries in villages indirectly assisted by the project), with women beneficiaries projected to be 60% of the beneficiaries. Overall, they seek to double household incomes[8] by establishing competitive value chains for these crops. When projected over the economy, "the project will generate an additional gross income of US$50 million for 22,000 [directly assisted] farmers by the end of project"[9]. The project will also develop monitoring and evaluation tools that enable project designers and implementers to assess the impact of the project and that is where this baseline survey comes in.

3. Overview of the baseline survey

3.1. Survey objectives

The baseline (and subsequent comparative surveys) is one tool among many monitoring and evaluation tools used by the ProRenda project. The principal purpose of the baseline survey is to measure indicators that can later be used to assess impact while also capturing aspects that may influence outcomes to control for other events. These indicators are ones that can measure improvements in farm family annual income measured through (1) increases in "gross receipts" from sales of targeted crops (potatoes, onions, and beans) and (2) increases in "gross margins" represented by gross sales receipts minus input costs for targeted crops.[10] There are also other indicators, which may be useful to identify changes in wealth or family wellbeing. The proposal calls for disaggregation of the results by gender to the extent possible and collection of data on a number of supplementary indicators able to capture the potential impacts of increased income on family expenditures or investments in durable goods, nutrition, health, and education. In addition, there are a number of indicators that will be used to track impacts of selected aspects of the WV program such as training in literacy and in the use of market information.

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[6] *The Private Sector, Government and Civil Society in Rural Development – Realizing Angola's Immense Potentials*; John W. Mellor; National Conference on Agriculture; Luanda, Angola; April 14-16, 2004. In the ProRenda Grant Proposal.

[7] See pages 12 and 13 of the ProRenda Grant Proposal for details.

[8] Actual percentages based on initial baseline income survey.

[9] See Appendix A: Project Objectives and Outcomes, ProRenda Grant Proposal.

[10] The terminology in this and other project documents is not consistent with respect to these income variables as the "gross margins" are sometimes referred to as "net crop income". Gross margin is a better term to use as what we are subtracting out as costs are only the costs of variable inputs (primarily seed, fertilizer, pesticides, and marketing costs). These gross margins can be viewed as the returns to family labor, land, and equipment investments; strictly speaking, "net income" would reflect the amount of income left after also subtracting these latter costs from gross receipts.

The baseline survey, conducted between January and April 2009, was designed to collect baseline information before the ProRenda project implementation began.[11] The sample design called for covering 40 communities and 672 farm families (see below). The primary tasks required for implementing the baseline data collection and analyses were:

- Determining the populations and sub-populations of interest and sampling efficiently from them, including control groups.
- Designing the survey instruments and implementing the survey
- Analyzing the data to describe the current characteristics of each population of interest.
- Assessing the quality of the baseline data on the key indicators planned for use in later comparisons.
- Describing the key characteristics at the community level that help to shape the initial conditions and permit us to capture both anticipated and unanticipated impacts and events.

3.2. Sample design for the farm and community surveys

The sample was designed by first purposively selecting target geographic areas (Provinces, Communes, and Municipalities), developing village lists for these target areas, classifying villages into categories required by the primary sample stratification design (see below), randomly selecting the required number of villages for each sample strata, development of a farm family listing for each selected village, classifying families into categories required by the secondary sample stratification design (see below), and random selection of families from this last list for each secondary strata.

The geographic areas of interest for this survey are those in or near the ProRenda project area in the provinces of Huambo (Caala, Bailundo, Londuimbali, Katchiungo, Ekunha, and Tchicalachuluanga municipalities[12]), Bie (Chinguar municipality) and Benguela (Babera municipality). World Vision staff assisted with the development of the various listings needed to select villages and farm families by strata. The lack of existing Census information or other representative surveys was a major constraint in sampling development and is discussed in detail in the baseline development report (Donovan and Kelly, 2009). The efficiency of the sample was affected negatively by this lack of information.

A community-level survey was conducted by supervisors in each village and includes information on infrastructure, economic activities, and other key aspects. This survey helps to control for changes in the overall environment for households and was conducted at the same time as the household surveys.

The population of interest for the farm survey was farming families producing horticultural crops, particularly potatoes, common beans, onions, carrots, and cabbages. The research design called for stratification based on three criteria[13.] Primary stratification was based on a classification of villages into three categories:

[11] See Donovan and Kelly 2009 for greater details on the Baseline Survey development and sampling considerations.

[12] A municipality in Angola is an administrative term similar to districts in Mozambique or counties in the United States. It does not refer to a solely urban area, although the name of the municipality is usually the same as the key urban area in that administrative area. For example, Caala municipality has the city of Caala as its main urban center and place of government offices for the municipality.

[13] See point 3.2 of this document for details.

- Primary Villages[14]: Villages expected to be direct participants in the early phases of the ProRenda project, many of which have already established WV producer associations
- Secondary Villages: Villages expected to be indirect beneficiaries of the ProRenda project due to smaller scale interventions during project years 2 and 3 and spillover benefits from the direct participants; the expectation was that these villages would have few, if any, producer associations at the time of the survey and no WV associations
- Control Villages: Villages where no WV activities are planned and WV staff felt there were few, if any, functioning producer associations at the time of the survey.
- There are two additional criteria for sampling: sex of household head and whether or not the household participated in producer associations. These criteria were used to ensure sufficient numbers of households for analysis, based on the project objectives. Thus, with the village listings, the second level of stratification simultaneously took into account sex of household head and whether or not the household participated in producer associations.

3.3. Realization of sampling strategy

Table 1 shows the different sub-populations of interest and anticipated number of respondents in each category. As can be seen in the last two rows of Table 1, the sampling plan was only partially achieved. In particular, we were unable to meet fully the proposed secondary strata composition in most of the villages due to insufficient numbers of female-headed households and households with association members. For example, in 62 percent of the primary WV project villages, there were no households participating in producer associations, although it was anticipated that there were participants in almost all the primary villages. This could have happened for various reasons. First, households were classified based on general information (including participation in farmer organizations) collected prior to conducting the in-depth interview with the household, and so the initial respondent may have provided inaccurate information. Respondents may have strictly interpreted "farmer organization" to be those organizations that are officially recognized, and thus not considered initial groups and their activities as participation in a "farmer organization". Finally, some of the primary villages are high priority for World Vision with this project, but may not have participated in prior World Vision efforts to organize farmers.

We also had some surprises with the control villages, for it was expected that there would be no producer associations in these villages. When the village listings were completed, no households were considered as participating in a producer association. However, during the survey, some households identified members who do participate in farmer associations (Table 1). There are no World Vision sponsored associations in those villages, but there have been activities by other agents supporting associations. Thus we end up with larger than anticipated number of farmers declaring membership in associations in the control areas, fewer participants in the primary and secondary villages indicating participation, and an analytical challenge to measure the impact of the ProRenda project.

While it was hoped to evaluate household based on both primary and secondary stratification, the data will not provide reliable information when disaggregated to that level. We will be able to look at male versus female households overall, or participating versus

[14] The terms "primary" and "secondary" are often used with sample selection, but here we use the terms relative to World Vision's use of primary villages as those with direct WV intervention and "secondary" villages as those who would only indirectly benefit from WV interventions, with farmer to farmer contact. WV will have direct efforts in one set of villages (primary) and anticipates more indirect impact through farmer to farmer contact for the secondary villages.

Table 1 Sampling design and realization, by sex of household head, village type and participation in farmer organizations

Village type	Numbers	Number of villages	Female-headed households		Male-headed households		Total
			Participants	Non-participants	Participants	Non-participants	
			(sample numbers)				
Primary							
	Proposed	16	64	64	64	64	256
	Realized	16	16	108	22	110	256
	Valid Surveys		16	102	22	107	247
Secondary							
	Proposed	16	64	64	64	64	256
	Realized	17	14	121	23	114	272
	Valid Surveys		14	112	22	110	258
Control							
	Proposed	8	0	80	0	80	160
	Realized	8	0	64	0	64	128
	Valid Surveys[1]		0	57	0	58	115
	Valid surveys reclassified[1]		12	45	9	49	115
Total	Proposed	40	128	208	128	208	672
	Realized	41	30	293	45	288	656
	Valid Surveys		30	271	44	275	620

[1] Some households indicated that they did not participate in any producer associations at the time of listing, but during interview, one or more people within the household did participate.

Source: ProRenda survey, 2009

nonparticipating households, or households by type of village (primary, secondary or control), but more detailed disaggregation (combining these criteria for example) would be limited. Figure 1 indicates where the sample villages are located in the ProRenda zone of activities.

The farmers selected for the sample do represent the population of interest, specifically the requirement that they produce at least one horticultural crop or beans. More farmers in the sample[15] planted common beans (68% of farmers), than potatoes (54%), and onions (44%). Only a small percentage of sample farmers planted cabbages (6%) or carrots (2%).

Potatoes were planted by more farmers in the primary and control villages, and by male-headed households. Beans, on the other hand, were planted by a higher percentage of farmers in the control villages and by female-headed households. Furthermore, onions were planted by more farmers in the primary villages and by male-headed households (Table 2).

Population weights were developed for the sample, based on village listing information for the region and observed cases in each selected village. The weights are used to extrapolate out to the population level for the World Vision areas of implementation and almost all reported statistics are based on the extrapolation, unless sample number indicated.

[15] See point 3.1 of this document for details.

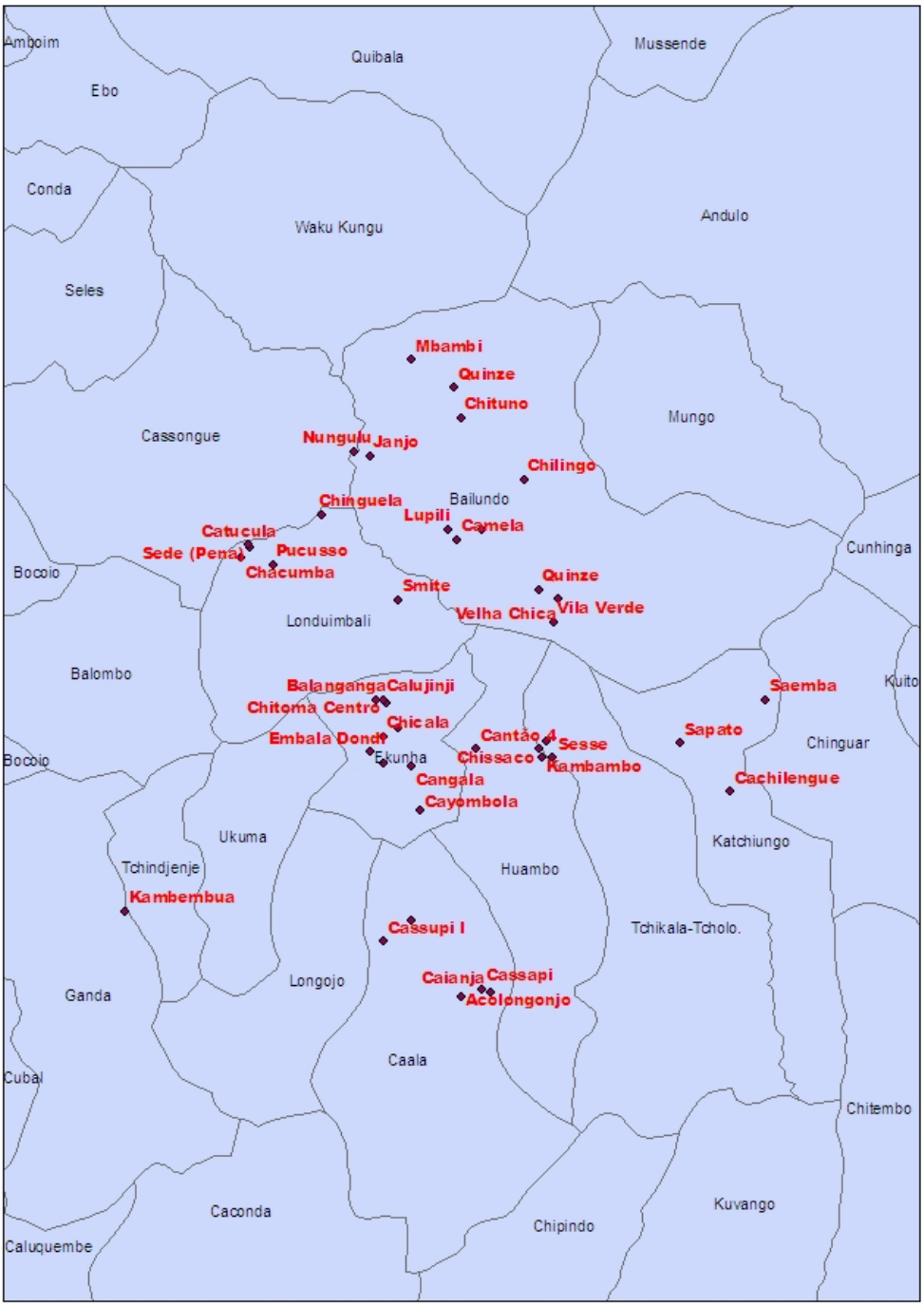

Figure 1 Map of community locations in survey sample

Table 2 Percentage of households growing key crops, per village type and sex of household head

Crop	Type of Village			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
	% of households within type or sex					
Potatoes	65	49	53	56	48	54
Beans	60	70	86	66	73	68
Onions	47	44	38	47	36	44
Carrots	3	2	1	3	1	2
Cabbages	4	7	1	7	3	6
Number of sample observations	216	212	105	286	247	533

NOTES: All variables are binary (0=NO, 1=YES). Estimates weighted to reflect population (except sample numbers).

Source: ProRenda survey, Angola, 2009.

Much more detail on the sampling and weighting design can be found in Annex 2 of this document and in Donovan and Kelly (2009).

3.4. Survey questionnaire design

Experiences in Mozambique, Zambia, Mali, Senegal and elsewhere were useful in designing the survey instrument. In particular, systems designed for the Mozambican agricultural surveys were adapted to the Angolan environment and cropping systems. The major issues that were addressed in the design of the survey instrument included:

- Understanding how rural families in the sample area are organized in terms of gender roles and the extent to which intra-family gender differences in income can be captured by a one-shot survey;
- Ability of farmers to recall a full year of production, input, and sales information by crop for the target crops;
- Ability of farmers to report information in standardized units (hectares, kilograms, etc.);
- Understanding how Farmer Organizations function (including gender dimensions) and the role they currently play in farmers' access to credit, inputs, markets, and various types of training;
- Testing the appropriateness of nutrition, health, education, and asset indicators suggested on the first page of Appendix A in the ProRenda grant proposal.

All of the questions in the surveys were field-tested and many modified a number of times to improve both interviewer and interviewee comprehension. As we collected information relevant to the issues listed above, we made a number of key decisions that affected the survey design; these decisions are summarized in pages 5-7 of Donovan and Kelly 2009. Annexes 4 and 5 to this report include the final household level survey questionnaire and community level survey, respectively.

4. Characteristics of the communities

We analyzed three categories of community-level characteristics: (1) basic services (electricity, education, health, communication, information, credit, extension, and markets for consumption); (2) transportation infrastructure (roads and bus service); and (3) local input and output markets. We expected some differences between village types and anticipated that primary villages may have greater access to services. Our expectations were realized for many of the community-level characteristics.

4.1. Basic services

The community-level data suggest that access to public power supply was limited: only 13% of primary villages and none of the secondary or control villages had this service. Many villages had access to electricity through private generator, although only half of the control villages had access to private generators, compared to three out of four secondary villages and 94% of the primary villages (Table 3).

Access to information through radio was widespread across villages. Primary villages had better access to television, compared to any other type of villages. This was reasonable since primary villages were the only ones with access to power supply and had more access to private generators. Additionally, more than half of the primary and secondary villages had access to cell phone, compared to less than 40% of the control villages. This helps to explain why almost 40% of the control villages had access to radio communication services, compared to only 6% and 31% of primary and secondary villages, respectively (Table 3).

Table 3 shows that many villages had access to traditional and 24-hr access (formal) banks. Fewer (44%) primary villages had access to traditional banks, compared to secondary (63%) and control (63%) villages. However, almost one out of three primary villages had access to formal banks. Regarding access to education, more than 90% of primary villages had access to elementary education, compared to only 63% of control villages. Surprisingly, almost one out of three secondary villages had access to higher education, compared to one out of five and none of the primary and control villages, respectively.

Access to health services was different across types of villages. While hospital service was greater in the primary villages, health centers access was greater for secondary and control villages (Table 3). This is understandable since one might expect access to (smaller) health centers would compensate the lack of access to hospitals. Surprisingly, more secondary villages reported having access to IDA offices in their communities than primary villages, and none of the control villages reported having access to this extension service.

Finally, none of the control villages had access to public markets for consumption and only a few had access to grocery shops. The opposite situation was observed in secondary and primary villages: 44%-57% of these villages had access to either public markets or grocery shops (Table 3).

4.2. Transportation infrastructure

Transportation infrastructure included two characteristics: (1) the quality of the road between the village and its most important commercial center, and (2) the existence of a train station in the village. The data suggest that control villages were the ones with the worst road quality; all of them reported having non-rehabilitated dirt roads connecting the village with its most important commercial center. A similar situation was seen with the primary villages - about nine out of ten of these villages were connected to the main commercial center through non-rehabilitated dirt roads. In contrast, more secondary villages had better roads; one in four had either paved roads (in different conditions) or dirt roads in good condition (Table 4).

Table 3 Percentage of villages with access to basic services within their village, per village type

Basic services (% YES)	Type of village			Total
	Primary	Secondary	Control	
Electricity:				
Power supply	13	0	0	5
Private generators	94	75	50	78
Information:				
National radio	94	94	100	95
Province/local radio	88	94	100	93
Television	56	38	38	45
Communication:				
Radio communication	6	31	38	23
Telephone network	0	0	0	0
Cell phone network	56	56	38	53
Credit institutions:				
Traditional banks	44	63	63	55
24 hr access banks	31	25	25	28
Education:				
Elementary school	94	75	63	80
Middle/high school	19	31	0	20
Health services:				
Health center	38	19	0	23
Hospital	6	13	13	10
Extension services:				
IDA offices	13	19	0	13
Markets:				
Grocery shop	19	25	13	20
Public market for consumption	38	19	0	23
Number of sample observations	16	16	8	40

Source: ProRenda survey, Angola, 2009.

Table 4 Percentage of villages with different road types and access to bus service within their village, per village type

Detail	Type of village			Total
	Primary	Secondary	Control	
State of roads to main commercial town (% YES)				
Dirt road, not rehabilitated	87	62	100	79
Dirt road, partially rehabilitated	13	13	0	10
Dirt road, rehabilitated	0	6	0	3
Paved road, not rehabilitated	0	0	0	0
Paved road, partially rehabilitated	0	13	0	5
Paved road, rehabilitated	0	6	0	3
Have train station in the village (% YES)	6	6	0	5
Number of sample observations	16	16	7	39

Source: ProRenda survey, Angola, 2009.

Finally, train service in both primary and secondary villages was present but limited—only six percent of each village types reported having a local train station. Overall, control villages had the worst transportation infrastructure because they had the worst road quality and none of them had a train station.

4.3. Local input and output markets

Overall, primary villages had better access to local input and output markets. Almost 20% of primary villages had local access to fertilizer in both whole sacks and small quantities, compared to none of the secondary and control villages. Access to certified seed varied across village types. While six percent of secondary villages were the only ones with access to certified potato seed, 13% of primary villages were the only ones with local access to certified onion seed. Similarly, selected primary and secondary villages were the only ones with access to certified bean seed. At least one of each village types had access to non-certified seed for these three crops. However, the number of primary villages with access to these seed was the highest for every crop (**Table 5**). Thus there are clear opportunities for improving access to quality seed in this region as a whole.

Regarding local output markets, farmers in primary and secondary villages sell their potatoes, onions, beans or other vegetables both locally and in other communities. Farmers in the control villages usually sell these agricultural products in other villages for lack of a market (

5. Characteristics of farm families

In this section we examine (1) demographic characteristics of the farm families (age and marital status of the family head, family size and dependency ratios, and adult literacy) and (2) economic characteristics (principal sources of income and investment priorities). We anticipated that the underlying demographic characteristics of the farm families in the sample would not differ significantly across the village types (primary, secondary, and non-beneficiaries of ProRenda activities), but we did anticipate some differences between the male- and female-headed families. We expected major sources of crop income to vary by geographic location and by association membership (associations are usually formed to promote particular crops), but not necessarily across the three village types. We also expected the relative share of crop and non-crop income to vary by gender, with women relying more on non-cropping sources. Finally, we expected investment/spending priorities to differ by sex and perhaps by membership or not in an association, but not by village types. Some, but not all, of our expectations were confirmed by the data.

Table 5**)**, in spite of the poor quality of the roads connecting control villages with their main commercial center. Availability of markets to sell outputs may be underestimated if respondents focused on wholesale marketing of outputs rather than simple retailing,

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Table 5 Percentage of villages with access to input and output markets within their village, per village type

Detail	Type of village			Total
	Primary	Secondary	Control	
Purchase these inputs in the village (% YES):	(% with input available)			
Fertilizer (whole sacks)	19	0	0	8
Fertilizer (small quantities)	19	0	0	8
Certified potato seed	0	6	0	3
Non-certified potato seed	50	38	14	38
Certified onion seed	13	0	0	5
Non-certified onion seed	50	38	14	38
Certified bean seed	13	6	0	8
Non-certified bean seed	63	50	14	49
Sell these outputs in the village (% YES):	(% of villages with output sales locally)			
Potatoes	25	13	0	15
Onions	38	19	0	23
Beans	38	31	0	28
Other vegetables	38	25	0	26
Number of sample observations	16	16	7	39

Source: ProRenda survey, Angola, 2009.

6.1. Demographics

Demographic variables examined include age, sex, and marital status of the household head, family size and composition, and the number and percent of adults who are literate in the family. Table 6 summarizes the results by village type and sex of the family head.

Family heads were, on average, 43 years old and 73% of heads were married. Average age was relatively similar across the village types and sex of head, with the only difference of note being a slightly younger average age (41 years) for family heads in WV primary villages.

Average family size was 5.3 for the entire sample—very close to the 5 people per family used to estimate village populations for the sample selection, and slightly higher than the average 4.2 persons found for rural families in the 2001 MICS survey (INE/UNICEF 2003). Female-headed households tend to have smaller families with fewer adult males than male-headed households. Across village types, families in the group targeted for primary project support have the lowest dependency ratio[16] (1.38 dependents to support per adult over 17 years of age) while the control group has the highest (1.63). There is a slight difference in dependency ratios based on the sex of the family head—male-headed households had more dependents (1.59 vs. 1.53).

Average share of literate adults for the sample was 39%. There were no significant differences in the percentage across the village types or sex of head. Adult literacy was defined as adults over 17 years of age who indicate that they can read and write (as declared by the household head). Although we do not have data on literacy among children, the

[16] Dependency ratio was estimated by dividing total members 17 or younger by total members older than 17 years.

Table 6 Summary of family demographics by village type and sex of household head

Household demographics	Village Type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Age of head (years)	41	44	45	43	43	43
Sex of head: % male	69	72	65			71
Martial status of head:						
Married	69	76	68	96	25	73
Single	6	1	3	1	7	3
Widow	19	16	23	3	48	17
Separated	6	7	6	0	20	6
Household size	5.0	5.4	5.0	5.7	4.3	5.3
No. males older than 17	1.0	1.0	0.8	1.2	0.5	1.0
No. females older than 17	1.1	1.1	1.1	1.0	1.2	1.1
No. children younger than 5	1.2	1.2	1.0	1.4	0.9	1.2
No. boys 5-17 yrs of age	0.8	1.2	1.0	1.2	0.8	1.1
No. girls 5-17 yrs of age	0.9	0.9	1.1	0.9	0.9	0.9
No. family members older than 17 who are literate*	1.0	0.9	0.8	0.9	1.0	0.9
Share of all adults who are literate (%)	43	37	34	38	41	39
Number of sample observations	227	223	103	296	257	553

* Literacy refers to people who were reported to be able to read and write.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

sample has an average school enrollment rate of 85%, suggesting that literacy for the next generation of adults will improve. More on child school participation and expenditures later in this document.

6.2. Economic characteristics

In an effort to understand the relative importance of income from different economic activities carried out by the farm families, family heads were asked to identify their most important sources of cash income, first for crop sources of cash income (crops sold) and then for non-crop sources of cash income. A separate question was addressed to female heads and to female spouses of male-heads concerning their personal sources of income.[17] The survey also had a series of questions to ascertain the investment and expenditure priorities of family heads and their spouses. This information helps identify investments and expenditures that may be used as indicators of increased incomes in subsequent surveys. In situations where the priorities differ between family heads and spouses, tracking the investments and expenditures in subsequent surveys should provide some information about whose views dominate in the decision making process.

6.2.1. Most important sources of crop and non-crop cash incomes

For the entire sample, 36% of family heads declared bean production to be their major source of agricultural cash income; potatoes were the second most cited commodity as the main source (24%) and maize was the third (21%) (Table 7). There were differences among the village types. Beans were most important in the secondary villages and in the control

[17] As indicated earlier, there was no attempt to estimate a full set of income components, but the cash income from selected commodities will be estimated and full value of production of these crops can also be estimated.

villages. However, the control villages also reported the highest share of family heads (26%) declaring potatoes as the main source of cash income and the highest share reporting onions as the principle source of agricultural cash income (11% vs. 6% for other village type). We did not anticipate that control villages would have such substantial potato and onion production. When combined, beans, potatoes and maize were the most important sources of income for approximately 80% of the farm families in each village type.

Regarding gender, 41% of female-headed households indicated beans as the main source of crop income, compared to 34% of male-headed households. At the same time, only 21% of female-headed households indicated potatoes as the main source, compared to 25% for men. The analysis based on participation in farmer organizations showed that there were major differences between participants and non-participants regarding their main source of crop income. The number of FO participants who reported potatoes as their major source of crop income was more than twice the number of non-participants. Contrary to this, almost ten times more non-participants reported beans as their principal source of agricultural cash income. Prior to the survey implementation, we expected major sources of crop income to vary by geographic location and association membership. These expectations were partially confirmed by the survey data since there were differences by village type (for beans and onions) and by FO membership (for potatoes and beans).

Given the survey results, it is clear that there are many farmers involved in potato production, although a special effort may be needed to reach more female-headed households. With 24% of farmers already heavily dependent on potatoes for income, ProRenda's anticipated value chain improvements for this crop are likely to have a larger income impact in the short-run than development of the other crop value chains. As Table 7 shows, onions, carrots and cabbage were less important than staples as cash income generating crops, although onions were indicated the most important crop for more households than carrots and cabbage.

When asked about non-crop cash income sources and the relative importance of each among them, off-farm agricultural labor was the most important source of non-crop cash income for 39% of all families, followed by commerce (24%) and the provision of services (18%). A much higher share of female-headed families (53%) reported off-farm agricultural labor income as their major source of non-cropping income than male-headed families (33%). Heavy reliance on off-farm agricultural labor income is likely to be low wage, low productivity labor, and may be correlated with low levels of crop productivity on own land or lack of access to good land. Additionally, while one in four male-headed households reported services as their most important source of non-crop income, less than one percent of female-headed households depended on services as their principal source of non-crop income.

6.2.2. Most important sources of crop and non-crop cash income for women

Women, both heads of households and spouses of heads, were asked specifically about their personal sources of cash income (both farm and non-farm), and from that, a slightly different picture emerges. Commerce was the major source of cash income for women in the three village types. This activity was cited much less frequently by women in the secondary villages, who reported their own production (from their farm) and farm labor as equally important sources of income. When comparing responses from female-heads to those from female spouses, similar percentages of women indicated commerce as the main source.

Table 7 Major sources of crop and non-crop household cash incomes, by village type, sex of household head and participation in farmer organizations (FO)

	Village type			Sex of head		Member of FO**		
Household characteristics	**Primary**	**Secondary**	**Control**	**Male**	**Female**	**Yes**	**No**	**Total**
Percent of family heads declaring crops below as their main source of crop income (%):*								
Potatoes	23	24	26	25	21	57	22	24
Corn	23	20	23	19	25	23	21	21
Beans	30	38	32	34	41	4	38	36
Onions	6	6	11	7	5	8	6	6
Carrots	0	0	0	0	0	0	0	0
Cabbage	1	1	0	1	<1	0	1	1
Others	17	11	8	14	7	8	12	12
Percent of family heads declaring activities below as their major source of non-crop income (%):								
Commerce	28	22	34	22	29	34	24	24
Services	13	19	15	25	<1	21	17	18
Farm labor	43	37	37	33	53	34	39	39
Gifts, retirements, transfers, remittances	5	6	7	4	11	3	6	6
Handcrafts, processed products	6	9	7	9	6	5	8	8
Others	5	6	1	7	0	4	5	5
Number of sample observations	144	152	70	196	170	59	306	366

* The columns in this section do not add up to 100% because only major crop categories and those of interest to ProRenda were included. Non-listed crops account for 7-17% of responses, depending on the village type.

** Sample number adds to 365 because one respondent didn't provide information about participation in FO.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Table 8 Major sources of crop and non-crop incomes reported by adult women, by village type and sex of household head

	Village type			Respondent		
Household characteristics	**Primary**	**Second-ary**	**Control**	**Female spouse**	**Female head**	**Total**
Percent of women declaring each income category below as their major source of **personal** income						
Commerce	34	27	35	29	29	29
Services	6	14	5	16	<1	11
Farm labor	28	24	27	18	43	25
Gifts, retirement, transfers, remittances	0	2	1	1	3	2
Handcrafts, processed products	9	3	6	5	4	5
Own farm	19	25	26	25	20	23
Others	4	5	1	6	0	4
Number of sample observations	144	152	70	196	170	366

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Unlike question to household heads in earlier section of questionnaire, this question combined both farm and off-farm sources into a single comparative response, thus comparisons must be made with care.

However there were two striking differences with non-crop income sources. About 16% of spouses of male heads cited services as the main source, although almost no women heads indicated services as the main source of cash income. In contrast, farm labor, known for being unskilled labor with low wage rates, was cited by 43% of female heads as their most important source of cash income (Table 7 and Table 8).

7. Wealth of the household

Since income can fluctuate substantially from year to year with rainfall patterns, plant pests and diseases, prices, and other factors, assets are often used as a proxy to understand the longer term economic status of households. For this baseline it was important to know what assets the household had at the time of the interview but also to know expenditures on these assets in the previous years. ProRenda project is expected to enable households to invest more in such assets during the project years.

7.1. Ownership of and expenditures on basic productive and other durable assets

The survey included several questions regarding the ownership of productive and durable assets, and about the characteristics of the home. Table 9 shows the % of households owning at least one of these assets by village type and by sex of the household head. As is clearly demonstrated in the last two columns of Table 9, male-headed households are more likely to have basic assets, both production assets as well as household assets such as improved roofs and tables and chairs. The villages with primary WV assistance are also starting out at a generally better position than secondary and control villages.

Looking at expenditures on such assets from January 2005 through January 2009, on average, farmers in the primary villages and male heads spent more on productive and household assets. Farmers in the primary villages spent 30% more than farmers in the secondary villages and 193% more than farmers in the control villages. On the other hand, male heads indicated spending 196% more on productive and household assets than female heads. The average total expenses on assets were Kw 15,162 (about US$202) during the period (Annex Table 5).

7.2. Asset-based Wealth Index

Researchers have developed asset indices as a way to look at wealth across various types of assets, and it has proven fairly robust in its ability to classify households. Interested readers can see Annex 3 for more details on theory and the construction of the index.

In Angola, the MICS survey (INE/UNICEF, 2003) used a wealth index and we have selected similar components for this survey. Ownership of the following assets was considered: tractors, trucks, cars, plows, carts, backpack sprayers, motorcycles, bicycles, cell phones, radios, tape recorders, televisions, gas stoves, tables, and chairs. It also included ownership of a well and a latrine at the homestead, and whether the roof of the home was made of zinc or lusalite, considered improved materials. Tractors, trucks, cars and gas stoves were excluded, because no household in the sample owned these items. The scoring factor divided by the standard error (seen in Table 9 in the first data column and in Table 10 in the fourth data column) indicates the importance of a given asset in the overall index. At the household level, a high value for the index indicates a higher level of ownership of these assets, implying greater wealth.

Table 9 Scoring factors and percentage of households owning assets, per village type and sex of household head for assets entering the computation of the first principal component (asset ownership)

Asset indicators	Scoring Factor / Std. Dev.	Percentage of households owning asset				
		Type of village			Sex of head	
		Primary	Secondary	Control	Male	Female
Own plow	0.82	6%	10%	18%	13%	2%
Own cart	1.50	0%	1%	0%	1%	0%
Own backpack sprayer	1.28	4%	2%	0%	3%	0%
Own motorcycle	1.26	11%	6%	3%	9%	3%
Own bicycle	0.67	17%	22%	11%	29%	3%
Own cell phone	1.12	6%	8%	3%	10%	3%
Have well in the house	0.36	24%	23%	12%	24%	21%
Have latrine in the house	0.29	84%	89%	81%	95%	71%
Have lusalite or zinc roof	0.67	42%	46%	38%	51%	30%
Own radio	0.59	33%	45%	46%	53%	18%
Own tape recorder	0.88	19%	12%	4%	18%	5%
Own television	1.44	7%	1%	2%	3%	1%
Own table	0.78	51%	48%	28%	62%	19%
Own chairs	0.73	64%	65%	54%	76%	41%
		Mean by group				
Overall wealth Index		0.276	0.220	-0.330	0.750	-0.900
Number of sample observations	549	216	222	111	273	276

Notes: Four of the 18 indicators were dropped because they had zero variance. Scoring Factor is the "weight" assigned to each indicator (normalized by its mean and standard deviation) in the linear combination of the variables that constitute the first principal component. The percentage of the covariance explained by the first principal component is 23.85%. The first eigenvalue is 3.34. Means provided in the last five columns were estimated with weights to reflect population.

Source: ProRenda survey, Angola, 2009.

After calculating the wealth indices, households were sorted according to their wealth index and the population was split into three groups (terciles).

Table 10 reports these results. The consistency of the index is reflected in the terciles percentages. For example, only 0.1% of the poorest tercile (lowest 33% of the population) owned plows, whereas 7.3% of the middle tercile and 17% of the highest tercile owned plows. The mean value of the index (by construction) is zero and its standard deviation is 1.8. The poorest tercile households had an average index of -1.68 while the richest tercile had an average index of 1.96, a difference of 3.64 units. One example of a combination of assets that would produce this difference is a household having a backpack sprayer (1.28), a motorcycle (1.26), and owning a cell phone (1.12) compared to a household with none of these assets.

Table 10 Scoring factors, summary statistics, and per tercile percentage of households owning assets, means for asset indicators entering the computation of the first principal component (asset ownership)

	Total sample				Percentage of farmers owning the asset		
Asset indicators	**Scoring Factors**	**Mean**	**Std. Dev.**	**Scoring Factor / Std. Dev.**	**Poorest asset tercile**	**Middle asset tercile**	**Highest asset tercile**
Own plow	0.243	0.098	0.298	0.82	0%	7%	17%
Own cart	0.142	0.009	0.095	1.50	0%	0%	1%
Own backpack sprayer	0.194	0.024	0.152	1.28	0%	0%	6%
Own motorcycle	0.312	0.066	0.248	1.26	0%	0%	19%
Own bicycle	0.238	0.146	0.353	0.67	0%	8%	45%
Own cell phone	0.275	0.064	0.245	1.12	0%	0%	19%
Have well in the house	0.144	0.202	0.402	0.36	13%	19%	34%
Have latrine in the house	0.116	0.796	0.403	0.29	73%	90%	94%
Have lusalite or zinc roof	0.333	0.461	0.499	0.67	11%	31%	79%
Own radio	0.286	0.372	0.484	0.59	6%	42%	66%
Own tape recorder	0.291	0.124	0.330	0.88	0%	2%	33%
Own television	0.257	0.033	0.178	1.44	0%	0%	7%
Own table	0.383	0.395	0.489	0.78	1%	41%	86%
Own chairs	0.360	0.574	0.495	0.73	4%	79%	94%
					Mean by tercile		
Economic Status Index		0.000	1.827		-1.685	-0.281	1.960
Number of sample observations		549			189	182	178

Notes: Four of the 18 indicators were dropped because they had zero variance. Scoring Factor is the "weight" assigned to each indicator (normalized by its mean and standard deviation) in the linear combination of the variables that constitute the first principal component. The percentage of the covariance explained by the first principal component is 23.85%. The first eigenvalue is 3.34. Percentages provided in the last three columns were estimated with weights to reflect population.

Source: ProRenda survey, Angola, 2009.

Since the wealth index is based on simply yes/no variables for ownership, taking only the values 0 or 1, it is easy to interpret the index.[18] A move from not having a certain asset to owning it (0 to 1) changes the index by f_{1i} / s^*_i (reported in data column 1 of Table 9 and column 4 of

Table **10**).

This wealth index suggests that farmers in the control villages and female-headed households may be the poorest (they have asset indices below the average index). These results are confirmed by a graphical analysis of the cumulative distribution of the index by village type (Figure 2). For each village type, Figure 2 shows a curve of asset index values from lowest to highest. To interpret this, look at the 0 level for asset index. About 50% of the households in the secondary (indirect) villages are below this index level, whereas 60% of the primary (direct) village households are below 0 and almost 70% of the control villages have an asset index below 0. Farmers in the control villages appear to be the poorest (based on the asset index).

[18] Additional to these tables, Annex Table 1 presents the asset index using the number of assets owned. The interpretation of the effect of each asset is a little more complex; however, the basic interpretation of the index is the same—higher index implies higher wealth.

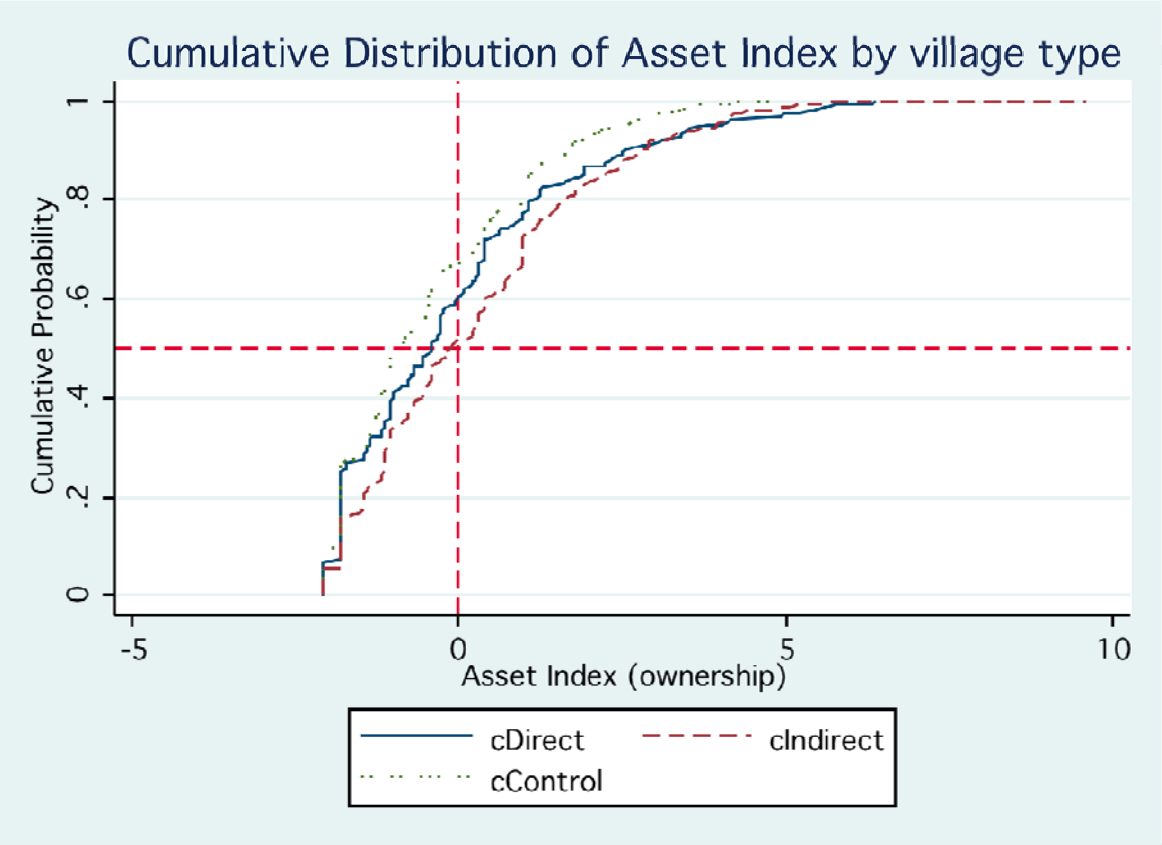

Figure 2 Cumulative distribution of asset index by village type

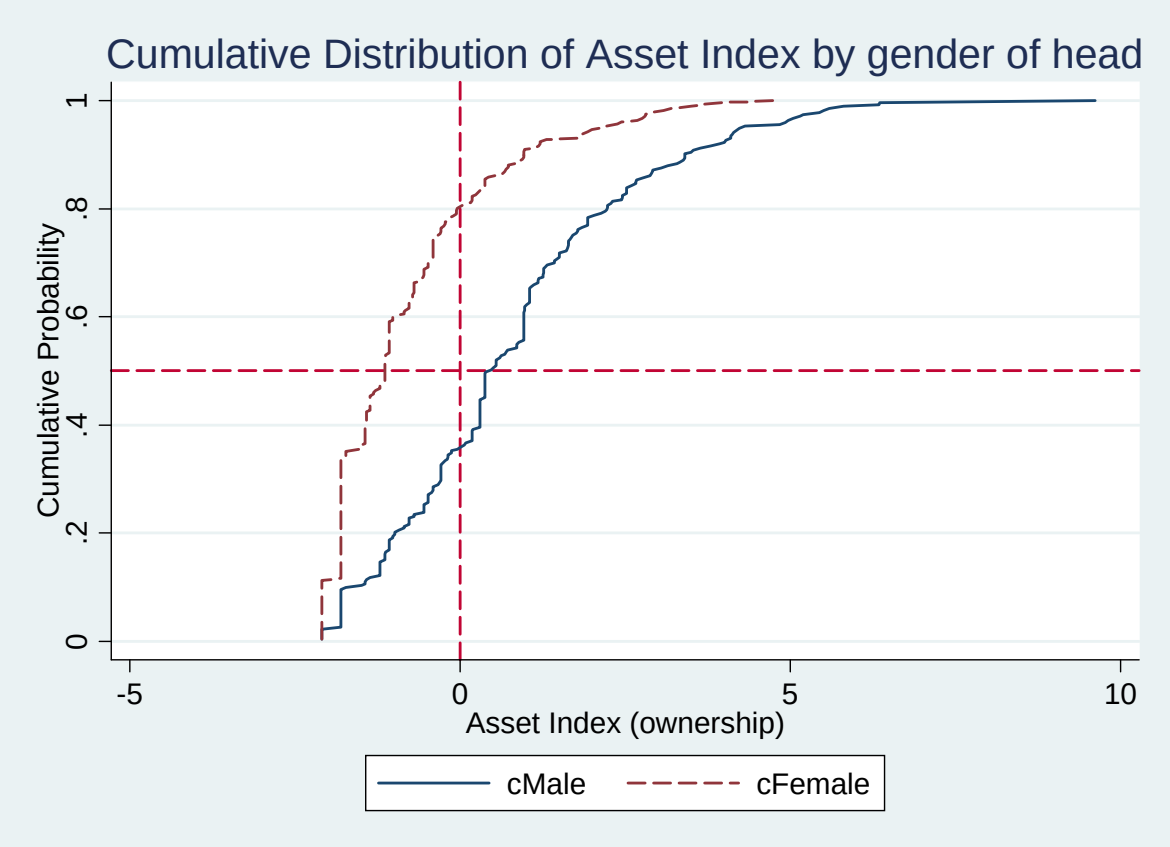

Figure 3 Cumulative distribution of asset index by sex of household head

Figure 2 suggests that farmers in the secondary (indirect) villages may be better off than farmers in the primary (direct) villages, since the curve for the asset index for secondary is to the right of the curve for the primary. Looking at the mean values, we find the primary villages with a higher mean index, which would occur if the primary villages have a few relatively wealthier farmers compared to the secondary villages, as suggested by the distribution curve crossing in the upper 10% of the distribution, with more direct (primary) village households in the higher ranges.

Figure 3 dramatically demonstrates the differences between male and female-headed households for the asset index. The female-headed households have indices that are consistently to the left, indicating higher percentages of households at lower asset levels.

7.3. Investment priorities

Households were asked about their top three investment priorities if their incomes doubled. We anticipate that men and women may have different investment priorities when they receive additional income, and we also anticipate differences in investment priorities based on the village type. For example, if marketing of agricultural crops is highly profitable in one zone compared to another, it is thought that investment in agricultural production would be more frequent responses in that zone compared to others. To use all the information, their answers were weighted (first priority was given a weight of 3, the second a weight of 2 and the third a weight of 1) and the average per investment category was estimated.[19] Table 11 summarizes this information.

In general, farmers in the three village types said that investing in livestock was their first priority, followed by investing in agriculture. Their third priority was different depending on the type of village. While farmers in the primary and control villages would invest in any kind of transportation, farmers in the secondary villages were more likely to invest in home maintenance or improvements.

[19] There were seven basic categories in the survey and within each category there were several options to choose from. Because of the difficulty of creating one index for each option, an index per category was estimated.

Table 11 Farmers' investment priorities, by village type and sex of head

Head's investment priorities*	Village Type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
			(mean values)			
Agriculture	1.1	1.1	1.1	1.2	0.9	1.1
Livestock	1.4	1.4	1.9	1.6	1.0	1.4
Transportation	1.0	0.8	0.8	1.3	0.1	0.9
Home furniture	0.4	0.2	0.2	0.2	0.5	0.3
Home electronics	0.2	0.2	0.1	0.3	0.1	0.2
Home maintenance/ improvement	0.7	0.9	0.7	0.8	1.0	0.8
Various household needs (more/better food, health, etc.)	0.7	0.8	0.5	0.4	1.6	0.8
Number of sample observations	245	241	115	310	291	601

* Respondents were asked to provide their first three investment priorities. The first priority was given a weight of 3, the second a weight of 2, and the third a weight of 1. Therefore, each category could have a value between 0-6 per respondent. Higher mean implies higher importance. For details contained within each category, please refer to section B3 of the ProRenda survey.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Table 12 Investment priorities of wives of household heads, per village type

Wife's investment priorities*	Head (Husband)	Village type			Wives Average Overall
		Primary	Secondary	Control	
			(mean values)		
Agriculture	1.2	0.5	0.2	0.8	0.3
Livestock	1.6	0.7	0.6	0.7	0.6
Transportation	1.3	0.3	0.4	0.2	0.3
Home furniture	0.2	0.6	0.3	0.5	0.4
Home electronics	0.3	0.1	0.3	0.0	0.2
Home maintenance/ improvements	0.8	0.6	0.7	0.2	0.7
Various household needs (more/better food, health, etc.)	0.4	1.0	1.1	1.4	1.1
Number of sample observations	310	128	124	58	310

* Respondents were asked to provide their first three investment priorities. The first priority was given a weight of 3, the second a weight of 2, and the third a weight of 1. Therefore, each category could have a value between 0-6 per respondent. Higher mean implies higher importance. For details contained within each category, please refer to section F3 of the ProRenda survey.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Investment priorities between male and female heads were contrasting. While male heads would most likely invest in livestock first, female heads were most likely to invest in various household needs (especially improving their diet). Investment priorities were similar between members and non-members of farmer organizations (Table 11).

Investment priorities between male heads and their female spouses differ substantially (Table 11 and Table 12). If income were to be doubled, male heads will first invest in livestock, a type of asset generally controlled by men. The female spouses generally chose as their highest priority investments in various household needs (purchasing more/better food mainly).

Table 13 Total receipts, costs and gross margins of households growing key crops[1], per village type and sex of household head

Detail	Village type			Sex of head		Overall Average
	Primary	Secondary	Control	Male	Female	
Receipts (Kw)	14,911	14,024	17,180	17,496	5,457	14,407
Costs (Kw)	8,106	7,022	6,498	8,826	2,934	7,314
Gross margins (Kw)	6,806	7,003	10,682	8,670	2,523	7,093
Number of sample observations	182	172	71	249	176	425

[1] Key crops include potatoes, onions and beans.

NOTES: Kw = Kwanzas. Costs include purchased inputs, hired labor and reported marketing costs. Variables are at the household level. Estimates weighted to reflect population.

Source: ProRenda survey, Angola, 2009.

8. Households' Gross Margins

While we will go into greater detail later in this report on the production and gross margins for the specific crops under study here, it is valuable to take a quick look at the gross crop margins to get a broader view. Household's gross margins include receipts, costs and margins of sales of potatoes, beans and onions only, and are based strictly on marketed quantities.[20] There was great variability in the gross margins and the only statistically significant difference (10% significance level) was between the households in the primary and control villages—primary villages reported lower gross margins than farmers in the control villages (Table 13). Additionally, male-headed households reported significantly (10% significance level) higher margins than female-headed households.

To interpret this, it is important to revisit Table 7 with the indication of importance of various crops in cash income. In the primary villages, households were more likely to have cash income from crops that were not intensively investigated in this research, especially maize. Sine the ProRenda project is oriented to increase crops income for the selected crops, the lack of information on maize and other crops is not fundamental for impact evaluation; however, it means that the comparison of gross margins needs to be conducted with care.

The sources of the margin differences can be found in the following sections, which discuss the incomes from the individual key crops under study here.

9. Potato production and potato farmers

ProRenda was designed based on an assessment that potatoes have excellent potential for development as a smallholder income crop. Research indicates that consumer demand is strong and the agro-climatic conditions are good. Some farmers were already producing and selling the potatoes for income with the earlier World Vision project. As ProRenda moves forward, it will be important to track how farmers' production and marketing of potatoes change, and how those changes are reflected in income generation.

[20] The exchange rate at the time of the survey was 75 Angolan Kwanzas per US$. Also the case numbers are reduced here due to households not selling the crops, even though they produce them.

Table 14 Potato production: Average production (kg) and planted area (ha) per village type, sex of household head, and participation in farmer organizations

Detail	Village type			Sex of head		Member of FO		
	Primary	Second-ary	Control	Male	Female	Yes	No	Total
Production (kg)	283	253	257	315	121	1,101	178	263
Quantity of seed planted (kg)	86	38	79	66	26	123	49	56
Estimated planted area (ha)	0.031	0.014	0.029	0.024	0.009	0.045	0.018	0.020
Number of sample observations	131	116	56	172	131	65	238	303

NOTES: FO = Farmer Organization. Planted area estimated using a seeding rate of 2,750kg/ha. Variables are at the household level. Estimates weighted to reflect population. Only households planting potatoes included.

Source: ProRenda survey, Angola, 2009.

9.1. Potato Production

Potato production was estimated at the household level and included the latest full year of data for each household. More than 50% of that production was sold between September 2007 and the day of the interview. As indicated in Donovan and Kelly (2009), planted area is a very difficult aspect to assess, and thus it was decided to estimate area based on typical seeding rates and quantity of seed potato used, assuming 2750 kg per hectare as a seeding rate.[21] On average, farmers produced approximately 260 kg of potatoes. Household average production was relatively similar across village type, ranging from 253 kg in the secondary villages to 283 kg in the primary villages (Table 14). Given the relatively low use of fertilizers and other external inputs, total production by a farmer will depend mainly on seeding (area planted), rainfall, and overall quality of land. When asked, the majority of farmers (67%) indicated that the year under study was a lower than normal year for potato production.

We found that farmers in the secondary villages produced 30kg less than farmers in the primary villages; however, they planted less than half the area (based on proxy with seeding rate), which suggests they may have faced better growing conditions. In contrast, sex of head and membership in farmer organizations (FO) had a large effect in production and estimated planted area. Male-headed households produced 2.6 times more than female-headed households. Farmers who were members (or who had someone in the family who was a member) of farmer organizations produced 6.2 times more than non-members. We estimated that male heads and members of FO used approximately 2.5 times more seed potatoes (thus indicating planting higher areas) than female heads or non-members, which helps to explain their higher production (Table 14).

9.2. Sales receipts and margins for September 2007 to January 2009

Prices that farmers receive may differ for a variety of reasons, and obtaining recall on prices obtained for each sale in each season has proven to be unreliable. To overcome this, farmers were asked the price they received for the largest quantity of potatoes they sold, and receipts and gross margins were estimated based on this information (Table 15).[22] Among

[21] Ideally both seeding rates and fertilization rates can be used to estimate area, but there were insufficient cases to use fertilization rates here.

[22] This proved to be reasonable since 98% of farmers sold all their potatoes at a single price for a given season.

Table 15 Potato sellers: Average receipts, costs, gross margins and percentage sold, per village type and sex of household head

Detail	Village type			Sex of head		Total
	Primary	Second-ary	Control	Male	Female	
			(mean values)			
Receipts (Kw)	15,734	19,004	24,337	20,451	8,702	18,122
Price per kg sold (Kw/kg)	89	87	82	89	79	87
Kg sold	177	218	297	230	110	208
Total Costs (Kw)	11,062	11,626	9,939	12,740	5,836	11,371
Production costs per kg produced (Kw/kg)	53.9	44.0	26.8	48	40	47
Marketing costs per kg sold (Kw/kg)	1.7	2.4	5.1	2.4	1.9	2.3
Gross margins (Kw)	4,672	7,378	14,398	7,711	2,866	6,751
Total quantity sold (% of total production)	83	87	77	86	80	85
Number of sample observations	92	85	32	134	75	209

NOTES: Kw = Kwanzas. Costs include purchased inputs, hired labor and reported marketing costs. Variables are at the household level. Estimates weighted to reflect population. Only households selling potatoes included in this analysis.

Source: ProRenda survey, Angola, 2009.

Table 16 Potato sellers: Median values for receipts, costs, gross margins and percentage sold, per village type and sex of household head

Detail	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
			(median values)			
Receipts (Kw)	6,600	5,490	12,000	6,600	2,800	5,850
Total Costs (Kw)	5,600	2,700	4,450	3,500	1,400	3,240
Gross margins (Kw)	1,700	1,200	5,280	1,630	800	1,600
Total quantity sold (% of total production)	100	100	90	100	100	100
Number of sample observations	92	85	32	134	75	209

NOTES: Kw = Kwanzas. Costs include purchased inputs, hired labor and reported marketing costs. Variables are at the household level. Only households selling potatoes included.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

farmers selling potatoes, farmers in the control villages had the highest receipts and gross margins, although the differences between the control and primary villages on these aspects were not statistically significant (Table 15)[23]. Farmers in the secondary villages sold a higher percentage of their potato production than any other village type; however, the only statistically significant difference (10% significance level, SL) was between secondary and control villages—farmers in the control villages sold less than farmers in the secondary villages.

Sex of household head appeared to have a large effect on the percentage of production sold, receipts, costs, and gross margins. However, we only found statistically significant differences in total costs and percentage sold (10 and 5% SL, respectively). There were no statistical differences in receipts or gross margins. Households with a male head had higher costs in production and marketing and sold a higher percent of their production than female-headed households (Table 15).

Rural household income studies often find that income estimates are sensitive to extreme values, such that the mean is not always a good reflection of the distribution. To determine the potential impact of outliers on the means reported in Table 15, we estimated the median values for various characteristics, shown in Table 16. As can been seen, households commonly sold 100% of their production. With only seventeen valid cases of household participating in a farmer organization, the statistics for participating/non-participating are not included here. Additional work will be required to understand the distribution of the various components.[24]

10. Bean production and bean farmers

10.1. Bean production

Similar to potatoes, bean crop production was estimated at the household level and included the latest harvest with more than 50% of the production sold between September 2007 and the day of the interview. Planted area was estimated by using the quantity of seed farmers used, assuming 60 kg per hectare as a seeding rate. On average, farmers produced 145 kg of beans during the period, with production highest in the primary villages (Table 17). Using the quantity of seeds as a proxy for land, farmers in the primary and secondary villages planted more land to beans than farmers in the control villages.

Sex of head and membership in FO also influenced production and seeding (planted area). Male-headed households produced more than female-headed households; however, they also used more seeds and by proxy, more land. Additionally, farmers who were FO members (or who had someone in the family who was a member) use less than half the quantity of bean seed as non-members and consequently produced half of non-members' production (Table 17).

[23] A statistical test to compare receipts and gross margin means between primary and control villages, primary and secondary villages, and secondary and control villages showed no statistical difference. Additionally, high standard errors (4 to 6 times higher, when compared to primary villages) of the means were observed for control villages.

[24] Additional analysis is also needed to evaluate the design effects of the stratified clustered sample. Initial analysis shows that measurements in the secondary villages tend to demonstrate design effects more than measurements in the other villages.

Table 17 Bean production: Average production (kg) and estimated planted area (ha) per village type, sex of household head, and participation in farmer organizations

	Village type			Sex of head		Member of FO		
Detail	**Primary**	**Secon-dary**	**Control**	**Male**	**Female**	**Yes**	**No**	**Total**
Production (kg)	226	123	76	154	123	76	147	145
Quantity of seed planted (kg)	33	33	20	37	22	13	33	32
Estimated planted area (ha)	0.55	0.55	0.34	0.61	0.36	0.22	0.55	0.53
Number of sample observations	135	141	87	192	171	40	323	363

NOTES: One ha = 10,000 square meters; FO = Farmer Organization. Planted area estimated using a seeding rate of 60kg/ha. Variables are at the household level. Estimates weighted to reflect population.

Source: ProRenda survey, Angola, 2009.

10.2. Sales receipts and margins for September 2007 to January 2009

As with potatoes, farmers could receive different prices for their sells. Therefore, farmers were asked the price they received for the largest quantity of beans they sold, and receipts and gross margins were estimated based on this information.[25] Among farmers selling beans, farmers in the primary villages had the highest receipts and gross margins; however, none of the differences across village types were statistically significant at any level (Table 18). Despite selling slightly less of their production compared to farmers in any other village type, farmers in the primary villages had more receipts because they produced more (Table 17 and Table 18).

Sex of household head had a large statistical effect on the percentage of production sold, receipts, costs, and gross margins. Male-headed households sold a higher percent of their production compared to female-headed households (69% vs. 61%; 1% SL) and had higher total costs (10% SL). However, female-headed households had lower marketing cost per unit of beans sold (1% SL); as will be shown below, female-headed households tended to sell in local markets. Additionally, female-headed households received less money for their sales (1% SL) and had lower margins (1% SL), compared to male-headed ones (Table 18). Fertilizer use is low on beans, as will be seen later (Table 22), so production costs here are low.

[25] Similar to potatoes, farmers sold over 97% of their total bean quantity sold at the same price.

Table 18 Bean sellers: Average receipts, costs, gross margins and percentage sold, per village type and sex of household head

Detail	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Receipts (Kw)	7,834	5,806	7,202	8,056	2,700	6,437
Price per kg sold (Kw/kg)	67	71	70	70	68	70
Costs (Kw)	1,327	1,267	1,851	1,521	813	1,307
Production costs per kg produced (Kw/kg)	6.4	11.3	9.1	8.7	12.3	9.8
Marketing costs per kg sold (Kw/kg)	2.0	2.9	4.4	3.1	1.7	2.7
Gross margins (Kw)	6,507	4,540	5,351	6,535	1,887	5,130
Total quantity sold (% of total production)	65	68	66	69	61	67
Number of sample observations	110	103	42	144	111	255

NOTES: Kw = Kwanzas. Costs include purchased inputs, hired labor and reported marketing costs. Variables are at the household level. Estimates weighted to reflect population. Bean sellers only.

Source: ProRenda survey, Angola, 2009.

11. Onion production and onion farmers

11.1. Onion production

Similar to potatoes and beans, onion production was estimated at the household level and included the latest harvest with more than 50% of the production sold between September 2007 and the day of the interview. Additionally, planted area was estimated by using the quantity of seed farmers used. Since the quantity of seed required to plant one hectare is small (1 kg)[26], small changes in this quantity will make planted area change by a large amount. This appears to be the case for onions because farmers reported amounts of seed that would indicate an average of 4.51 ha of land planted in onion, which is very difficult to believe. We were unable to measure the quantity of seed used and a can of seed could have had different weight, so we do not report seed quantities nor any estimated area planted in Table 19.

Production was highly variable across village type, ranging from a low average of 55 kg in the control villages to a high average of 93 kg in the primary villages (Table 19). Farmers were asked whether their production was lower compared to a normal year's production and 35-61% of farmers in different village type said it was. Farmers in the control villages were more likely to report lower production in the recent year. In every village type, the lack of fertilizer was the main reason; however, this was more important in the control villages compared to the primary villages (59% vs. 46%, respectively).

Sex of head and membership in FO also influenced production. Male-headed households produced twice as much onions as female-headed households. Additionally, farmers who were members of organizations produced 3.5 times more than non-members (Table 19). Female-headed households were more likely to indicate that the most recent harvest was lower than a normal year (70% vs. 49%). Fertilizer use may also be a factor as seen below (**Error! Reference source not found.**).

[26] Estimate from the World Vision's ProRenda staff.

Table 19 Onion production: Average production (kg) per village type, sex of household head, and participation in farmer organizations

	Village type			Sex of head		Member of FO		
Detail	**Primary**	**Second-ary**	**Control**	**Male**	**Female**	**Yes**	**No**	**Total**
Production (kg)	93	60	55	79	38	216	61	69
Number of sample observations	84	84	40	121	87	41	167	208

NOTES: FO = Farmer Organization. Quantity of seed used and planted area not reported because they appear to be inconsistent. Estimates weighted to reflect population. Only onion producers included.

Source: ProRenda survey, Angola, 2009.

11.2. Sales receipts and gross margins

As with potatoes and beans, onion receipts and gross margins were estimated for the period September 2007 to January 2009 using the same method of value based on largest sales amount and price, a reasonable approach since almost all farmers sold their onions in a single sale. Among farmers selling onions, farmers in the secondary villages had the highest receipts and gross margins; however, none of these differences were statistically significant (Table 20). There was high variability among the sellers for all the aspects measured.[27]

Female-headed households have significantly lower receipts (10% SL) and costs (5% SL) compared to male-headed households. However, the differences in gross margins were not statistically significant. Male-headed households invested more in external inputs resulting in 3.5 higher total costs than female-headed farmers, and resulting in much higher receipts.

12. Use of fertilizers and pesticides

12.1. Potato producers' input use

Since potatoes are seen primarily as a cash crop for households, it is expected that fertilizer use among the potato farmers would be relatively common. About 57% of the sample did use fertilizers, although we cannot know with these data the dose used for fertilizers, as area measurements are not available. Fertilizer use was more common among male-headed households and households who participate in farmer organizations. Pesticide use was more common in the primary villages compared to other villages and more common with households who participate in farmer organization (

Table 21).

[27] As found with the potato analysis, additional work to evaluate the distributions of these variables is warranted.

Table 20 Onion sellers: Average receipts, costs, gross margins and percentage sold, per village type and sex of household head

Detail	Village type			Sex of head		Total
	Primary	Second-ary	Control	Male	Female	
Receipts (Kw)	4,559	7,194	4,062	6,997	1,945	6,149
Price per kg sold (Kw/kg)	103.0	95.8	90.0	93.5	120.3	98.0
Costs (Kw)	3,265	3,806	1,965	4,018	1,145	3,535
Production costs per kg produced (Kw/kg)	74	76	33	80	43	73
Marketing costs per kg sold (Kw/kg)	3	3	6	3	3	3
Gross margins (Kw)	1,294	3,388	2,097	2,979	800	2,614
Total quantity sold (% of total production)	79.0	80.9	86.1	80.6	80.1	80.5
Number of sample observations	61	48	31	90	50	140

NOTES: Kw = Kwanzas. Costs include purchased inputs, hired labor and reported marketing costs. Variables are at the household level. Estimates weighted to reflect population.

Source: ProRenda survey, Angola, 2009.

Table 21 Potato production: Farmers using fertilizers and pesticides, average quantity of NPK used and average expenses on fertilizers, per village type, sex of head and participation in farmer organizations

Detail	Village type			Sex of head		Member of FO		Total
	Primary	Secondary	Control	Male	Female	Yes	No	
Use fertilizer (%)	65.2	52.8	62.9	62.8	42.3	89.4	54.1	57.4
Use pesticide (%)	24.6	6.0	6.2	12.1	12.0	27.9	10.5	12.1
Quantity of NPK used (kg)	39.7	31.2	41.0	39.8	19.7	109.4	26.8	34.4
Expenses on fertilizer (Kw)	5,382	4,129	3,403	5,485	1,782	13,646	3,571	4,506
Number of sample observations	133	116	56	175	130	66	239	305

NOTES: Use of fertilizer and use of pesticide are binary (0=No, 1=YES). Kw = Kwanzas. Estimates weighted to reflect population. Only potato producers included.

Source: ProRenda survey, Angola, 2009.

Table 22 Bean production: Farmers using fertilizers and pesticides, average quantity of NPK used and average expenses on fertilizers, per village type, sex of head and participation in farmer organizations

	Village type			Sex of head		Member of FO		
Detail	Primary	Secondary	Control	Male	Female	Yes	No	Total
Use fertilizer (%)	0.1	3.7	3.5	3.4	1.7	11.0	2.5	2.8
Use pesticide (%)	0.0	0.2	0.0	0.1	0.4	1.3	0.1	0.2
Expenses on fertilizer (Kw)	33	121	221	142	31	1,380	56.36	106.4
Number of sample observations	137	142	87	193	173	40	326	366

NOTES: Use of fertilizer and use of pesticide are binary (0=No, 1=YES). Kw = Kwanzas. Estimates weighted to reflect population. Only bean producers included.

Source: ProRenda survey, Angola, 2009.

Table 23 Onion production: Farmers using fertilizers and pesticides, average quantity of NPK used and average expenses on fertilizers, per village type, sex of head and participation in farmer organizations

	Village type			Sex of head		Member of FO		
Detail	Primary	Secondary	Control	Male	Female	Yes	No	Total
Use fertilizer (%)	66.9	39.5	62.8	53.2	33.3	88.3	46.1	48.4
Use pesticide (%)	4.3	0.0	3.6	1.8	0.1	0.6	1.4	1.4
Quantity of NPK used (kg)	22.6	16.2	18.4	18.6	16.6	59.6	15.8	18.1
Expenses on fertilizer (Kw)	2,180	1,230	979	1,795	557	9,042	1,068	1,494
Number of sample observations	84	84	40	121	87	41	167	208

NOTES: Use of fertilizer and use of pesticide are binary (0=No, 1=YES). Kw = Kwanzas. Estimates weighted to reflect population. Onion producers only included.

Source: ProRenda survey, Angola, 2009.

12.2. Bean producers' input use

Since beans are primarily a food security crop and marketed amounts are lower proportions of total production, it is not expected that many households apply external inputs (fertilizers or pesticides) to their bean crops. As can be seen in Table 22, this logic holds. A few cases of large use are driving the means above 0 values.

12.3. Onion producers' input use

Onions, like potatoes, are seen as a cash crop and thus the use of fertilizers is once again expected to be more common than in bean production, but the area planted to onions is usually small and thus the quantities needed are small. As shown in **Error! Reference source not found.**, these smallholders used small quantities of inputs in their production and thus the cash production costs are quite low. Members of farmer organizations tend to use more fertilizers than other farmers. As was seen earlier, the gross margins for onions are also relatively low, primarily due to low total production of onions.

Table 24 Carrot production: percentage of farmers using fertilizers and pesticides, average quantity of NPK used and average expenses on fertilizers (NPK + manure), per village type, sex of household head and participation in farmer organization

	Village type			Sex of head		Member of FO		
Detail	Primary	Secondary	Control	Male	Female	Yes	No	Total
Use fertilizer (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Use pesticide (%)	1.5	0.0	0.0	0.0	6.5	3.0	0.0	0.7
Quantity of NPK used (kg)	12.7	99.8	52.0	64.1	42.0	74.7	58.3	61.9
Expenses on fertilizer (Kw)	1,752	9,280	5,200	6,035	5,692	9,875	4,920	6,000
Number of sample observations	9	9	1	12	7	11	8	19

NOTES: Use of fertilizer and use of pesticide are binary (0=No, 1=YES). Kw = Kwanzas. Estimates weighted to reflect population. Only carrot producers included.

Source: ProRenda survey, Angola, 2009.

12.4. Carrot producers' use

Carrot production, like onions and potatoes, is primarily for the market. Among farmers producing carrots, all of them used fertilizer; however, less than one percent of them applied pesticides. On average, farmers used 62 kg of NPK and spent Kw 6,000 on fertilizers (NPK and manure) (**Error! Reference source not found.**). When comparing expenses, farmers spent more on production of carrots than on potatoes, beans or onions.

As mentioned above, all farmers used fertilizer. The amount of NPK used and expenses on fertilizer was smallest in the primary villages and highest in the secondary ones. Additionally, male-headed households and members of farmer organizations used a greater quantity of NPK and spent more on fertilizer compared to female-headed households and non-members (**Error! Reference source not found.**). It should be noted that there are relatively few cases and estimates should be taken with care.

12.5. Cabbage producers' use

Among farmers producing cabbages, four out of five farmers used fertilizer and five percent of them applied pesticides. Compared to carrot producers, cabbage producers applied more pesticides and spent 17% less on fertilizers (**Error! Reference source not found.** and Table 25). Fertilizer use varied by village type, sex of household head and membership of organizations, but the number of cases is small for reliable interpretation. It does appear that membership in FO and sex of head was important in fertilizer and pesticide use (Table 25).

Table 25 Cabbage production: percentage of farmers using fertilizers and pesticides, average quantity of NPK used and average expenses on fertilizers (NPK + manure), per village type, sex of household head and participation in farmer organization

	Village type			Sex of head		Member of FO		
Detail	Primary	Secondary	Control	Male	Female	Yes	No	Total
Use fertilizer (%)	98.4	75.1	100.0	88.4	29.9	100.0	76.3	79.6
Use pesticide (%)	21.3	1.3	0.0	5.8	0.0	7.4	4.6	5.0
Quantity of NPK used (kg)	40.8	38.7	129.4	42.8	24.6	90.5	31.9	40.1
Expenses on fertilizer (Kw)	6,956	4,601	1,230	5,458	2,383	11,542	3,939	4,998
Number of sample observations	10	19	2	21	10	9	22	31

NOTES: Use of fertilizer and use of pesticide are binary (0=No, 1=YES). Kw = Kwanzas. Estimates weighted to reflect population. Only cabbage producers included.

Source: ProRenda survey, Angola, 2009.

13. Marketing strategies for horticultural crops

Given ProRenda's emphasis on improving marketing for selected crops as a way to improve incomes, it was important for the baseline to capture the key marketing strategies of farmers in the region. Farmers were asked about when they sell and why, as well as where they sell and their access to market information. The questions were asked at a crop level for each of the key crops with the understanding that there may be important differences in marketing among the crop. However, there are many aspects in common between the crops, so we will focus on the commonalities and then highlight key differences. Annex Tables 2-4 present the detailed statistics, based on the commodity.

13.1. Timing of sales

Regarding the timing of their sales, farmers were asked to identify the single main month of sales for each crop and cropping season (Table 26). For each commodity there were key sales months: (1) potato sales from November through January; (2) bean sales January, February and June; and (3) onion sales from December through February, and August.

For all crops, the main reason for selecting any given period was that it was the harvest time, implying that there is little storage of commodities. Lack of storage was rarely cited as a reason for selecting a particular period, but further interviews are needed to understand the link between harvest period sales and possible storage constraints or marketing constraints. Good prices were an important reason for selecting a specific time, as is the case of December for sales of potatoes and onions, and February and September for beans. Among the other reasons cited across the crops on timing of sales were needs for funds to pay expenses (school, holiday period), illness, and presence of a buyer (or lack thereof).

When disaggregating the results to look at responses for male and female-headed households, we found that female-headed households were more likely to mention lack of storage as a reason for selling in a given month, although it was still relatively few households. For example, for potatoes, 5% of the female-headed households mentioned storage, mainly for the months of December and January. Women-headed households are more likely to mention a range of reasons for timing that include schools needs, health and

Table 26 Farmers' timing of sales and reasons for that timing, by crop

Month of sales	Reason for selecting this month				Total
	Harvest	Good price	Lack of storage	Other	
			(% of farmers)		
Potato					
January	8.0	0.7	0.3	2.1	11.0
February	1.4	1.3	0.0	1.7	4.4
March	0.1	0.1	0.0	0.0	0.3
April	1.4	0.0	0.0	0.0	1.4
May	0.1	0.0	0.0	0.4	0.5
June	2.7	2.5	0.0	2.5	7.7
July	4.7	1.2	0.0	1.0	6.9
August	1.2	0.4	0.0	0.6	2.2
September	3.0	1.2	0.0	0.3	4.6
October	3.8	3.0	0.0	3.9	10.7
November	6.2	4.0	0.0	0.4	10.6
December	22.7	14.4	0.7	2.0	39.9
Overall	55.4	28.8	1.0	14.8	100.0
Beans					
January	14.8	2.1	0.0	7.0	23.9
February	15.7	5.9	0.4	3.7	25.7
March	4.0	1.3	0.0	1.0	6.3
April	2.3	0.7	0.2	0.8	4.2
May	2.6	1.5	0.0	0.0	4.1
June	7.9	2.9	0.0	1.6	12.3
July	0.7	3.8	0.0	1.4	5.9
August	0.8	2.0	0.0	1.6	4.4
September	2.1	5.3	0.0	0.1	7.5
October	0.0	1.3	0.0	0.3	1.5
November	0.0	1.3	0.0	0.1	1.4
December	2.2	0.2	0.0	0.4	2.8
Overall	53.1	28.3	0.7	18.0	100.0
Onions					
January	13.3	3.2	0.0	6.0	22.5
February	10.7	5.3	0.3	0.4	16.7
March	0.3	0.0	0.0	0.2	0.5
April	5.3	0.0	0.0	0.1	5.4
May	5.5	0.0	0.0	0.0	5.5
June	3.4	0.0	0.0	0.6	4.0
July	4.7	1.2	0.0	0.0	6.0
August	11.4	0.6	0.0	0.9	12.9
September	0.9	6.1	0.0	0.0	7.0
October	2.3	0.4	0.4	0.6	3.7
November	3.2	0.5	0.0	0.5	4.2
December	3.6	7.0	0.0	1.2	11.7
Overall	64.6	24.3	0.7	10.4	100.0

Note: Each farmer was asked to indicate only one main reason for choice. In each crop, only producers of the crop selling into the market are included.
Source: ProRenda Survey, Angola, 2009. Estimates weighted to reflect population.

other aspects, especially for their bean sales, for which 27% of females-headed households cited other reasons, with January as the most important month for such reasons.

13.2. Location of sales

Across the village types and across the commodities, most farmers used their local markets for selling produce, and indicate that it is chosen because it is the easiest market in which to sell (Table 27). About 50% of all farmers across the three key crops used local markets, and the majority of those farmers indicated that they sold in those markets due to ease of sales (32%) or lack of transport (10%). Selling from the field or the homestead occurred with about 21-28% of households, depending on the crop. For the 24-26% (depending on crop) of farmers who sold in other markets (such as the district center market), price was clearly a key reason for selecting those others markets. Fully 65% of potato farmers selling in these other markets sold there due to price, for example.

When evaluating the difference in market choices between male and female-headed households, we see that women also tend to use other markets (rather than their local ones) due to higher prices. When using the local markets, female-headed households are less likely to indicate transport problems as a reason for selling into local markets, whereas ease of market is very strongly stated for those markets (eg. 84% of these households indicated ease when choosing local market for beans). To sell onions, very few female heads tend to go to other markets than their local markets, but selling onions directly from home is more likely for female-headed households than male-headed.

The control villages demonstrate higher use of other markets than their local markets and for potatoes, 21% of all households in control villages indicated that they chose their sales point due to good relations with traders, while 34% chose where to sell their potatoes based on good prices.

13.3. Responsibility for sales and price information

Given the lack of variability across village types and crops, we report in general terms the responses concerning the person responsible for sales and whether and how they access price information and more detail can be found in Annex Tables 2-4. Within the farm households and across the crops, the head of the household was the person responsible for selling the main crops across village type and sex of head (Annex Tables 2-4).

The person responsible for sales tried to find information of prices in between 55 to 70% of cases (Annex Tables 2-4). None of the households obtained information of prices for any of the crops from formal sources (i.e. radio, associations, IDA staff). Angola does not currently have any price dissemination system, public or private. Thus, households' primary sources of information were either their friends, middlemen[28] or, in the case of potatoes and beans, the spouse. Friends were more important in zones where households for each commodity relied more on local markets, as in the primary and secondary villages.

The source of the information varied somewhat depending on the sex of head. The people responsible for sales were less likely to rely on middlemen in female headed households than in other households. Also, in female headed households, women were more likely to be involved in the selling of crops, although, surprisingly, in about 40% of female-headed households for each crop, women were not among the sellers.

[28] A middleman is a person who usually buys farmers' surpluses at the farm gate or in local markets.

Table 27 Farmers' location of sales and main reason for that choice of location, by crop

Place of sales	Reasons for selecting this place: Ease of sales	Good price	Lack of transport	Good relations with traders	Other	Total
	(% of farmers)					
Potato						
Own field	4.1	0.0	0.8	0.3	0.0	5.2
Own home	11.6	1.0	2.9	0.5	0.6	16.7
Local market	37.8	1.8	9.1	1.2	0.3	50.2
Other market	3.7	16.9	0.0	2.4	2.8	25.8
Other place	0.1	2.0	0.0	0.0	0.0	2.1
Overall	57.4	21.7	12.8	4.4	3.7	100.0
Beans						
Own field	0.6	0.0	0.5	0.4	0.0	1.6
Own home	10.5	0.6	2.8	5.3	0.5	19.7
Local market	31.2	7.4	12.1	0.5	0.3	51.5
Other market	7.6	14.0	0.0	3.6	0.6	25.9
Other place	0.6	0.0	0.0	0.0	0.8	1.4
Overall	50.5	22.0	15.5	9.9	2.2	100.0
Onions						
Own field	5.5	0.0	0.7	0.4	0.0	6.6
Own home	14.6	0.7	4.7	1.3	0.0	21.3
Local market	28.3	5.4	9.5	3.2	0.4	46.8
Other market	3.1	15.9	1.2	0.7	2.7	23.6
Other place	0.1	1.6	0.0	0.0	0.0	1.7
Overall	51.5	23.6	16.2	5.6	3.1	100.0

Note: Each farmer was asked to indicate only one main reason for choice.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

14. Household livestock

The survey included several questions regarding the ownership of livestock during the period January 2005 through January 2009. As was seen earlier in the priorities for investment, animals were a key choice for new investments and thus important to the families, both for production purposes (animal traction) and possibly for income and savings. To compare different species of animals across geographical regions, we used the FAO conversion factors for sub-Saharan Africa to estimate the total number of tropical livestock units (TLU) owned by households (FAO, 2009). The livestock unit is a standardized animal unit obtained with a conversion factor for each type of animal that takes into account feed requirements for the animal (FAO, 2009), such that each oxen is equal 0.5 TLU, whereas one goat is equal to 0.1 TLU, one pig is 0.2 TLU and one chicken is 0.01. For each household, the total number of TLUs can be estimated by summing across types of animals.

Table 28 Average livestock wealth[1] of households, per village type and sex of household headTable 28 reports the average TLU and expenses on purchases of livestock. Farmers in the control villages owned slightly more TLU than farmers in any other village type; however, the differences were minimal. Expenses on TLU are expenses incurred in buying livestock only between February 2008 and January 2009. Farmers in the secondary

villages spent more on TLU than farmers in any other village type. Finally, the number of and total purchasing expenses on TLU varied significantly by sex of head. Male heads owned more livestock (over twice as much) and spent 1.8 times more on TLU purchases than female heads.

Table 28 Average livestock wealth[1] of households, per village type and sex of household head

	Village type			Sex of head		
Livestock wealth	**Primary**	**Secondary**	**Control**	**Male**	**Female**	**Total**
No. TLU (if TLU>0)	0.46	0.46	0.49	0.53	0.24	0.46
Expenses on purchasing TLU (Kwanzas)	7,055	8,629	8,132	9,213	5,048	8,168
Number of sample observations	185	174	96	267	188	455

[1] Livestock wealth refers to the total tropical livestock units (TLU) and total expenses on TLU (between February 2008 and January 2009) per household, for households with TLU> 0.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

15. Family welfare, food consumption and food scarcity

With the investments of the ProRenda project, it is thought that households will see improved incomes and welfare over the years of the project, thus working with the families to obtain a baseline on household observations regarding food consumption, food security, and food scarcity is important. Surveys in Mozambique and elsewhere indicate that the household perceptions of wellbeing and changes correspond well to estimated changes in income and wealth.

15.1. Food consumption: Today versus previous two years

The heads of households were asked whether their consumption of food was better, worse or the same during 2008, compared to the previous two years, and the response was followed up to determine their perception of why that change occurred.[29] Half of the farmers reported that their family's food consumption in 2008 didn't change, compared to the previous two years, while about one in three households reported that their food consumption was better in 2008, with a minority indicating that consumption was worse (Table 29).

The households indicated both what shifted and why they thought that consumption quality shifted in the given period. Table 30 presents the responses from the heads of the households (whether male or female) on better food consumption at the time of the interview, whereas Table 31 presents the responses on worse food consumption. Better food consumption is generally related to more food on the table or more fish or meat in the diet and is generally related to improved agricultural production (Table 30). Worse food consumption is also mostly linked to lower quantity of food, although for female heads, quality changes also occurred. The change for the worse is most commonly related to lower agricultural production (Table 31).

[29] The same questions were asked to the wife of male heads and the answers were similar to the answers of the head. The only difference was that male heads in the control villages reported that the positive change in food consumption was given by a change in the quantity consumed, while their wives reported that the change in food consumption was given by a change in the amount of fish or meat they ate. See Annex Table 6 to 8 for details.

Table 29 Qualitative assessment of food consumption changes of households, per village type and sex of household head

Food welfare[1]	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Family's food consumption	(% of households)					
Better	38	29	45	30	37	32
Worse	20	17	13	18	16	17
Same	42	54	41	52	47	50
Number of sample observations	244	237	115	307	289	596

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Head's responses.

Table 30 Head's perception of reasons for having better food welfare[1], per village type and sex of household head

Food welfare	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
How did food consumption shift (%)?						
Shift in quantity consumed	57.3	49.9	48.5	64.7	29.7	52.2
Shift in fish / meat	39.0	49.4	48.3	33.2	69.1	45.9
Shift in fruits and vegetables	3.4	0.7	0.8	1.8	1.2	1.6
Others	0.2	0.0	2.4	0.3	0.0	0.2
Why did food consumption shift (%)?						
Shift in the number of people	10.7	7.6	6.8	11.6	3.1	8.6
Shift in crop production	47.6	56.4	50.8	62.9	35.5	53.1
Shift in agricultural sales	29.0	16.5	18.1	17.0	27.3	20.7
Shift in non-agricultural income	12.5	19.5	21.9	8.2	34.0	17.4
Others	0.1	0.0	2.4	0.3	0.0	0.2
Number of sample observations	93	86	51	113	117	230

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Head's responses.

Table 31 Head's perception of reasons for having worse food welfare[1], per village type and sex of household head

Food welfare	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
How did food consumption shift (%)?						
Shift in quantity consumed	68.0	87.6	100.0	90.8	60.4	81.8
Shift in fish / meat	12.0	7.3	0.0	3.0	21.7	8.5
Shift in fruits and vegetables	3.1	1.1	0.0	1.4	2.3	1.7
Others	16.8	4.1	0.0	4.9	15.5	8.0
Why did food consumption shift (%)?						
Shift in the number of people	6.8	7.3	5.6	7.1	7.0	7.1
Shift in crop yields	65.6	49.5	94.4	58.7	50.3	56.2
Shift in agricultural sales	10.4	8.9	0.0	7.9	11.9	9.1
Shift in non-agricultural income	3.6	16.0	0.0	14.1	5.2	11.5
Others	13.7	18.3	0.0	12.2	25.7	16.2
Number of sample observations	50	38	16	59	45	104

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Head's responses.

15.2. Food stocks and dietary diversity

To understand more about food security in the household, the key women (i.e. female heads or wives of male heads) were asked if there are periods during the year in which there was not sufficient food for the family. Ninety percent of households indicated that there had been such periods, and this was similar across all the types of villages. When asked a follow up question about how many times a year, about one half of the respondents indicated more than four weeks per year, across all the village types. Heads of female-headed households were much more likely to report more than four weeks than women the male headed households (Table 32).

In the Angolan context, when evaluating different measures to assess dietary diversity, households and World Vision staff indicated that consumption of dried or fresh fish was a key diversification strategy30 and so the lead women in the households were asked about the frequency of eating fish. Most households (65%) only eat fish during special occasions; however, one out of three households reported eating fish several times per week (Table 32). There were no significant differences between the households based on type of village or sex of the head. While this attempt at looking at consumption diversification is not showing differences across the village types, we do find a significant link between the frequency of fish and the wealth index, with households in the highest tercile of the index more likely to eat fish several times per week. Thus, an increase in fish consumption would appear to be valuable to continue to track as it reflects wealth classifications.

16. Education of children

Schooling of children is often seen as a good indicator of household welfare and investment in the future, at least in communities that have schools available. The INE/UNICEF Report (2003) for Angola indicated that school-age children who are not in school are usually involved in labor activities to help meet basic needs of families, and thus households under greatest stress are likely to have lower school participation rates and lower

[30] Donovan and Kelly (2009) discuss the challenges with the dietary diversity issues and what to use as an indicator of food security or nutritional adequacy.

Table 32 Food security and consumption of fish by households [1], per village type and sex of household head

	Village type			Sex of head		
Food security	**Primary**	**Secondary**	**Control**	**Male**	**Female**	**Total**
Food is scarce during the year[2] (%)	92	89	93	89	93	90
If food is scarce, scarcity occurs with what frequency/duration? (%): [3]						
Less than two weeks / year	15	14	6	19	5	14
Three to four weeks / year	35	38	43	38	35	37
More than four weeks / year	49	48	51	43	60	49
Your family eats fresh or dry fish (%):						
Daily	2	2	2	2	1	2
Several times / week	35	32	39	33	35	33
Special occasions only	63	66	59	65	64	65
Number of sample observations	230	236	110	295	281	576

Notes: [1] Responses are from females only (i.e. female-head or head's wife).
[2] Binary variable (0 = NO, 1 = YES).
[3] Asked only of households in which food was scarce during the year.
Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Table 33 Average schooling participation rates of children between five and seventeen years of age, per village type and sex of household head

	Village type			Sex of head		
Schooling participation rates	**Primary**	**Secondary**	**Control**	**Male**	**Female**	**Total**
Children in school in 2008 (% of school age children)	90.6	81.6	98.0	85.5	83.7	85.0
Number of days missed because of sickness in 2008	5.7	5.0	2.7	5.1	5.0	5.1
Number of days missed because of sickness in 2008 per child per year	2.7	2.3	1.1	2.2	2.7	2.4
Number of sample observations	183	156	79	226	192	418

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

spending on schooling. Here we examine the percentage of school age children who were attending school as well as absence due to illness and school expenditures.

16.1. Schooling participation rates (5 – 17 years old)

Participation rates varied across village type and sex of household head, with a household average participation rate of 85%. Farmers in the secondary villages had the lowest percentage (82%) of children between 5-17 years old that were enrolled in school in 2008 (Table 33). In contrast, 91% of children of households in the primary villages and 98% of children of households in the control villages were enrolled in school in 2008. There were no differences in school enrollment by sex of head. These numbers overall are higher than those found in the 2003 MICS survey (INE/UNICEF 2003), and may reflect government efforts to expand educational opportunities, as well as improved household capacity to maintain children in school.

Research suggests that absence from school due to illness can help to identify households in which there are health problems and households likely to be under stress.

When looking at the number of school days missed during 2008 due to illness, the average numbers of days per child was about 2.4 days. Additionally, children in the control villages missed fewer school days compared to children in any other village type (Table 33).

16.2. Expenditures in school supplies

Expenditures in school supplies between February 2008 and January 2009 averaged Kw 2,000. The differences between the primary and secondary villages, and by sex of household head were minimal. However, farmers in the control villages spent approximately 22% less on school supplies than farmers in any other village type (Annex Table 9), even though they had the highest school participation rates across the village types.

17. Review of key results

In this section, we provide just a brief summary on the key results from the baseline. Given the zone and the sample selection, most farmers in the surveyed provinces planted common beans, potatoes, and onions, and only a small percentage of them also planted cabbages or carrots. Beans are a key crop, both for sales and for food security in this zone of Angola. Participation in farmer associations was very low (6%), lower than expected in this region.

Overall, the average number of literate adults per household was very low (less than one member was literate). However, this number was slightly higher in the primary villages and in female-headed households. This has consequences for extension efforts, as written communication will be less effective than oral and demonstrations. Most male heads were married and thus have spouses present in the household. However, only one in four female heads had a spouse present and one in two were widowed, as might be expected, given the relatively recent signing of the peace accords.

The major non-farm source of income across village type and sex of head was off-farm labor, namely working in other people's plots, as well as commerce and various service occupations. For female-headed households, 53% of households indicated off-farm agricultural labor as the most important non-farm source of income, with <1% indicating services as source of income; a significant difference with male-headed households in which services are also important.

Agriculture and livestock are the mainstay of the households in this region and most would invest in livestock and agriculture if they saw a doubling of their cash income. If farmers were able to double their income, male heads will most likely invest in livestock (mainly oxen) while female heads will most likely invest in miscellaneous household needs (mainly more/better food). Since men generally handle livestock, it is logical that they would be more likely to invest in them.

Most potato, bean and onion producers reported the head as the person responsible of sales. In most households, the person responsible of sales looked for information of prices before selling their product, and there were two main sources of information: friends and middlemen. None of the farmers obtained information of prices from formal sources.

The wealth index was useful in providing a categorization of the farmers. Farmers in the control villages and female-headed households are more likely to fall into the lowest tercile of wealth. While there is an apparent contradiction between the wealth categories and the gross margins observed, it is important to remember that the families in the Primary villages tend to have additional sources of agricultural incomes including maize, that provide incomes. The presence of markets in primary and secondary villages offers additional sources of income for families in those communities. Additionally, results for the control households have fewer observations and higher variability (wider confidence intervals) than

the results for other types of households. The distribution graph for incomes suggests that control villages have a few high income families.

The wealth index was correlated with livestock (TLU) ownership. Female heads owned less TLU than male heads. Additionally, farmers in the secondary villages and male heads spent more in the previous period on buying TLU than farmers in any other village type and female heads.

Most farmers reported that their family's food consumption in 2008 didn't change. Among the heads that reported that consumption has changed, this change was given by a shift in the quantity consumed and the main reason for this was because crop production changed. Most households had periods when the food was scarce. Surprisingly, food was scarce for more than three weeks per year[31] in most of the households.

Overall, schooling participation rates were good. However, a higher percent of children in the secondary villages and in female-headed households were not enrolled in any school in 2008. The number of school days missed because of sickness was very small, but there may be measurement error in this variable.

These results are not just valuable to suggest current status of rural households in this zone of Angola, but they also present the key information that will be useful in evaluating change over time with ProRenda project interventions, as will be discussed below.

18. Usefulness of baseline and implications for impact evaluation

The 2009 Baseline Survey was designed to capture the initial levels of key indicators to be used later for the impact evaluation. The baseline captures the gross margins (as defined in the initial chapter) over the three key crops. These measures can be compared in the end of project survey and later impact survey to see how households have done in increasing total production and gross incomes from these crops. Productivity of land (yield) will not be able to be measured with the baseline survey due to the problems of land area measurement. The use of a seeding rate proxy for land area cultivated will need to be evaluated for potatoes and beans, but cannot be used for onions.

Farmers were asked questions about their assets and what their priorities will be if they are able to increase their incomes. This was important to ensure that ProRenda can demonstrate effects on wealth accumulation on the households over time. As determined here, investments in livestock was seen as high priority, as well as in agricultural production. The baseline survey was able to capture current levels of these investments, and so it will be useful in later periods to evaluate if households working with ProRenda have been able to move upward in their wealth, accumulating productive and consumer assets. The wealth index and the expenditures on assets can be used to evaluate progress.

Given the challenges with the sample, it will be difficult for this baseline to demonstrate improvements for current members of farmers organizations within the types of villages, but there can be analysis overall, with the additional challenge that households will shift category, becoming members or dropping out. In the WV villages, both primary and secondary, we anticipate increasing numbers of participating farmers, and these new participants will form a separate potential level of analysis.

Fertilizer questions proved especially difficult, as the assumed unit was 50 kg sacks (suggested through pre-testing) and yet the farmers purchased and applied fertilizer in units other than the 50 kg sacks. This has made it difficult to analyze the productivity of fertilizer applications compared to output. When combined with the lack of field measurements and

[31] Sum of farmers who reported food was scarce three to four weeks per year + more than four weeks per year.

the non-standardized size of units for seed potatoes, estimating areas and thus yields in the farmers' fields is difficult and unreliable.

As detailed in Donovan and Kelly (2009), the range of cropping seasons and types of land provide challenges for accurate collection of information on production and sales related to a single year or cropping season. Given that cropping seasons overlap among the crops and between the types of land, the follow up survey will need to address a similar time frame to that used here in order to ensure comparability of data.

The lack of literacy poses a problem for using farmer records, although the high school participation rates suggest that within households and communities, there might be young people with the literacy skills to be able to help a local association maintain more production and marketing records, at an individual farmer or FO level.

There is clearly more analysis that can be done from a gender perspective than the researchers were able to conduct within this baseline report. In particular, the data contain sufficient information at a crop level to look at sales strategies and understand the differences between men and women as the responsible person for sales. That investment priorities varied by sex provides a way to evaluate the dynamic of resource control and investments within the households.

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Annexes

Annex 1: Additional tables

Annex Table 1 Scoring factors, summary statistics and per tercile means for asset indicators entering the computation of the first principal component

	Total sample				Means		
Asset indicators	**Scoring Factors**	**Mean**	**Std. Dev.**	**Scoring Factor / Std. Dev.**	**Poorest 33%**	**Middle 33%**	**Richest 33%**
Number of plows	0.245	0.109	0.346	0.71	0.001	0.078	0.188
Number of carts	0.137	0.009	0.095	1.44	0.000	0.000	0.012
Number of backpack sprayers	0.183	0.026	0.169	1.09	0.000	0.000	0.058
Number of motorcycles	0.325	0.067	0.258	1.26	0.000	0.000	0.182
Number of bicycles	0.230	0.149	0.367	0.63	0.000	0.090	0.438
Number of cell phones	0.287	0.064	0.245	1.17	0.000	0.000	0.184
Have well in the house	0.154	0.202	0.402	0.38	0.134	0.198	0.322
Have latrine in the house	0.104	0.796	0.403	0.26	0.731	0.900	0.942
Have lusalite or zinc roof	0.325	0.461	0.499	0.65	0.026	0.356	0.795
Number of radios	0.284	0.373	0.488	0.58	0.063	0.405	0.671
Number of tape recorders	0.287	0.124	0.330	0.87	0.000	0.021	0.323
Number of televisions	0.281	0.033	0.178	1.58	0.000	0.000	0.066
Number of tables	0.320	0.423	0.659	0.49	0.012	0.424	0.902
Number of chairs	0.402	1.863	2.022	0.20	0.227	1.949	3.590
Economic Status Index		0.000	1.819		-1.563	-0.409	1.838
Number of sample observations		549			193	173	183

Notes: Four of the 18 indicators were dropped because they had zero variance. Scoring Factor is the "weight" assigned to each indicator (normalized by its mean and standard deviation) in the linear combination of the variables that constitute the first principal component. The percentage of the covariance explained by the first principal component is 23.64%. The first eigenvalue is 3.31. Means provided in the last three columns were estimated with weights to reflect population.

Source: ProRenda survey, Angola, 2009.

Annex Table 2 Marketing strategies among farmers producing potato, per village type and sex of household head

Marketing strategies	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Person responsible of sales: (%)						
Head	70	62	82	69	55	66
Spouse	24	26	16	21	38	25
Both	4	9	2	9	1	7
Female is at least one of the responsible people	36	36	22	30	56	35
Responsible of sales looked for information of prices (%)*	56	63	61	62	53	60
If YES, main source of information: (%)**						
Spouse	6	4	7	4	6	5
Friend	54	60	51	55	74	58
Radio, Association, or IDA staff	0	0	0	0	0	0
Middlemen	35	31	39	35	19	32
Number of sample observations	97	91	34	141	81	222

* Binary variable (0 = NO, 1 = YES).

** Only if responsible of sales looked for information of prices.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Annex Table 3 Marketing strategies among farmers producing beans, per village type and sex of household head

Marketing strategies	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Person responsible of sales (%)						
Head	73	67	62	73	57	68
Spouse	21	25	33	19	38	24
Both	3	6	3	7	0	5
Female is at least one of the responsible people	33	35	43	26	57	35
Responsible of sales looked for information of prices (%)*	67	71	71	70	69	70
If YES, main source of information: (%)**						
Spouse	2	6	5	5	5	5
Friend	44	46	50	43	52	46
Radio, Association, or IDA staff	0	0	0	0	0	0
Middlemen	47	44	44	50	31	45
Number of sample observations	110	106	44	148	112	260

* Binary variable (0 = NO, 1 = YES).

** Only if responsible of sales looked for information of prices.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Annex Table 4 Marketing strategies among farmers producing onions, per village type and sex of household head

Marketing strategies	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Person responsible of sales (%)						
Head	66	55	55	58	59	59
Spouse	29	29	43	29	31	29
Both	2	5	1	4	0	4
Female is at least one of the responsible people	37	37	46	33	59	38
Responsible of sales looked for information of prices (%)*	48	59	60	58	38	55
If YES, main source of information: (%)**						
Spouse	0	0	0	0	0	0
Friend	62	51	53	55	49	54
Radio, Association, or IDA staff	0	0	0	0	0	0
Middlemen	28	49	44	43	41	42
Number of sample observations	72	58	35	107	58	165

* Binary variable (0 = NO, 1 = YES).

** Only if responsible of sales looked for information of prices.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Annex Table 5 Average household expenses on productive and household quality assets[1] per village type and sex of household head (period of January 2005 to January 2009)

Expenses (Kwanzas)	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Expenses, if expenses $\geq$ 0 (all cases):						
Productive assets	9,031	6,832	1,998	10,035	1,105	7,231
Household quality assets	3,469	2,861	1,887	3,809	1,193	2,987
Total	12,500	9,693	3,885	13,844	2,298	10,219
Number of sample observations	247	242	115	312	292	604
Expenses, if expenses > 0 (only cases with positive expenses on any type of asset):						
Productive assets	13,457	10,059	3,264	12,515	2,801	10,730
Household quality assets	5,169	4,212	3,083	4,750	3,024	4,432
Total	18,626	14,271	6,347	17,264	5,825	15,162
Number of sample observations	144	158	64	246	120	366

[1] Productive assets include plows, carts, backpack sprayers, motorcycles, bicycles, and cell phones. Household quality assets include radios, tape recorders, televisions, tables, and chairs. Expenses on wells, latrines or zinc roof were not included because this information was not collected.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Annex Table 6 Qualitative assessment of food consumption changes of households (wife's assessment), per village type

Food welfare[1]	Village type			Total
	Primary	Secondary	Control	
Family's food consumption: (%)				
Better	31	38	40	36
Worse	25	13	12	17
Same	44	49	48	47
Number of sample observations	89	77	40	206

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Wife's responses (of male-headed households) only.

Annex Table 7 Wife's perception of reasons for having better food welfare[1], per village type

Food welfare	Village type			Total
	Primary	Secondary	Control	
How did food consumption shift (%)?				
Shift in quantity consumed	62.3	49.7	5.8	50.7
Shift in fish / meat	32.1	37.7	76.6	38.2
Shift in fruits and vegetables	5.5	6.5	11.5	6.5
Others	0.1	6.2	6.1	4.6
Why did food consumption shift (%)?				
Shift in the number of people	30.0	0.8	7.4	8.6
Shift in crop yields	37.5	46.3	23.4	42.9
Shift in agricultural sales	31.5	36.9	39.7	35.6
Shift in non-agricultural income	0.6	16.0	23.4	12.4
Others	0.5	0.0	6.1	0.4
Number of sample observations	32	30	17	79

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Wife's responses (of male-headed households) only.

Annex Table 8 Wife's perception of reasons for having worse food welfare[1], per village type

Food welfare	Village type			Total
	Primary	Secondary	Control	
How did food consumption shift (%)?				
Shift in quantity consumed	85.1	84.2	100.0	85.1
Shift in fish / meat	0.0	15.8	0.0	8.3
Shift in fruits and vegetables	5.3	0.0	0.0	2.3
Others	9.7	0.0	0.0	4.3
Why did food consumption shift (%)?				
Shift in the number of people	5.3	11.9	0.0	8.6
Shift in crop yields	70.5	64.3	73.5	67.4
Shift in agricultural sales	18.2	11.9	0.0	14.3
Shift in non-agricultural income	0.0	0.0	26.5	0.8
Others	6.0	11.9	0.0	8.9
Number of sample observations	16	11	5	32

[1] "Food welfare" refers to household qualitative assessment of food consumption in 2008 compared to the previous two years.

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population. Wife's responses (of male-headed households) only.

Annex Table 9 Average expenses on school supplies[1] between February 2008 and January 2009, per village type and sex of household head

Expenses (Kwanzas)	Village type			Sex of head		Total
	Primary	Secondary	Control	Male	Female	
Expenses, if expenses>0	2,021	2,008	1,565	1,959	2,068	1,992
Number of sample observations	170	157	74	212	189	401

[1] School supplies include uniforms, shoes, materials (pencils, etc.), and others (tips, etc.)

Source: ProRenda survey, Angola, 2009. Estimates weighted to reflect population.

Annex 2: Methodology: Sampling and questionnaire design

Sampling Frame

The population designed to be in scope for this survey are farming families in municipal areas of Huambo, Bie and Benguela Provinces identified by World Vision as primarily agricultural with good potential for market development of horticultural crops. Areas with uncleared landmines and other areas with very limited access have been excluded from the population frame, as they are not target areas for smallholder commercial development of horticultural products. The following municipalities are included in this study: Caala, Bailundo, Londuimbali, Katchiungo, Ekunha, and Tchicalachuluanga in Huambo; Chinguar in Bie; and Babaera in Benguela.

The primary sampling unit (PSU) selected at the first stage is the village or a subdivision ("neighborhood") of the village within the municipalities covered by the baseline survey. The sampling frame of villages was obtained from a list of villages and neighborhoods (within larger villages) developed by World Vision. This list included the communes and municipalities targeted by World Vision (candidates for primary and secondary beneficiaries, see 3.2 for details). This list included the total number of households and total population in each PSU. Since there is no Census data in the country, when total population was not available, the total number of households was multiplied by five to obtain total population.

The PSUs were selected with probability proportional to size (PPS), where the measure of size was based on the total population in the village. The larger PSUs (i.e. with more than 150 families) that were selected in the sample were subdivided into smaller segments (neighborhoods) of 80-100 families each, and one segment was selected with equal probability. The instructions for dividing the large sample villages into segments were adapted from previous work by MSU, based on sketching the village with landmarks (Annex 1 of Donovan and Kelly 2009).

A listing of families was conducted in each sample village or segment. The listed families were grouped into second stage (secondary) strata corresponding to different subpopulation groups as explained in the section below, and a sample of households was selected within each group. The listing instrument was not used to exclude non-agricultural families, since the number was though to be very small. Instead, at the time of interviews, a screening question was asked at the beginning, and families whose direct source of cash income was non-agricultural were not interviewed.

The units of analysis for the baseline survey are the individual households.

Stratification

There were two levels of stratification. In order to increase the efficiency of the sample design for the baseline survey, first the sampling frame was divided into three strata (the first level of stratification) that were as homogeneous as possible. The nature of the stratification depended on the most important characteristics to be measured in the survey, as well as the domains of analysis. This first level of stratification generated three categories of villages or strata: primary, secondary, and control (Annex Table 10). The survey results are presented for these three categories.

Annex Table 10 Stratification of villages based on village type

Category	Description of primary stratification	Number of Villages (PSUs)
Primary	Direct beneficiaries: families in the villages with direct associations [32] supported by World Vision ProRenda	16
Secondary	Secondary beneficiaries: families in the villages with secondary associations supported by World Vision ProRenda	16
Control	Control zone: families in villages that do not have associations supported by World Vision ProRenda	8

Given the need to provide estimates for different subpopulation groups, the second level of stratification corresponded to type of families within each primary stratum (category) for each PSU. For the primary and secondary categories, the families listed within each sample PSU or segments were divided into four secondary strata based on sex of family head and participation in associations. For the control category, the families were divided into two secondary strata based on sex of family head. A separate sample of families was selected for each group listed within a sample PSU at the secondary strata level (Annex Table 11).

Annex Table 11 Secondary stratification based on type of families. World Vision ProRenda Project, Angola

Category	Number of Villages (PSUs)	Secondary Strata at Village Level	Number of families per PSU
Primary	16	Female-headed families, participants in associations	4
		Female-headed families, non-participants ("secondary participants")	4
		Male-headed families, participants in associations	4
		Male-headed families, non-participants ("secondary participants")	4
Secondary	16	Female-headed families, participants in associations	4
		Female-headed families, non-participants ("secondary participants")	4
		Male-headed families, participants in associations	4
		Male-headed families, non-participants ("secondary participants")	4
Control	8	Female-headed families, all nonparticipants	10
		Male-headed families, all nonparticipants	10

[32] "Primary associations" are those associations directly receiving farmer training from ProRenda based on selected farmer leaders for each association. "Secondary associations" are associations who do not have leaders participating in the initial training. Instead, farmer leaders from secondary associations will be trained in later periods using farmer-to-farmer methods with the farmer leaders from the primary associations.

Sample Size and Allocation

Sample size has been determined based on the domains of estimation and probability of sufficient household numbers. Unfortunately the statistical reporting in Angola does not generally include indications of variability; means for key variables are available but without indications of distributions around the mean. Statisticians use variability in important characteristics or key indicators to determine the efficient sample size, but we do not have previous Angolan survey data for this. For some variables we have used results from other countries in the region. For instance, in the Mozambican agricultural survey in 2005, the variability (measured by coefficient of variation) in sales of cash crops (cotton and tobacco) and of maize ranges from 6-16%, which may be low for Angolan conditions. Given these estimates and then checking if the variability were doubled, a sample size of at least 60 per strata would be needed to ensure results that were within 5% of the population estimates for the variable. We remain concerned, however, about the lack of reliable information on the variability of key variables (e.g. value of sales, cost of inputs). If the variability is higher than our best estimates indicate, the reliability of the results will not be as precise as anticipated.

The sampling was based on selecting villages for survey and then selecting farmers within just those villages. This is known as clustering of the sample and contrasts to simple random sample in which we would have a list of all farmers in the production zones and sample among all farmers. The clustering will result in design effects likely to result in lower precision for the secondary strata, but it should be satisfactory. The stratification will increase efficiency of the sample if the individual strata have different characteristics. Since the majority of the indicators that we are measuring concern activities that most households are involved in, the design should be efficient.

Another threat to the quality of the survey results from reductions in the effective sample size. We estimated that at least 5% of the projected sample was going to produce questionnaires that cannot be used or in families that refused. Note that refusal rates in other family surveys in the southern African region are very low (<1% in rural Mozambique in 2005), so the primary problem we expected was with poorly designed questions, enumerator error and lack of supervision. Field testing and intensive training were critical to reduce some of these issues. Rates of excluded surveys above 10% occur, but we assumed that the extensive design work, effective training and supervision kept the exclusion rate low. The sample included additional families to cover some exclusions.

As indicated in the previous section, at the primary stratification level, it was decided to select 16 sample PSUs for categories 1 and 2, and 8 sample PSUs for category 3. At the secondary stratification level, it was decided to select a sample of 16 to 20 families per PSU, depending on the number of subpopulation groups found in the PSU. Within each sample PSU, up to 4 sample families (10 for control PSUs) were selected for each subpopulation group.

The community level survey was conducted by supervisors in each village and includes information on infrastructure, economic activities, and other key aspects. This survey helps to control for changes in the overall environment for households and was conducted at the same time as the household surveys.

Sample Selection Procedures

Within each category, up to three sampling stages were used to select the sample families, depending on the size of the PSU. Each of these sampling stages is described separately below.

First Sampling Stage

The first stage sample of PSUs within each category was selected systematically with probability proportional to size (PPS). The PSUs in each category were first ordered geographically in order to provide implicit stratification. The sample PSUs within each category were selected using the following procedures:

- Cumulate the measures of size (population per PSU) down the ordered list of PSUs within the primary strata (category). The final cumulated measure of size (cumulative population) for the strata is M_h.
- To obtain the sampling interval for stratum h (I_h; h = 1, 2, 3), divide M_h by the total number of PSUs to be selected in stratum h (n_h): $I_h = M_h/n_h$. For stratum (categories) 1 and 2, n_h is equal to 16 for each; while for stratum (category) 3, n_h is equal to 8.
- Select a random number (R_h) between 0 and I_h. The sample PSUs in stratum h will be identified by the following selection numbers:

$$PSU_{hi} = R_h + [I_h \times (i - 1)], \quad \text{Rounded up;}$$

where i = 1, 2, ..., n_h

The i-th selected PSU is the one with a cumulated measure of size closest to PSU_{hi} while greater than or equal to PSU_{hi}.

For category 1, R_1 was selected by using the last four digits of the serie of a 10 Kwanza bill. For category 2, R_2 was selected by using the last four digits of the serie of a 500 Kwanza bill. For category 3, R_3 was selected by using the last four digits of the serie of a Kwanza bill.

An Excel spreadsheet was used for selecting the PSUs within each stratum (category) using these procedures. The Excel file has a separate spreadsheet for each category, showing the ordered frame of PSUs with the corresponding information on the measures of size.

Selection of Substitute Villages (sub-PSUs)

Category 1. Eleven substitute villages were selected. These sub-PSUs were selected using the following without-replacing sampling method:

- The sample PSUs selected above were excluded from the Excel file containing the information on cumulative measure of size. The new cumulative measure of size for this strata (category) is M_h'.
- Random numbers (R_i) between 0 and M_h' were generated in Excel. The sub-PSUs in stratum h will be identified by:

  $PSU_{hi}' = R_i$,

  Rounded up, and where i = 1, 2, ..., 11 if h = 1

  The i-th selected sub-PSU is the one with a cumulated measure of size closest to PSU_{hi}' while greater than or equal to PSU_{hi}'.

Categories 2 and 3. These sub-PSUs were selected using the following with-replacing sampling method:

- The cumulative measure of size is M_h.
- Random numbers (R_i) between 0 and M_h were generated in Excel. The sub-PSUs in stratum *h* will be identified by:

  $PSU_{hi}' = R_i$,

  Rounded up, and where

  $i = 1, 2, ..., 8$ if $h = 2$; and

  $i = 1, 2, ..., 6$ if $h = 3$

  The *i*-th selected sub-PSU is the one with a cumulated measure of size closest to PSU_{hi}' while greater than or equal to PSU_{hi}'.

Following the first stage selection, a summary spreadsheet was developed with the information for the entire sample PSUs that was later used for the calculation of the weights.

Segmenting Large Segments

In the case of large sample villages (with 150 or more families), they were subdivided into segments with approximately 80 to 100 families each, and one segment was selected at random. Smaller villages were treated as a single segment.

Selection of Families in Sample Segments

A listing of families was conducted in each sample segment. Information about the name of family head, sex, and whether they participate in a farmer organization was collected and used to classify each family by subpopulation group. Then a random systematic sample of families was selected for each group within the segment.

Weights Estimation Procedures

In order for the sample estimates from the baseline survey to be representative of the population covered by the survey, it was necessary to multiply the data by a sampling weight, or expansion factor. The basic weight for each sample household was equal to the inverse of its probability of selection (calculated by multiplying the probabilities at each sampling stage). This weight is easy to attach to each sample family record in the computer files, and the tabulation programs can weight the data automatically.

The sampling probabilities at each stage of selection were maintained in an Excel spreadsheet so that the overall probability and corresponding weight could be calculated for the sample families in each sample segment and subpopulation group. The overall probability of selection for sample families includes factors for up to three sampling stages, expressed as follows:

$$p_{Ghi} = \frac{n_h \times M_{hi}}{M_h} \times \frac{1}{S_{hi}} \times \frac{m_{Ghi}}{M_{Ghi}},$$

where:

p_{Ghi} = probability of selection for the sample families in subpopulation group G in the *i*-th sample PSU (village) in stratum (category) *h*

n_h = number of sample PSUs selected in stratum *h* for the baseline survey

M_h = total population in the frame (cumulated measure of size) for stratum *h*

M_{hi} = total population in the frame for the *i*-th sample PSU in stratum *h*

S_{hi} = total number of segments (neighborhoods) delineated in the *i*-th sample PSU in stratum *h*; for sample PSUs that are not subdivided into segments, $S_{hi} = 1$

m_{Ghi} = number of sample households selected for subpopulation group G in the *i*-th sample PSU (or segment if $S_{hi} > 1$) in stratum *h*

M_{Ghi} = total number of households listed for subpopulation group G in the *i*-th sample PSU (or segment if $S_{hi} > 1$) in stratum *h*

The three components of this probability of selection correspond to the individual sampling stages.

The basic sampling weight, or expansion factor, was calculated as the inverse of this probability of selection. Based on the previous expression for the probability, the weight can be simplified as follows:

$$W_{Ghi} = \frac{M_h \times S_{hi} \times M_{Ghi}}{n_h \times M_{hi} \times m_{Ghi}},$$

where:

W_{Ghi} = weight for the sample families in the *i*-th sample PSU in stratum *h*

However, after the data was cleaned, many surveys appeared to have unreliable/missing data. Because of this, these surveys were excluded from the analysis and the original weights were re-estimated to account for these exclusions. The re-estimation of weights was simple: we reduced the number of sample households selected (m_{Ghi}) to m'_{Ghi}. Therefore, the overall probability of selection for sample families became:

$$p'_{Ghi} = \frac{n_h \times M_{hi}}{M_h} \times \frac{1}{S_{hi}} \times \frac{m'_{Ghi}}{M_{Ghi}},$$

where:

m'_{Ghi} = the number of <u>valid</u> sample households selected for subpopulation group G in the *i*-th sample PSU (or segment if $S_{hi} > 1$) in stratum *h*.

And, the basic sampling weight became:

$$W'_{Ghi} = \frac{M_h \times S_{hi} \times M_{Ghi}}{n_h \times M_{hi} \times m'_{Ghi}}$$

Annex 3: Wealth Indices

In order to construct an asset index, we followed the methodology described by Filmer and Pritchett (2001); Minujin and Hee Bang (2002); McKenzie (2005); and Córdova (2008). From a total of 18 asset indicators,[33] four were excluded from the estimation because they had zero variance, that is, none of the farmers owned any of these assets.[34]

First, the set of (original) indicators, a^*_{1j} to a^*_{Nj} (N=1,…,18) representing the ownership of N assets by each household j were normalized by its mean (a^*_N) and standard deviation (s^*_N). For example, for the number of tractors (e.g. first of 18 indicators), the normalized number of tractors for household j was:

$$a_{1j} = (a^*_{1j} - a^*_1) / (s^*_1)$$

Where a^*_1 is the mean of the number of tractors across households and s^*_1 is its standard deviation. After normalizing every indicator, the asset index for each household j was estimated by expressing these indicators as a weighted linear combination (excluding indicators with zero variance):

$$A_j = f_{11} \times (a^*_{1j} - a^*_1) / (s^*_1) + f_{12} \times (a^*_{2j} - a^*_2) / (s^*_2) + \ldots + f_{1N} \times (a^*_{Nj} - a^*_N) / (s^*_N)$$

Where A_j is the asset index for household j, and f_{11} to f_{1N} are the weights obtained from the first principal component (eigenvector of the first component). [35]

[33] The asset indicators included the number of: tractors, trucks, cars, plows, carts, backpack sprayers, motorcycles, bicycles, cell phones, radios, tape recorders, televisions, gas stoves, tables, and chairs. It also included ownership of well and latrine in the house, and whether the roof was made of zinc or lusalite.

[34] Tractors, trucks, cars, and gas stoves were excluded from the index estimation.

[35] The principal component estimation gives as many components as indicators entering the computation (14 in our case). For each of these, eigenvectors (weights) are provided. In our case, we used the eigenvector of the first component only.

Annex 4: Community-level survey questionnaire

Annex 5: Household level survey questionnaire