RESADE





COUNTRIES BASELINE SURVEY REPORT

Improving Agricultural REsilience to SAlinity Through DEvelopment and Promotion of Pro-poor Technologies and Management Strategies in Selected Countries of Sub-Saharan Africa (RESADE project)

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1 Introduction

1.1 Project context, objectives, and expectations

This report focuses on the baseline survey data and findings conducted in the framework of the RESADE project, an agriculture project funded by the International Fund for Agricultural Development (IFAD) and the Arab Bank for Economic Development in Africa (BADEA). The project is implemented by the International Center for Biosaline Agriculture (ICBA) in partnership with the national partners- the National Agricultural Research and Extension Services (NARES). RESADE project has been introducing and promoting adapted climate-smart technologies and new crop varieties with high tolerance to salinity and drought-resilient crops to small-scale farmers in several villages in the targeted seven (7) countries since 2019. The targeted countries are Gambia, Liberia, Sierra Leone, and Togo in Western Africa, and Botswana, Mozambique, and Namibia in Southern Africa. Using the best practice hubs and farmer-field schools' approaches, the project allowed the dissemination of sustainable technologies, to increase awareness and strengthen smallholder farmers with knowledge of new agriculture technologies to especially overcome the growing soil salinity challenges, increase crop yield, and ensure household food security in the targeted areas.

The RESADE project aims in 48 months to support national agricultural development policies and strategies of the targeted countries by rehabilitating and increasing the productivity of salinity-affected lands and providing technical assistance in salinity management to other IFAD- and BADEA-funded projects being implemented in these countries as well. The initiative will utilize ICBA's crucial previous and current projects as a basis for pertinent and valuable experience in implementing salinity management techniques for small-scale farmers especially women farmers living in severe conditions environments. These projects essentially include:

- Rehabilitation and Management of Salt-affected Soils to Improve Agricultural Productivity (RAMSAP) being implemented in Ethiopia with funding from IFAD;
- Creating Opportunities to Develop Resilient Agriculture (CODRA), implemented in Mauritania and Senegal as well as in Yemen, Egypt, and Lebanon, also with funding from IFAD;

- Improving Crop and Seed Production Systems under Water/Irrigation Management in Sub-Saharan Africa, implemented in Burkina Faso, Gambia, Niger, Nigeria, Mauritania, Mali, and Senegal, with funding from the Islamic Development Bank (IDB).

Therefore, the RESADE project also aims to enhance food security and alleviate poverty among smallholder farmers in salinity-affected areas, especially women, in selected countries. To achieve this, the project's main objective is to boost agricultural productivity and income in these areas by eventually introducing salt-tolerant new crops and best agronomic management practices; developing value chains for introduced cropping systems; and enhancing the skills of farmers and extension workers in agriculture that is resilient to salinity and climate-smart, in partnership with NARES.

As the expected outcomes, the project looks forward to the following interconnected results:

- To impact approximately 11,550 smallholder farmers in specific areas, with at least half of them being women. The aim is for these farmers to adopt new cropping systems that can withstand changes in climate and salinity, and to utilize innovative agriculture intensification technologies and practices that are climate-friendly and sustainable. These methods will help to prevent soil salinization, improve soil quality, and further increase productivity as well.
- To increase the productivity of saline lands by 30% and the economic returns of the targeted smallholder farmers by 20%. This will increase farmers and economic welfare.
- The incorporation of climate-smart and salinity-resilient agricultural models and approaches into national agricultural development policies and strategies in the seven targeted countries. That will improve agriculture policy development in the fight against climate change.

1.2 Baseline Survey Context

Before implementing a development project or any intervention, a baseline study is necessarily conducted to gather data on the current situation, attitudes, and behaviors of the targeted population. This initial assessment serves as a reference point for evaluating progress throughout the project cycle. This is why the baseline survey should be followed by an end-line survey for impact assessment purposes that enable us to compare the evolution introduced after an intervention. By identifying gaps and providing valuable insights, the baseline study also helps in developing appropriate interventions and establishing important indicators to track progress toward achieving the desired outcomes.

The purpose of this socioeconomic baseline survey before the implementation of the climate-smart technologies in the framework of the RESADE project is to provide an information base against which ICBA

will measure the degree and quality of change after the implementation of its projects. The information provided by this survey will be used as a reference or counterfactual during the impact assessment phase for measuring the project's profitability, success, or failure. The information generated from the Baseline will provide historical points of reference that will inform project planning, target setting, monitoring, and evaluating change during and after project implementation as well as impact assessment.

The RESADE project baseline survey implementation had some specific objectives, which were:

- To establish the starting values for all performance indicators related to impacts and outcomes in the countries being targeted.
- To gather and analyze data on the current situation of the beneficiaries being targeted.
- To gather and analyze data on the production sources and levels, growing crops, income, access to materials and services, productive resources, as well as the nutrition and food security of the farmers being targeted.
- To determine the level of salinity and its effect on crop production and yields, as well as potential strategies used in coping to overcome these challenges.

Apart from the introduction section, the following section provides the methodology including the study areas description, the sampling method, the questionnaire design, and the data collection and processing. The last section presents the main findings from the data collected analysis, the conclusions, and recommendations.

2 Methodology

This section of the report deals with the intervention site description, the approach, and the methodology used to conduct the baseline survey and analyze the data collected.

The desk study on the project design and proposal including details on the stakeholders and target beneficiaries helped to develop the sampling and data collection methodology and the study tools. The survey work was carried out by the country's local partner's team under the supervision of ICBA scientists and the project management team. The primary data was collected through an individual survey from randomly sampled farmers' households in the targeted areas, using a structured questionnaire in the English language. However, to avoid any confusion, the questionnaires were translated into local languages when necessary.

2.1 Study Areas

The ICBA proposes to implement the RESADE project in seven Sub-Saharan countries in which salinization of agricultural land is a growing problem and where agriculture plays an important role – namely, Gambia, Liberia, Sierra Leone, and Togo in Western Africa and Mozambique, Botswana, and Namibia in Southern Africa. However, the baseline data were collected only in the first 6 countries. However, the survey has covered 5 regions and 6 villages in Liberia (1), 4 villages in the northern region of the Kambia district in Sierra Leone (2), 8 villages in the South and Sul regions (Moamba district) of Mozambique (3), 10 villages in the regions of Central River Region North and Central Revier Region in the district of Lower Saloum in The Gambia (4) and 4 villages in the Assahoun district of Maritime region of Togo (5) and finally in Kweneng district of Botswana (6) (Table 2.1).

Table 2-1. Survey covered areas.

Countries	Regions	Districts	Villages	Village number
Togo	Maritime region	Assassin	Ado keke kope	4
			Atti Betekpo	
			Atite Kope	
			Atti Apedokoe	
The Gambia	Central River Region North	Lower Saloum	Balagharr Mbentenki	10
			Balagarr Njog	
			Balagarr Njoke	
			Balangarr Mbentenke	
			Ballangarr	
			Jahurr Mandinka	
			Jahaour Tukulor	
			Jahaurr	
			Jahour Saloum	
			Jahurr Fula	
Mozambique	South and Sul region	Moamba	Bairro de Abril	8
			Bairro Central	
			Central	
			Cimento	
			Condene	
			Madinguir	
			Matadouro	
			Ndlavela	
Liberia	Lower Bassa Lower Grand Bassa	District No. 1	Edina	6
			Edina City	
			King Town	
			Kingsville	
			Pluncal	
			Sam Town	
Sierra Leone	Northern region	Kambia district	Makatic	4
			Robat	
			Robumbeh	
			Rokupr	
Botswana		Kweneng district	Gabane	

2.2 Sampling

To select respondents in specific districts or regions, the selection criteria during the sampling process were developed. A probability single-stage cluster sampling method to choose participants in target regions across each country has been used. The two-stage sampling approach involved selecting primary units of regions and villages, and households as the ultimate sampling unit. Finally, a total of 473 were interviewed across the six countries, with 64 farmers in Liberia, 82 in Sierra Leone, 51 in Mozambique, 60 in Gambia, 152 farmers in Botswana, and 64 respondents in Togo (Table 2.2). The survey covered at least 5-10 villages in the different regions and districts in each country, but the number of households interviewed was not fairly distributed among the countries. The sample size was determined based on the available resources and time for data collection.

Table 2-2. Number of farmers interviewed by country

Countries	**Number of farmers**
Togo	64
The Gambia	60
Mozambique	51
Liberia	64
Sierra Leone	82
Total	321

2.3 Questionnaire Design

The survey sheet comprises 10 sections, each containing structured questions. Its objective was to gather information about various aspects of the farm household's livelihood. These sections cover general farming aspects and household characteristics, including demographic, social, and economic factors. The survey also aims to collect data on geographical and spatial factors that impact farming, such as natural disasters, market access, infrastructure access, and road access conditions.

The purpose of Section l is to collect basic information about the **household's location and demographics**. This information is crucial for ensuring the accuracy and validity of the survey data. Additionally, it will allow us to keep track of individual households during the later stages of the project and the impact

evaluation analysis. In Section II, information is gathered regarding the **landholdings of farmers** that aim to determine the per-capita land size that is available for irrigation and non-irrigation farming. Additionally, this section will provide insights into the soil quality and whether households have access to irrigation systems. Section III focuses on the **production portfolio and gathering information on production inputs and outputs**. The section lists all questions on the potential inputs used in different crop production, as well as the crops farm households produce. It also includes information on the quantities of crops consumed at home or sold to the market, along with their respective prices. Section IV provides information on the **labor involved in farming activities**. This labor is categorized into three sub-sections: own labor, hired labor, and household labor employed in the non-farm sector. In Section V, we requested data on **household income by source**. It's necessary to differentiate between various income sources. While farm income will be the main indicator of farm profitability for the impact assessment, income from other sources can also impact the household's capacity to buy production inputs and hire labor, which in turn affects production and overall well-being. Therefore, it's crucial to consider income from other sources in the impact evaluation analysis. The objective of Section VI is to gather information about the **assets owned by households** to determine their poverty level. To create an accurate index, it is necessary to collect information about all assets owned. Therefore, this section aims to identify the types and number of assets owned by each household. In Section VII, there is a comprehensive questionnaire that covers all **potential natural disasters that farmers may encounter.** It also explores how these disasters directly impact farming and whether households have implemented any coping mechanisms for loss. Additionally, the section gathers data on soil and water salinity, which is one of the crucial aspects of the project. Section VIII represents information on gender that will be used to assess **women's involvement in agricultural activities**, later in the project as a whole, and in decision making. In Section IV, we aim to collect data on **households' access to food**. This information will help establish a benchmark for food security, which we will use during the evaluation phase to measure the project's impact on food security and child nutrition before and after implementation. Finally, section V gathered information on household **access agricultural market and information on agricultural product market prices**. This section's questions seek to collect data on the value chain and market functioning to take actions of development during the project implementation.

2.4 Data Collection and Processing

Our team, responsible for collecting data, underwent training on survey questionnaires and data collection processes. Before starting the survey, we conducted a pre-test of the questions. Any issues

raised by the interviewers were thoroughly examined, discussed, rectified, and incorporated into the final survey questions. The NARES teams in each country collected data using the structured questionnaire between January and March 2020 for the first round of the project. All the data collected was entered into the MS Access database and later on into Excell. Once data entry and cleaning were complete, it was imported into STATA software for various statistical descriptive analyses, and the findings are presented below.

3 Results for Botswana

3.1 Country Profile

Botswana, whose capital is Gaborone, is a landlocked country in southern Africa, bordered by Namibia to the west and north, Zimbabwe to the northeast, Zambia to the north, and South Africa to the south and southeast. The country accounts for 581,730 sq km with 566,730 sq km of land and 15,000 sq km of water area (CIA World Factbook – Botswana, 2024). Botswana had a population of around 2.6 million according to the most recent knowledge update in 2022. The country has experienced steady economic growth over the years, driven by diamond mining, which contributes significantly to its GDP. Yet poverty remains high despite Botswana's relatively high level of income, job creation is falling behind, unemployment is high on a historical basis (25.4% by the end of 2022) and the level of inequality, with a Gini index of 53.3, is one of the highest in the world (World Bank, 2023). Due to multiple shocks, economic growth has been declining since 2010 and has become more volatile in recent years. GDP grew at an average annual rate of 3.2% between 2009 and 2014 but slowed to 2.4% between 2015 and 2021. GDP per capita growth has also slowed from 1.2% to 0.4% (Diaz-Bonilla et al., 2023).

Agriculture plays a crucial role in Botswana's economic development (comprises approximately 2% of GDP), by providing employment (employs 20.4% of the working population), and income, and contributing to food security (Statistics Botswana, 2019). However, the sector faces challenges such as water scarcity and variable climatic conditions such as extreme drought. Botswana has diverse soil types, including sandy soils, clayey soils, and loamy soils. Soil fertility varies, and agricultural practices often require careful consideration of soil management. According to climate conditions, Botswana experiences a semi-arid to arid climate with hot temperatures, thus the country, like many in the region, is vulnerable to the impacts

of climate change, including changes in precipitation patterns and increased temperatures[1]. Maize (66.3% % of national cereal production), sorghum (28.4), millet (5.2%), and various types of beans are among the staple crops grown as strategic crops (MADFS of Botswana). Agriculture is dominated by traditional farming methods and mainly rainfed, but due to arid conditions, the rainfall is low and highly variable posing a risk to crop production so that many cultivable areas rely on irrigation for crop production (Temoso et al., 2021). Also, livestock farming, including cattle, is a significant component of agriculture (estimated at 80% part of GDP). Cattle, livestock, and grazing constitute Botswana's main agricultural products and exports by far. The cattle herd is estimated at 2.1 million head. Cattle production exceeds national requirements, and the country has exported a significant amount of beef to the European Union[2]. The majority of the crop farmers are subsistence farmers (70% of the country's citizens) who rely on the government for assistance to remain in farming (IFAD, 2020). Crop yields remain low due to droughts, prolonged dry spells within the season, poor soils, and low use of agricultural technologies by small-scale farmers, exacerbating the country's dependence on imports for basic (Jelinek et al., 2022). The FAO (2021) has reported that food insecurity in Botswana is continuing to increase as a result of the impact of COVID-19, exacerbating the country's vulnerability.

Despite its challenges, agriculture is still a good alternative for reducing poverty and creating employment (Statistics Botswana, 2019), and optimal yields are achievable through the use of appropriate technologies. This suggests that smallholders could improve crop yield by adopting appropriate technologies. Thus, adaptation strategies to climate change consequences in agriculture in Botswana include Implementing efficient water management practices to cope with water scarcity, encouraging crop diversification to adapt to changing climate conditions, embracing technology, such as drought-resistant crop varieties and precision agriculture, and involving local communities in the development and implementation of adaptation strategies. These can improve crop yields but also have environmental and socio-economic benefits for achieving sustainable dryland agriculture under the changing climate in Botswana. To raise arable land production and productivity at the farm level, the government as well as significant project interventions like the RESADE project have provided significant support to farmers. Table 3.1 summarizes the country's important indicators built from the World Bank microdata.

Table 3-1. Botswana-Country profile indicators

[1] https://www.wri.org/insights/highest-water-stressed-countries
[2] https://www.privacyshield.gov/ps/article?id=Botswana-Agricultural-Sectors

Indicators	Values
Population, total	2,630,296 (2022)
Population growth (annual %)	1.6 (2022)
GDP (current US$, value in billion)	20.36 (2022)
GDP per capita (current US$)	7,738.9 (2022)
GDP growth (annual %)	5.8 (2022)
Unemployment, total (% of total labor force) (modeled ILO estimate)	20.7 (2022)
Poverty headcount ratio at $2.15 a day (2017 PPP) (% of the population)	15.4 (2015)
Literacy rate, adult total (% of people ages 15 and above)	87 (2013)
Urban population (% of the total population)	72 (2022)
Total greenhouse gas emissions (kt of CO2 equivalent)	12,375 (2020)
CO2 emissions (metric tons per capita)	2.3 (2020)
Droughts, floods, extreme temperatures (% of population, average 1990-2009)	0.7 (2009)
Internally new displacement associated with disasters (number of cases)	780 (2020)
Forest area (% of land area)	26.7 (2021)
Agricultural land (% of land area)	45.6 (2021)
Crop production index (2014-2016 = 100)	147.3 (2021)
Livestock production index (2014-2016 = 100)	99.5 (2021)
Agriculture, forestry, and fishing, value added (% of GDP)	1.8 (2022)
Prevalence of severe food insecurity in the population (%)	26.7 (2021)

Source: World Development Indicators

3.2 Botswana Study Site and Data Characteristics

In the framework of the RESADE project, the survey was conducted in the peri-urban areas of Gaborone in the Gabane village. Gabane is a village in the Kweneng District of Botswana located 15 km west of Gaborone, the capital of Botswana. Agriculture is the main source of income for the older generation of the village in rapid urbanization. In addition, Kweneng district is one of the ten (10) agricultural districts in Botswana. It is one of the districts with the highest number of people living below the poverty line. The district has three (3) sub-districts Moshopa, Lentsweletau, and Letlhakeng which have a total of four hundred and forty-seven (447) farmers. The population for the study was determined using the Integrated Support Programme for Arable Agriculture Development (ISPAAD) data for the past five years since 2018. A stratified random technique was used to select the participants for the study. A sample of one hundred and six-one (161) respondents were selected to participate in the study which is equivalent to 36% of the population (Bartlett et al. 2001; Israel, 2003). A face-to-face interview was conducted from April to June 2022. The target was to interview 161 respondents and 152 managed to be interviewed. A structured questionnaire was used to collect quantitative data. The questionnaire was pre-tested in the field before the main survey. A team of enumerators was also trained before conducting the survey.

3.3 Household Demography and Socioeconomic Profile

In this section, the demographic characteristics of the sample respondents including gender, age, education, household composition, and marital status are represented. The data collection has included 152 farmers in total in the Kweneng district and its sub-district (Lentsweletau, Letlhakeng, and Moshupa) of Botswana. Results show that 50.66% (77 respondents) were men farmers and 48.68% (74 respondents) were women farmers with 1 missing information on gender between 25 minimum and 86 years old maximum. For both females and males, the average age was approximately 55 years old (Table 3.2).

Table 3-2. Respondents' gender and age distribution

Respondent gender	Number		Age (years)		
	Frequency	%	Mean	Min	Max
Male	77	51	55.54	27	86
Female	74	49	55.48	25	84
Total	151	100	55.51	25	86

The household roster information shows that the number of people in a household can range from a minimum of 1 person to a maximum of 9 people with a median of 2 individuals and a standard deviation of 3 meaning that the household size is clustered around the mean (which is also approximately 2 individuals). The table of household composition by age shows that the majority of household members, both male and female, fall between the ages of 15 to 65 years and 14 years and below. However, the smallest fraction of household composition for both male and female groups is made up of elderly respondents (those who are 65 years old or older) (Table 3.3).

Table 3-3. Household composition by gender and group of age

Household members information		Min	Max	Mean	Median	Std. Dev.
Household size		1.00	9.00	2.40	2.00	1.77
Male	Children (14 years of age and below)	1.00	3.00	1.22	1.00	0.55
	Adults (15 years of age and above)	1.00	5.00	1.38	1.00	0.71
	Adults (65 years of age and above)	1.00	2.00	1.09	1.00	0.29
Female	Children (14 years of age and below)	1.00	4.00	1.56	1.00	0.89
	Adults (15 years of age and above)	1.00	5.00	1.43	1.00	0.80
	Adults (65 years of age and above)	1.00	1.00	1.00	1.00	0.00

It has been reported that around 44 % of the respondents' men were a household head, while only about 29 % were female household heads. In total 74% of the respondents were heading a household and the rest 26% were a household other member such as spouse or children. The estimated average age of household heads is approximately 56 years old, with variations based on gender. For example, female household heads have an average age of around 56 years, while the average age for male household heads is estimated to be 56 years old. In addition, 77% of the household male heads are married while only 12% of the respondent's female household heads are married (Table 3.4).

Table 3-4. Household heads characteristics

Household head	Frequency (%)	Mean age. (years)	Married Freq (%)	Single Freq (%)	Widow Freq (%)
Male	67 (44.08)	55.88	75 (76.53)	12 (12.24)	3 (3.06)
Female	45 (29.60)	56.34	6 (12.50)	22 (45.83)	18 (37.50)
Total	112 (73.68)	56.06	81 (53.28)	34 (22.36)	21 (13.81)

Data on the literacy and education degree of the principal respondent and household members show that the majority 74% of all the respondents in the sample were literate (can read and write) compared to 26% illiterate (can neither read nor write). However, 67 % (99 respondents) of the heads of households in the sample are literate, while only around 33 % (49 respondents) of heads of households are thought to be illiterate. Of the household principal respondents who reported having received formal education, around 21% had completed primary school, 29% had secondary school level, and 11 % had completed a bachelor's degree (Table 3.5).

Table 3-5. Formal Education and degree obtained by the household head

	Frequency	%
Primary school	21	21
Junior Secondary School	29	29
Senior secondary school	7	7
A-level	3	3
Diploma	11	11
Bachelors	11	11
Master	9	9
PhD	2	2
Other	2	2
Total	100	100

Socio-economic data reported that pastoral farming (livestock production) is the largest (23.23%) source of household income of total household income followed by crop production (19.87) and permanent employment (16.50 %). Household income data revealed that the average household income is estimated at around 19,321 Botswana Pula (approximately USD 1,400 today), with significantly higher contributions from both women and men. However, when the data is disaggregated by gender, the contribution of women (an average of 28,664) to household income is considerably lower than that of men (an average of 40200.08). In addition, results revealed that most of the household income is spent on non-food items (2,047 Botswana Pula) than on food consumption (1,260 Botswana Pula). However, both males and females have a word to say in expenditure decision-making (Table 3.6).

Table 3-6. Decision-making by gender in Consumption expenditures

Decision maker	Food expenditure Freq (%)	Non-food expenditure Freq (%)
Men	15 (10.64)	13 (10.48)
Women	41 (29.08)	36 (29.03)
Both	81 (60.28)	75 (60.48)
Total	141 (100)	124 (100)

Data on household asset ownership shows that the most used assets owned by the respondents are houses (88%), followed by mobile phones (82s%), cars (57%), refrigerators (43%), solar panels (30%), electricity generators (25%), computers (24%), boreholes (21%), tractors (16%) and others. Many assets are collectively owned by both genders especially most of them own houses, mobile phones, and cars/trucks (Figure 3.1).

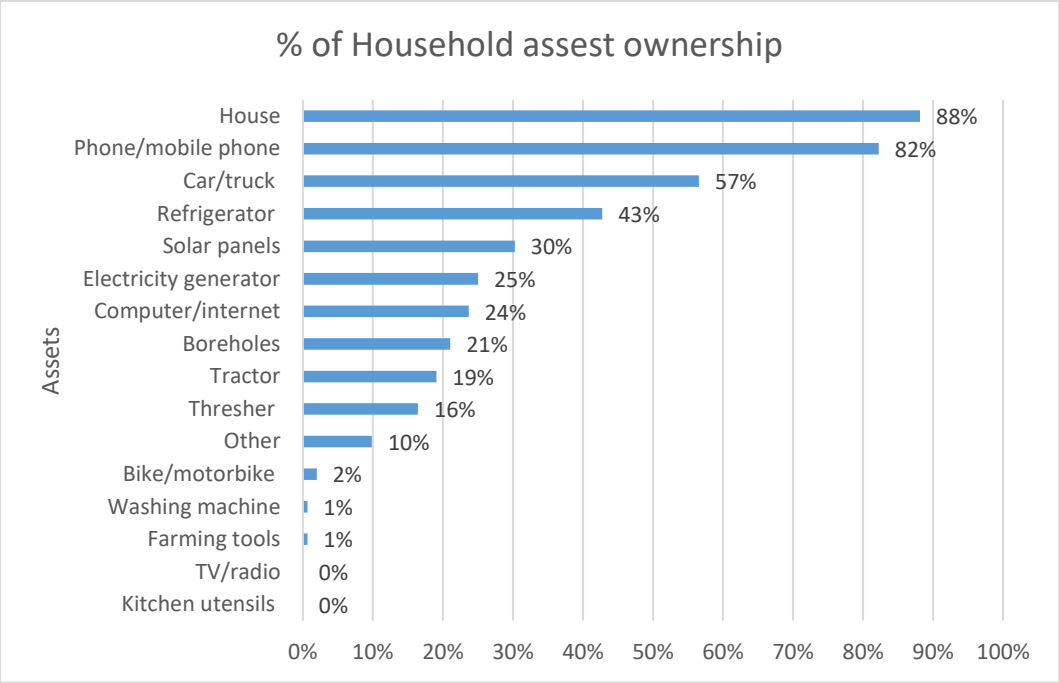

Figure 3-1. Household percentage of asset ownership

3.4 Agricultural holdings/Land ownership and agricultural production

The baseline survey data revealed that most of the farmers (78.67%) are operating in rainfed farming and both rainfed and irrigation combination (14.67%), while only a small fraction of 6.67% are using only irrigation systems. Also, the data collected show that 80% of the land in which the farmers operate is their possession, while only 18.42% of farmers were using land leased portion and almost 5% land rented. However, the average size of the land held by the farmers is 12.91 hectares in average of which 6.16 hectares are used for crop production, 4.92 ha are undeveloped, and 2.18 hectares are left fallow (Figure 3.2).

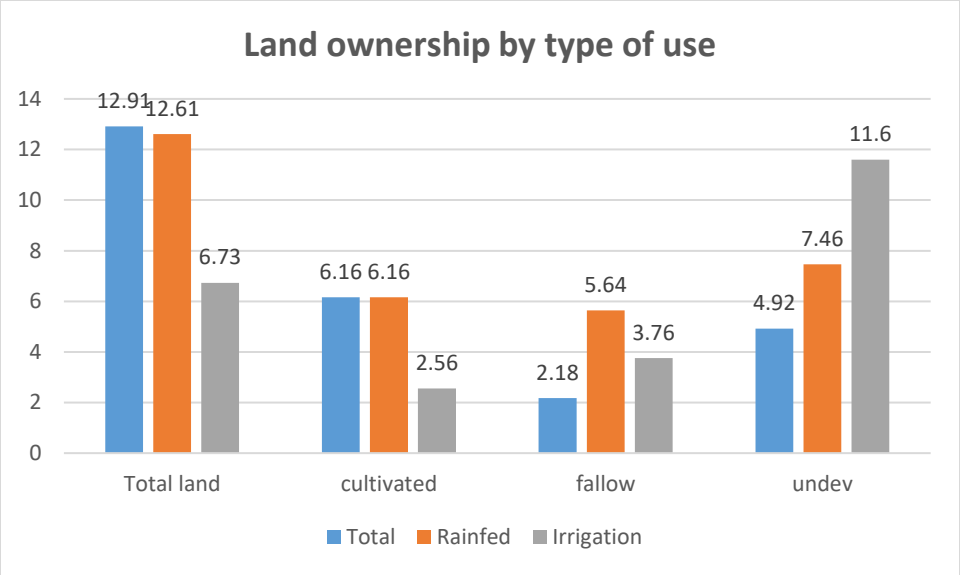

Figure 3-2. Land ownership by type of use

The respondents have also reported their perception of operated soil type and the perception rate of soil fertility according to crop productivity. On one hand, the analysis findings show that 45% of the soil was reported to be sandy, 37 % loam, and 14% clay. On the other hand, considering the soil fertility, 41 % of the households have rated the soil fertility level to be average, while 32% think that the soil fertility is good, 12% and 11% of the respondents have classified the soil quality to be poor and very good respectively. Only a small fraction, 3%, of the respondents think that their soil quality is very poor in terms of soil productivity (Table 3.7).

Table 3-7: Soil type and soil fertility

Soil type				Soil fertility			
Type	Frequency	%	Cumulative	Fertility level	Frequency	%	cumulative
Sandy	68	45.03	45.03	Very poor	5	3.29	3.29
Clay	21	13.91	58.94	Poor	18	11.84	15.13
				Average	62	40.78	55.91
Loam	56	37.09	96.03	Good	49	32.23	88.14
				Very good	17	11.18	99.32
Missing	7	3.97	100	Missing	1	0.66	100
Total	152	100		Total	152	100	

Results show that, although, most of the respondents appear to produce at least one of the key staple crops with a cropping calendar situated between January-March and October-December. These crops include wheat, sorghum, sesame, mung bean, banana, maize, and soybean are among the most important staple crops, among other crops grown at the farm level in the Kweneng district in Botswana. However, in terms of percentage, wheat, and sorghum crops are the main produced ones. While 25.78 % of the households are reported to grow wheat, 20.65% of the households in the sample reported to grow sorghum. In addition, only 12 % of households reported growing sesame, 9.16 % mung bean, and 6.52% banana. However, the average amount of total production for rice, onion, soybean, cashew nut, and palm oil appears to have a large amount yield with 6178 kg, 5000 kg, 4012 kg, 3600 kg, and 2333 kg respectively (Figure 3.26; Figure 3.27).

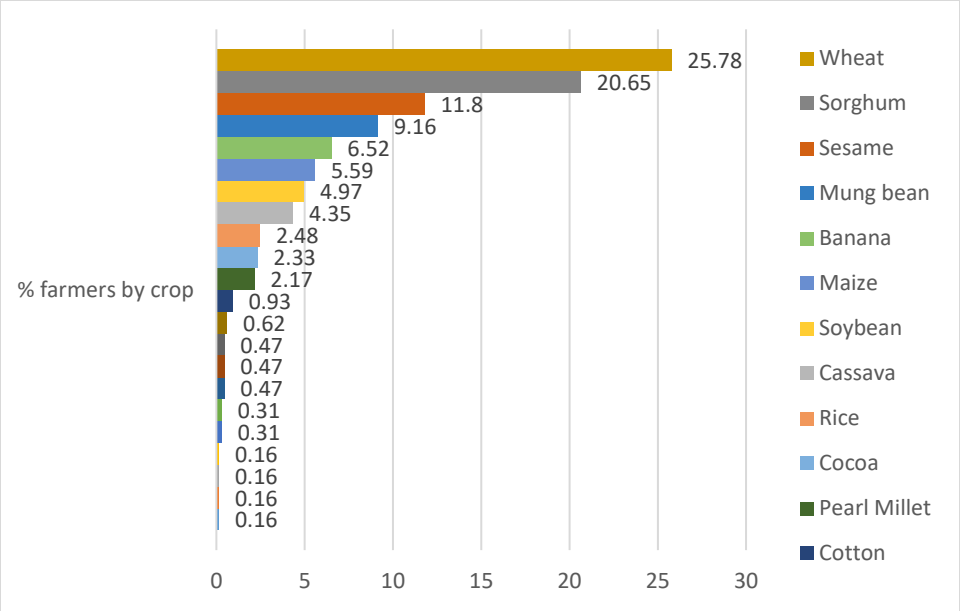

Figure 3-3: Figure: Percentage of farmers by crop produced.

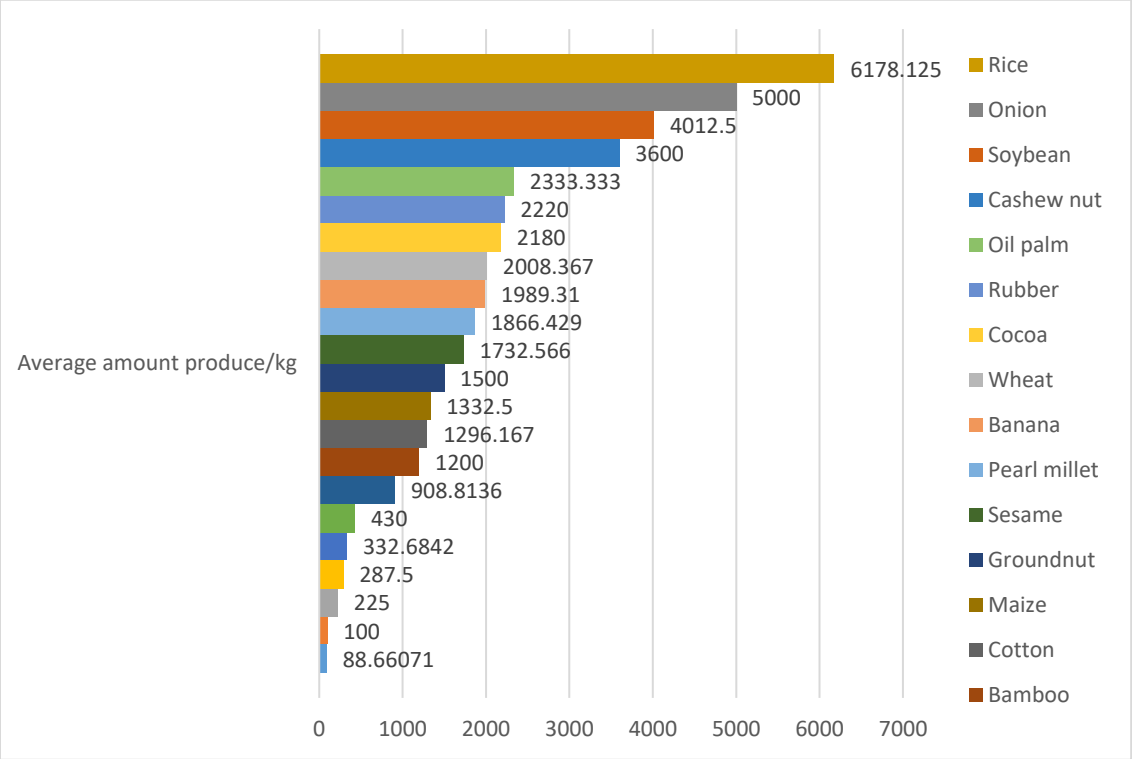

Figure 3-4: Average amount of quantity produces per crop

The data of land allocated by crops show that the rainfed area is large compared to crops allocated to irrigation system area. Also, 4 crops including wheat, sorghum, sesame, and mung bean production occupied a large part of the land (Figure 3.28). Of the total land, around 26% is allocated to wheat, 21% to sorghum, and 12 % to sesame cropping (Figure 3.29). However, the yield data shows higher production per unit firstly for rice, onion, and soybean as mentioned above. This may suggest that the production of wheat, sorghum, and sesame is not currently producing favorable yields, which is why more land is allocated to those crops. With the introduction of new crop varieties through the RESADE project, farmers will be able to diversify and increase yields of staple crops as well as food security in Botswana. Furthermore, farmers reported post-harvest loss situations. For example, the data show that, on average, 81 kg, 52kg, and 14 kg of Wheat, Sorghum, and Maize produced on the farm suffer losses during the post-harvest stages than the other crops. These losses are not neglected, they represent a big amount of loss as wheat and sorghum are also part of the crops consumed by the household according to the analysis findings. To solve this problem, the project can provide some modern promoted harvesting machines and storage facilities. Besides that, after harvesting, In addition to consumption, rice, wheat, and pearl millet are among the most crops sold in the market by the households in the Kweneng district in Botswana, and other cash crops like coffee, cotton, palm oil, cocoa, rubber, cashew nuts, and mango. The selling prices vary among the products and on average 71, 46, and 26 Botswana Pula were the prices of wheat, sorghum, and sesame respectively according to the data (1 Botswana Pula is equivalent to $ 1,400 US today).

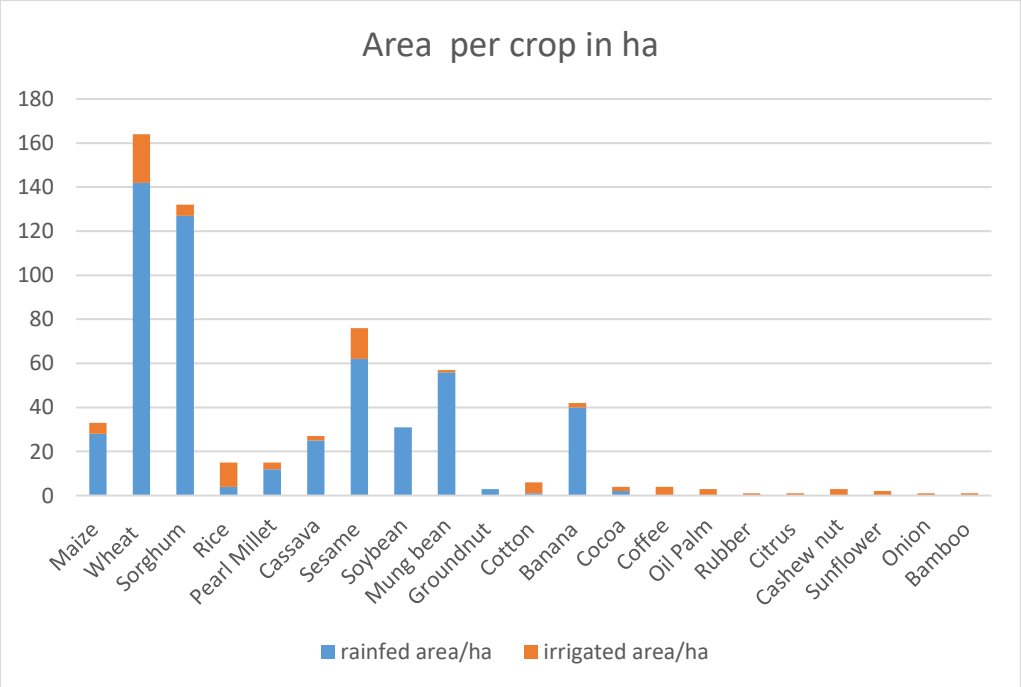

Figure 3-5: Land allocated by crop in hectare

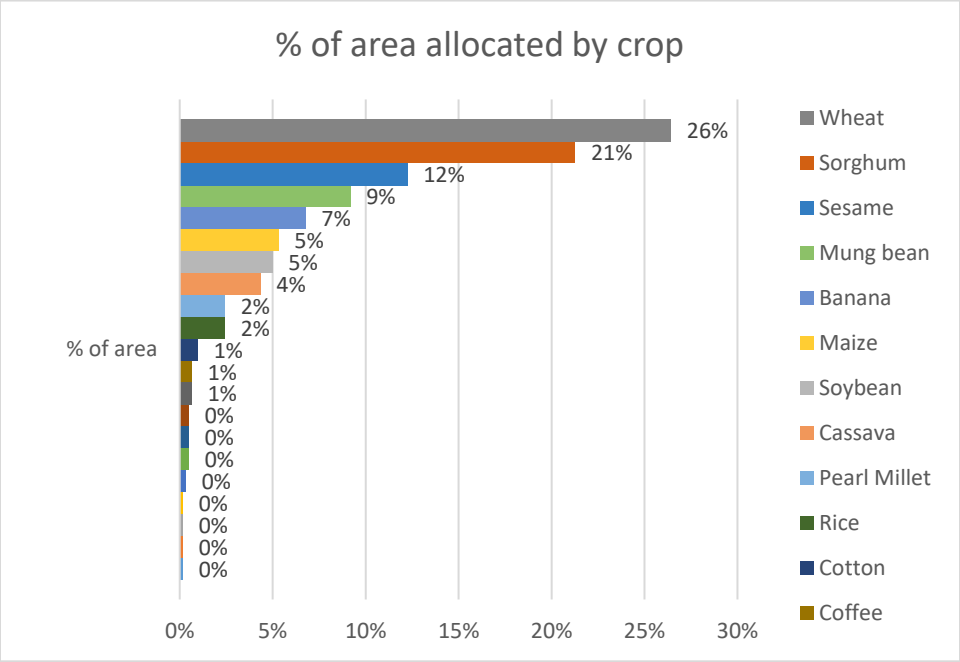

Figure 3-6: Percentage of land allocated by crop

Data on livestock production show that 86% of households own calves, while around 78% own bulls, 66% ox, and 50% cows. However, less than 50% of households own animals such as heifers (45%), goats (33%), sheep (26%), and poultry (9%) (Figure 3.30).

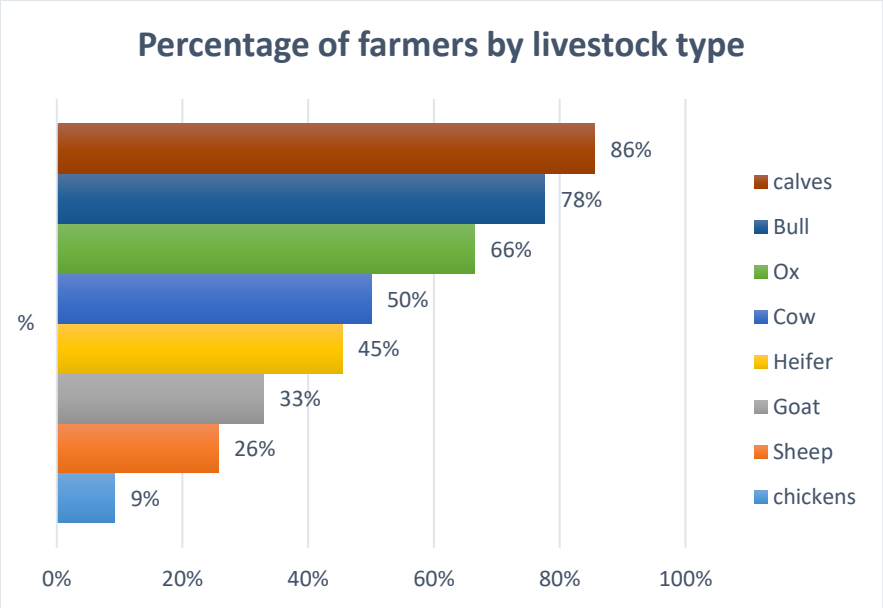

Figure 3-7: Percentage of farmers by livestock type owned

3.5 Farmers' Organizations and Access to Extension Services

Results on the access to extension show that almost all of the farmers in Botswana have access to extension services. While 94% of respondents declare to have access to extension services, only 6% are reported not to have access to agricultural extension services. For those farmers that reported having access to extension services, almost 56% specified that extension agents visit their farms rarely, 29% of farmers affirmed to have extension agents sometimes, and only around 4% affirmed that the extension services visit them at least once a week (Table 3.32). The services provided by the extension agents are mostly crop production techniques and the adoption of agricultural new technologies. However, data on the farmer's cooperatives have been collected in the case of this study.

Table 3-8: Farmers access to extension services

Access to extension services		Number of extension visits					
		Never	Rarely	Sometimes	Once a week	Missing	Total
Yes	Freq.	9	85	44	6	8	152
	%	5.92	55.92	28.94	3.94	5.26	100

3.6 Labor Involved in Farming Activities

In this section, data on labor information in agriculture in the study area is provided. On average, 2 workers (household members more than 15 years old) are involved in agricultural activities. However, more men (average 2) than women (average 1) are involved in farming activities. In addition, men (9 hours) work more hours and days than women (7 hours). The average wage is estimated at 420 Botswana Pula per day, with higher wages for men than for women. In addition, only 9% of the respondents affirmed hiring labor outside the household member to help at some point during the farming season, while around 28% of them reported that their household members are doing off-farm jobs (Table 3.33).

Table 3-9: Involvement of laborers in the farming activities

Gender	Variables	Mean	Sd. Dev	Min	Max
Male	Avg no. of laborers (month)	2.26	1.59	1.00	10.00
	Avg. days worked. (days/month)	19.40	27.03	2.00	360.00
	Avg hours worked (hours/day)	8.96	10.53	1.00	100.00
	Wage (LCU/day)	473.78	1323.08	1.00	5700.00
Female	Avg no. of laborers (month)	1.31	1.42	0.00	10.00
	Avg. days worked (days/month)	7.30	7.75	0.00	30.00
	Avg hours worked (hours/day)	6.81	8.85	0.00	70.00
	Wage (LCU/day)	231.02	472.00	0.00	1500.00
Both	Avg no. of laborers (month)	2.11	2.12	0.00	15.00
	Avg. days worked (days/month)	14.70	24.28	0.00	360.00
	Avg hours worked (hours/day)	7.63	12.65	0.00	140.00
	Wage (LCU/day)	420.54	1425.14	0.00	7200.00

3.7 Natural Disasters and Soil Salinity Issues

This section analyzes the disasters faced by the interviewed farmers and households. Overall, results show that soil salinity issues exist in the study region. More than half of the sampled farmers (around 52%) indicated that salinity is a common big issue in their village directly affecting soil quality and agricultural production yield, while more than 94% of them declared to not received any salinity information training. When respondents in the sample were asked to indicate the signs of salinity, they indicated white crust as

the most common observed sign of salinization, whereas some households also indicated low infiltration of water in the soil, soil compactness, and appearance of a dark brown color of soil as other symptoms of salinization. Only 3.28% of the households reported that their land is severely affected with a high impact on production leading to a loss in yields, while 18% of the households indicated medium severity, and 13.15% of the households indicated a low severity of salinity effect on their land productivity. The potential causes of salinity according to the farmers were recorded as well. However, most of the respondents think that the soil salinity issue comes from natural change or parent material effects. To remedy salinity's consequence on crop productivity, farmers think that crop rotation (12.5% of respondents), soil amendment application, and the usage of green manure are the most important intervention strategies among others.

3.8 Gender and Women's Involvement in Activities

Women's involvement in household different activities is an important aspect of household and farm management. However, according to the survey, about 90% of the respondents in the survey area stated that women are actively participating in farming activities in the study area as well as in decision-making related to household management (91% of the respondent's affirmation) (Table 3.34).

Table 3-10: Women's involvement in decision making

Women's involvement in decisions making	Yes		No		Total
	Freq.	%	Freq.	%	
Household decision	138	90.78	11	7.23	149
Farm decision	137	90.13	11	7.23	148

In addition, if we look at the specific area of decision-making between men and women within the household, it seems that the majority of decisions relating to the access to land (rented or cultivated), the choice of crops, the purchase of agricultural tools and inputs, the hiring of labor, the sale of agricultural products, and income spend are taken by both and not by men alone. Results even show that in all decision making women have the highest percentage, meaning that in Botswana, women are the principal involved in decision-making and have a say in all decision-making (household and non-household decisions). Decisions on food and non-food expenditure are taken jointly by men and women (81% and 75% of affirmations respectively for food and non-food expenditure decisions). However, only 10% of respondents

say that men make decisions about food expenditure and non-food expenditure alone, while 29% said that women decide for the same causes (Table 3.35).

Table 3-11: Percentage of gender decisions by items expenditures

Gender	Decision making/ Freq (%)								
	Land access	Crop cultivation	Inputs use	Farm tools	Hire labor	Crop selling		Food expense	Nonfood expense.
Men	10 (9.01)	15 (10.49)	14 (11.38)	15 (13.76)	12 (10.71)	14 (12.28)	12 (10.08)	15 (10.64)	13 (10.48)
Women	17 (15.32)	32 (22.38)	25 (20.33)	21 (19.27)	18 (16.07)	23 (20.18)	22 (18.49)	41 (29.08)	36 (29.03)
Both	84 (75.68)	96 (67.13)	84 (68.29)	73 (66.97)	82 (73.21)	77 (67.54)	85 (71.43)	81 (60.28)	75 (60.48)
Obs.	111	143	123	109	112	114	119	141	124

3.9 Food Consumption and Nutrition

Foods commonly consumed by households in the sample over a week include maize, rice, potatoes, nuts and other cereals, beans and peas, poultry and egg products, and dairy products. According to access to these staples that make up the household's main diet, around 11% of households said they had had access to maize in the last 7 days, while 11.23% of households said they had had access to other cereals, 10.52% of households had had access to rice, 10.44% had eaten potatoes and 10.28% had had access to nuts (Figure 3.31). Although households grow agricultural produce, their food consumption demand is mainly met by market supply. Around 72% of household consumption depends on markets, with only 25% reporting that they consume only their produce.

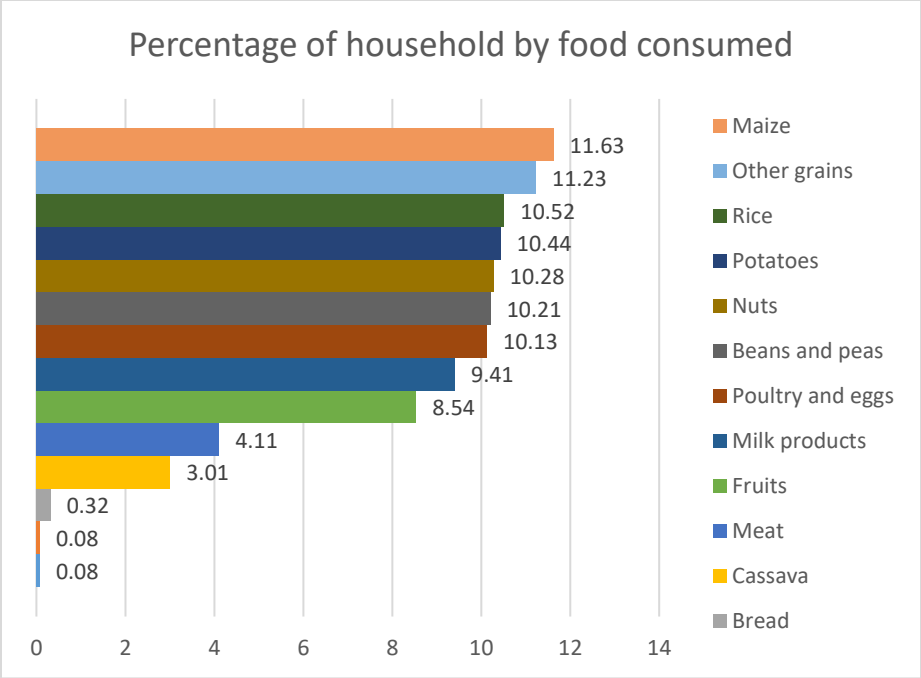

Figure 3-8: Percentage of household by food consumed weekly

3.10 Access to Infrastructure and Services

Access to infrastructure and services includes access to roads, access to local and regional markets, access to agricultural credit, health and education facilities, and water. According to the data recorded, more than 97% of the households have reported having road access (with 89% of them having access to unpaved roads), and more than 78% to local markets to buy and sell products. Better access to markets and roads allows the development of an agricultural value chain for crops and agricultural technologies. However, 53% of the households reported that markets are located within a radius of less than 60 minutes of their community, whereas only a small number, 29% of the households claimed that the markets are reachable within 1 to 2 hours from their location. Around 75% of households can reach the nearest markets by car and 17% are reaching the market by walking. Almost 82% of households in the sample indicated that they had access to market information, while only 2% of the sample confirmed that they did not have access to market information. In addition, the statistics show that of the households in the sample, 53% indicated that they had access to drinking water, while 50% of households confirmed that they had access to educational facilities. Only 1% of households have access to health services, 16% to electricity, and 28% to transport services. 35% of households in the sample said they had access to microfinance and credit services (Figure 3.32).

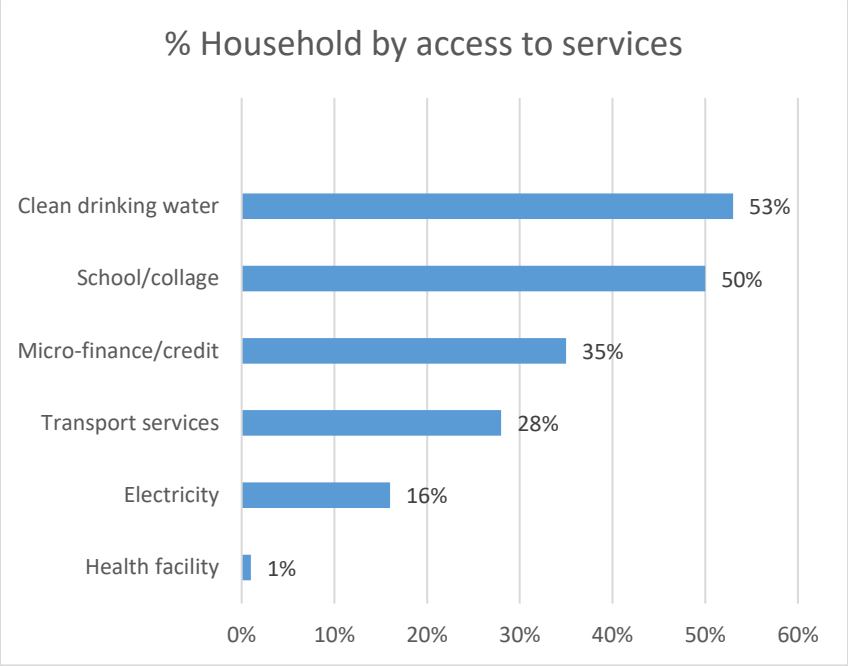

Figure 3-9: Percentage of households by access to services

3.11 Conclusion for Botswana

Before the implementation of the RESADE project in Botswana country, a household baseline survey including a face-to-face interview was conducted in the Kweneng district, located 15 km west of Gaborone, the capital of Botswana. Agriculture (cropping and livestock) is the main source of income for the older generation of the village in rapid urbanization. In addition, Kweneng district is one of the ten (10) agricultural districts in Botswana. The district has three (3) sub-districts Moshopa, Lentsweletau, and Letlhakeng which have a total of four hundred and forty-seven (447) farmers.

In the framework of this baseline survey, the information sought from the sampled households included Household demographics, agricultural holdings, crop production information, revenue and income sources, labor involved in farming, assets owned by households, natural disasters encountered and soil salinity issues, women's involvement in household and agricultural activities and decision making, access to extension services, cooperatives, access agricultural market and information on agricultural product market prices, household food accessibility and nutrition and access to basic infrastructure and other facilities.

As a result, in total 152 farmers were interviewed in which group 50.66% (77 respondents) were male farmers and 48.68% (74 respondents) were women farmers, between 25 minimum and 86 years old maximum. For both females and males, the average age was approximately 55 years old. The household roster information shows that the number of people in a household can range from a minimum of 1 person to a maximum of 9 people with the majority of household members, both male and female, falling between the ages of 15 to 65 years and 14 years and below. It has been reported that around 44 % of the respondents' men were a household head, while only about 29 % were female household heads with an average age of around 56 years. 77% of the household male heads are married while only 12% of the respondent's female household heads are married. The statistics show that the majority 74% of the heads of households in the sample are literate while around 26% remained illiterate. Among the principal respondents, around 21% had completed primary school, 29% had secondary school level, and 11 % had completed a bachelor's degree. Socio-economic data reported that pastoral farming (livestock production) is the largest (23.23%) source of household income of total household income followed by crop production (19.87) and permanent employment (16.50 %). Household income data revealed that the average household income is estimated at around 19,321 Botswana Pula (approximately USD 1,400 today), with significantly higher contributions from both women and men and both males and females have a word to say in expenditure decision-making. Data on household asset ownership shows that the most used assets owned by the respondents are houses possession (88%), followed by mobile phones (82s%), cars (57%), refrigerators (43%), solar panels (30%), electricity generators (25%), computers (24%), boreholes (21%), and tractors (16%).

Looking at agriculture holdings, the survey revealed that 78.67% of the farmers are operating in rainfed farming and both rainfed and irrigation combination farming include 14.67% of them, while only a small fraction of 6.67% are using only irrigation systems. Also, the data collected show that 80% of the land in which the farmers operate is in their possession, while only 18.42% of farmers were using land leased portion and almost 5% land rented. However, the average size of the land held by the farmers is average 12.91 hectares of which 6.16 hectares are used for crop production, 4.92 ha are undeveloped, and 2.18 hectares are left fallow. The respondents have also reported their perception of operated soil type and the perception rate of soil fertility according to crop productivity. On one hand, the analysis findings show that 45% of the soil was reported to be sandy, 37 % loam, and 14% clay. On the other hand, considering the soil fertility, 41 % of the households have rated the soil fertility level to be average, while 32% think that the soil fertility is good, 12% and 11% of the respondents have classified the soil quality to be poor and very good respectively. Most of the respondents appear to produce at least one of the key staple crops

including wheat (25.78 % of the households), sorghum (20.65% of the households), sesame, mung bean, banana, maize, and soybean among other crops grown at the farm level in the Kweneng district in Botswana. Data on livestock production show that 86% of households own calves, while around 78% own bulls, 66% ox, and 50% cows, and less than 50% of households own animals such as heifers (45%), goats (33%), sheep (26%) and poultry (9%). Results on the access to extension services show that almost all the farmers in Botswana have access to extension services. While 94% of respondents declare to have access to extension services, only 6% are reported not to have access to agricultural extension services. However, no data was collected on farmers' membership in any farmer's cooperatives or organization.

In the sample, more than half of the sampled farmers (around 52%) indicated that salinity is a common big issue in their village directly affecting soil quality and agricultural production yield, while more than 94% of them declared not received any salinity information training. Only 3.28% of the households reported that their land is severely affected with a high impact of salinity on production leading to a loss in yields, while 18% of the households indicated medium severity and 13.15% of the households indicated a low severity of salinity effect on their land productivity.

According to women's involvement in household different activities about 90% of the respondents in the survey area stated that women are actively participating in farming activities in the study area as well as in decision-making related to household management (91% of the respondent’s affirmation). Results even show that in all decision-making women have the highest percentage, meaning that in Botswana, women are the principal involved in decision-making and have a say in all decision-making. For example, decisions on food and non-food expenditure are taken jointly by men and women (81% and 75% of affirmations respectively for food and non-food expenditure decisions). However, only 10% of respondents say that men make decisions about food expenditure and non-food expenditure alone, while 29% said that women decide for the same causes.

In household nutrition information, foods commonly consumed by households in the sample over a week include maize, rice, potatoes, nuts and other cereals, beans and peas, poultry and egg products, and dairy products. According to the access to these staples food that makes up the household's main diet, around 11% of households said they had had access to maize in the last 7 days, while 11.23% of households said they had access to other cereals, 10.52% of households had access to rice, 10.44% had eaten potatoes and 10.28% had access to nuts. Although households grow agricultural produce, their food consumption demand is mainly met by market supply. Around 72% of household consumption depends on markets, with only 25% reporting that they consume only their produce.

In the analysis of access to social facilities, the results show that more than 97% of the households have reported having access to roads (with 89% of them having access to unpaved roads), and more than 78% to local markets to buy and sell products. Around 75% of households can reach the nearest markets by car and 17% are reaching the market by walking. Almost 82% of households in the sample indicated that they had access to market information, while only 2% of the sample confirmed that they did not have access to market information. In addition, the statistics show that of the households in the sample, 53% indicated that they had access to drinking water, while 50% of households confirmed that they had access to educational facilities. Only 1% of households have access to health services, 16% to electricity, and 28% to transport services. 35% of households in the sample said they had access to microfinance and credit services.

Regarding all the above results, farmers in Botswana need extension services support, training, and knowledge on soil salinity and management, modern agricultural management technologies, storage facilities, market access facilities, other infrastructures development such as roads, formation of cooperatives as well as credit access facility and support to address climate change impacts and boost their productivity, food security, income, and living standards, which align with the RESADE project objectives.

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