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# LIVELIHOOD ANALYSIS OF HOUSEHOLDS IN SOLWEZI DISTRICT, ZAMBIA



JULY 2017

DEVELOPING VALUE CHAIN INNOVATION  
PLATFORMS TO IMPROVE FOOD SECURITY IN EAST  
AND SOUTHERN AFRICA (VIP4FS) PROJECT  
(FST/2014/093)

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## ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ANOVA	Analysis of Variance
DFID	Department for International Development
DRC	Democratic Republic of Congo
FISP	Farmer Input Support Programme
FRA	Food Reserve Agency
ND	Newcastle Disease
VIP4FS	Value Chain Innovation Platforms for Food Security

## **EXECUTIVE SUMMARY**

The study report aimed to provide information for understanding the context in which smallholder farmers operate in order to be able to propose interventions that will improve food security and hence enhance their livelihoods. This was done through a household survey that was carried out in Solwezi district. Livelihood analysis focused on household characteristics, institutions, agricultural and livestock production with a focus on village chicken, soya beans and Solwezi beans. Household income, assets, dietary diversity, wealth status and infrastructure were also assessed. Dietary diversity and wealth index was computed as a proxy for food security and poverty levels of households in the area respectively.

Solwezi district, a focus district for the VIP4FS project, falls in zone 6 of the Zambia's livelihoods zones. Zone 6 covers communal areas in and around new copper mining areas of Solwezi and Kasempa districts in the Northwestern Province and bordering DRC in the north. Mining activities are increasingly gaining prominence in these areas and provide an important source of employment and market for local agricultural produce. Mining activities have shifted the livelihoods in the area. Employment in the mines, particularly among men, is becoming an important source of household income. Trade in agricultural produce with the mines is also increasingly proving important livelihood activity in the zone. Agriculture, however, remains an important livelihood activity in Solwezi especially for those who fail to secure employment in the mining sector such as women, the elderly and children. Solwezi farmers mainly rely on rain-fed agriculture and the households are able to produce cassava, maize, sorghum, beans, and sweet potatoes which are traditionally grown using the slash and burn (chitemene) system.

The data for the household analysis was collected from 437 farmers drawn from five blocks in Solwezi: St Francis, Mutanda, Lunga, Mushindamo and Mukumbi. The blocks and camps were purposefully selected based on availability of farmers and/or traders who produce and sell soya beans. The selected blocks and camps were those with considerable number of soya bean farmers. Solwezi is mainly inhabited by Kaonde tribe, one of the tribes in vast Zambia. More than three quarters of the households interviewed were married monogamous and had an average of seven people living in the household.

## **Agricultural production with a focus on Solwezi beans, soya beans and village chicken**

Households in Solwezi highly depended on agriculture as their primary occupation. Farmers had an average of three crops and only one livestock enterprise which was mainly local chicken. Main crops grown were maize production, cassava, millet, sorghum, yams, squash and beans. Most households (98%), grow maize both for consumption as well as a cash crop. Maize is considered a staple food in the area and is used in making *Nsimba* dish made maize flour (white corn meal) and water. Maize is also mainly grown in Solwezi due to the benefits from the farmer input support programme (FISP) and has a reliable buyer, the Food Reserve Agency (FRA). Solwezi beans was moderately practiced by farmers in Solwezi, with 64% of households producing the crop on average. Of the blocks interviewed, the highest number of farmers produced Solwezi beans in St Francis, followed by Mutanda and Lunga blocks. Solwezi beans production was mainly hampered by high incidences of pests (53%) and diseases (39%), and low productivity (22%). Only 46.2% of farmers received income from sale of Solwezi beans.

Production levels of soya beans were found to be quite low in the district. Only 17.2% of households produced soya beans. Soya beans in Solwezi is mostly grown for commercial purposes and its production highly depended on the availability of the market. With the promotion of soya beans by a number of development agencies, farmers have increased in the recent years. Mushindamo block had the highest percentage of farmers producing soya beans, this was particularly so because of proximity of Mushindamo to the Democratic Republic of Congo border (DRC) who are major buyers of soya beans. A few farmers in Mutanda and St Francis also practiced soya beans production. Soya beans production is mainly hampered by lack of reliable buyers (32%), limited access to extension services and market (33%) and high incidences of pests (32%). Only 12.6% of households received income from sale of soya beans.

Village chicken was embraced by almost all households in the area, 91% of households kept local chicken in Solwezi. The chickens however had high mortality rates where farmers lost almost half of the number of local chicken under their care. Farmers in all blocks lost about 50% of all village chicken kept. Village chicken were often kept for household consumption and on very few instances used to generate income. Farmers faced several challenges while rearing chicken. The highest proportion of farmers (89%) were constrained by high incidence of diseases

such as Newcastle disease (ND). Other challenges facing farmers included lack of proper housing for chickens. The farmers in Solwezi built temporary chicken houses mostly on trees. The village chicken enterprise if embraced as a business has potential to improve the livelihoods of households especially women and youth in Solwezi. . Interventions for improving the productivity of chicken should focus on proper housing and management of the ND through a community based control approach that could entail training of community trainers who will in turn spearhead vaccination campaigns to tackle ND.

### **Participation in farmer groups**

Farmer group membership is highly prevalent in Solwezi district. From the households interviewed, about 85% of households had at least one family member to have ever belonged to a farmer group out of which 97% belonged to the groups in the past 12 months. Farmer groups have been considered good avenues for farmer integration to take advantage of markets, information and technical advice that would otherwise be difficult to obtain as an individual. There was no significant difference in membership between the different household types: male and female headed households. Households joined farmer groups to access inputs from donors or the government (52.1%) and to generate income for their households (24.1%). Most of the groups formed engage in agriculture related activities (94.3%) with a few engaging in financing/savings and credit (3.7%) and business (3.4%). Highest proportion of farmers groups had maize as their major crop enterprise (72.5%). The Ministry of Agriculture and Livestock in Zambia often supplies inputs such as fertilizers and seeds through farmer groups and all farmers resident in the district are all required to join a farmer group to be able to benefit. About 46.2% of framers in groups indicated that they are not facing any challenges while some mentioned challenges such as lack of commitment by members on group activities (14.5%), poor leadership (9.7%), misuse and embezzlements of funds (5.8%). Over reliance on external support for inputs makes the groups not sustainable. The VIP4FS project will intervene to improve farmer engagement in the groups and create awareness about the importance of working together for a common goal. Training on governance, work planning, member responsibilities, trust and marketing will be undertaken.

## Dietary diversity

Dietary diversity was used as a proxy indicator for household food security. Dietary diversity presents the number of unique foods consumed over a given period of time and is considered a good measure of household food access. Dietary diversity was measured by counting the number of food items household consumed within a 7 day period. Households were also categorized into 3 different groups: **Poor, borderline and acceptable.** Farmers in the poor category are those households who are less dietary diverse, borderline have moderate dietary diversity and acceptable categories have good dietary diversity. Majority of the blocks had households in the borderline category with exception of Mukumbi that had more households in the acceptable category. St Francis and Mushindamo had more households in the “poor” category than those in the acceptable category. A higher percentage of female headed households were in the poor and borderline category than male headed households which had more households in the acceptable and borderline categories. With exception of staples and vegetables, households with poor dietary diversity consumed less of proteins, pulses, beverages and oils. All households in the acceptable category consumed all foods at higher rates than other dietary diversity categories.

The most consumed food items in Solwezi within 7 days of the survey were cereals (100%), roots and tubers (93.6%), vegetables (98.9%) and oils (94.7%). The least consumed food items by all blocks were milk consumed by only 18.1% of the households, fruits (43%), eggs (46.9%) and meat (49%). Food consumption by male and female headed households did not differ significantly. Even though beans were grown by more than 60% of households in Solwezi, the crop was consumed on average 3 times within a 7 day period.

## Wealth index

Wealth index was used to measure household cumulative wealth living standards. The index is calculated using household ownership of different household items such as television, bicycles, cars, roofing materials, type of drinking water source, toilet facility and other characteristics related to wealth status. Each of the assets was assigned a weight or factor score generated through principal component analysis, first principal component index. Wealth index provides a stable and understandable yardstick for evaluating and comparing the economic situation of households, social groups and societies across all regions of the developing world. A

household's ranking on wealth index indicates to what extent the household possesses a basic set of assets, valued highly by people all across the globe. Three categories of wealth were generated: **low, middle and high income**. Households in the low income category were those whose wealth scores fell below the 25<sup>th</sup> percentile while middle income category are those whose scores fell between 25<sup>th</sup> and 75<sup>th</sup> percentiles of the wealth index score, high level incomes were considered to fall above the 75<sup>th</sup> percentile score. St Francis, Mutanda and Lunga and Mushindamo blocks all had higher proportion of households in the middle income category. Mukumbi block had the highest category of farmers in the high income category. Mushindamo and St Francis had the least proportion of farmers in the high income and therefore had more farmers in the low incomes category. A comparison between male and female headed households showed that more female headed households fell in the low income category while a higher percent of male headed households significantly fell in middle income and high income categories. High income households had better access to information as more households in this category owned mobile phones, radio, television, computer and accessed internet more than the middle and low income households, 87%, 81%, 59.1%, 14.5% and 12.7% respectively. A small percent of low income households owned mobile phones (12.7%) and radio (30.7%). These households did not own any computer and had no internet access and had the least access to electricity in their homes (2.7%) Land ownership did not significantly differ between households in the different wealth categories.

## **1.0 BACKGROUND**

The Value Chains Innovation Platforms for Food Security (VIP4FS) project is an action research project, led by the World Agroforestry Centre (ICRAF) and working with international partners from Australia and national partners in Zambia and Uganda. The project began its operations in June 2015. VIP4FS project focuses on what makes Value Chain Innovation Platforms (VIPs) that incorporate value chain development strategies successful in terms of institutional, technological, market and policy factors that determine Innovation Platform (IP) performance and how the establishment of IPs can be most cost-effectively scaled up across a range of contexts. The main goal of the project is to identify principles and drivers that support scalable establishment of effective and equitable innovation platforms that enhance food security through greater engagement of smallholder farmers with markets. The project has a particular focus on enabling women and young people to improve their livelihoods. The project's goal is to be realized through five interconnected thematic areas under the following objectives:

1. To assess smallholder livelihoods, institutional arrangements across scales, and identify drivers that enable value chain IP development for sustainable agricultural commercialization.
2. To identify best fit value chain development strategies and market information delivery systems, and examine their influence on the success of value chain innovation platforms in enhancing rural enterprise development.
3. To develop and evaluate scalable approaches for promoting value chain innovation platforms among smallholders and other stakeholders in ways that generate inclusive and sustainable economic benefits.
4. To engage with and strengthen the capacity of key stakeholder groups to both enhance the research process and promote the widespread scaling up of approaches generated by the project.
5. To systematically monitor and review project implementation and evaluate its outcomes and impacts.

Objective one is to be realized through five main activities: (i) small holder livelihood analysis (ii) comparative analysis of rural institutions across project sites (iii) characterization of rural institutional development across multiple scales iv) facilitation of rural institutional visioning and partnership identification in support of an enabling environment for rural enterprise and market development and, (v) identification of institutional drivers and trade-offs for integrating markets and natural resource management. This report is based on activity (i) on the assessment of livelihood status of households in Solwezi district with a view to understanding smallholder livelihood strategies and the challenges they face which will enable the VIP4FS project propose interventions to improve their livelihoods.

Zambia, a landlocked country located in the southern part of Africa, has some of the largest copper and cobalt deposits in the world. Although Zambia's national economy is heavily dependent on mining, agriculture remains the backbone of livelihoods and livelihood strategies for a majority of the rural population. Zambia is abundantly endowed with resources that are required to stimulate agricultural, rural development and poverty reduction. The country has a landmass area of approximately 752,000 square kilometers. The country has good climate, abundant arable land, labor and plenty of water resources. Approximately 48 million hectares could be considered suitable for agricultural purposes. Large parts of this, while subject to some limitations, have the capacity to produce a variety of arable crops on a sustainable basis. The rest, although not well-suited to crop production, is quite suitable for tree crops and for grazing. However, only about 14 percent of the arable land is presently cultivated. Most parts of the country have only one growing season each year, with most parts receiving adequate rainfall for the production of arable crops. There is limited investment in mechanized agriculture and therefore less arable land being utilized.

In addition to agriculture, other common sources of food and income are related to natural resource exploitation which includes timber and charcoal production, fishing, honey production, hunting and mining. The overall gains in agricultural output have however not adequately translated to reductions in poverty. More than half of the total population still lives below the national poverty line. The livelihood of small-scale farmers is largely dependent on legume systems such as soya beans and is affected by poor yields, extreme poverty, and environmental

degradation. The livelihoods strategies adopted by farmers in Solwezi are highly dependent on the zones that the households belong: there are a total of 21 livelihood zones in Zambia and each of these zones focuses on a specific livelihood strategy. Solwezi, a focus district for the VIP4FS project, falls in zone 6 of the livelihoods zones. The zone covers communal areas in and around new copper mining areas of Solwezi and Kasempa districts in the Northwestern Province bordering DRC in the north. Land in Solwezi is generally flat to gently undulating slopes.

Zone 6 receives between 1000-1500mm of rainfall per annum between November and April. Maximum temperatures peak at 32 degrees Celsius between September and December. During the winter months of May-July, average minimum temperatures fall between 16 and 18 degrees Celsius with a slight risk of frost, especially in wetland areas and particularly damaging to horticulture crops. The well-drained soils consist of deep, strong red, acidic, clayey and coarse, sandy soils. In some parts of the zone, shallow, imperfectly-drained and loamy soils exist. Vegetation is mainly composed of Miombo woodlands and open savannah grasslands. The zone is sparsely populated with less than 10 persons per km<sup>2</sup>. The average land cultivated in the zone ranges from 1 to 1.5 hectares per household. Kaonde are the main ethnic group inhabiting this zone.

Non-agricultural activities practiced in the zone include exploitation of copper, iron, zinc, and nickel which began in recent years, there also exist game reserves in the area that provide hunting opportunities. Mining activities are gradually gaining prominence in the area and provide an important source of employment and market for local agricultural produce which also led to shifting of livelihood strategies. Employment in the mines, particularly among men, is becoming an important source of household income. Trading in agricultural produce and other basic non-food items has increasingly become an important additional livelihood activity with the coming of mines. Agriculture, however, remains an important livelihood activity in Solwezi. Most farmers depend on rain-fed agriculture which supports the production of cassava, maize, sorghum, beans, and sweet potatoes, and are grown using traditional farming systems such as slash and burn (chitemene).

## **1.1 LIVELIHOOD ANALYSIS**

Livelihood analysis assessment which is the subject of this report aimed at providing useful information for understanding initial status of households in the area. The assessment focused on farmer sources of income, land ownership, asset ownership and agricultural production of Solwezi beans, soya beans and local chicken. Other variables assessed were dietary diversity and wealth. The project adapted the sustainable livelihoods framework (Figure 1) by (DFID, 2000) and (Donovan and Stoian, 2012) to identify opportunities for inclusive and sustainable value chain development to achieve balanced improvement of key livelihood assets (human, social, natural, physical and financial) as elaborated in the 5Capitals tool. This links household access to livelihood assets with greater well-being and resilience. Likewise, the economic viability and performance of smallholder enterprises is linked to their access to business assets. We used this framework to assess the extent to which existing asset endowments determine the outcomes of value chain development, relationships between asset building at enterprise and household levels, and the role of market, political and institutional factors in facilitating or hindering favourable outcomes, separating the changes caused by interactions and interventions in value chains from those induced by the overall context. Trade-offs and synergies amongst natural, social and financial assets are explicitly considered. Livelihood is the material means whereby people live and involves many activities that people partake to provide for their basic needs<sup>1</sup>. Livelihood is a concept of research and development and includes what people do (given their resources and assets) and what they achieve by doing it. Livelihood analysis investigates people, their capabilities and their means of living including food, income, and properties one owns<sup>2</sup>. According to DFID (2000), a livelihood is considered sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in future, while not undermining the natural resource base. Livelihood strategies consist of a set of activities that an individual undertakes in order to meet basic needs. Understanding livelihood strategies will assist the VIP4FS project identify interventions that can be acted upon in order to improve livelihood prospects which is a prerequisite to reduction of

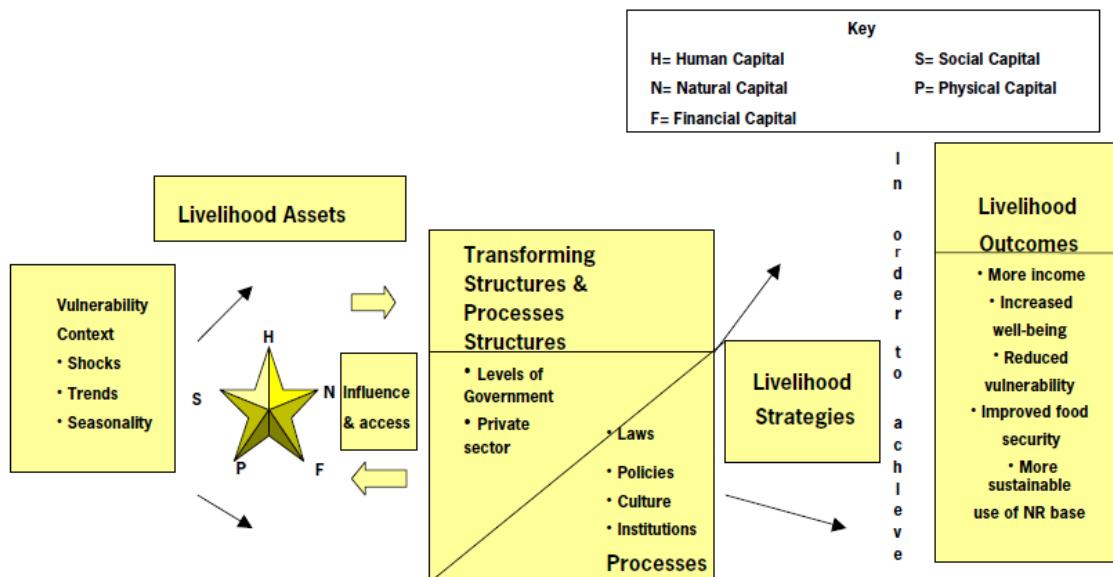
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<sup>1</sup> Rural livelihood systems: conceptual framework (vol 1). Anke nichof and Lisa Price. Published 2001

<sup>2</sup> Chambers, R., Conway, G., 1992. Sustainable rural livelihoods; practical concepts for the 21<sup>st</sup> century. Discussion paper 296. IDS. Sussex.

rural poverty. According to the World Bank group, strategies seek patterns that can be acted upon in order to improve the livelihood prospects of the poor through discovering alternatives and increasing options. In order to adequately address rural poverty, farmers are required to adopt sustainable livelihood strategies.

Using the DFID framework, the project conceptualizes how households operate within a vulnerability context that is shaped by different factors and opportunities and how they draw on different types of livelihood assets or capitals which may be influenced by the vulnerability contexts, institutions and processes and how they use their asset base to develop a range of livelihood strategies to achieve desired livelihood outcomes (De Satge et al., 2002)



**FIGURE 1: THE SUSTAINABLE LIVELIHOOD FRAMEWORK (DFID 2000)**

The assessment was guided by the five capitals; human capital natural capital, financial capital, physical capital and social capital. The three value chains of interest (village chicken, soya beans and Solwezi beans) were preselected based on agreed upon nine point criteria by the project team after extensive consultation with community understandings and preferences.

## **2.0 METHODOLOGY**

### **2.1 SOLWEZI DISTRICT, ZAMBIA**

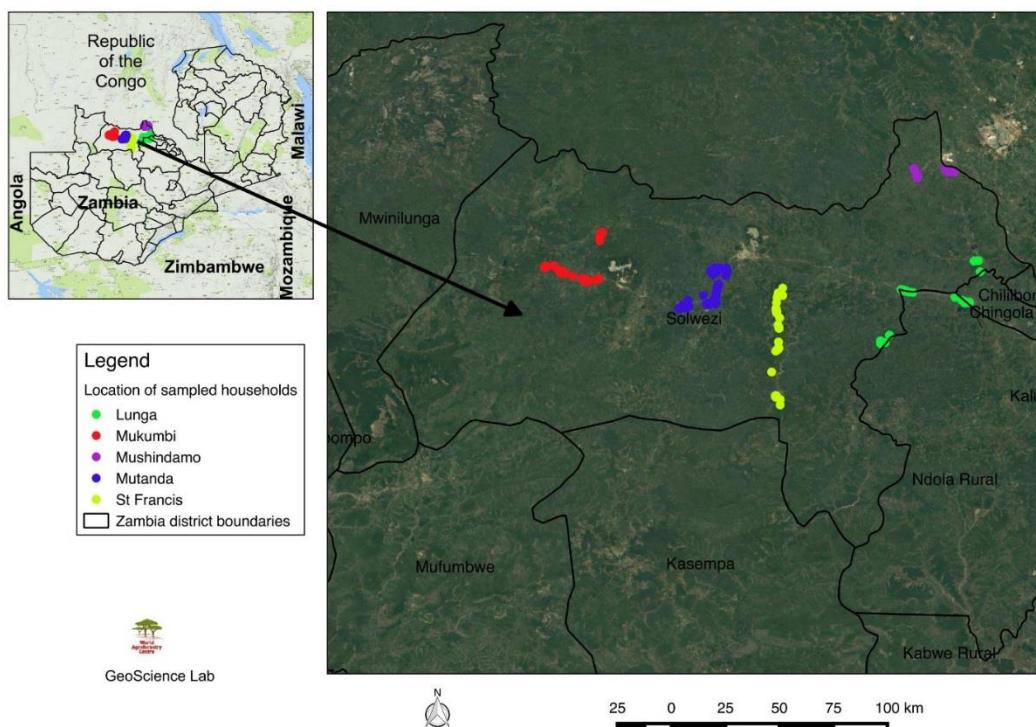
Solwezi district is located in the “new Copperbelt area” in the North Western province. The district covers an area of 30, 361km<sup>2</sup> and with a total population of 254, 470 people according to the national census conducted in 2010-16. The area has been underdeveloped for a long time but with mining companies coming into the area, including one of the largest copper mines in Africa, there are new opportunities for economic activity and growth. Solwezi is home to Kanshanshi and Lumwana mines which are some of the largest open pit mines in Africa. This has led to increased population in the area as the mines provide employment for the rural community. Vast market opportunities and improved infrastructure (e.g. construction of Solwezi-Mwinilunga road) are envisaged to increase urban population and demand for goods and services. The area has excellent climate, with favourable rainfall (1000-1500mm/year) and has high potential for agricultural production. As is the case of whole Zambia, Northwestern province is occupied by tribal territories headed by chiefs. The administrative structure in Solwezi is as follows: district, blocks, camps, villages and households.

### **2.2 DATA COLLECTION**

Data was collected from households (Figure 2) in the following blocks: St Francis, Mutanda, Lunga, Mushindamo and Mukumbi. The blocks and camps were purposefully selected based on availability of farmers and/or traders who produce and sell soya beans. The selected blocks and camps were those with considerable number of soya bean farmers, the other blocks were automatically left out were selected and others discarded. Soya beans production, as one of the focus products of the VIP4FS project, was used as a basis for selection as it was produced by only a few farmers in the area. The other products of interest to the project, Solwezi beans and village chicken are largely produced by almost all farmers in all blocks.

At the camp level, villages were the randomly selected from a list provided by the camp officers. From the villages selected, camp officers were then asked to provide farmer lists, farmers were then randomly selected from the provided lists but proportional to total number of farmers in the

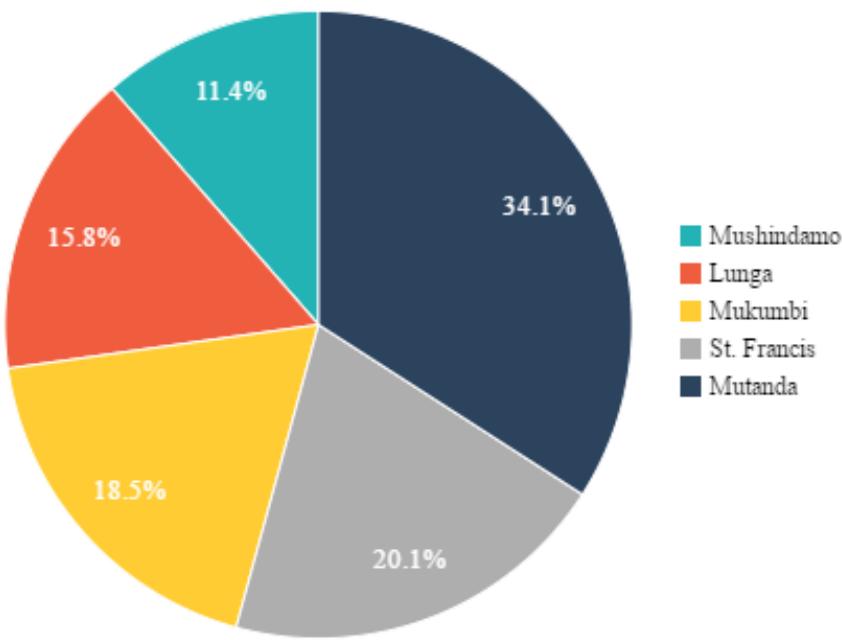
village. Villages with a higher number of farmers had more farmers interviewed for the study. A total of 437 farmers were interviewed, 43.3% of this being male and 56.7% female. Only farmers/households that reside in their farm and constantly undertake farming activities in the area were selected. A few blocks such as Meheba and Central block were dropped from the survey and replaced with other blocks not selected in first instance due to farmers not being permanent residents in the blocks. Meheba, a predominant refugee camp, was not selected as refugees were not permanent residents of the area with majority of the inhabitants originating from foreign countries such as Angola, the DRC and Burundi and would relocate back to their countries at any time making implementation and follow up challenging. As a result, the block was replaced with Lunga block. Similarly, Central block was also dropped as most of its residents lived in Solwezi town and only visited their farms sparingly. These farmers could not easily be identified and could not be tracked for interviews. Central block was therefore replaced with Mukumbi block.



**FIGURE 2: HOUSEHOLD LOCATIONS IN SOLWEZI DISTRICT**

Adults present in the households were interviewed for the survey. Regardless of person selected for the interview, information provided was representative of household information. Data

collection areas and number of farmers from each of the selected blocks are presented in Figure 3.



**FIGURE 3: PERCENTAGE OF INTERVIEWED HOUSEHOLDS FROM EACH BLOCK**

Mutanda block had most farmers due to its intense population with 34.1% of households and proximity to the main road as well as Solwezi town. St Francis, which is also not very far from Solwezi town, had the second highest percent of farmers selected. It is accessible by use of murram road. Mukumbi and Lunga blocks were accessible by tarmac road but the villages within the blocks were less accessible. Mushindamo had the least number of households selected for the survey. Mushindamo was purposefully selected due to the number of soya beans farmers in the area. It also has a good market for its products due to its proximity to the Congo border market.

The camps selected from each block are shown in Table 1. In St Francis, data was collected from St Francis and Mujivanzovu camps and in Mushindamo block, data was collected in Mushindamo camps, Table 1.

**TABLE 1: FREQUENCY AND PERCENTAGE OF FARMERS FROM DIFFERENT BLOCKS AND CAMPS**

<b>Block name</b>	<b>Camp name</b>	<b>Frequency</b>	<b>Percent of farmers (%)</b>
St Francis	St Francis	60	68.2
	Mujimanzovu	28	31.8
	<b>Total</b>	<b>88</b>	
Mutanda	Mutanda	100	67.1
	Kyabankaka	49	32.9
	<b>Total</b>	<b>149</b>	
Lunga	Kasapa	33	47.8
	Kangwena	36	52.2
	<b>Total</b>	<b>69</b>	
Mushindamo	Mushindamo	50	
Mukumbi	Lumwana East	63	77.8
	Mukumbi	18	22.2
	<b>Total</b>	<b>81</b>	
<b>Grand Total</b>		<b>437</b>	

Of all respondents interviewed, 57% were found to be heads of households, while 36.8% were spouses of household heads. 2.3% of the respondents were children of household. Before the beginning of the survey, both supervisors and enumerators ensured selected respondents were of sound mind and were able to correctly account for the household activities including production levels and assets. All others selected households without an adult or anyone from the household with limited knowledge of production levels of the households were replaced.

### **2.3 DATA ANALYSIS**

Variables from households and individual respondent characteristics were assessed to capture relevant information from respondents. Descriptive statistics such as frequency counts, percentages, mean and standard error of mean were used to display the data. Data analysed was on demographic characteristics of households, education, land ownership, crop enterprises, household assets, income, institutions, agricultural and livestock production with a focus on soya beans, Solwezi beans and village chicken. Dietary diversity was computed as a proxy of food security. Dietary scores and percentage of households consuming each food group was used as a one-time measure. The dietary score in this study was measured by the following criteria:

- i) Creating food group variables for each of the food groups and aggregations done by the food group category. For the purposes of the study the categorization in Table 2 was used.
- ii) Generating a combined variable for all food groups falling under each of the defined categories in Table 2. The combination was defined to be 1 if a household consumed at least one of the food items
- iii) Dietary diversity was computed by summing all food groups consumed by the household within a 7 day period.
- iv) Food consumption score was computed as a factor of the household consuming the food category and the number of days the households have consumed the food item in a period of seven days multiplied by the assigned food consumption score
- v) Summation of the total household consumption score for each household
- vi) Categorization of households in different food consumption categories using percentiles. Those households with less than 25<sup>th</sup> percentile were considered having ‘poor’ dietary diversity, households with greater than 25<sup>th</sup> and less than 75<sup>th</sup> percentile were considered to have “borderline” diversity while those with greater than 75<sup>th</sup> percentile were considered to have “acceptable” diversity and food consumption.

**TABLE 2: CATEGORIZATION OF DIFFERENT FOOD TYPES**

<b>Food Category</b>	<b>Types of foods</b>	<b>Food consumption score</b>
Proteins	Meat, milk, fish and eggs	4
Vitamins A rich	Fruits and vegetables	1
Pulses	Beans and peas	3
Staples	Tubers, roots, cereals and grains	2
Sugars	Sugars and beverages	0.5
Oils	Oils	0.5

• • •

Dietary diversity was presented by use of “count” which is the number of food categories consumed by a given household. Counting the number of food categories is more indicative of diversity than count of different food types as the types would be providing similar nutrients for instance a household that consumes proteins, vitamins and roots would be considered more diet diverse than a household that consumes different type of cereals.

### Wealth index

The wealth index which is a composite measure of a household cumulative living standard was calculated using household ownership of different items such as television, bicycles and cars. Type of roofing materials, type of drinking water sources, toilet facility and other characteristics related to wealth status were also used. Each of the assets was assigned a weight or factor score generated through principal component analysis. The scores were then standardized in relation to standard normal distribution with a mean of zero and standard deviation of one. The standardized scores were then used to create the break points that define wealth quintiles: low, middle and high income households. Asset index has replaced previous popular income and consumption data and depicts an individual or a household’s long-run economic status and therefore do not necessarily account for short-term fluctuations in economic wellbeing (Filmer and Pritchett, 2001). The wealth index of a given household,  $i$ , is a linear combination of assets owned.

The wealth index,  $y_i$ , calculated as below:

$$y_i = \alpha_1 \left( \frac{x_1 - \bar{x}_1}{\delta_1} \right) + \alpha_2 \left( \frac{x_2 - \bar{x}_2}{\delta_2} \right) + \dots + \alpha_k \left( \frac{x_k - \bar{x}_k}{\delta_k} \right)$$

Where,  $\bar{x}$  and  $\delta_k$  are mean and standard deviations of assets  $x_k$  and  $\alpha$  represents the weight for each variable  $x_k$  for the first principal component. The first principal component,  $y$ , yields a wealth index that assigns a larger weight to assets that vary the most across households so that an asset found in all households is given a weight of zero (McKenzie, 2005). The first principal component or wealth index can take positive as well as negative values.

## 3.0 RESULTS

### 3.1 DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLDS IN SOLWEZI DISTRICT

Solwezi is mainly inhabited by Kaonde tribe (56.9%), one of the major tribes in vast Zambia. Other tribes present in the district include Lunda tribe (16.6%) and 12.3% Lamba tribe (Figure 4). The Kaondes are matrilineal in nature and reside near the kin of their husband in large villages. They are headed by chiefdoms.

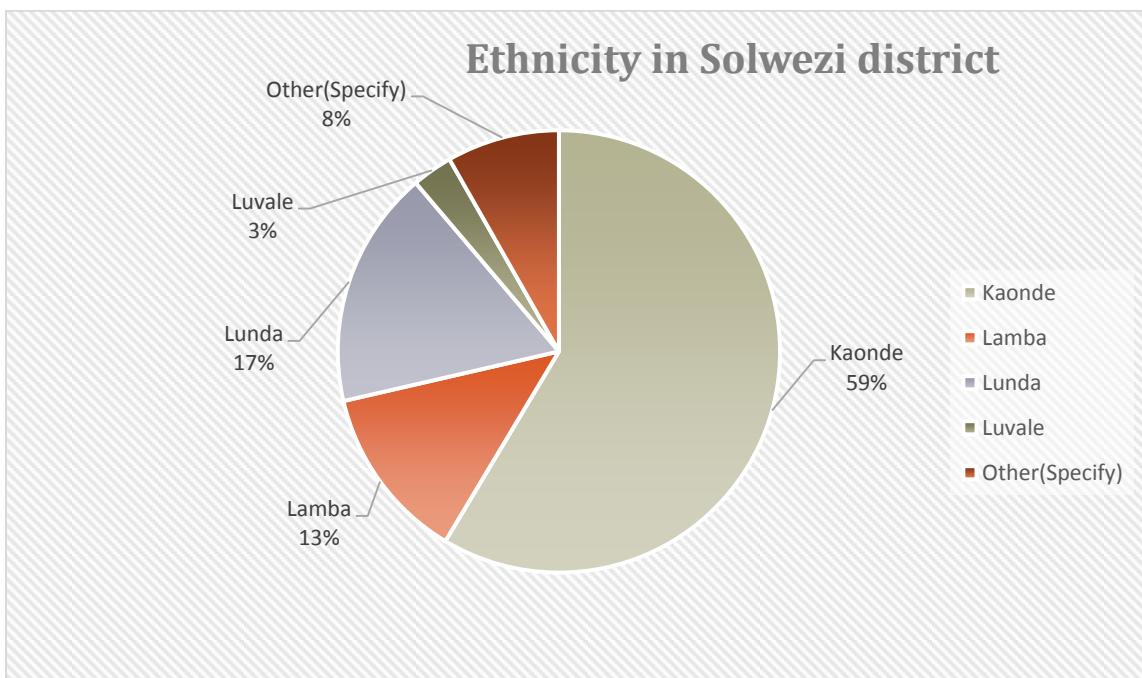
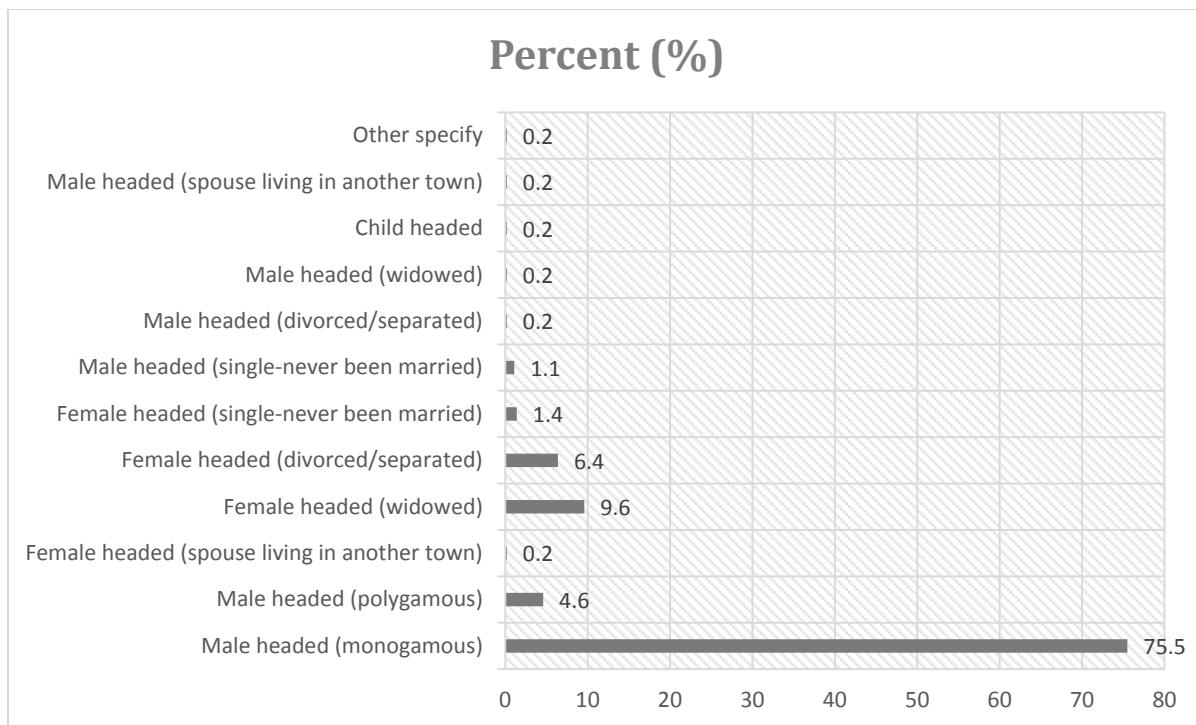


FIGURE 4: ETHNICITY IN SOLWEZI DISTRICT

Almost three quarters of the households interviewed were married monogamous (75.5%), 9.6% of the households were female headed widowed, 6.4% are female headed divorced/separated. Only 4.6% were male headed polygamous, Figure 5.



**FIGURE 5: DIFFERENT HOUSEHOLDS TYPES FOUND IN SOLWEZI**

About 52% of the farmers interviewed attained at least some form of primary school education with 27% having had some form of secondary school education. Only a few farmers attended university or tertiary education, Table 3.

**TABLE 3: HIGHEST EDUCATION LEVEL OF PRODUCERS IN SOLWEZI**

<i>Highest level of education (%)</i>	<i>St. Francis (%) (n=88)</i>	<i>Mutanda (%) (n=149)</i>	<i>Lunga (%) (n=69)</i>	<i>Mushindamo (%) (n=50)</i>	<i>Mukumbi (%) (n=81)</i>	<i>Solwezi (%) (N=437)</i>
<i>None</i>	15	16	13	38	10	17
<i>Primary</i>	60	48	57	44	53	52
<i>Secondary</i>	21	31	30	16	32	27
<i>Tertiary</i>	4	5	0	2	5	4

All households interviewed in the survey had lived in the village for an average of 18.61 years. Average household size in Solwezi was 7 members per household (Table 4). Farmers in Solwezi had on their farm

an average 3 crop enterprises at the time of study. On livestock production most farmers had only one livestock enterprise on their farm (Table 3).

**TABLE 4: SUMMARY OF HOUSEHOLD CHARACTERISTICS**

<i>Household characteristics</i>	<i>Min.</i>	<i>Max.</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>Months stayed in the house during the last 12 months</i>	4	12	11.74	0.9
<i>Age of producer</i>	15	88	45.06	14.1
<i>Age of household head</i>	19	92	48.74	14.02
<i>Years respondent has lived in village</i>	1	68	18.61	13.8
<i>Number of people staying in the household</i>	0	27	7	3.1
<i>Number of crop enterprises in the farm in the previous season of October 2014 to April 2015</i>	0	11	3.41	1.6
<i>Number of livestock enterprises in the farm in the previous season of October 2014 to April 2015</i>	0	35	1.48	2.1

Households also had an average of 3 crop enterprises in the year 2014-2015 cropping season and average of one livestock enterprises in the same period. More than 90% of farmers interviewed had farming as their main occupation with only a few having regular employment (3.2%) and/or running own business (1.8%), Table 5.

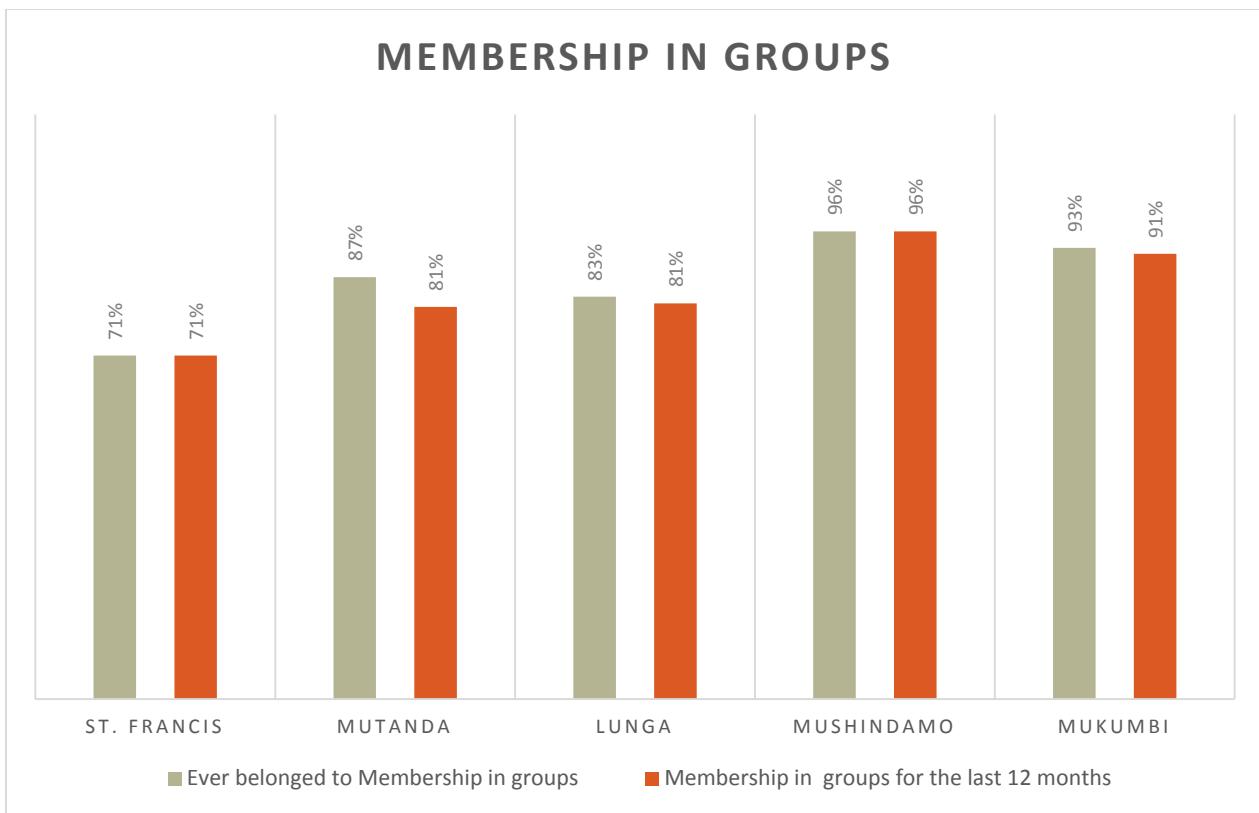
TABLE 5: DIFFERENT OCCUPATION OF FARMERS IN SOLWEZI

Main occupation of farmer	Primary occupation n=(437)	Secondary occupation of the farmer (n=437)
<b>Farmer (crop and/or livestock)</b>	92.94	7.76
<b>Regular employment</b>	3.29	0.47
<b>Runs self-owned off-farm business</b>	1.65	26.35
<b>Not involved in productive work due to age or health reasons</b>	0.71	0.47
<b>Casual off-farm employment like construction</b>	0.47	3.53
<b>Housewife</b>	0.47	7.53
<b>Agricultural casual labourer</b>	0.24	0.47
<b>Retired</b>	0.24	0.47
<b>None</b>	-	52.94

### 3.2 PARTICIPATION OF HOUSEHOLDS IN FARMER GROUPS

There are a number of farmer groups serving different functions in Solwezi. About 85% of households had at least one family member to ever belong to a farmer group and 97% of the households belonged to the groups in the past 12 months. This suggests a fairly widespread participation of household members in farmer groups. Farmer groups are considered a good avenue for farmer integration as well as a place for farmers to take advantage of markets, information and technical advice that would otherwise be difficult to obtain as an individual.

Membership in groups significantly differed between blocks: Mushindamo and Mukumbi blocks recorded the highest numbers of farmers belonging to groups with St Francis having the least membership in farmers groups with only 70.5% belonging to groups (Figure 6).



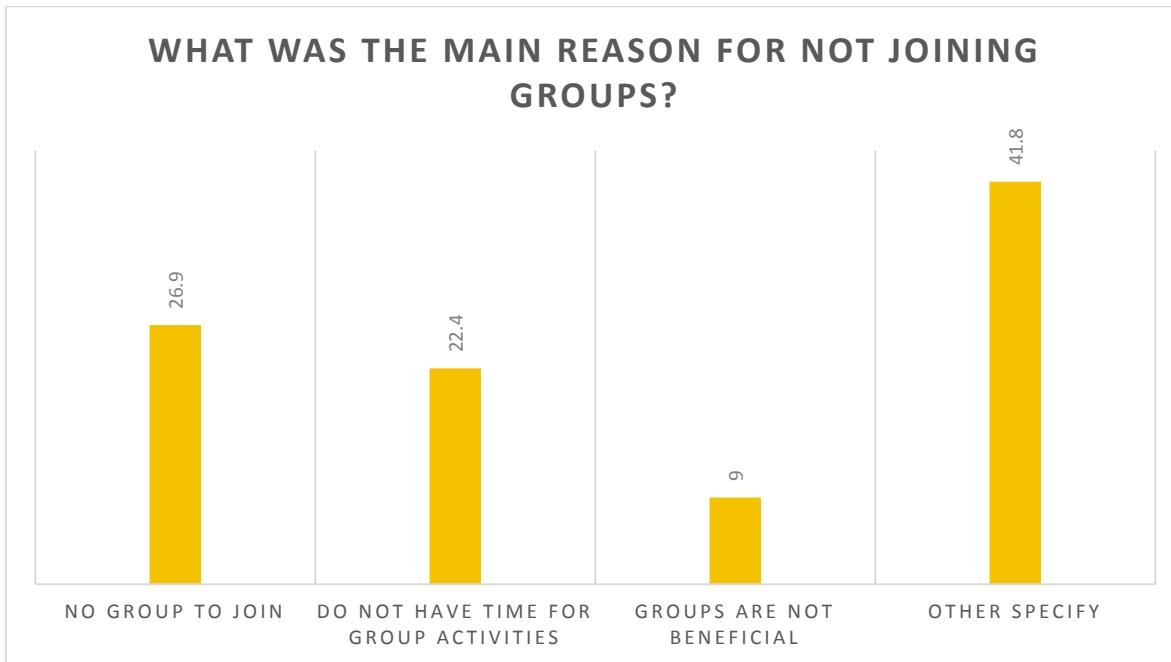
**FIGURE 6: MEMBERSHIP IN FARMERS GROUPS BY FARMERS IN DIFFERENT BLOCKS**

There was no significant difference in membership between the different household types: male and female headed households. About 97% of the households belonged to groups in both household types. Households joined farmer groups to access benefits from donors or government (52.1%) and to generate income for their households (24.1%). A few others were in groups for social welfare and meeting other people (Table 6).

**TABLE 6: MAIN REASON FOR JOINING FARMER GROUPS**

What was the MAIN reason for joining the group?	% of households (n=371)
Increased Income generation for my household	24.3
Social (meeting people and support each other)	11.9
Access to information and technology,	8.9
Access to benefits e.g. from donor/government	54.2
Coerced or pressured by Government / Neighbors	.54
Other specify	0.27

Only 15% of households did not have any member ever belonging to a farmer group. The main reasons for not joining include no groups to join in the area (26.9%) while 22.4% indicated that there was no time to undertake or perform group activities (Figure 7).



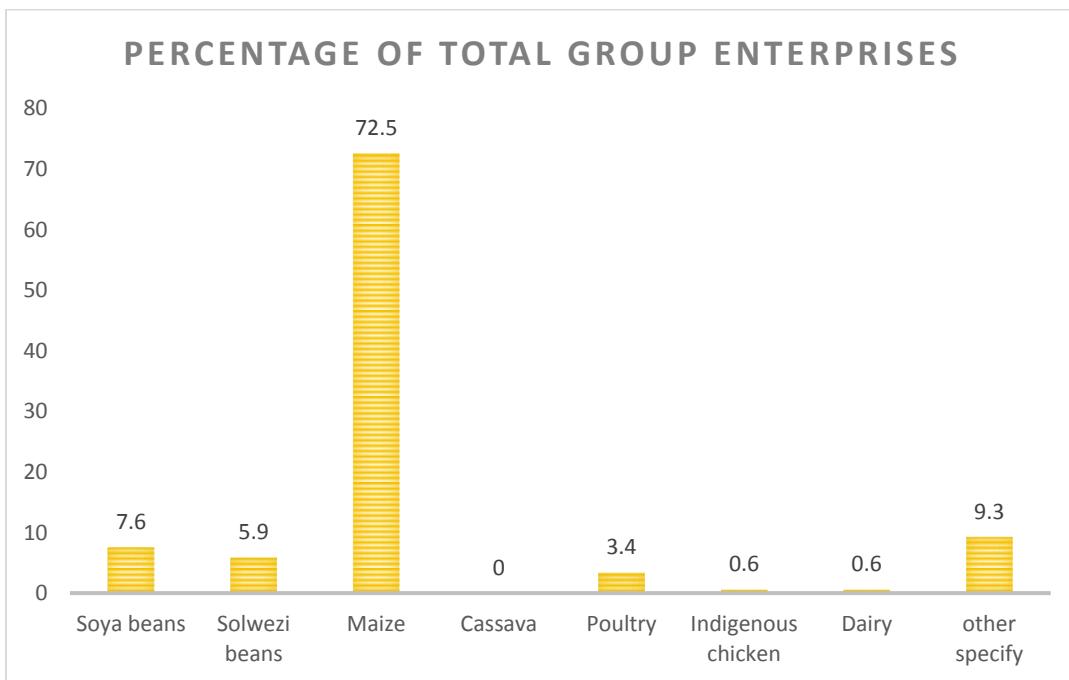
**FIGURE 7: MAIN REASONS FOR NOT JOINING FARMER GROUPS**

Most of the groups formed engage in agriculture related activities (94.3%) with a few engaging in financing/savings and credit (3.7%) and 3.4% in business (Table 6).

**TABLE 7: GROUPS FUNCTIONS IN SOLWEZI DISTRICT**

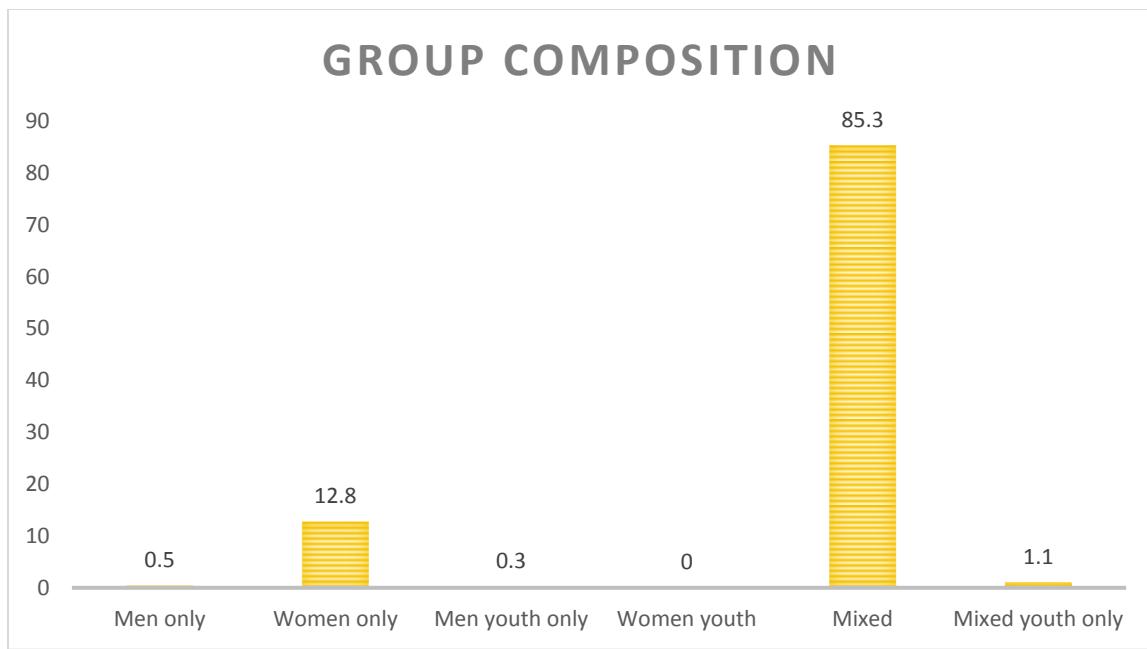
Type of group	% of group functions n=353
Agricultural (livestock, aquaculture, bee keeping, crops)	94.3
Financing/savings and credit	3.7
Education	0.8
Environmental services	0.0
Religious	0.3
Advocacy	0.6
Welfare	1.1
User associations	0.0
Business	3.4
Other specify	2.5

Highest proportion of farmer groups had maize as their major crop enterprises (72.5%). The Ministry of Agriculture and Livestock in Zambia often supplies inputs such as fertilizers and seeds through farmer groups. All farmers resident in the district are therefore all required to join a farmer group. Most farmer groups in the area are mainly formed for this purpose and often seize to function on their own until the time for inputs provision. This therefore suggests that the farmer groups do not have their own voluntary mandates and goals as independent groups but only aggregate to receive inputs. Other enterprises that groups practiced were soya beans production (7.6%) and Solwezi beans production (5.9%). There were barely any groups engaged in production of village/indigenous chicken (0.6%), Figure 8.



**FIGURE 8: GROUP ENTERPRISES IN SOLWEZI**

Farmers groups were mostly of mixed gender with men and women being members of groups (85.3%). Only 12.8% of the formed groups were women-only groups. There were barely any youth and men membership only groups in the area (Figure 9).



**FIGURE 9: GENDER COMPOSITIONS OF FARMER GROUPS**

As earlier highlighted the major reasons why farmers joined groups was to receive benefits such as inputs from the government. From the study, a higher proportion of members mainly received benefits such as input supplies (68.6%), credit or loans (8.1%) and to get markets for their products (6.3%). Very few farmers received services on water management or advocacy and representation from groups (Table 8).

**TABLE 8: MAIN SERVICES RECEIVED BY GROUPS IN SOLWEZI**

Main service received from the group	% of households (n=353)
Input suppliers	68.6
Credit/Loan	8.1
Marketing of group products	6.3
Joint extension services	6.1
Savings	3.8
Other	3.5
Market information	2.0
Advocacy and representation	1.3
Water Catchment	0.3

Most farmers groups did not indicate any challenges faced by their group (46.2%). A few groups faced challenges such as lack of commitment by members on group activities (14.5%), poor leadership (9.7%) and misuse and embezzlements of funds (Table 8).

**TABLE 9: CHALLENGES FACED BY FARMER GROUPS**

Challenges the group face	Percentage of farmers
None	46.2
Poor leadership	9.7
Lack of trust among members	2.7
Embezzlement of funds	5.8
Lack of commitment among members	14.5
Other specify	21.1

Although almost all households in Solwezi district belong to farmer groups, these groups were only formed for the sole purpose of receiving farm inputs from the government. These groups did not therefore plan for any activities within their group. The groups only receive benefits such as inputs and therefore do not take advantage of the farmer groups' ability to provide other benefits such as welfare and economies of scale. About 46% of the farmers did not indicate the challenges facing their farmer group which is an indication that the groups are functioning well to the farmer satisfaction as per the purpose of the group. Possible interventions that could improve farmer engagement in the groups and an understanding of the important of working together for a common goal are required. These may include training on leadership, work planning, member responsibilities, trust, collective action, business skills, governance etc.

### **3.3 AGRICULTURAL ENTERPRISES IN SOLWEZI DISTRICT**

Almost all households (98.9%) in Solwezi owned farm lands. Farmers in the area mostly preferred to live near the road but undertake their farming activities further from the household. Households interviewed mainly practiced agricultural production with maize, cassava, millet, sorghum, yams, squash and beans being highest produced. About (98%) of households in Solwezi cultivated maize both for consumptions as well as a cash crop. Maize is considered a staple food in the area and is used in making *Nsimba* dish

made from maize flour and water. Maize was also mainly grown in Solwezi due to the benefits from the Farmer Input Support Programm(FISP) and the fact that there is a reliable buyer, the Food Reserve Agency (FRA). This has resulted in overreliance on one crop by the farmers. Other crops cultivated by majority of the producers include Solwezi beans (also known as sugar beans or mixed beans) practiced by 64% of farmers. Solwezi beans are often grown in two seasons, one season intercropped with maize and another season the beans are not intercropped with any crop. Other crops grown in the area are groundnuts and sweet potato produced by 41.4% and 40% of farmers respectively (Table 10).

**TABLE 10: CROP ENTERPRISES UNDERTAKEN BY HOUSEHOLDS IN SOLWEZI**

<b>Crop enterprises grown in 2014_2015 season</b>	<b>Percentage of households (%) (n=437)</b>
Maize	99.1
Solwezi/Mixed beans	64.5
Groundnuts	41.4
Sweet Potato	40.0
Cassava	26.1
Soya beans	17.6
Other specify	11.9
Irish potato	7.6
Tomato	6.2
Cabbage	5.7
Rapeseed	4.6
Chinese cabbage	4.1
Eggplant	3.9
Finger millet	2.5
Okra	1.8
Sorghum	1.8
Pineapple	1.4
Onions	1.4
Cucumber	0.7
Squash	0.7
Kales	0.2
Butternut	0.2
Sunflower	0
Cowpeas	0

Crops grown by a few households in the area include cowpeas, sunflower, butternut, squash, kales and cucumber all grown by less than 1% of households (Table 10). Farming practices in

households had not changed much from the year before (2014-2015) cropping season. Only 32% of the households had introduced new crops in their farms in the 2015/16 cropping season. Most households introduced only one crop in the season 2015/16 (75.5%) and 19% of the households introduced two crops. Only 4 % introduced the new types of crops (Table 11).

**TABLE 11: NEW CROPS INTRODUCED IN THE HOUSEHOLD 2015/2016 SEASON**

	% of farmers	No of new crops introduced		
		1	2	3
<b>New crop enterprises</b>	Yes	67.6	75.5	19.6
	No	32.4		4.9

The new crops introduced by the households are as shown in Table 12. More than 10 % of farmers introduced sweet potatoes, Solwezi/mixed beans and cassava. Introduction of new crops indicate a new appreciation of the crops or farmers have found new markets/buyers of the products (Table 12).

**TABLE 12: NEW CROPS INTRODUCED**

Which are these new crop enterprises?	Percentage of households (n=143)
Sweet Potato	6.1
Solwezi/Mixed beans	5.3
Cassava	3.3
Soya beans	2.8
Groundnuts	2.2
Chinese cabbage	1.8
Eggplant	1.3
Sorghum	1.3
Okra	0.9
Cabbage	0.9
Tomato	0.7
Finger Millet	0.7
Irish potato	0.4
Pineapple	0.2
Onions	0.2
Cucumber	0.2
Other specify	3.1

## **3.4 PRODUCTION OF SOLWEZI BEANS AND SOYA BEANS**

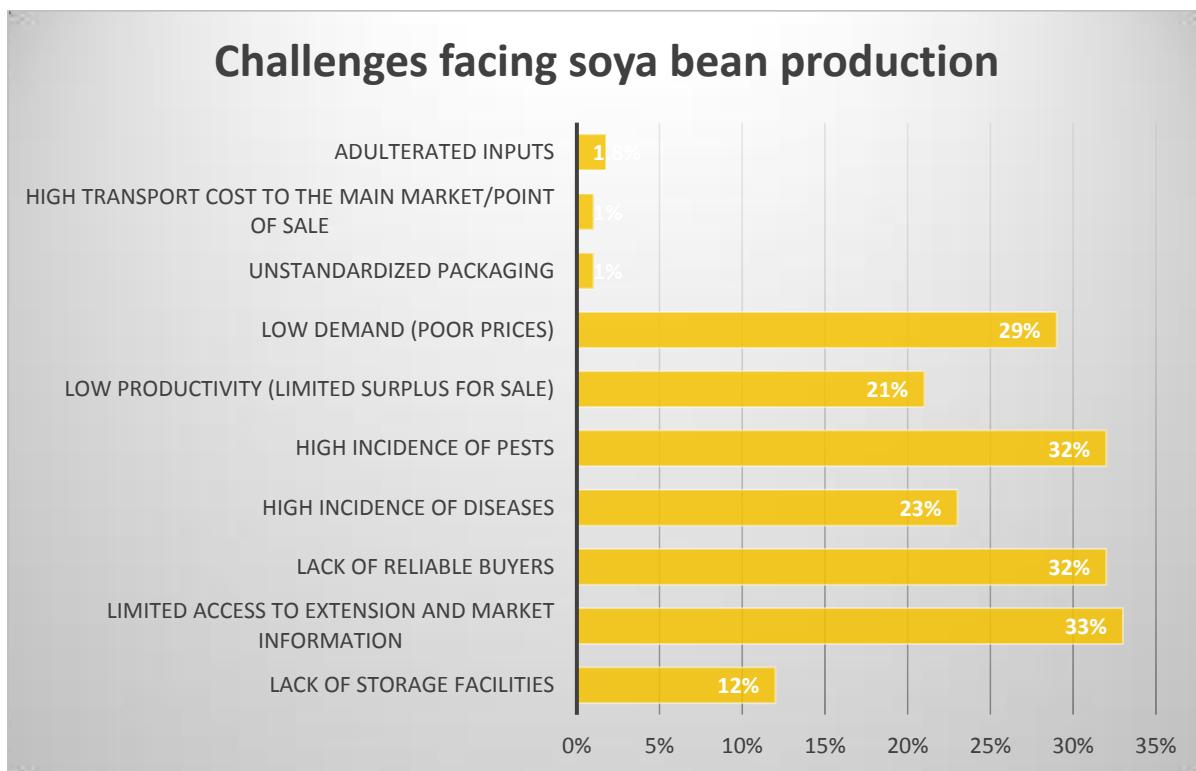
### **3.4.1 SOYA BEANS**

Production levels of Soya beans were found to be quite low in the district. Only 17.2% of households produced soya beans. Soya beans in Solwezi was mostly grown for commercial purposes and highly dependent on the availability of the market. With the promotion of soya beans by a number of development agencies, soya beans farmers have increased in the recent years. The average area under cultivation for soya beans was 0.38ha per household. A comparison between levels of productions of soya beans in the different blocks show that Mushindamo block had the highest percentage of farmers practicing soya beans. This was particularly so because of proximity of Mushindamo to the DRC who are major buyers of soya beans. A few farmers in Mutanda and St Francis also practiced soya beans production. The acreage dedicated to soya beans significantly differed between blocks with Lunga block having larger proportion of land on average followed by Mushindamo and Mukumbi blocks. The amounts harvested also significantly differed between blocks where households in Lunga and Mushindamo harvested highest amount of soya beans at 107.11 and 126.41 kgs respectively (Table 13). Almost all of the soya beans harvested was sold in all blocks an indication of its high potential as a source of household income.

**TABLE 13: SOYA BEANS PRODUCTION IN SOLWEZI**

Blocks	Households producing soya beans (n=437)		Land size of soya beans in ha	Amount harvested (kgs)	Amount sold (kgs)
	No	Yes			
<b>St. Francis</b>	93.2	6.8	0.15	11.4	11.5
<b>Mutanda</b>	84.6	15.4	0.31	58.2	44.16
<b>Lunga</b>	87.0	13.0	0.65	107.11	117.71
<b>Mushindamo</b>	32.0	68.0	0.41	126.41	109.84
<b>Mukumbi</b>	96.3	3.7	0.33	52.67	76.5

About 18.7% of the farmers that planted soya beans intercropped it with other crops. Most farmers intercropped it with maize (18.7%) with only a few intercropping it with ground nuts and Solwezi beans (<2%). Most farmers stated that growing of soya beans was mainly hampered by lack of reliable buyers (32%), limited access to extension and market (33%) and high incidences of pests (Figure 10).



**FIGURE 10: CHALLENGES FACING SOYA BEAN FARMERS**

Major challenges facing soya beans production included low usage of yield improvement inputs which has resulted in low productivity. Smallholder farmers rarely used inputs such as inoculum due to lack of knowledge about its benefits, coupled with problems associated with acquisition and storage. Poor harvests were also related to poor crop management practices, such as late planting and poor disease management. Some farmers also believed that the market for soya is less certain than, say, maize, which therefore discourages growing of the crop.

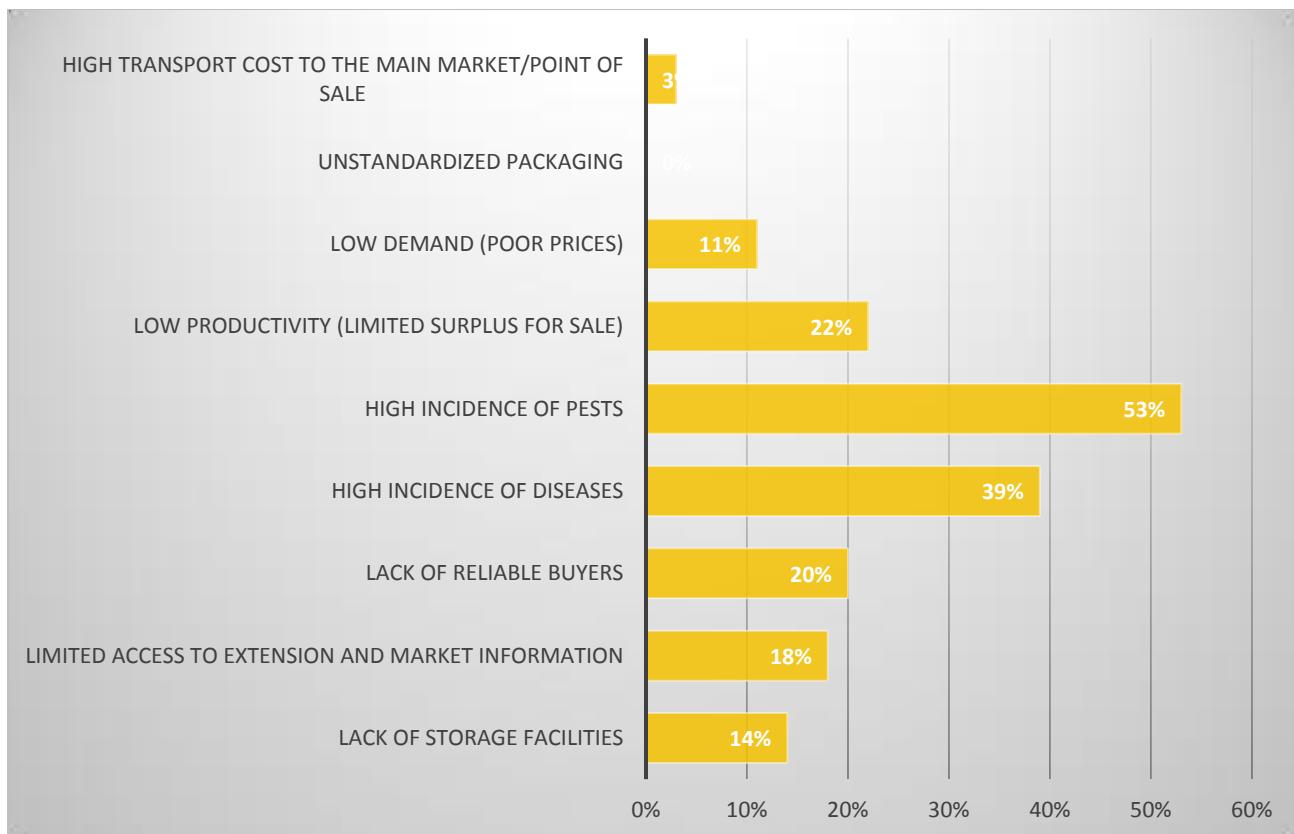
### **3.4.2 SOLWEZI BEANS**

Solwezi beans was produced by 64% of households. The area under cultivation for Solwezi beans was 0.36 ha. The highest number of farmers produced Solwezi beans in St Francis, followed by Mutanda and Lunga blocks. The average yield for the farmers with the highest number of households producing Solwezi beans was lower than blocks with least percent of farmers producing the crop. Higher yields in Mushindamo and Mukumbi could be due to increased awareness about the importance of applying fertilizers or the use of better management practices than farmers in St Francis and Mutanda. The farmers in Mushindamo and Mukumbi also sold a higher amount of Solwezi beans than all other blocks (Table 14)

**TABLE 14: PRODUCTION OF SOLWEZI BEANS**

<b>Blocks</b>	<b>Households producing Solwezi beans</b>		<b>Land size of Solwezi beans in ha</b>	<b>Amount harvested (kgs)</b>	<b>Amount sold (kgs)</b>
	No	Yes			
<b>St. Francis</b>	28.4	71.6	0.33	47.58	32.62
<b>Mutanda</b>	33.6	66.4	0.29	53.66	33.66
<b>Lunga</b>	36.2	63.8	0.44	48.51	44.28
<b>Mushindamo</b>	50.0	50.0	0.29	72.44	63.64
<b>Mukumbi</b>	43.2	56.8	0.49	73.47	61.34

About 78.3 % of farmers did not intercrop Solwezi beans with any other crop. Solwezi beans was commonly intercropped with maize (13.3%), ground nuts and sweet potatoes. Unlike soya beans, Solwezi beans production was majorly hampered by high incidences of pests (53%) and diseases (39%) and low productivity (Figure 11).



**FIGURE 11: CHALLENGES FACED IN PRODUCING SOLWEZI BEANS**

Challenges in Solwezi beans production ranged from production to marketing as well as information with production related challenges being the most. Interventions relating to this commodity should therefore focus on production however farmers should be sensitized on markets and its availability as well as good agricultural productivity.

### 3.5 LAND OWNERSHIP

All land in Zambia is held in trust by the state and is designated customary land, with access and use controlled by chiefs and village headmen. There was however an enactment of Lands Act (GRZ, 1995), that allows for conversion of customary land to leasehold. Land access in Zambia was considered an issue with a high number of famers believing there is limited land for farming as traditional leaders having already allocated most of the land in and around villages. In Solwezi, however the study found available land for cultivation. From the study, 99% of households interviewed owned land. The average land size owned per households for the year 2014-2015 season was 4.9 ha. Land ownership in 2014/2015 significantly differed between the blocks  $p<0.05$  where households in St Francis owned an average of

5.98 ha, which was the highest (Table 15). Households in Mutanda owned the least size of land of 2.84 ha. Mutanda is one of the highly populated blocks due to its proximity to Solwezi town.

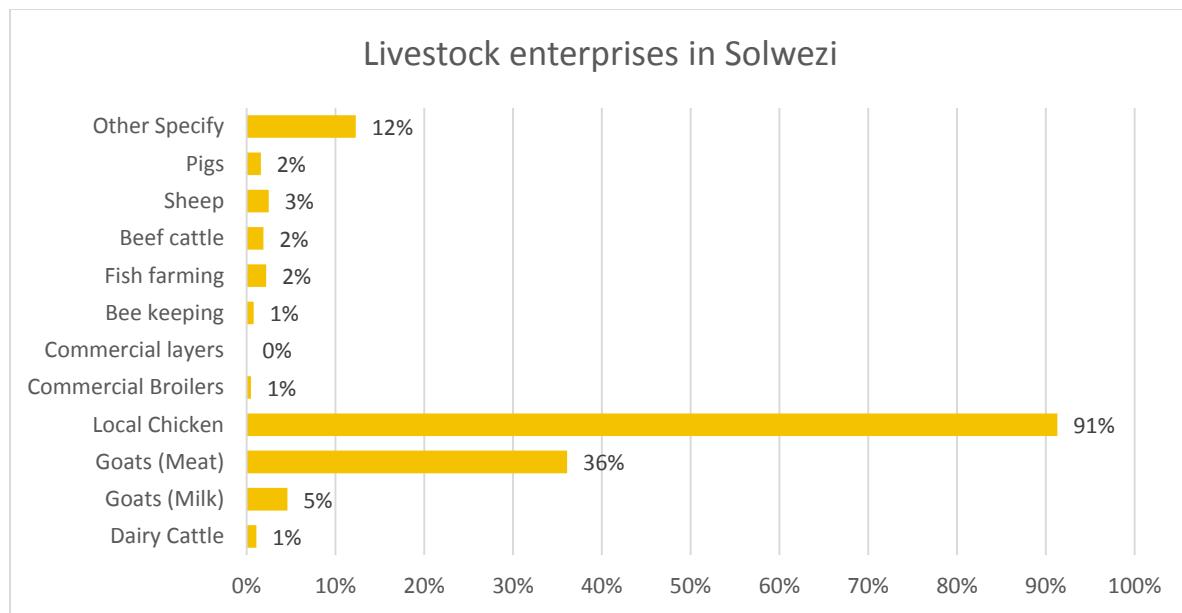
TABLE 15: LAND OWNERSHIP IN SOLWEZI

<b>Blocks</b>	<b>Land size owned in 2015 in ha</b>	<b>Land area cultivated in 2015</b>
<b>St. Francis</b>	5.98	1.47
<b>Mutanda</b>	2.84	1.43
<b>Lunga</b>	2.92	1.57
<b>Mushindamo</b>	4.96	1.44
<b>Mukumbi</b>	5.20	1.73

The area under cultivation did not differ significantly between the different blocks. The average size of land under cultivation during the 2014/15 season was only 1.52ha, this represented only 43% of the land owned being cultivated. Farmers in these areas therefore own sizeable lands but only cultivated a small area, despite the good climate that Solwezi enjoys. A few households (<3%) rented or leased out land.

### 3.6 LIVESTOCK ENTERPRISES

Solwezi farmers are not traditional livestock keepers; most had an average of 2 livestock enterprises in the period October 2014 -April 2015, with a higher percentage (48%) of farmers having only one livestock enterprise. A higher proportion of farmers owned local poultry (91.3%) and about 36.1% owned goats (Figure 12). Farmers were less involved in capital intensive activities such dairy, fish farming and keeping of commercial broilers and layers.



**FIGURE 12: LIVESTOCK ENTERPRISES**

Of all the livestock owned, 96% were of local breed and only 3% of the livestock enterprises were of improved breed. Poultry and goats were mostly of local breeds and were mainly kept for meat. Households with other types of livestock enterprises preferred improved breeds to local breeds (Table 16).

**TABLE 16: DIFFERENT LIVESTOCK ENTERPRISES BY HOUSEHOLDS IN SOLWEZI**

Livestock types	Improved		Local	
	% of livestock enterprise (n=359)	% of households (n=437)	% of livestock enterprise (n=359)	% of households (n=437)
Dairy Cattle	6.5	15.0	0.5	0.8
Goats (Milk)	8.7	20.0	2.7	4.2
Goats (Meat)	6.5	15.0	23.6	36.8
Local Chicken	28.3	65.0	59.6	92.8
Commercial Broilers	4.3	10.0	0.2	0.3
Commercial layers	0.0	0.0	0.0	0.0
Bee keeping	4.3	10.0	0.5	0.8
Fish farming	10.9	25.0	1.3	1.9
Beef cattle	4.3	10.0	1.3	1.9
Sheep	4.3	10.0	1.6	2.5
Pigs	6.5	15.0	1.1	1.7
Other Specify	15.2	35.0	7.7	12.0

Those households with dairy livestock had more improved breeds than the local breeds.

Only 7.3% of the households introduced new livestock enterprises in the cropping season October 2015-April 2016. On average only one enterprise was introduced in the aforementioned season. The livestock enterprises introduced by farmers were goats (meat) and local chicken by 31.3% and 31.3% of farmers respectively.

The major purposes of the livestock were subsistence farming 54.5%, while 45.5% had the enterprise for commercial purposes. In Table 17, goats (meat) were mainly for sale while local poultry were both for subsistence and commercial purposes in the same proportion.

**TABLE 17: PURPOSE FOR KEEPING LIVESTOCK**

Livestock enterprises	Purpose of keeping livestock		
	Subsistence/ Consumption	Commercial/Sale	Total
	Percent of livestock enterprise (n=220)	Percent of livestock enterprise (n=184)	Percent of livestock enterprise (n=366)
Local Chicken	92.7	91.3	91.3
Goats (Meat)	31.8	46.7	36.1
Other Specify	15.5	10.9	12.3
Goats (Milk)	4.5	5.4	4.6
Sheep	2.3	4.3	2.5
Fish farming	1.8	4.3	2.2
Pigs	1.4	2.7	1.6
Dairy Cattle	0.9	1.1	1.1
Bee keeping	0.9	1.6	0.8
Beef cattle	0.9	3.8	1.9
Commercial broilers	0.0	1.1	0.5
Commercial layers	0.0	0.0	0.0

### 3.7 LOCAL CHICKEN

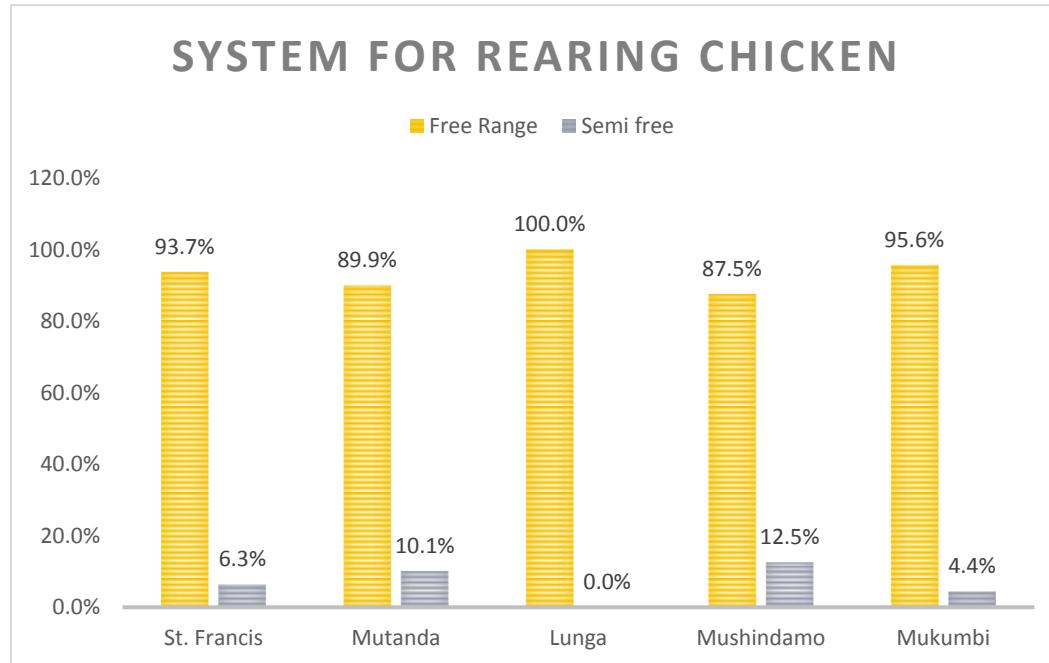
Local poultry was embraced by almost all households in the area (91%). These farmers owned an average of 25 local chicken, with 90% owning between 2 and 50 chicken. The average number of chicken owned did not significantly different between blocks (Table 18). Most of the farmers kept chicken mainly for consumption with only very few farmers keeping chicken for commercial purposes. An average of 59% of farmers sold chicken.

**TABLE 18: PRODUCTION OF LOCAL CHICKEN IN SOLWEZI DISTRICT**

Village chicken	% Production	% Sold	Mean Number of village chicken owned	Mean number of chicken that died
<b>St. Francis</b>	89.8	59.5	24	8
<b>Mutanda</b>	79.9	60.5	25	14
<b>Lunga</b>	75.4	65.4	25	12
<b>Mushindamo</b>	80.0	57.5	21	10
<b>Mukumbi</b>	84.0	55.9	29	18

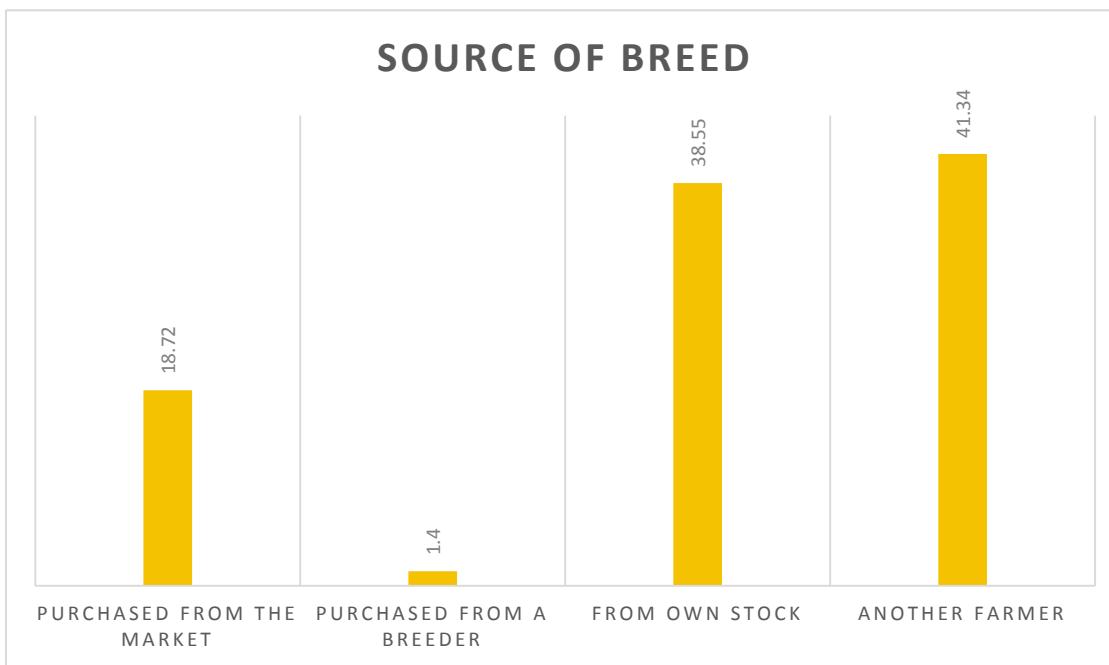
Local chicken in Solwezi also had high mortality rates where farmers lost a number of local chicken under their care (Table 18). Farmers in all blocks lost about 50% of all village/local chicken owned with exception of St Francis that lost only 1/3 of the chicken owned. The number of chicken lost did not significantly differ between blocks.

Almost all households in all blocks reared chicken using the free range system with only a few households having a semi free system (Figure 13).



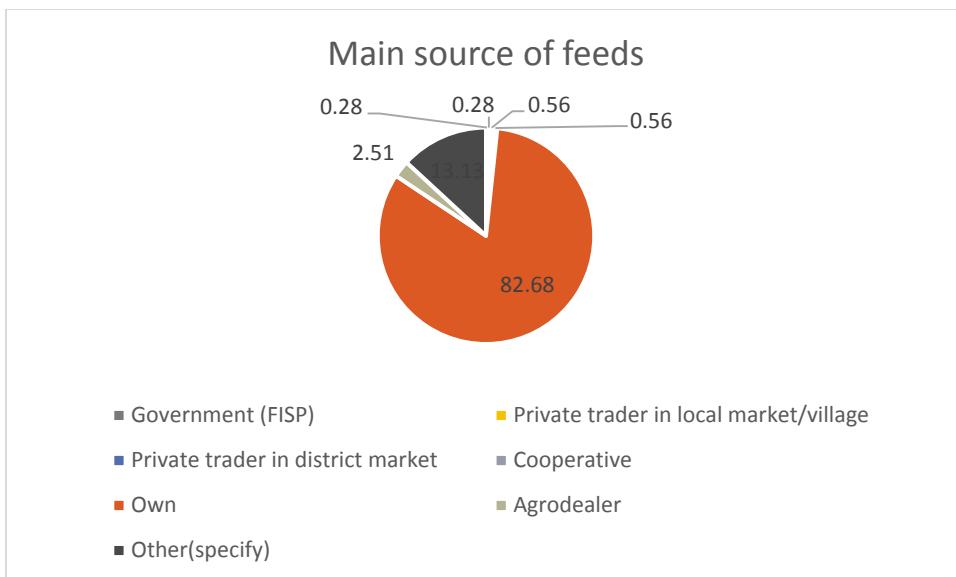
**FIGURE 13: SYSTEMS FOR REARING CHICKEN**

Smallholders farmers obtained breeds from own stock (38.55%) or from other farmers (Figure 14). This type of breeding could be a source of exponential mortality and spread of diseases. The breeds kept by the farmers and their neighbors would also be genetically susceptible for particular diseases and pests. The farmers rarely cross bred or tried to obtain better breeds from what was already owned. A high proportion of chicken mortality in Solwezi was due to New Castle disease, a contagious viral bird disease that easily spreads between infected and uninfected chickens. Farmers also rarely contacted a veterinary doctor to check on their poultry. A few farmers (17%) incurred some form of expenses relating to vet services and/or other preventive measures for rearing chicken such as vaccination, drugs and treatment.



**FIGURE 14: SOURCES OF VILLAGE/LOCAL CHICKEN BREEDS**

About 82.6% of farmers in Solwezi mainly depended on own feeds for feeding chicken with only 2% buying feeds from agro dealers (Figure 15).



**FIGURE 15: MAIN SOURCES OF FEEDS FOR VILLAGE/LOCAL CHICKEN**

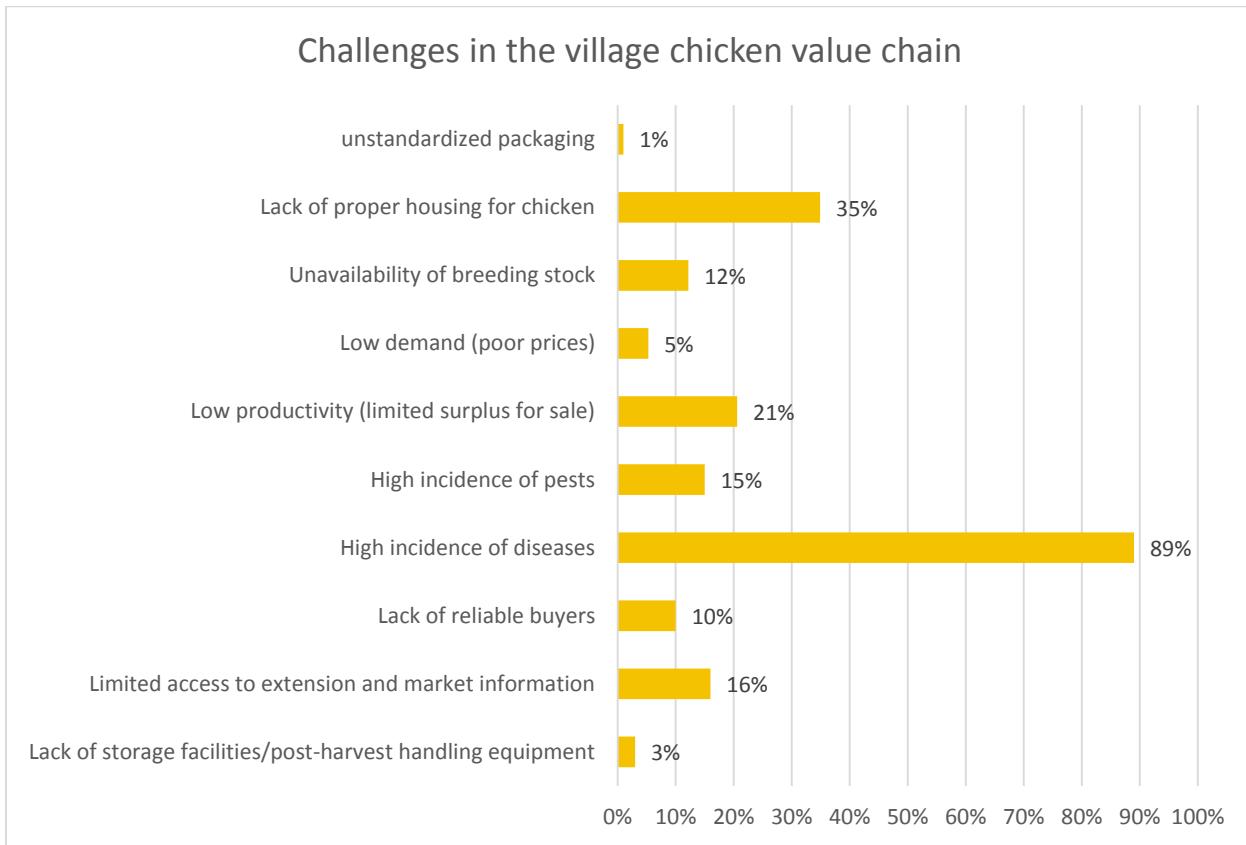
Local chicken were often kept for household consumption and on few instances used to generate income for the family. As earlier indicated about 59% of farmers sold chicken in the previous year prior to the survey. The chickens were however sold in very small quantities. The income received was considered reliable but not sufficient to meet household needs (Table 19).

**TABLE 19: IMPORTANCE OF INCOMES FROM SALE OF LOCAL CHICKEN**

Income ratings from sale of local chicken in terms of its importance to your household's livelihood	Percent of households (n=239)
Not important (income is negligible)	3.8
Somehow important (income received was intermittent)	29.7
Important (Income is reliable but not sufficient to meet the household needs)	61.1
Very important (income is reliable and sufficient- is the main source)	5.4

Farmers faced several challenges while rearing village chicken. The highest proportion of farmers was constrained by high incidence of diseases (89%). Other challenges facing farmers included lack of proper housing for chickens. The farmers in Solwezi built temporary chicken

houses mostly on trees. Farmers also practiced limited management for the chicken and rarely vaccinated them. This poor management of chicken can lead to low productivity and high incidence of pests and diseases (Figure 16).



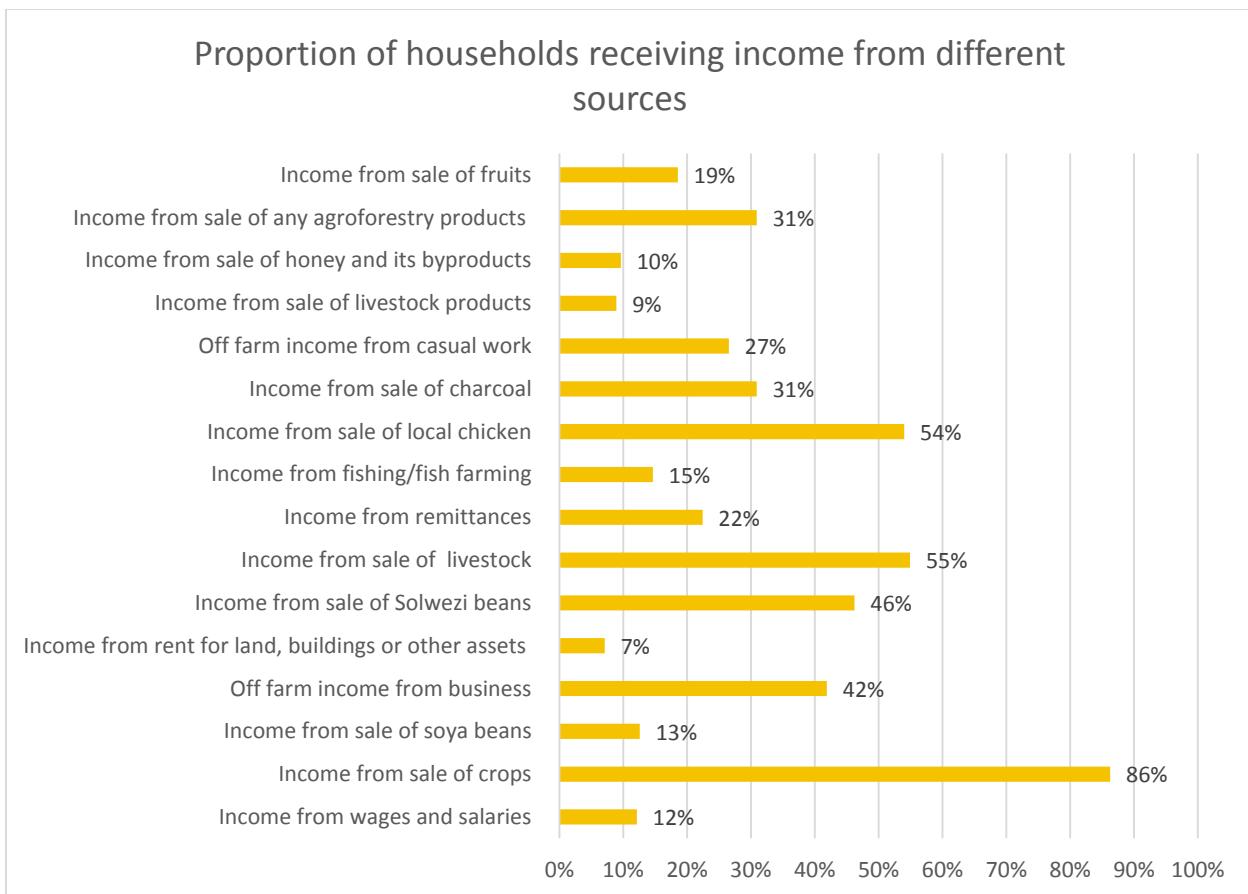
**FIGURE 16: CHALLENGES EXPERIENCED WHEN REARING VILLAGE CHICKEN**



Picture 1: Traditional chicken house in Solwezi

### 3.8 HOUSEHOLD INCOME

Mining in Solwezi is a major income generating activity. That notwithstanding, a number of farmers also engaged in agricultural activities to generate income. From the survey, almost all farmers received income from sale of crops (86.3%) and a few from livestock (54.9%). The income received from sale of livestock was mostly through sale of local chicken. Only 46.2% of farmers received income from sale of Solwezi beans while only 12.6% received income from sale of soya beans. A higher percentage of farmers received income from sale of local chicken (Figure 17).



**FIGURE 17: PROPORTION OF HOUSEHOLDS THAT RECEIVED INCOME FROM DIFFERENT SOURCES**

The low percentage of farmers selling soya beans is due to the small number of farmers farming the crop; only 17.6% farmed the crop in period 2014-2015 and of this 12.6% of the households sold the produce. For Solwezi beans, 64.5% of households interviewed planted the crop in the period 2014-2015, and only 46.2% sold it for income purposes. Other important income generating activities by farmers were business, received by 41.9% households, sale of agroforestry products such as tree seedlings and sale of charcoal (30.9%).

The study also sought to find out how farmers rate incomes received from the different sources by use of weighted scores (Table 20). Income from wages and salaries was ranked highest in contributing to overall households' income. Wages and salaries obtained by households was income from employment in mining companies which was about 12.1%. It was considered to be reliable and sufficient in meeting household needs. There were also other income sources that were considered somehow important by farmers; these include income from sale of agroforestry products (43.7%) and income from sale of fruits (Table 20).

The second most important income source as rated by farmers was sale of crops. Third most important income source was sale of soya beans despite being sold by only 13% of the households. Sale of local chicken was ranked 10<sup>th</sup> in overall importance. This suggests that even with more than 90% of households rearing chicken only 54% of them sold for cash. The cash received was not sufficient to meet households' needs. Sale of Solwezi beans came in 6<sup>th</sup> (Table 20).

**TABLE 20: WEIGHTED SCORES FROM DIFFERENT INCOME SOURCES**

Income ratings from different sources	Proportion of farmers (%) (n=437)	Average income scores	Ranks of income streams according to importance
Income from wages and salaries	12	3.38	1
Income from sale of crops	86	3.18	2
Income from sale of soya beans	13	3.16	3
Off farm income from business	42	2.91	4
Income from rent for land, buildings or other assets	7	2.9	5
Income from sale of Solwezi beans	46	2.84	6
Income from sale of livestock	55	2.82	7
Income from remittances	22	2.77	8
Income from fishing/fish farming	15	2.7	9
Income from sale of local chicken	54	2.68	10
Income from sale of charcoal	31	2.67	11
Off farm income from casual work	27	2.53	12
Income from sale of livestock products	9	2.46	13
Income from sale of honey and its byproducts	10	2.43	14
Income from sale of any agroforestry products	31	2.4	15
Income from sale of fruits	19	1.88	16

### **3.9 DIETARY DIVERSITY**

Dietary diversity is a proxy indicator for household food security. Dietary diversity presents the number of unique foods consumed over a given period of time and is considered a good measure of household food access. Household food security as a measure of well-being encompasses three dimensions: availability (measure of food that is physically available in the relevant

vicinity of a population: access (measure of the population ability to food during a given period and utilization (whether the population will be able to derive sufficient nutrition during a given period. A dietary diversity score can be created, which is the sum of the different food groups consumed. Dietary diversity aims to identify households that are food insecure, to characterize their insecurity, monitor changes in their circumstances and assess the impact of interventions. Varied diet is associated with improved birth weight and general health in the households. Dietary diversity aims to identify households that are food insecure, to characterize their insecurity, monitor changes in their circumstances and assess the impact of interventions (Hoddinott and Yohannes, 2002, Kennedy et al., 2013). Varied diet is associated with improved birth weight and general health in the households. Dietary diversity scores and percentage of households consuming each food group was used as a one-time measure or ongoing monitoring. The dietary score in this study was measured by the criteria discussed in the methodology section.

An analysis of dietary diversity was presented by use of ‘count’ which is the number food categories consumed by a given household. Counting the number of food categories is more indicative of diversity than count of different food types as the types would be providing similar nutrients for instance a household that consumes proteins, vitamins and roots would be considered more diet diverse than household that consumes different type of cereals. In Solwezi districts, more than 90% of households in all blocks consumed cereals, roots and tubers, oils and vegetables within 7 days of the survey. Households moderately consumed pulses, fish, sugars and beverages (Table 21).

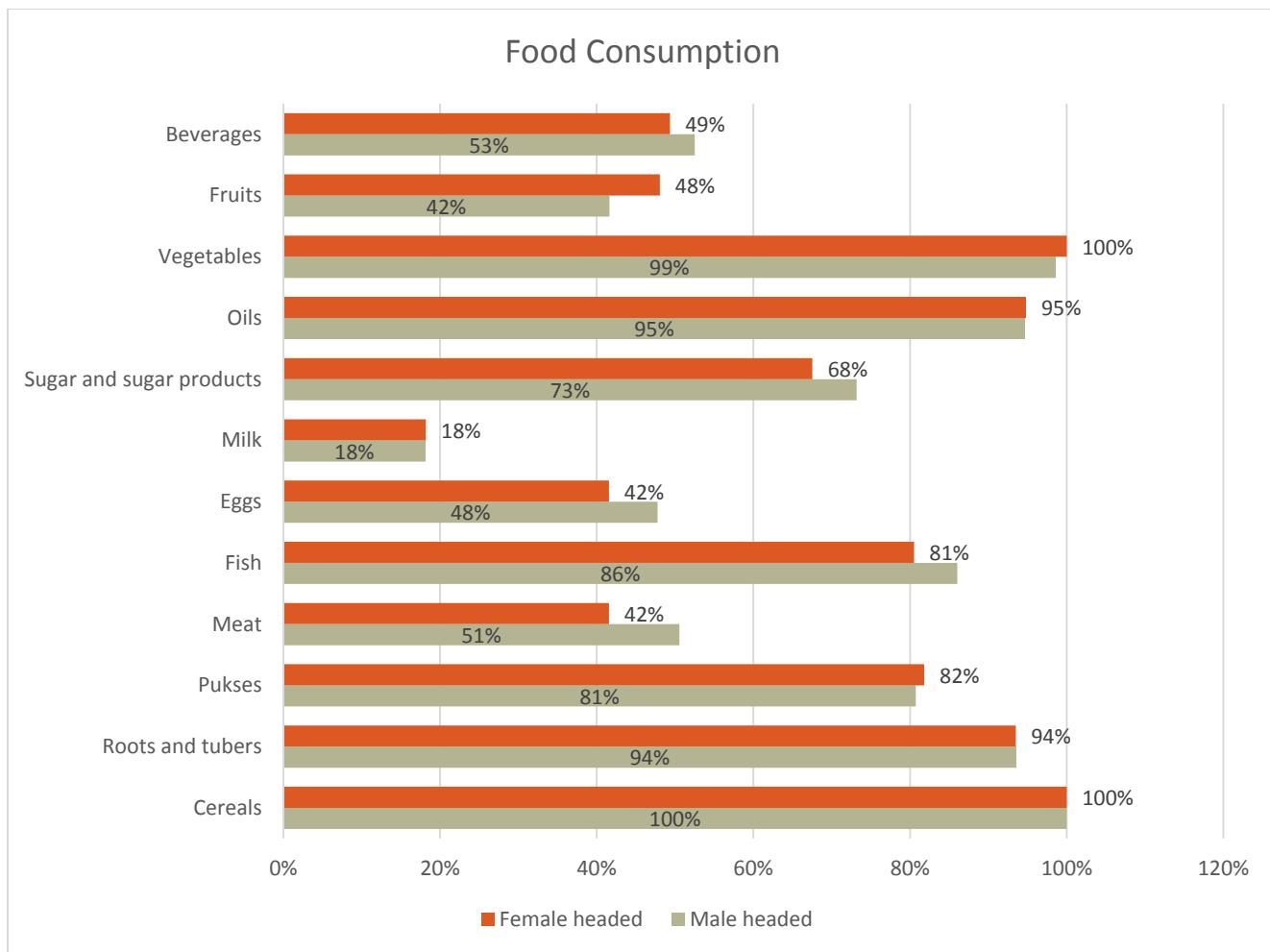
Consumption of cereals, roots and tubers, fish and milk did not significantly differ between blocks. Only a few households consumed milk and milk products in all blocks. A higher proportion of households in St Francis, Mutanda and Lunga blocks consumed pulses than households in Mushindamo and Mukumbi. More than 50% of households in Mutanda and Mukumbi consumed meat and meat products. More than 50% of households in Mushindamo and Mukumbi blocks consumed eggs and Mushindamo block least consumed fruits (Table 21). The least consumed food type by all blocks were milk consumed by only 18.1% of the households,

fruits (43%), eggs (46.9%) and meat (49%). Even though more than 90% of farmers reared chicken, only 46% took eggs in the 7 day period preceding the survey (Table 21).

TABLE 21: FOOD CONSUMPTION IN DIFFERENT BLOCKS

<b>Food types</b>	<b>St. Francis (%)</b>	<b>Mutanda (%)</b>	<b>Lunga (%)</b>	<b>Mushindamo (%)</b>	<b>Mukumbi (%)</b>	<b>Total (%)</b>
	(n=88)	(n=146)	(n=69)	(n=50)	(n=81)	(n=437)
<b>Cereals</b>	100	100	100	100	100	100
<b>Roots and tubers</b>	90.9	97.3	88.4	94.0	93.8	93.6
<b>Pulses</b>	87.5	83.9	82.6	70.0	74.1	81.0
<b>Meat</b>	33.0	61.1	49.3	30.0	55.6	49.0
<b>Fish</b>	81.8	81.9	89.9	88.0	88.9	85.1
<b>Eggs</b>	30.7	49.7	46.4	50.0	58.0	46.9
<b>Milk</b>	9.1	17.4	21.7	24.0	22.2	18.1
<b>Sugar and sugar products</b>	54.5	78.5	68.1	84.0	75.3	72.1
<b>Oils</b>	89.8	94.6	97.1	100	95.1	94.7
<b>Vegetables</b>	98.9	100	100	94.0	98.8	98.9
<b>Fruits</b>	42.0	47.0	44.9	24.0	46.9	43.0
<b>Beverages</b>	25.0	55.7	56.5	62.0	64.2	51.9

There was no significant difference in consumption of the different food types between male and female headed households (Figure 18). The percentage of farmers that consumed cereal, proteins and other foods did not differ between households. Although the consumption of food did not significantly differ between households a higher proportion of male headed households consumed sugar and sugar products, eggs and fish than female headed households. The low consumption of milk and milk products in both household types would raise concerns on calcium intake by children. Fruits consumption was also very low in both households types.



**FIGURE 18: DIFFERENCE IN FOOD CONSUMPTION BETWEEN MALE AND FEMALE HEADED HOUSEHOLDS**

### 3.9.1 COMPARISON IN CONSUMPTION OF DIFFERENT FOOD CATEGORIES

Categorization of foods was done as indicated in Table 2. Combination of the different food types into distinct categories ensures that weights of foods providing similar nutrients are grouped together and also ensures foods are not counted more than they should.

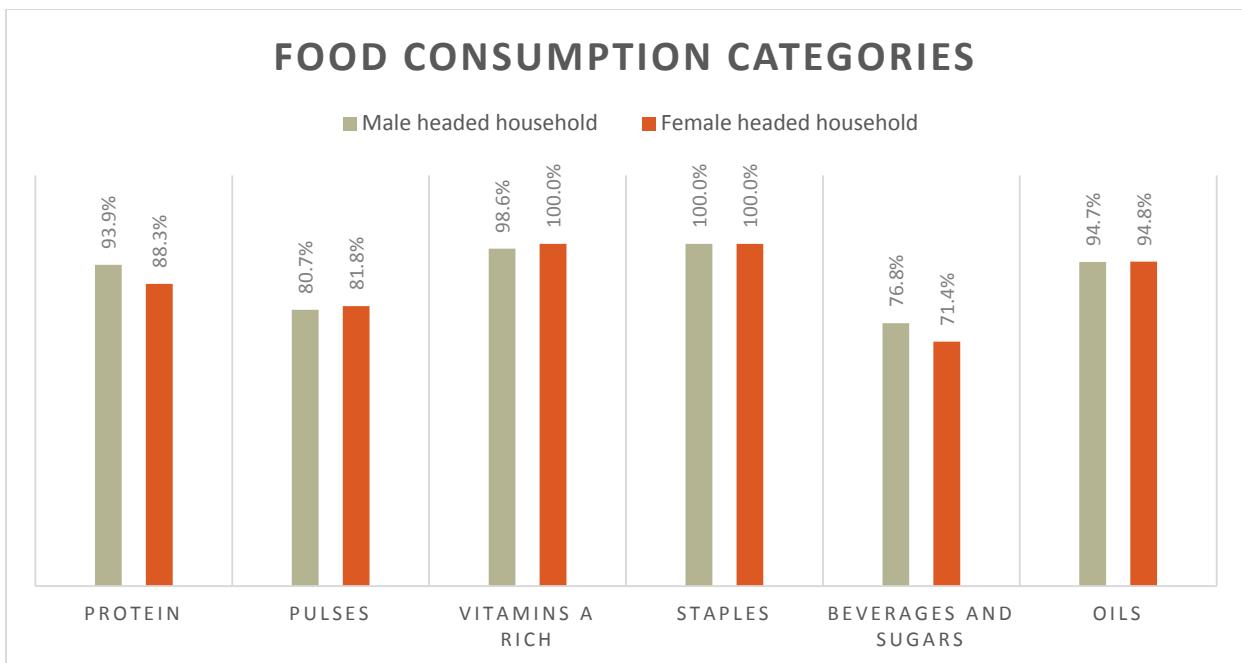
The consumption of different food categories showed that there was no significant difference in consumption of staples and proteins in different blocks as they were consumed by all households interviewed in the sampled blocks. Staples consisted of cereals, tubers and roots where households consumed on average 10 times in a 7 day period prior the survey. The second and third most consumed food category were vitamin A rich foods (vegetables and fruits) and oils consumed on average of 7 and 6 times respectively within the 7 day period. Consumption of

pulses (beans and peas), vitamins A and sugars significantly differed between blocks,  $p<0.05$ . (Table 23). Pulses were the least consumed food. Even though beans were grown by more than 60% of households in Solwezi, the crop was consumed on average 3 times within the 7 day period (Table 22).

TABLE 22: CONSUMPTION OF DIFFERENT FOOD CATEGORIES IN SOLWEZI

<b>Food categories</b>	<b>St. Francis (%) (n=88)</b>	<b>Mutanda (%) (n=149)</b>	<b>Lunga (%) (n=69)</b>	<b>Mushindamo (%) (n=50)</b>	<b>Mukumbi (%) (n=81)</b>	<b>Solwezi (%) (n=437)</b>	<b>Average no. of times food category was consumed in 7day period</b>
<b>Protein</b>	90.9	91.3	97.1	94.0	93.8	92.9	5.43
<b>Pulses</b>	87.5	83.9	82.6	70.0	74.1	81.0	3.09
<b>Vitamins A rich</b>	98.9	100.0	100.0	94.0	98.8	98.9	7.46
<b>Staples</b>	100.0	100.0	100.0	100.0	100.0	100.0	10.8
<b>Beverages and sugars</b>	58.0	82.6	72.5	86.0	79.0	75.7	5.65
<b>Oils</b>	89.8	94.6	97.1	100.0	95.1	94.7	6.18

Male households consumed proteins more than female headed households,  $p<0.10$ . All other food categories: pulses, vitamins A rich, staples, beverages and oils did not significantly differ between different household types (Figure 19).



**FIGURE 19: DIFFERENCE IN CONSUMPTION OF DIFFERENT FOOD CATEGORIES BY MALE AND FEMALE HEADED HOUSEHOLDS**

In Solwezi district, all households consumed at least two different food categories with a higher proportion of households consuming all six food categories within a seven day period (Table 23). The mean number of food categories consumed by households in all blocks did not significantly differ. The average number of food categories consumed was 5.4 for all blocks (ANOVA, 1.83, p value=0.1234).

**TABLE 23: TOTAL NUMBER OF FOOD CATEGORIES CONSUMED IN DIFFERENT BLOCKS**

Total Number of food categories consumed by HHs	St. Francis	Mutanda	Lunga	Mushindamo	Mukumbi	Total
2	1.1	0.7	0.0	0.0	2.5	0.9
3	2.3	1.3	0.0	2.0	2.5	1.6
4	11.4	7.4	10.1	8.0	4.9	8.2
5	40.9	26.2	30.4	34.0	32.1	31.8
6	44.3	64.4	59.4	56.0	58.0	57.4

Patterns of consumption between household types did not differ between different types of households, (Table 24). Male headed households consumed at least two food categories while female headed households consumed at least three food categories.

**TABLE 24: TOTAL NUMBER OF FOODS CONSUMED BY HOUSEHOLD TYPES**

Total number of food categories consumed	Male headed	Female headed
2	1.1	0.0
3	0.8	5.2
4	7.8	10.4
5	32.7	27.3
6	57.5	57.1

The number of food categories consumed by male and female headed household did not differ significantly ( $p=0.4$ ). Both household types consumed an average of 5 types within a 7 day period (Table 25).

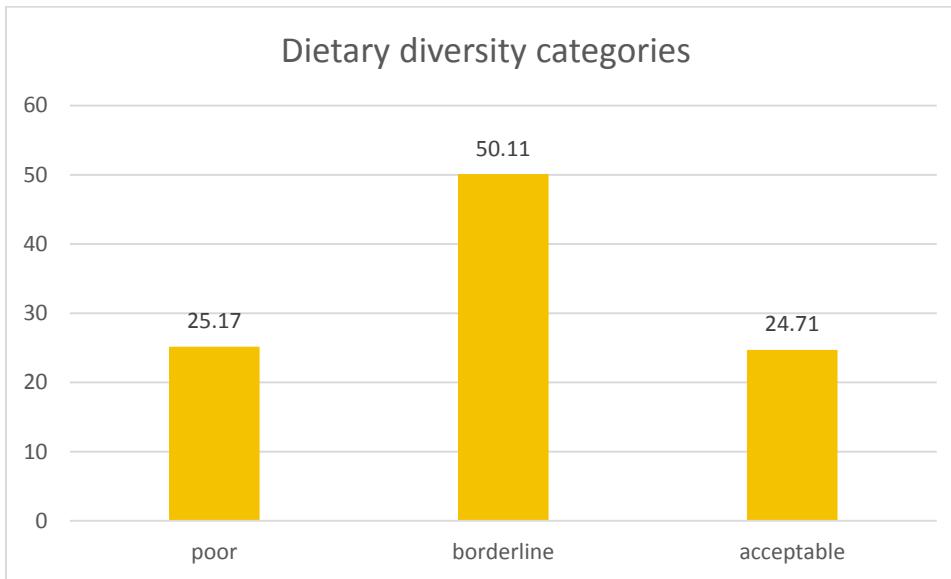
**TABLE 25: DIFFERENCE IN NUMBER OF FOOD CATEGORIES CONSUMED WITHIN A 7 DAY PERIOD**

Group	N	Mean	Std. Err.	Std. Dev.
Male headed	358	5.45	0.04	0.77
Female headed	77	5.36	0.10	0.87
Total	435	5.43	0.04	0.79
diff		0.08	0.10	

### **3.9.2 DETERMINING TOTAL CONSUMPTION SCORE FOR DIFFERENT HOUSEHOLDS**

The next step is to compute the food consumptions score as a factor of the household consumption of a particular food category and the number of days the households have consumed the food item in a period of seven days multiplied by the assigned food consumption score. The scores were summed to obtain the total score for each household.

As earlier highlighted in the methodology section, percentiles were used to categorize households into different food consumption categories: **poor, borderline and acceptable**. The percentage of households in the three categories are presented in Figure 20. The proportion of households in the different food consumption categories were significantly different in the district ( $p<0.1$ ).



**FIGURE 20: CATEGORIES OF DIETARY DIVERSITY**

The mean score for each of the food consumption categories was: 39.7, 61.04 and 95.67 for poor, borderline and acceptable respectively. Analysis of variance (ANOVA) was used to validate the categorization. The ANOVA results showed that there is a significant difference in total diversity scores between the three different dietary diversity categories ( $p<0.05$ ) Figure 21.

Number of obs =	437	R-squared =	0.7856		
Root MSE =	10.4888	Adj R-squared =	0.7846		
<hr/>					
Source	Partial SS	df	MS	F	Prob>F
Model	174984.17	2	87492.086	795.27	0.0000
fcs_ug	174984.17	2	87492.086	795.27	0.0000
Residual	47746.566	434	110.01513		
Total	222730.74	436	510.85031		

**FIGURE 21: ANALYSIS OF VARIANCE ON THE DIFFERNT DIETARY DIVERSITY**

### **3.9.3 COMPARISON IN FOOD CONSUMPTION BETWEEN THE THREE DIETARY DIVERSITY GROUPS**

The average number of food categories consumed by poor, borderline and acceptable categories of households was 4.8, 5.54 and 5.84 respectively. Households in the poor category mainly consumed less than 5 food categories while borderline and acceptable consumed 5 or more food categories (Table 26).

**TABLE 26: NUMBER OF FOOD CATEGORIES CONSUMED BY DIFFERENT DIETARY CATEGORIES**

Total number of food categories consumed	Poor (n=110)	Borderline (n=219)	Acceptable (n=108)	Total (n=437)
Percentage of households				
<b>2</b>	4	0	0	1%
<b>3</b>	5	0	0	2%
<b>4</b>	22	5	0	8%
<b>5</b>	45	33	16	32%
<b>6</b>	24	61	84	57%

At least 50% of households in Solwezi belonged to the borderline category with only 24.7% and 25.2% belonging to acceptable and poor category respectively. The different blocks in Solwezi slightly differed in the proportion of farmers in the different dietary diversity categories.

• • •

Majority of the blocks had households in the borderline category with exception of Mukumbi that had more households in the acceptable category. St Francis and Mushindamo had more households in the “poor” category than those in the acceptable category (Table 27).

TABLE 27: PROPORTION OF HOUSEHOLDS IN DIFFERENT DIETARY CATEGORIES

Dietary diversity	Poor n=110	Borderline n=219	Acceptable n=108
Percentage of households			
<b>St. Francis</b>	36.4	58.0	5.7
<b>Mutanda</b>	20.8	50.3	28.9
<b>Lunga</b>	17.4	53.6	29.0
<b>Mushindamo</b>	32.0	54.0	14.0
<b>Mukumbi</b>	23.5	35.8	40.7
<b>Total</b>	25.2	50.1	24.7

A higher percentage of female headed households were in the poor and borderline categories than male headed households which had more households in the acceptable and borderline categories (Figure 22). Therefore even though the number of total food categories did not significantly differ between household types, female headed households had poor dietary diversity than male headed households.

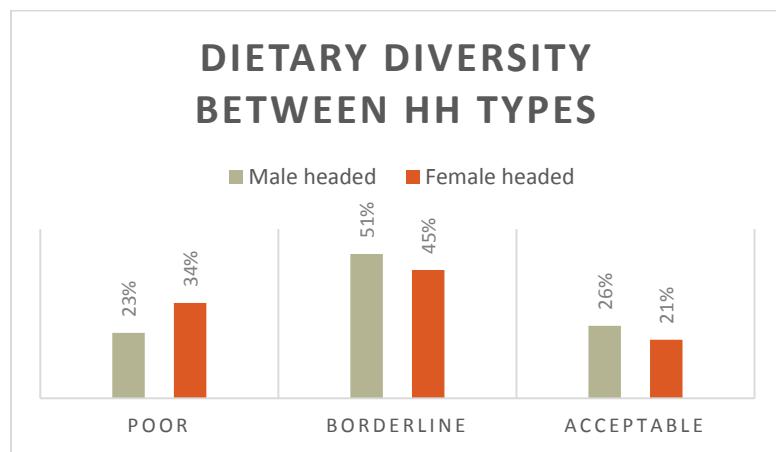
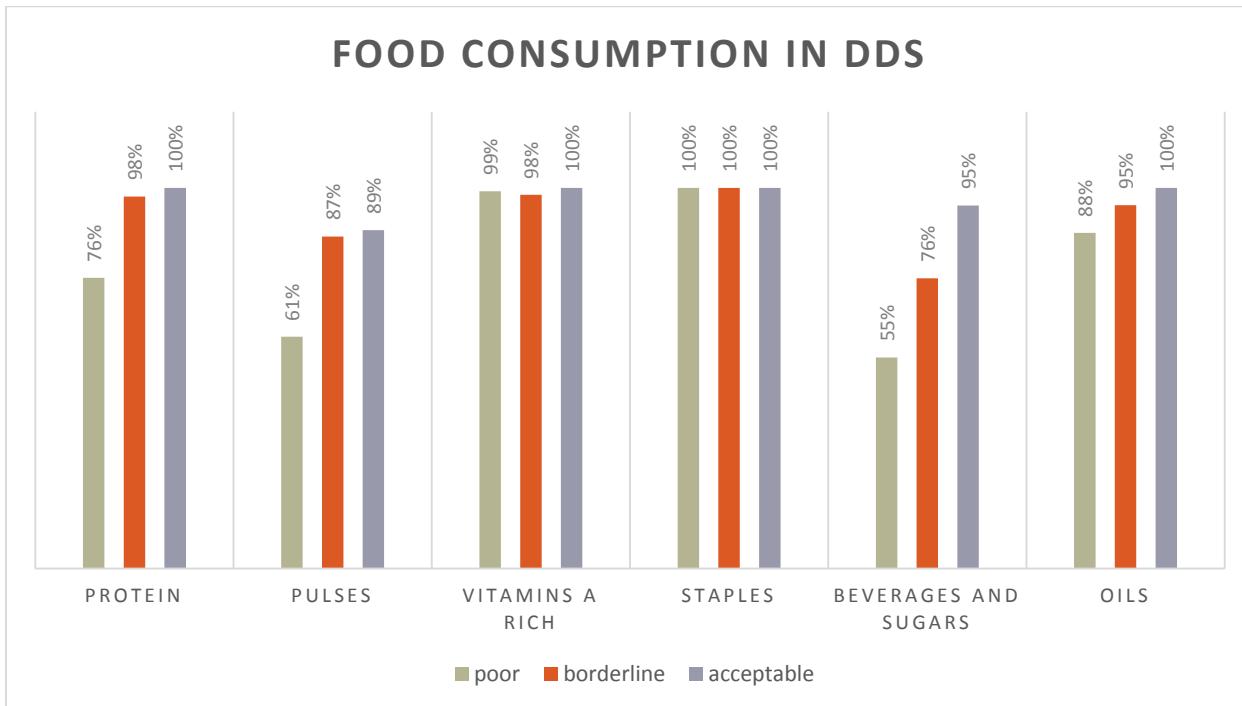


FIGURE 22: DIFFERENCE IN DIETARY DIVERSITY BETWEEN HOUSEHOLDS

With expectation of staples and vegetables, households with poor dietary diversity consumed less of proteins, pulses, beverages and oils. All households in the acceptable category consumed all foods at higher rates than other dietary diversity categories (Figure 23).



**FIGURE 23: DIFFERENCE IN CONSUMPTION OF DIFFERENT FOOD BETWEEN DIETARY CATEGORIES**

The number of days each of the household categories consumed each of the different food categories varied between the different categories. Protein and beverages were least consumed by households in the poor category. Households in this category only consumed meat, milk or eggs two times in a seven day period. These households also consumed beans and peas two times within the seven day period. The poor category mostly consumed cereals, tubers and roots at a higher rate in the seven day period, average of 10 times. This households scarcely consumed protein, pulses and beverages containing sugars with the same period (Table 28).

TABLE 28: AVERAGE NUMBER OF DAYS AND CONSUMPTION BETWEEN DIETARY CATEGORIES

<b>Food categories</b>	<b>Poor</b>	<b>Borderline</b>	<b>Acceptable</b>	<b>ANOVA</b>
	n=110	n=219	n=108	p<0.001
<b>Protein</b>	1.69	4.47	11.175	***
<b>Pulses</b>	1.97	3.089	3.87	***
<b>Vitamins A rich</b>	6.5	7.3	8.7	***
<b>Staples</b>	9.6	10.9	11.79	***
<b>Beverages and sugars</b>	1.9	5.48	9.82	***
<b>Oils</b>	5.33	6.3	6.8	***

### 3.10 ASSETS ENDOWMENTS

The DFID sustainable livelihoods framework was used to assess the extent to which existing asset endowments determine the outcomes of value chain development, relationships between asset building at enterprise and household levels, and the role of market, political and institutional factors in facilitating or hindering favourable outcomes, separating the changes caused by interactions and interventions in value chains from those induced by the overall context.

Ownership of household assets is important for agricultural production as well as the overall household well-being. Of the farmers interviewed in Solwezi, 99% owned at least one farm tool. Hoe/Jembe and axes were owned by 99.8% and 96.1% of households respectively (Table 29). Solwezi being bushy and mainly composed of bushy grasslands, these two assets are of high importance for clearing farms and for land preparations.

Despite owning relatively large pieces of land, only a few of the households interviewed had mechanized machinery for land cultivation or land preparation. None of the households owned a tractor. Farmers therefore used hoes to till and prepare agricultural land thus explaining the small sizes of land being cultivated in the district. Households owned household assets such as furniture and furnishings, non-farm land and kettles, 63.5%, 38% and 25.9% respectively. Such assets make the household members comfortable in their everyday life.

TABLE 29: ASSET OWNERSHIP IN SOLWEZI

<b>Household tools</b>	<b>Assets</b>	<b>Number of households</b>	<b>(%) of Households (n=437)</b>
<b>Farm tools</b>	Hoe/Jembe	436	99.8
	Axe	420	96.1
	Slasher	350	80.1
	Panga/machete	206	47.1
	Spade	135	30.9
	Sprayer	95	21.7
	Tractor	70	16.0
	Watering cans	48	11.0
	Pruning knives	30	6.9
	Fork hoe	30	6.9
	Spray pump	17	3.9
	Modern poultry house	17	3.9
	Plough	13	3.0
	Milk can	8	1.8
	Motorised watering pump	6	1.4
	Animal drawn-plough	4	0.9
	Pail	4	0.9
	Water storage tank	4	0.9
	Sheller	2	0.5
<b>Buildings and household furniture</b>	Jab planter	1	0.2
	Animal drawn cart	1	0.2
	Motorized spray pump	1	0.2
	Zero grazing unit	1	0.2
	Harrow/cultivator	0	0.0
	Furniture/Furnishings	276	63.2
<b>Information access tools</b>	Non-farm land	166	38.0
	Household Appliances e.g. Kettle, Flat iron,	113	25.9
	Rental house (s)	36	8.2
	Other buildings	31	7.1
	Radio/Cassette/DVD player	285	65.2
	Mobile phone	274	62.7
<b>Power generators</b>	Television	99	22.7
	Computer	18	4.1
	Internet Access	14	3.2
	Other electronic equipment	9	2.1
	Generators	39	8.9
	Solar panel/electric inverters	172	39.4
<b>Transport</b>	Bicycle	373	85.4
	Motorcycle	25	5.7
	Motor vehicle	17	3.9
	Boat	1	0.2
	Other transport equipment	2	0.5
<b>Jewelry and Watches</b>		20	4.6
<b>Other household assets e.g. lawn mowers, etc.</b>		4	0.9

On assets for information access, most farmers owned a radio (65.2%) and mobile phones (62.7%). Only 22% of the households owned television sets. Computer and internet access was barely owned or accessed by the interviewed households, 4.1% and 2.1% respectively. 24% have electricity in their homes. The most used means of transport in Solwezi is use of bicycles which are owned by 85.4% of households (Table 29).

Asset ownership between blocks is presented in Table 30. At least 24% of households in Solwezi had electricity in their homes with 43% of households being in Mukumbi area. A higher percent of households had more than three rooms in their homes. Mukumbi had the highest percentage of farmers with more than 4 rooms in the main house. More than 80% of households used firewood as the main source of fuel with exception of Mukumbi that has some households using charcoal as an alternative fuel source. There were no households using gas and electricity as a main source of fuel. Dirt/soil/dung was mainly used as floor material in all blocks in Solwezi with a few, 35% of households in Mukumbi using cement. In other blocks less than 20% of the households had cement as main floor material. Households in Solwezi obtained clean drinking water from a private borehole and a protected well. There were no households receiving piped water or public taps.

The commonly used toilet facility in Solwezi district is use of private traditional toilet facility by 90% of households. Most farmers also used dirt bricks and burnt bricks for making house walls and use of iron sheets for the roof (84%).

TABLE 30: DIFFERENT ASSET TYPES IN HOUSEHOLDS OF SOLWEZI ZAMBIA

Different assets types in households of Solwezi Zambia		St.Francis (%) (n=88)	Mutanda (%) (n=146)	Lunga (%) (n=69)	Mushindamo (%) (n=50)	Mukumbi (%) (n=81)	Total (%) (n=437)
<b>Households with Electricity</b>		23	21	14	12	43	24
<b>Number of rooms in the households main house</b>	Zero or one room	5	4	6	18	1	5
	two rooms	27	28	33	24	21	27
	three rooms	40	32	29	34	31	33
	more than 4 rooms	28	37	32	24	47	35
<b>Main source of fuel</b>	Electricity	2	1	0	0	0	1
	Gas	0	0	0	0	1	0

	Charcoal	6	19	20	20	26	18
	Firewood	92	80	80	80	73	81
<b>Main material used for floor</b>	Dirt/soil/dung	90	81	87	96	65	83
	Wood	0	0	1	0	0	0
	Cement	10	19	12	4	35	17
<b>Main source of drinking water</b>	Piped water into home	0	1	0	0	0	0
	Public tap/stand pipe	0	4	0	0	0	1
	Borehole/tube well	44	30	20	44	28	32
	Protected dug well/spring	30	29	48	38	30	33
	Unprotected well/spring	17	28	22	14	33	24
	River, pond, stream,	9	9	10	4	9	8
<b>Main type of toilet facility</b>	Private flush toilet	0	1	0	0	4	1
	Private improved pit	2	8	1	0	7	5
	Private traditional p	94	89	93	86	86	90
	Shared pit latrine	3	3	4	12	2	4
	Bush, forest, or some	0	0	1	2	0	0
<b>Main material used for walls</b>	Cement block	3	4	3	0	11	5
	Zinc wall	0	1	0	0	0	0
	Stone and mud	0	1	0	0	0	0
	Dirt bricks	84	73	78	86	60	75
	Sticks and mud	2	1	7	10	0	3
	Stone and cement	0	0	0	0	1	0
	Burnt bricks	10	20	12	2	27	16
<b>Main Material used for roof</b>	Iron sheet (zinc)	82	91	65	82	94	84
	Clay tile/concrete	0	1	0	0	0	0
	Grass/thatch/bamboo	18	8	33	16	4	14
	Plastic sheet/ tarpaulin	0	1	0	0	0	0
	Other	0	0	1	2	2	1

### **3.11 WEALTH INDEX**

The wealth index provides a stable and understandable yardstick for evaluating and comparing the economic situation of households, social groups and societies across all regions of the developing world. A household's ranking on wealth index indicates to what extent the household possesses basic set of assets, valued highly by people all across the globe. Wealth index also measures a household's level of material well-being by looking at the household's possession of durables, access to basic services, and characteristics of the house in which people are living in. Households that own more expensive durables, have a better quality house and have access to basic services are considered to have a higher level of material well-being than households with less expensive durables, worse housing and no access to services. During computation of the wealth index, assets that contribute to material well-being are important depending on the country or site of interest (Smits and Steendijk, 2014). Material well-being is associated with the satisfaction of the basic needs of food, clothing and safety/shelter, which have to be met to survive. Material well-being therefore refers to the possession of goods and access to basic services that make life easier and more comfortable. Such assets include: all kinds of relatively cheap assets but make people more comfortable (tables, chairs, carpets, beds). Household access to electricity opens up infinite new possibilities for increasing material well-being in relatively cheap ways. With electric light, the time that can be spent on useful and leisure activities increases considerably. Electric tools and utensils reduce time spent on cooking and on work around the home. Access to clean water allows households workload to reduce, as this may save an often considerable amount of time spent on fetching water.

The quality of the house in which the household lives in is also an important aspect of material well-being. The kind of building and flooring material determines how much maintenance there is to the house, whether rain, wind and pests are kept outside well, and how comfortable the house is. Having more than one room, a separate kitchen and bathroom, and a decent in-house toilet facility greatly enhances quality of living. Besides technical equipment that makes life easier, material wellbeing can also be improved by means of transportation and communication equipment. With a bike, cart, boat, motorbike or car transportation of heavy loads becomes easier and travelling time is reduced. Radio and television bring the world into the home and phones,

computers and the internet greatly enhance communication and access to information (Smits and Steendijk, 2014).

Assets, including farm level and household level assets, that are durable with ability to contribute to the household livelihood were included in the analysis of households in Solwezi. The assets used to analyze the wealth index are presented in Table 32. The table also contains the 1st principal component index obtained by running a principal component analysis on all the selected assets. Assets that vary the most between households are assigned higher scores and vice versa. Some assets: fuel wood, floor material, wall material and water resources have been accumulated to allow different assets that are thought to have similar weights be included in the same category. High quality fuel includes use of gas and electricity while medium fuel wood includes charcoal and low quality includes firewood and use of crop residue.

Floor and wall materials are also an indication of the conditions of the households and quality of the material varies with the quality of house. High quality material include use of cement and burnt bricks while medium quality include use of wood while low quality material entails use of dirt/soil or dung.

The water sources quality also has effect on quality of health. High quality water sources include piped water and bottled water. Medium quality includes protected springs while low quality includes unprotected springs and stream. The higher the number of rooms in the households is an indication of better livelihoods of farmers. Table 31 shows the assets used in the calculation of the wealth index.

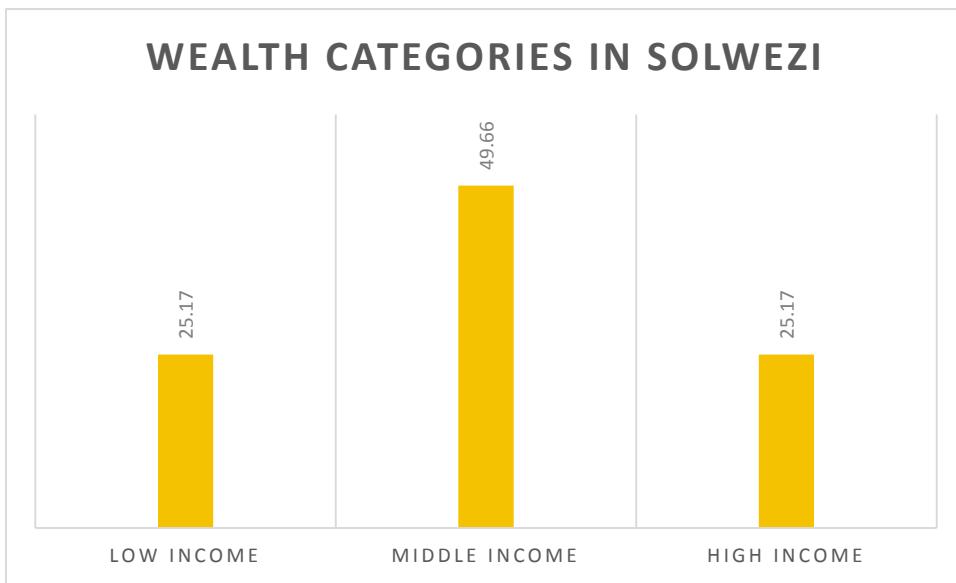
TABLE 31: SUMMARY STATISTICS OF ASSETS USED IN CALCULATION OF WEALTH INDEX

Household assets		Solwezi district (% of HH) (n=437)	Mean	Standard Deviation	1 <sup>st</sup> Principal Component index
<b>Furniture and furnishings</b>		63.2	0.63	0.48	0.10
<b>Radio/cassette/DVD player</b>		65.2	0.65	0.48	0.13
<b>Mobile phone</b>		62.7	0.63	0.48	0.16
<b>Bicycle</b>		78.5	0.78	0.41	0.04
<b>Solar panel/electrical inverters</b>		39.6	0.39	0.49	0.17
<b>Rental house</b>		13.7	0.14	0.34	0.15
<b>Land ownership</b>		99.0	0.99	0.11	-0.03
<b>Television</b>		22.7	0.23	0.42	0.24
<b>Motor cycle</b>		5.7	0.06	0.23	0.04
<b>Generators</b>		8.9	0.09	0.29	0.18
<b>Internet access</b>		3.2	0.03	0.18	0.21
<b>Computer</b>		4.1	0.04	0.20	0.22
<b>Motor vehicle</b>		3.9	0.04	0.19	0.21
<b>Fuel wood</b>	High quality	1.1	0.01	0.15	0.11
	Medium quality	17.9	0.18	0.17	0.38
	Low quality	81.0	0.81	-0.21	0.39
<b>Floor material</b>	High quality	17.2	0.17	0.30	0.38
	Medium quality	0.2	0.00	-0.01	0.05
	Low quality	82.6	0.83	-0.29	0.38
<b>Wall materials</b>	High quality	20.8	0.21	0.26	0.41
	Medium quality	75.3	0.75	-0.22	0.43
	Low quality	3.4	0.03	-0.05	0.18
<b>Toilet</b>	High quality	0.9	0.01	0.17	0.10
	Medium quality	4.8	0.05	0.21	0.21
	Low quality	94.3	0.94	-0.26	0.23
<b>Roof materials</b>	High quality	84.7	0.85	0.11	0.36
	Medium quality	0.2	0.00	-0.01	0.05
	Low quality	14.2	0.14	-0.12	0.35
<b>Water sources</b>	High quality	0.5	0.00	0.09	0.07
	Medium quality	34.6	0.35	0.01	0.48
	Low quality	65.0	0.65	-0.02	0.48
<b>Number of rooms in the households</b>	Zero or one room	5.5	0.05	-0.06	0.23
	Two rooms	26.8	0.27	-0.13	0.44
	Three rooms	33.0	0.33	-0.06	0.47
	Four rooms and more	34.8	0.35	0.21	0.48

### 3.11.1 WEALTH CATEGORIES

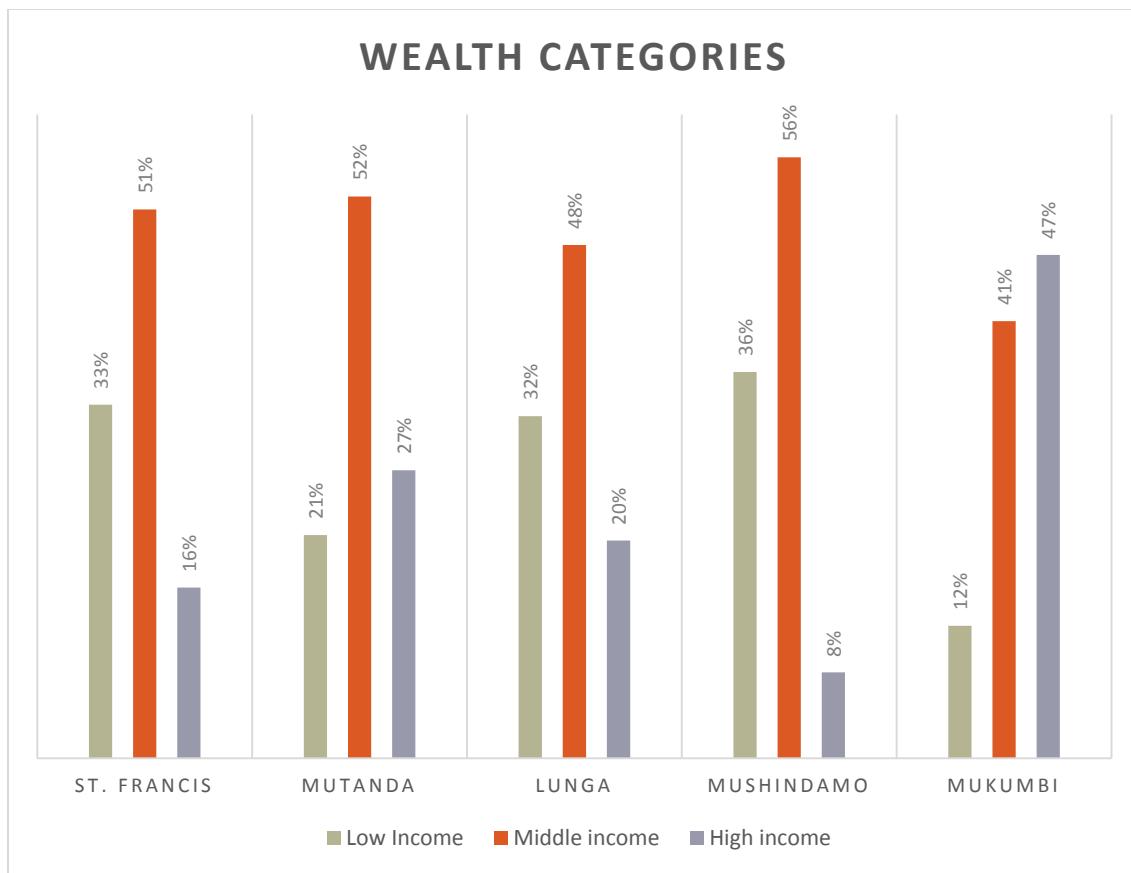
The total wealth score was calculated as described in Table 31, three categories of wealth were generated: **Low, Middle and High income**. Households in low incomes were those that their

wealth scores fell below the 25<sup>th</sup> percentile while middle incomes scores fell between 25<sup>th</sup> and 75<sup>th</sup> percentiles of the wealth index score, high level incomes were considered to fall above the 75<sup>th</sup> percentile score. The wealth categories had an average score of -1.89, -0.55 and 2.98 for low, middle and high income levels respectively. Due to the application of PCAs 1<sup>st</sup> component the wealth score can take both negative and positive values. The proportion of households in each wealth category is shown in Figure 24. High income and low income constituted 25% each while the middle income percent constituting 50%.



**FIGURE 24: WEALTH CATEGORIES IN SOLWEZI**

The proportion of farmers belonging to the different wealth categories varied between blocks, (Figure 25). In St Francis, Mutanda, Lunga and Mushindamo, more households belonged to middle income categories while households in Mukumbi belonging to high income. Mushindamo and St Francis had the least households with 8% and 16% respectively. These two blocks also had the highest number of households in the low incomes category. Lunga block on the other hand had 32% of households in low income category and 20% in high incomes. Mutanda, the block nearest to Solwezi than all other blocks, had more households in high income category, 27%, than in low income category, 20%.



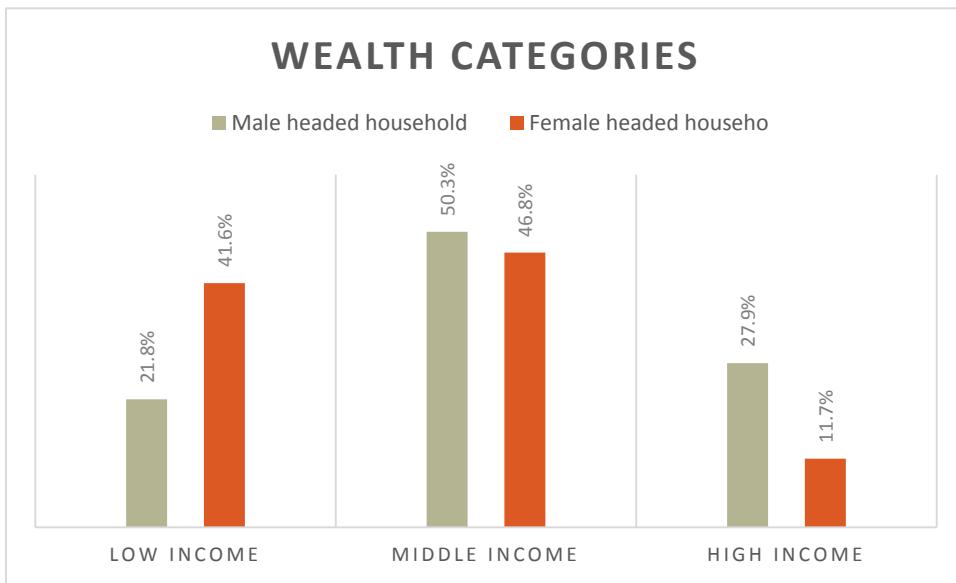
**FIGURE 25: WEALTH CATEGORIZATION OF HOUSEHOLDS IN DIFFERENT BLOCKS**

Wealth scores significantly differed between blocks and between different wealth categories (Table 32).

**TABLE 32: AVERAGE WEALTH SCORES PER BLOCK**

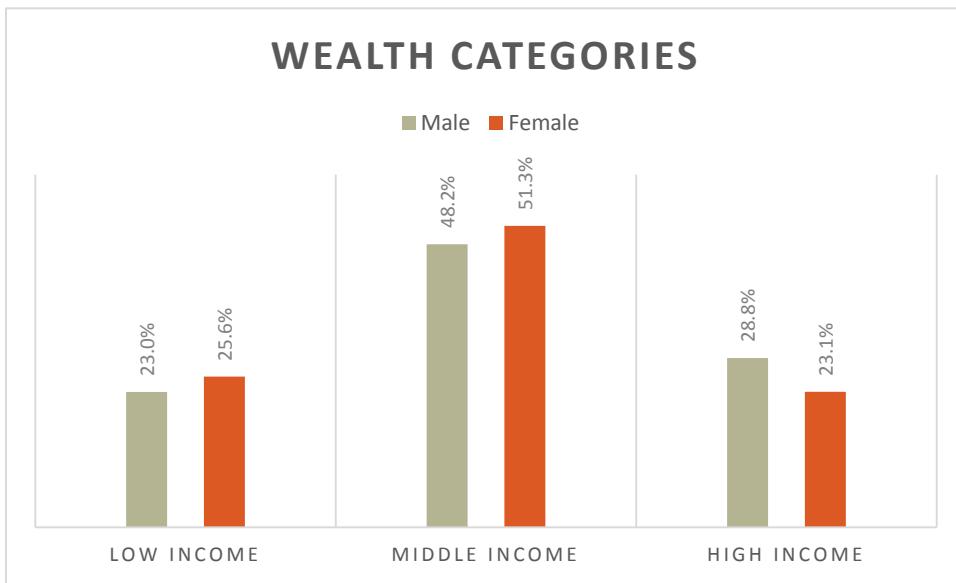
Wealth categories	Low income			Middle income			High income		
Blocks	Mean	Std. Dev.	N	Mean	Std. Dev.	N.	Mean	Std. Dev.	N
<b>St. Francis</b>	-2.0	0.4	29.0	-0.6	0.58	45	3.0	3.0	14.0
<b>Mutanda</b>	-1.8	0.3	31.0	-0.5	0.61	78	3.1	2.6	40.0
<b>Lunga</b>	-2.0	0.3	22.0	-0.5	0.60	33	1.8	1.5	14.0
<b>Mushindamo</b>	-1.8	0.2	18.0	-0.7	0.62	28	1.7	1.0	4.0
<b>Mukumbi</b>	-1.7	0.3	10.0	-0.6	0.58	33	3.5	2.6	38.0
<b>Total</b>	-1.9	0.3	110.0	-0.6	0.60	217	3.0	2.5	110.0

A comparison between male and female headed households showed that more female headed households fell in the low income category while a higher percent of male headed households significantly fell in middle income and high income categories. Only 11% of female headed households belonged to the high income category (Figure 26). This therefore suggests that female headed households owned less assets than male headed households and should therefore be targeted to enable them move out of the low income category.



**FIGURE 26: DIFFERENCE IN WEALTH BETWEEN MALE AND FEMALE HEADED HOUSEHOLDS**

There was no significant difference in wealth categorization between male and female farmers,  $P>0.05$  (Figure 27).



**FIGURE 27: DIFFERENCE IN WEALTH BETWEEN MALE AND FEMALE FARMERS**

The difference in ownership of assets by different wealth categories is presented in Table 33.

Low, middle and high income households differed significantly in ownership of all assets owned. Households in the high income category significantly owned more assets than other middle and low income households. Land ownership did not significantly differ between households in the different wealth categories. High income households had better access to information as more households in this category owned mobile phones, radio, television, computer and accessed internet more than the middle and low income households, 87%, 81%, 59.1%, 14.5% and 12.7% respectively. Least percent of low income households owned mobile phones, 12.7% and radio 30.7%. These households did not own any computer and had no internet access and had the least access to electricity (2.7%). The number of rooms in homes of high income households was significantly higher than middle and low income household's average of 4, 3 and 2 rooms respectively.

High income households also had assets that would assist their mobility. A higher proportion of households in the high income category owned bicycles, solar/electrical systems, and motor vehicles. A few, 8.2% of the households owned motorcycles.

TABLE 33: ASSET OWNERSHIP BY DIFFERENT WEALTH CATEGORIES

Household assets	WEALTH CATEGORIES ((% of households)			P value
	Low (n=110)	Middle (n=217)	High (n=110)	
Furniture and furnishings	63.6	55.8	77.3	***
Radio/cassette/DVD player	30.9	74.7	80.9	***
Mobile phone	12.7	75.6	87.3	***
Bicycle	64.5	81.1	87.3	***
solar panel/electrical inverters	5.5	40.6	70.9	***
Rental house	1.8	11.5	28.2	
Land ownership	100.0	99.1	97.3	<b>0.149</b>
Television	0.9	15.2	59.1	***
Motor cycle	0.9	6.9	8.2	**
Generators	2.7	4.6	23.6	***
Internet access	0.0	0.0	12.7	***
Computer	0.0	0.9	14.5	***
Motor vehicle	0.0	0.5	14.5	***
Electricity	2.7	23.5	44.5	***
Fuel wood	High quality	0.0	0.5	**
	Medium quality	0.0	15.2	***
	Low quality	100.0	84.3	***
Floor material	High quality	0.0	2.3	63.6
	Medium quality	0.9	0.0	0.0
	Low quality	99.1	97.7	36.4
Wall materials	High quality	0.0	8.8	65.5
	Medium quality	91.8	87.6	34.5
	Low quality	8.2	2.8	0.0
Toilet	High quality	0.0	0.0	3.6
	Medium quality	0.0	0.9	17.3
	Low quality	100.0	99.1	79.1
Roof materials	High quality	58.2	91.2	98.2
	Medium quality	0.9	0.0	0.0
	Low quality	40.0	7.8	0.9
Water sources	High quality	0.0	0.0	1.8
	Medium quality	25.5	36.9	39.1
	Low quality	74.5	63.1	59.1
Number of rooms	mean (Std. dev)	2.28 (0.69)	3.04 (1.04)	4.36 (1.85)

\*\*\*p value &lt;0.001, \*\* p value&lt;0.05

Low incomes households mainly used low quality fuel wood such as firewood and crop residue as their main source of fuel wood. High income categories not only used the low quality fuel wood but also used medium quality such as charcoal. Low and middle income households also used low quality material in building their floors. The floors were mostly made of dirt, soil or dung. High income household not only had the low quality materials for their floors, a few households used high quality materials such cement and burnt bricks. The toilets used by

households in Solwezi were mainly of low quality that include shared latrines and nearby bushes. Households in the low and middle income category mainly used low quality latrines while households in high income used both low and middle quality latrines such as private pits.

### **3.12 INFRASTRUCTURE**

#### **3.12.1 TRANSPORT SERVICES, ROAD SYSTEMS**

Road infrastructure is essential in everyday livelihoods of farmers, more so for farmers in rural areas. Road infrastructure ensures households have access to markets, have access to health and information facilities and can take their products to the market when harvested. In Solwezi district, at least three of the five blocks visited had access to a tarmac road with the least access to tarmac road being in Mushindamo and St Francis (Table 34).

**TABLE 34: ROAD INFRASTRUCTURE IN SOLWEZI DISTRICT\_TARMAC ROAD**

Different road infrastructure	St. Francis	Mutanda	Lunga	Mushindamo	Mukumbi	Solwezi
<b>Trunk road</b>						
<b>Accessibility (%)</b>						
No	91	18	25	98	33	46
Yes	9	82	75	2	67	54
<b>Usability of the different road types (%)</b>						
No	9	1	7	18	0	5
Yes	91	99	93	82	100	95
<b>Commonest way of reaching nearest trunk road (%)</b>						
Walking	2	88	68	0	70	54
Taxi (car)	7	1	0	10	6	4
Bus/minibus	74	0	1	78	16	27
Motorcycle	5	0	3	0	0	1
Bicycle	9	11	28	2	7	11
Other (Specify)	3	0	0	10	0	2
<b>If un usable, Why</b>						
Bad weather	2	0	0	0	0	0
Bad terrain	0	0	0	0	0	0
Poor drainage	0%	0%	0%	0%	0%	0%
Pot holes	2%	0%	7%	8%	0%	3%
Not applicable to the context	0%	0%	0%	0%	0%	0%
Bushy roads	0%	0%	0%	0%	0%	0%

Households that had access to the tarmac road considered it usable and is accessed mainly through walking in Mutanda, Lunga and Mukumbi. In St Francis and Mushindamo farmers accessed the road via a bus. Other commonly found road infrastructure in Solwezi was feeder and community access road, where 71% and 85 % of households accessed these roads respectively (Table 36). There were few murram roads in the area accessed by only 33% of households interviewed. The feeder, community and murram roads were considered usable by households. Murram and feeder roads were accessible through walking as well as use of bicycles. Community roads were mainly accessed through walking (Table 35).

TABLE 35: OTHER ROAD INFRASTRUCTURE IN SOLWEZI

Different Road infrastructure	St. Francis (%)	Mutanda (%)	Lunga (%)	Mushindamo (%)	Mukumbi (%)	Total (%)
	n=88	n=149	n=69	n=50	n=81	n=437
<b>Murram road</b>						
<b>Accessibility</b>						
No	75	57	75	54	77	67
Yes	25	43	25	46	23	33
<b>Usability of the different road types</b>						
No	3	19	9	14	0	10
Yes	35	66	22	48	26	43
<b>Commonest way of reaching nearest trunk road</b>						
Walking	32	54	20	36	37	39
Taxi (car)	2	3	0	0	0	1
Bus/minibus	13	2	9	14	6	7
Motorcycle	1	0	0	2	1	1
Bicycle	13	16	22	26	4	15
Other (Specify)	40	25	49	22	52	36
<b>If unusable, Why</b>						
Bad weather	0	0	0	0	0	0
Bad terrain	2	0	0	2	0	0
Poor drainage	0	0	0	0	0	0
Pot holes	0	1	4	10	0	0
Not applicable to the context	0	0	0	0	0	0
Bushy roads	0	1	0	2	0	0
Other (specify)						
<b>Feeder road</b>						
<b>Accessibility</b>						
No	11	37	33	14	37	29
Yes	89	63	67	86	63	71
<b>Usability of the different road types</b>						
No	9	19	17	18	19	17
Yes	91	81	83	82	81	83

<b>Commonest way of reaching nearest trunk road</b>						
<b>Walking</b>	72	58	57	66	57	61
<b>Taxi (car)</b>	5	3	0	4	1	3
<b>Bus/minibus</b>	7	7	6	0	5	5
<b>Motorcycle</b>	0	0	3	2	0	1
<b>Bicycle</b>	9	14	19	24	15	15
<b>Other (Specify)</b>	8	17	16	4	22	15
<b>If un usable, Why</b>						
<b>Bad weather</b>	0	0	0	0	0	0
<b>Bad terrain</b>	2	0	1	8	0	2
<b>Poor drainage</b>	0	0	0	0	0	0
<b>Pot holes</b>	0	1	0	4	0	1
<b>Not applicable to the context</b>	0	0	0	0	0	0
<b>Bushy roads</b>	0	0	0	2	0	0
<b>Other (specify)</b>						
<b>Community access</b>						
<b>Accessibility</b>						
<b>No</b>	16	15	10	4	22	15
<b>Yes</b>	84	85	90	96	78	85
<b>Usability of the different road types</b>						
<b>No</b>	16	11	10	0	19	12
<b>Yes</b>	84	89	90	100	81	88
<b>Commonest way of reaching nearest trunk road</b>						
<b>Walking</b>	82	89	86	100	78	86
<b>Taxi (car)</b>	0	1	0	0	0	0
<b>Bus/minibus</b>	0	1	0	0	2	1
<b>Motorcycle</b>	0	0	0	0	0	0
<b>Bicycle</b>	3	3	4	0	0	3
<b>Other (Specify)</b>	15	6	10	0	20	10
<b>If un usable, Why</b>						
<b>Bad weather</b>	0	0	1	0	0	0
<b>Bad terrain</b>	0	0	0	0	0	0
<b>Poor drainage</b>	0	0	0	0	0	0
<b>Pot holes</b>	0	0	1	0	0	0
<b>Not applicable to the context</b>	0	0	0	0	0	0
<b>Bushy roads</b>	1	5	0	0	0	2
<b>Other (specify)</b>	15	7	7	0	19	10

The distance to the different road infrastructure varied between blocks (Table 36). Farmers in St Francis and Mushindamo travelled a greater distance to reach a tarmac road while those in Mutanda and Mukumbi travelled the least. Community feeder roads were highly accessible in all blocks.

TABLE 36: DISTANCE TO DIFFERNT ROAD INFRASTRUCTURE

	Trunk road		Murram road		Feeder road		Community road	
	Distance (km)	Distance (minutes)	Distance (km)	Distance (minutes)	Distance (km)	Distance (minutes)	Distance (km)	Distance (minutes)
<b>St. Francis</b>	49.2	86.6	12.3	24.8	23.5	20.8	1.0	6.4
<b>Mutanda</b>	6.4	16.1	5.3	13.9	6.7	13.7	5.9	7.0
<b>Lunga</b>	8.7	49.8	5.2	37.2	6.9	27.3	1.0	6.3
<b>Mushindamo</b>	104.7	222.3	9.0	56.2	7.5	43.8	0.1	2.4
<b>Mukumbi</b>	7.9	23.8	3.5	12.8	2.4	14.2	0.9	5.2
<b>Total</b>	26.9	60.6	6.8	22.7	6.5	21.0	2.6	5.9

### 3.12.2 MARKETS INFRASTRUCTURE AND OTHER FACILITIES

Only 47% of farmers mentioned to have access to crop market while 36% had access to livestock market. A higher proportion of households, 59%, in Lunga block had access to crop market followed by Mushindamo and Mukumbi at 52% each. St Francis had the least access to crop and tree market with only 31% mentioning to have access to these markets. Mushindamo had the highest proportion of farmers accessing livestock market. Since farmers in Solwezi rarely kept livestock, the market in Mushindamo is mainly for goats and chicken. St Francis had the least proportion, 19% of farmers accessing livestock markets (Table 37).

Agrovets were only accessible to 23% of farmers in Solwezi district. With Mutanda and Mushindamo constituting highest proportion. About 36% of households in each of the two blocks had access to Agrovets. This would be due to Mutanda proximity to Solwezi town and Mushindamo's proximity to the Congo border. The border allows Zambian nationals to cross over to sell and or buy basic products. The livestock markets and agrovets are only available by use of buses with a few farmers walking long distances. Crop markets are more available than livestock and agrovets and a higher percentage of farmers' access through walking to the market. A few farmers in St Francis, 52%, had to take the bus to arrive to the crop market.

TABLE 37: HOUSEHOLDS ACCESS TO MARKETS AND AGROVETS IN SOLWEZI

Different market infrastructure	St. Francis (%) n=88	Mutanda (%) n=149	Lunga (%) n=69	Mushindamo (%) n=50	Mukumbi (%) n=81	Total (%) n=437
<b>Access to crop market</b>						
No	69	54	41	48	48	53
Yes	31	46	59	52	52	47
<b>Usability of the crop market</b>						
No	5	1	7	14	1	5
Yes	95	97	93	86	99	95
<b>Common way of reaching nearest crop market</b>						
Walking	24	39	51	18	43	36
Taxi (car)	6	10	0	0	7	6
Bus/minibus	52	33	17	14	32	32
Motorcycle	3	0	3	6	0	2
Bicycle	8	13	26	62	15	20
Other (Specify)	7	5	3	0	2	4
<b>Access to livestock market</b>						
No	81	64	55	48	62	64
Yes	19	36	45	52	38	36
<b>Usability of the livestock market</b>						
No	9	7	6	14	0	7
Yes	91	93	94	86	100	93
<b>Common way of reaching nearest livestock market</b>						
Walking	15	28	35	20	31	26
Taxi (car)	6	11	1	0	12	7
Bus/minibus	64	42	30	12	43	41
Motorcycle	2	0	3	6	0	2
Bicycle	3	12	26	62	12	18
Other (Specify)	10	7	4	0	1	5
<b>Access to Agrovet</b>						
No	98	64	78	64	85	77
Yes	2	36	22	36	15	23
<b>Usability of the Agrovet</b>						
No	10	2	10	14	0	6
Yes	90	98	90	86	100	94
<b>Common way of reaching the nearest Agrovet</b>						
Walking	0	30	10	18	5	15
Taxi (car)	6	7	1	4	15	7
Bus/minibus	89	49	67	40	72	63
Motorcycle	2	0	1	0	0	1
Bicycle	2	14	20	38	7	14
Other (Specify)	1	1	0	0	1	1

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## **4.0 CONCLUSIONS**

The objective of the study was to provide information for understanding initial livelihood status of households in Solwezi district. To achieve this, the status of household livelihoods in Solwezi was determined through collection of data on institutions, agricultural and livestock production with a focus on village chicken, soya beans and Solwezi beans. Household income, assets, dietary diversity, wealth status and infrastructure were also assessed. Dietary diversity and wealth index was computed as a proxy for food security and poverty levels of households in the area respectively.

In Solwezi, mining has been gaining prominence in the area and is increasingly becoming a major employer to the local community. Mining has brought new opportunities to residents of Solwezi, as most of the male members are employed in the mines hence bringing new income stream. The mines also provide a huge market for produce from around Solwezi. Having mines in the area also opens up the area for new traders and supermarkets that provide markets for agricultural and livestock products. This potential however remains untapped. Despite this new income source, the study found that households are still highly dependent on agricultural production for their livelihoods especially by vulnerable groups such as the elderly, females and children.

Farmers in Solwezi had an average of three crop enterprises in their farm for season 2014-2015 with almost all farmers, 98%, mainly producing maize. Other crop enterprises include Solwezi beans, groundnuts and sweet potato. Soya beans, one of the focus crops for the VIP4FS project, was produced by 17.2% of farmers many of whom were found in Mushindamo and a few in St Francis and Mutanda blocks. Soya beans production was majorly hampered by lack of reliable markets, limited access to extension and high incidence of pests and diseases. Solwezi beans was also hampered by high incidences of pests and disease and low productivity of the crop. Any future interventions should therefore focus on production to improve productivity and linking farmers to reliable buyers.

Village chicken, the only livestock enterprise kept by more than 90% of households, was hampered by high mortality due to the New Castle disease. Despite many households having

village chicken, less than 50% of the households consumed eggs within the 7 day period preceding the survey. This therefore indicates very low egg production by the chickens. Farmers in all blocks also lost about 50% of all village chickens owned either to the Newcastle disease or to predators. This study has shown that farmers lack proper housing for their chicken and hence prone to predatory attacks. Keeping chicken was also not seen as a business enterprise and was only kept for consumption

Solwezi beans and village chicken are constraint at production level and therefore interventions would be more meaningful if focus would be on boosting production as well as use of improved management practices. Furthermore, farmers need business skills so that they can rear village chicken as a business enterprise. Other interventions for improving the productivity of chicken should also focus on proper housing and management of the Newcastle disease (ND) through a community based control approach that could entail training of community trainers who will in turn spearhead vaccination campaigns to tackle ND. Soya beans would highly benefit from vertical integration where farmers are connected to available markets through linkages available within and outside of Solwezi. Better performing farmers and farmer groups would be used as a medium for better economies of scale.

Although farmer groups were found to be highly prevalent in Solwezi, most of the groups were only formed to receive inputs from government. The farmer groups did not have own mandates and mainly did not set their priorities. The groups had limited members' commitment hampered by poor leadership. Group members could also not adequately state challenges faced by their groups. We suggest the project to focus on strengthening farmer group functions, training farmers on membership and leadership responsibilities, governance and group dynamics. Training on importance of groups and benefits that accrue when members aggregate would boost the farmers to establish own work plans besides receipts of inputs. Furthermore working in groups could also enable them to work collectively thus benefiting from economies of scale both in production and marketing.

## **Dietary diversity**

Using the household's dietary diversity to establish household's food security in Solwezi, dietary analysis shows that a higher proportion of households fell into the borderline category (moderate dietary diversity) with only Mukumbi block having more households in acceptable category (good dietary diversity). St Francis and Mushindamo had more households in the "poor" category than those in the acceptable category, which would then be classified least dietary diverse blocks. The study also found that higher percentage of female headed households had poor and moderate diet diverse than male headed households which were considered to have better dietary diversity. Households in all blocks mostly consumed cereals, roots and tubers, vegetables and oils while least consumed milk, eggs and meat were least consumed. Poor dietary diverse households consumed less of proteins, pulses and beverages with an average of 1.69, 1.97, 1.9 times respectively in a seven day period whereas households in acceptable categories consumed all foods at a higher rate than other categories. Acceptable category consumed proteins 11.18 times, stapes 11.79 and beverage and sugars 9.82 times within seven day period. Improving the production of village chicken, soya beans and Solwezi beans will have a positive impact on diet diversity. Deliberate effort needs to be made to ensure that female headed households are targeted so that their household diet diversity can improve.

## **Wealth index**

Using assets owned by households, St Francis, Mutanda and Lunga and Mushindamo blocks were considered middle income households as they all had higher proportion of households in the middle income category. Mukumbi block was wealthiest in the analysis as it had highest category of farmers in high income category. Mushindamo and St Francis had less proportion of farmers in the high income and therefore had more farmers in the low income category and would therefore be considered low income blocks. High income households had better access to information as more households in this category owned mobile phones, radio, television, computer and accessed internet more than the middle and low income households, 87%, 81%, 59.1%, 14.5% and 12.7% respectively. Least percentage of low income households owned mobile phones, 12.7% and radio 30.7%. These households did not own any computer and had no internet access and have least access to electricity only 2.7% of households had electricity in

their homes. Land ownership did not significantly differ between households in the different wealth categories.

### **Market infrastructure**

Accessibility of crop and livestock markets were quite low in Solwezi, with 47% and 36% households pointing to have access to these markets respectively. Agrovets were also not generally accessible with only 23% of farmers having accessed an agrovet. These facilities improve crop production and sales. Without proper information streams and information sharing platforms farmers would not be able to improve on their management practices. Having agrovets in the different camps and villages especially established by farmers groups would be a sure way of improving production of village chicken, Solwezi beans and soya beans which are highly constrained by pests and diseases.

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