Impact of nutrition education centers on food and nutrition security in Kamuli District, Uganda

by

Samuel Ikendi

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Program of Study Committee:
Francis Owusu, Major Professor
Carmen Bain
Ann Oberhauser

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

To the NECs hosts, NEC Trainers, and my mum Christine Lubaale, may the Gracious Lord reward you all abundantly for your generosity.

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ANOVA	-	Analysis of Variance
BMI	-	Body Mass Index
CBAHWs	-	Community Based Animal Health Workers
CBNTs	-	Community Based Nutrition Trainers
CFSVA	-	Comprehensive Food Security and Vulnerability Analysis
CGIAR	-	Consultative Group on International Agriculture Research
CIGI	-	Community Income Generation Innovations
CSRL	-	Center for Sustainable Rural Livelihoods
FANTA	-	Food and Nutrition Technical Assistance
FCS	-	Food Consumption Score
GHI	-	Global Hunger Index
HAZ	-	Height-for-Age Z-score
HDDS	-	Household Dietary Diversity Score
HFIAS	-	Household Food Insecurity Access Scale
HGA	-	Health Gardens Approach
HIPICs	-	Heavily Indebted Poor Countries
HLPE	-	High Level Panel of Experts on Food Security and Nutrition
IFAD	-	International Fund For Agricultural Development
IFPRI	-	International Food Policy Research Institute
ILRI	-	International Livestock Research Institute
INDDEX	-	International Dietary Data Expansion Project
IPC	-	Integrated Food Security Phase Classification
ISU-UP	-	Iowa State University - Uganda Program
MAAIF	-	Ministry of Agriculture, Animal Industry and Fisheries
MAM	-	Moderately Acutely Malnourished
MFPED	-	Ministry of Finance, Planning and Economic Development

MUAC	-	Mid Upper Arm Circumference
NAADS	-	(Uganda) National Agricultural Advisory Services
NECs	-	Nutrition Education Centers
NEPs	-	Nutrition Education Programs
PEAP	-	Poverty Eradication Action Plan
PMA	-	Plan for Modernization of Agriculture
PRSPs	-	Poverty Reduction Strategy Papers
SAM	-	Severely Acutely Malnourished
SPSS	-	Statistical Package for the Social Sciences
UBOS	-	Uganda Bureau of Statistics
UFNC	-	Uganda Food and Nutrition Council
UFNSIP	-	Uganda Food and Nutrition Strategy Investment Plan
UNAP	-	Uganda Nutrition Action Plan
UNICEF	-	United Nations International Children's Emergency Fund
USAID	-	United States Agency for International Development
VEDCO	-	Volunteer Efforts for Development Concerns
VHTs	-	Village Health Trainers
VSLA	-	Village Savings and Loan Associations
WASH	-	Water, Health, Hygiene and Sanitation
WAZ	-	Weight-for-Age Z-score
WFP	-	(United Nations) World Food Program
WHA	-	World Health Assembly
WHO	-	World Health Organization
WHZ	-	Weight-for-Height Z-score
WRA	-	Women of Reproductive Age
WUCs	-	Water User Committees
YEP	-	Youth Entrepreneurship Program
ZARDC	-	Zonal Agricultural Research Development Center

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ABSTRACT

Achieving food and nutrition security is among the goals of many public-private partnerships in Uganda. This study examined the impacts of Nutrition Education Centers' (NECs) training programs on food and nutrition security in Kamuli, Uganda. Using a comparative approach, the study explored the relationship between participants' affiliation with NECs, dimensions and quality of their participation, as well as their household characteristics, and food and nutrition security. The study was based on survey of 454 households with 606 children aged 0-59 months from two sub-counties. Anthropometric measures were also taken of caretakers, children, which were transformed into Z-score using WHO-Anthro. Respondents were categorized into NEC participants (NEC and Non-NEC clients) and Non-participants and data were analyzed using IBM-SPSS 24.

Results showed that Non-NEC clients were more food secure and had better dietary diversity than NEC clients and Non-participants, however, their caloric intake was not higher than the former. Food security was also influenced by household's participation in programs, availability of livestock, land acreage owned, WASH facilities conditions, meals eaten during food scarcity, time taken to collect water, membership of burials and festival groups, and days of illness of adult males. For nutrition security, NEC clients and Non-participants mothers had better health than Non-NEC clients. However, the former had more underweight mothers than the two groups. Incidence of underweight was associated with education and age at first pregnancy. Children of Non-participants and NEC clients had higher cases of stunting and underweight than Non-NEC. Wasting significantly affected NEC and Non-NEC than Non-participants.

Recommendations for improving the program include participatory planning involving community, cultural and government officials in design of activities, decision making to strengthen implementation, monitoring and evaluation. Expanding microfinance project to increase livestock distribution and continue to empower households in records keeping involving production. Help farmers access high value staple crops to increase food production and incomes, in addition to encouraging clients to have vegetable gardens. Collaborating with Water User Committees, district health, and development departments to improve monitoring households' WASH facilities. Collaboration with health workers, Village Health Trainers to educate and encourage households to adopt improved maternity practices and monitoring of children

CHAPTER 1: BACKGROUND STUDY

1.1 Introduction

The global food tragedy has often been symbolized to as "the perfect storm" (Mehta, 2008). This is because food insecurity is usually a consequence of multifaceted factors that jointly support one another resulting in a magnified scope and hence broadening the complexity of the problem. The United Nations (UN) Sustainable Development Goals (SDGs) set for 2030 (SDGs, 2015) focusses on ending hunger, achieving food security and promoting nutrition as one of its central themes. Monitoring of the initial Millennium Development Goals (MDGs, 2000) that were drafted on a historic promise of *"Meeting the needs of the world's poorest citizens"* marked an end in 2015. It was in 1996 when the Heads of 182 States convened in Rome - Italy for a World Food Summit (WFS), they swore to eliminate hunger within their countries and to have the proportion of hungry people halved by 2015 (FAO, 1996; FAO and WSFS 2009). The State of Food Insecurity in the World 2015 presented updates showing that developing nations achieved the MDG 1(c) – the population of hungry people was reduced by half (FAO, IFAD, and WFP, 2015). In further clarification of the updates, two scenarios were presented; first was that, as viewed from a statistical lens, the set target was missed by a minor range and the second was that, from a development standpoint, the core of MDG 1(c) pledge was satisfied on a global scale (FAO, IFAD, and WFP, 2015).

According to the report by FAO, IFAD, and WFP (2015), the number of hungry people has been decreasing since the inception of MDGs on the global scale (refer to table 1 below for details). For instance, the number of people who were hungry declined from 18.6 percent

in 1990/92 to about 10.9 percent by 2014/16. Developing nations, that have the largest share of the total hungry population, saw an impressive decline in hunger from 27.6 percent to about 12.9 percent over the same period. Looking at Africa as a region, whereas the absolute numbers depict an increase in the hungry population, in terms of percentage, the proportion affected by hunger decreased from 27.6 percent to 20.0 percent – the corresponding numbers for Sub-Saharan Africa is a reduction from 33.2 percent to 23.2 percent (FAO, IFAD, and WFP, 2015). In sum, although the magnitude varied, all these regions saw significant decreases in the percent of people who are hungry between 1990 and 2016.

Table 1.1 Estimated Trend of Hunger Reduction in the World by Region 1990/92 - 2014/16

Region considered	Baseline 1990-92		End-line 2014-16	
	Population in millions	Percent	Population in millions	Percent
Global Scale	1,010.6	18.6	794.6	10.9
Developing Nations	990.7	27.6	779.9	12.9
African continent	181.7	27.6	232.5	20.0
Sub-Saharan Africa	175.7	33.2	220.0	23.2

Adopted from (FAO, IFAD, and WFP, 2015).

However, the initial phase of the SDGs set in 2015 to be achieved by 2030 under the theme of *"leave no one behind"* - achieving zero hunger in all forms among all people, having access to nutritious and adequate food throughout the year started from a sad note. Updates presented by "The State of Food Security and Nutrition 2018" on a global scale shows an increase in number of hungry people – from 794.6 million in 2015 to 804 million in 2016 and by 2017 it was estimated at 821 million people, and further reported regions of Africa and South America being more affected whereas those of Asia was relatively stable (FAO, IFAD, UNICEF, WFP and WHO, 2018). Another way to look at this is that one in the nine rural based

population relying on rain-fed agriculture are more affected. An immediate and a more cohesive approach need to be adopted to avert the situation, regain the glory of achieved MDGs and put forward the SDGs set for 2030.

1.2 The State of Food Insecurity in Uganda

At the national level, food and nutrition insecurity is one of the major factors deterring Uganda' development. The country ranks among the ill-nourished nations of the world and from the Global Hunger Index (GHI) statistics, it's among the lowest at 16.7 placing her in the position of 42 of 81 countries ranked (Ssewanyana & Bategeka, 2007), and in 2016, it was at 26.4 placing her in a position of 87 of 118 developing states measured, and in a lower category (Von Grebmer et al., 2016). The food insecurity situation in the country is a cause for alarm. The percentage of food secure people drastically reduced from 83 percent in 2016 to 69 percent in 2017, with an approximation of 10.9 million people in a critically food insecure state. In the same instance, within the critical food insecure about 1.6 million people making up five percent were found to be in a widening food consumption gap and with a worsening dietary diversity, and starvation (IPC, 2017).

In 2011, the results of UN's World Food Program (WFP) showed that 72.4 percent of the households surveyed were food secure in general and that the country did not lack food (WFP, 2011; FAO, 2011a). The country had taken a positive trajectory to improve food security by virtual of the statistics presented by WFP (2011) of 72.4 to 83 percent presented by the Integrated Food Security Phase Classification (IPC) in 2017. However, the fact that the reports at different intervals revealed lack of dietary diversity among household together with a reduction in the food secure

households by 2017 signals that food and nutrition insecurity is still a problem in the country that require urgent attention.

A large population making up 83.6 percent of Uganda's population is rural based whose livelihood is derived from agriculture (World Bank, 2016). The agricultural sector is the backbone of the country's economy but the activities within the sector are mainly done by small landholder farmers at substance level of which over 50 percent of the output is for home consumption (UBOS, 2016). Their low productivity explains the high level of food and nutrition insecurity at household, and nationwide as the income derived from substance sales cannot effectively meet the requirements of the farmers. The sector's production is highly dependent on nature specifically weather and fertility of the soil. Food insecurity prevails where there is insufficient rainfall causing drying of crops and pastures, excessive rainfall causing floods, pests and diseases that are destructive to both crops and animals all of which escalate the severity of the problem (Bahiigwa, 1999).

According to the Uganda Census of Agriculture [UCA] (2010), 57 percent of the 3.6 million households surveyed in 2008-09 could not maintain a normal consumption level in the previous 12 months. Similarly, FAO (2010) statistics, revealed that a lag phase in the farmer's calendar between planting and harvesting coupled with an inability to have proper storage facilities resulted into hunger, with reference to northern Uganda. FAO (2010a) further points out that 27 percent of the total rural dwellers were below the poverty line yet their main expenses of approximately 63 percent were on food.

1.3 Agricultural Production, and Food and Nutrition Security Strategies in Uganda

Uganda for long has experienced "deep pockets of hunger" since the periods of political turmoil in the 1970s (Griffiths & Binns 1988). The problem continued even after the restoration of peace in the late 1980s which led to a complete realization of the then and still the current government of the need to lay foundations, draft policies and strategies to tackle the problem (Ssewanyana, et al., 2006). Increasing food production is at the forefront of all policies and strategies that have been formulated.

Uganda's history of agricultural and food production dates far back before independence in 1962 (Sserunkuuma, 1999) and has since then undergone drastic changes with the ruling regimes. During the colonial administration, agricultural research, extension, and production were attentive to cash crops specifically coffee and cotton, with local chiefs of the territories executing the operations on behalf of the colonial masters in an authoritative approach (Semana, 1999, and 2002). At the eve of independence in the late 1950s, technology inventions in agriculture began to play a role where the "Transfer of Technology" (ToT) model adopted by colonial masters used extensionists who were sent and reached out to communities, identified and trained model farmers who later managed public demo gardens as training sites for their respective communities (Opio-Odongo, 1992).

However, barely 10 years after independence, all systems were devastated by the 1970-85 political strife[1]. A new agricultural extension model of "Training and Visit" (T&V) was drafted and adopted in 1992 by the government with support from World Bank (WB) after fulfillment of

[1] Matthews et al., (2007) elaborated on the distortions to agriculture motivations in the post-independence era that was captivated by military coups in 1971, 1979, 1985 and 1986 specifically the burden of tax levies that exponentially increased in that military regime coupled with political chaos undermined the potential of agricultural development.

the terms and conditions of Structural Adjustment Policies [SAPs] (Anderson, Feder & Ganguly, 2006). Whereas the country was ranked among the first star references of the SAPs package by World Bank and International Monetary Fund [IMF] (Kreimer, 2000), and the economy registered a growth of six percent per year during the first seven years attributed to adoption of SAPs (Sharer, 1995), this did not translate into economic independence and more other strategies had to be drafted for adoption to spearhead development.

A report released by World Bank in 1996 listed Uganda as among the countries with a high debt burden. The World Bank thought of initiatives to help such poor countries through debt waivers under agreed terms (World Bank, 1996, and 2018). The Heavily Indebted Poor Countries (HIPCs) were tasked to draft Poverty Reduction Strategy Papers (PRSPs), Uganda came up with a holistic Poverty Eradication Action Plan (PEAP) covering a period of 20 years from 1997 to 2017, targeting a reduction of "absolute poverty" by 10 percent (MFPED, 2000, and 2001a). To boost agricultural and food production, the program incorporated the Plan for Modernization of Agriculture (PMA) that was drafted in 2000 and effected in 2001 with a mission to transform small-scale substance into large-scale commercial agriculture (MAAIF and MFPED, 2000, p. 27).

The mission and objectives of PMA are translated into reality by National Agriculture Advisory Services (NAADS) through "farmer to farmer" group formation at the village level, to the parish, sub-county to district level depicting a decentralization system of service delivery (MAAIF and NAADS, 2000). The system used to implement and deliver the services under the PMA arrangements was an inclusive one that used a demand-driven model. The fund source was a crowd in nature from a varied source including government, donors and local farmers - cost sharing (MAAIF and NAADS, 2000). To effectively implement and deliver services to the target

communities, the country was divided into agro-ecological zones with each having a Zonal Agricultural Research Development Center (ZARDC) to cater for that specific community where its located (MAAIF, 2004).

Nevertheless, the PMA program was not effective in executing its core duties. In the evaluation report by Oxford Policy Management [OPM] (2005), three main issues of poverty, gender, and environment were identified as outliers that were not properly incorporated into PMA mechanisms. Muwonge (2007) also noted that whereas farmers through their groups influenced policies, gained knowledge, skills, and practices in managing diversified enterprises, this did not significantly translate into increased productivity and hence could not raise their incomes. A more worrying note, after 13 years of operation, on 28th May 2014 the President through the cabinet decided to halt and finally dissolved the operation of NAADS citing misplaced priorities and abuse of public funds (Akena and Ofwono, 2014). This was just three years to end of the 20 years of PEAP strategy timeline. NAADS was a program of the PMA under the umbrella of PEAP. The PEAP was a PRSP which was a requirement by WB and IMF for all HIPCs as a condition of loans waived off. This vicious cycle of corruption coupled with weather vagaries, continue to place the country under the food insecurity situations.

However, in other developments within the country, whereas the above-attempted strategies were general in scope tackling poverty and food insecurity in a dissimilar dimension, behind the scene was a roadmap in the formulation of a comprehensive Uganda Food and Nutrition Policy (UFNSIP, 2005). This process started far back in 1991 and took 10 years to be completed by 2001 and approved by the government in 2003. In October of 2003, a policy's strategy named Uganda Food and Nutrition Strategy (UFNS) - a guide to action for UFNP got funded by Food and

Agriculture Organization (FAO) of the UN to be designed, and the first draft was developed in March of 2004 (UFNSIP, 2005). Subsequent stages were followed in its development into law and was launched in September of 2007 with a mission of ensuring enough food access and nutrition for every citizen of Uganda in a period of 10 years. The strategy was designed to incorporate three fundamental principles, and these include (Uganda Food and Nutrition Strategy and Investment Plan (2005: p12-18);

i. The principle of human right that prescribes food as a human right. It was sought that the strategy rests on the core of transparency, clear documentation of beneficiaries who were termed as "rights-holders" and those who deliver the service also termed as "duty-bearers". This core principle stipulates how the vulnerable people referring to the food insecure can be served and makes it clear of the strategy to move from basic needs model to the empowerment of both the "rights-holders" and "duty-bearers".

ii. The principle of gender that stems from the conception that food and nutrition security roles are intrinsically gendered. That different activity pertaining to food and nutrition are played differently between men and women in the same household. Whereas more men are engaged in income generating activities, women are in cultivation to secure food for home consumption and they determine more on the nutrition status of their children than men. This core principle recommends that agricultural planners be sensitive on the reproductive, productive and practical gender needs during planning.

iii. The role of leadership, governance, and advocacy principle. This core notes it that all policies are political, the strategy encourages good leadership and governance as the food insecurity problem is not only at the household level but at national and global. It, therefore,

calls for public concern in advocacy by leaders, policymakers to build a political will and rapport of the vulnerable and none vulnerable population in communities.

The UNFS has an official home in the Uganda Food and Nutrition Council (UFNC) which is housed in the Office of the Prime Minister (OPM). The UFNC directs the operations of the UNFS through line ministries. It's a comprehensive synergy of inter-sectoral and inter-ministerial coordination that include but not limited to ministry of agriculture, finance, health, gender, trade, justice, lands, local government, education, and the Office of the prime minister, Uganda Bureau of Standards (UBOS), Non-Governmental Organizations (NGOs) among other stakeholders, all supervised by UNFC (UFNSIP, 2005).

Many more strategies were formulated to tackle food and nutrition insecurity issues in different angles across a large spectrum. For instance, the Health Sector Strategic Plan (HSSP) II drafted by the Ministry of Health (MoH) in 2005 that operated through 2010 focused on reducing infant malnutrition with emphasis on micronutrient supplementations (McKinney, 2009). The Uganda National Development Plan (UNDP) was drafted in 2010 to help improve general nutrition in the country (FAO, 2010). The Uganda Nutrition Action Plan (UNAP) passed in 2011 to operate for five years in the fight against food and nutrition insecurity, all of which are subsequent strategies embedded in PEAP of 1997-2017, and UNFS of 2007-2017.

1.4 Nutrition Education Program Approach to Food & Nutrition Security in Uganda

Nutrition education and training programs are clearly stipulated in the UNFP (2003) and the UFNSIP (2005) with an intent to create awareness and effect behavioral changes through mobilization of communities to identify challenges and help them find a solution in food and nutrition areas. Emphasizing these programs was because of the government's realization of the

problem of malnutrition a major concern and a need for urgent action (UFNC, 2000). The UNFP (2003) specifies Ministry of Health (MoH), and Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) as lead government entities in initiation and implementation of these programs, working closely with other ministries, NGOs and other stakeholders. The joint statement reads as follows:

> *"We appeal to Government Ministries, Local Governments, national and international agencies, non-government organizations and all other stakeholders, to work closely with the Ministry of Health, Ministry of Agriculture, Animal Industry and Fisheries and the Uganda Food and Nutrition Council to implement the Uganda Food and Nutrition Policy" (Ministers: Wilberforce Kisamba Mugerwa (MAAIF), and Jim Muhwezi (MoH) in UFNP, 2003).*

Information about food and nutrition security is conveyed in different names such as community nutrition, health promotion, food and nutrition education, behavior change communication, information, communication, and education, extra depending on the line ministry, and or stakeholder implementing the program (Cristina, 2012). The attempts to pass on the food and nutrition education and knowledge was through primary health care workers, teachers, and agricultural extension staff but these were fruitless as they were few compared to the number of people they had to serve (UFNC, 2000).

Gillespie et al, (2013) affirm that effective nutrition programs need timely data to ascertain the nature and magnitude of the problem to give time for finding out what can work well, and how to coordinate between actors, build capacity, and commitment for effective implementation and sustainable partnership in funding the interventions. The hand of NGOs and agencies has been

very influential in these programs. For instance, many agencies have drafted approaches to address the knowledge gap on nutrition and malnutrition like one that focusses on the first 1000 days of life *"between the time of pregnancy to the child's next birthday"* and maternal nutrition, such drivers in this global initiative is the Scaling Up Nutrition (SUN) program (SUN, 2010). The Food and Nutrition Technical Assistance (FANTA) is another agency actively involved in closing the information gap on food and nutrition through drafting and dissemination of training manuals. The agency was actively involved in guiding the drafting and implementation of Uganda Nutrition Action Plan (UNAP) 2011 with a goal reducing the incidence of undernourishment among Women of Reproductive Age (WRA) and children (FANTA, 2018).

The Nutrition Education Program (NEP) is the principal focus of this research paper and as earlier noted, tackling food and nutritional insecurity is a synergy across all sectors, line-ministries, NGOs among other stakeholders. In this study, I am focusing on evaluating the NEP of the Center for Sustainable Rural Livelihood (CSRL) on improving the food and nutrition security of small landholder farmers in Kamuli district, Uganda. In a tripartite partnership arrangement, Iowa State University (ISU) through the CSRL, implements a livelihoods program in Uganda through a registered international NGO - Iowa State University - Uganda Program (ISU-UP) in partnership with Makerere University Kampala (MUK). CSRL's goal is to combat global hunger, malnutrition, and poverty in the developing world by supporting resilient and sustainable rural livelihoods through the discovery and application of science-based and indigenous knowledge (https://www.csrl.cals.iastate.edu/about-csrl). This is achieved through training and development of activities that strengthen the capabilities of rural people to improve agricultural and natural resource management practices, build assets, diversify income sources, and achieve food security,

good nutrition, and health. In addition, the program builds the next generation of development experts through service learning. CSRL's livelihood program approach utilizes a life-long learning and capacity development model (https://www.csrl.cals.iastate.edu/transforming-lives).

In this research, the focus was on the activities of the Nutrition Education Centers (NECs) of the CSRL's NEP (details in chapter three). These centers were initiated in 2010 with a goal to end hunger and malnutrition in the Kamuli district of Uganda. Specifically, the program seeks to reduce malnutrition levels among Women of Reproductive Age (WRA), and children 0-59 months of age. To achieve this objective, the program works to improve nutritional status of at-risk WRA and children, improve nutrition and health-related behaviors, strengthen community capacity on nutrition and health, improve household access to quality and diverse foods, promote and strengthen access to clean water and use of hygiene and sanitation facilities, strengthen women's access to micro-finance, and strengthen linkages to other service providers.

The purpose of this research is to examine whether and how the participation in the NECs' activities improve food and nutrition security situation of small landholder farmers in Kamuli. As already noted earlier, one of the main goals of CSRL is to increase household food and nutrition security. This is being done by expanding emphasis on nutrition and health, growing the number of women and children served by NECs and ensure that these benefits are sustainable by the community. In this respect, the NECs are an approach to improve agricultural production, nutrition, health, and income that eventually will lead to an improvement in food and nutrition security among households.

1.5 Research Objective

The main goal of the study is to examine the impact of the NECs on the food and nutrition security of small landholder farmers in Kamuli District, Uganda.

1.5.1 Specific Objectives

i. To understand the functions and the activities of the NECs, especially in terms of their expected impacts on the food and nutrition security of community members.
ii. To determine the food and nutrition security status of NECs and Non-NECs participants
iii. Assess the effectiveness of the NECs in improving food and nutrition security.
iv. Offer recommendations for improving the performance of the NECs in addressing food security and nutrition in the community

1.5.2 Main Research Question

Does participation in NECs' activities improve the participants' household food and nutrition security?

1.5.3 Specific Research Questions

i. What are the activities of the NECs that impact the household food and nutrition security?
ii. What household socio-economic, and demographic characteristics influence their food and nutrition security?
iii. What is the food and nutrition security status of participants in NEC and Non-NEC?
iv. Does participation in the activities of the NECs impact the household food and nutrition security?

Its hypothesized that households with mothers and/or a member who attends to the NECs and or has/have participated in any of the core activities of the NECs have improved knowledge of the

food groups, improved beliefs about foods appropriate for children, pregnant and lactating mothers and will provide their children with nutritionally adequate meals, care and are food secure with improving income than household who have not participated in NEC activities.

1.6 The Significance of the Research

The goal of the study is to conduct evaluation research of the CSRL's Nutrition Education Programs' work in relation to food and nutrition security of small landholder farmers in the Kamuli district of Uganda. The study is seeking to determine the impact the programs have had on the livelihoods of the people who have been working with it since 2014 and will be comparing results with those who have not participated in the program at all. Specifically, the study will determine the changes in the livelihoods of the program clients that can be attributed to CSRL's Nutrition Education Programs. Results of this study will inform the Center for Sustainable Rural Livelihoods, Iowa State University Uganda Program, Makerere University Kampala and the stakeholders on the progress made in implementing the sustainable rural livelihoods program in Uganda.

The study will provide information on the numbers of clients reached by the program. The activities completed in the areas of nutrition and feeding, health, hygiene, and sanitation, agronomy and livestock production, community income generation innovations, and entrepreneurship. In addition, the study seeks to determine the impact of the program on participants' food and nutrition security and their livelihoods. The results will enable the program to track progress being made, identify gaps and weaknesses in implementation thereby providing timely information for adjusting implementation arrangements, help in guiding the planning, prioritization, allocation and

management of resources, provide recommendations for program management and help to guide the strategic planning exercise for the next phase of the program.

To the academic field, the results of this study will enrich the field with a body of literature and knowledge in the areas of food and nutrition security using a tripartite partnership with Nutrition Education Program approach, and the Nutrition Education Centers as implementing engines. To the policymakers, the results will inform the government on the benefits and efforts so far achieved from tapping philanthropy from a generosity of donors and further design better policies that do not jeopardize the activities of public-private partnerships in the fight against food and nutrition insecurity as stipulated in the Uganda Nation Food Policy, the policy's strategies, and the strategies' investment and implementation plans in the country. The results of this evaluation research will help to generate suitable strategies to tackle food insecurity that can be adopted by other partner stakeholders and government in the same struggle.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provides a detailed review and studies about the concepts of food security, nutrition security, and a combined concept of food and nutrition security as well as the pillars that define the stages of achieving a stable FNS, discusses the measures of FNS and how they are linked to the pillars. It goes further to discuss the FNS interventions that set a stage for the research's case study. It provides an overview of the conceptual framework adopted by the case study and then addresses its operationalization through participation in the training programs as a way of building capacity for communities to bridge the gap between the source of knowledge (Learning institutions, Research Stations), transmitters (Extensionists), and the farmers themselves. It concludes with discussing the various characteristics of households that are believed to influence the overall food and nutrition status among themselves and their communities.

2.2 The Concept of Food and Nutrition Security

Food and Nutrition Security (FNS) is broadly categorized into two socio and administrative levels; macro – measured at global, regional national levels and micro – measured at household and individual levels (Smith et al., 2000; Weingärtner, 2010). There have been concerted efforts at all levels – ranging from the United Nations to regional, national, and grassroots levels – in a bid to achieve a stable FNS status, yet the issue remains a challenge. This is partly due to the difficulty in understanding and interpreting the nature and complexity of the concept. FNS are complex concepts with many socio-economic facets that requires collective action on all of them (Alder et al., 2012). For instance, to achieve Food Security

(FS), all people must physically, socially, economically and consistently have access always to adequate, safe and healthy food that meet their nutritional needs and food favorites to live and sustain them in an active and healthy life (FAO and WSFS, 2009; IFRC, 2011; Gross et al., 2000). Whereas to achieve Nutrition Security (NS), all people must physically, socially, economically, and consistently have access always to adequate food in terms of quantity, quality, safety, diversity in nutrient composition, to meet their daily nutritional needs and food favorites to live and sustain them in an active and healthy life coupled with conducive hygienic conditions with a vivacious health and care (CFS, 2012; FAO and WSFS, 2009; IFRC, 2011; Gross et al., 2000).

The concepts FS and NS have been adopted and used synonymously with one another by the international bodies such as International Food Policy Research Institute (IFPRI), Food and Agriculture Organization (FAO) of the United Nations (UN), and The United Nations International Children's Emergency Fund (UNICEF) (Pangaribowo et al., 2013). For instance, IFPRI began using the term the two terms FS and NS as one (FNS) in the mid-1990s, and the UN's bodies - High-Level Task Force on Global Food Security (HLTF) and Comprehensive Framework for Action (CFA) too use the same terminology in their research and activities (CFS, 2012). Though the concepts of FS and NS have at times been used interchangeably, the scope of their goals is quite different. FS focuses on production and access, and NS focuses on utilization hence it was deemed relevant to have the two terms combined as one (FNS) with a collective goal of achieving production, accessibility, utilization (that is further influenced by sanitary conditions, health, care). The concept of stability was later incorporated into the overall term FNS that describes a condition of being able to have continued access to food

even during lean periods (CFS, 2012; Carletto et al., 2013; CFS, 2011; FAO, IFAD and WFP, 2013; Pangaribowo et al., 2013; Hwalla et al., 2016).

FNS is vital in community development efforts; however, many organizations have left out the focus on nutrition. Food security can be achieved while there are still problems with nutrition security. This is made clear by the mortality rate remaining stagnant or even rising in regions where these organizations have intervened (Hwalla et al., 2016). It was therefore found paramount to integrate the FS and NS concepts altogether, design a single policy goal that once implemented can achieve a more realistic situation and widely accepted results (Pangaribowo et al., 2013; Weingärtner 2010; Hwalla et al.,2016).

2.3 The Four Pillars of Food and Nutrition Security

FNS has four profound pillars that reinforce each other and were born out a consensus that achieving FNS in totality, there was a need to design a more comprehensive and inclusive strategy that tackles food production to increases accessibility but also take into consideration the sanitary of the environment that influence human health as stability that influence continued access to influence given the changing state of supply (FAO and WSFS, 2009; IFRC, 2011; Carletto et al., 2013; CFS, 2011; FAO, IFAD and WFP, 2013; Weingärtner, 2004; Gross et al., 2000). These four pillars are food availability, food access, food utilization, and food stability are explained follow:

2.3.1 Food Availability

Food availability occurs when people can physically obtain adequately nutritious food from domestic production, imports, food aid, and or a combination of these sources (FAO, 2006). However, a clear signal of food and nutrition insecurity is evident if the importation

rate is high which means that there is no food available for people to consume and therefore a likelihood of spending a day, and or even a night without eating. Food availability is determined by the production capacity of a country (Barrett and Lentz, 2009), meaning it is largely influenced by the physical and natural endowments in terms of soil fertility, climate, pest and disease prevalence, government policies in agriculture in the country (UN Millennium Project, 2005). One very important topic when it comes to domestic production is the role of women in cropping and livestock systems, particularly for home consumption, women's role in agri-food production sector is paramount (World Bank, 2009). It is further affirmed by Doss (2011) that women's share in the agro-related labor force has a very substantial influence on national food production that fulfills the core of food availability. The flip side of this gender role is that women's limited access and control over land, credit, technology among others have all limited the potential to exploit their ability to full capacity (Deere and Doss, 2006; World Bank, 2009).

However, Pangaribowo et al., (2013) recommended that accelerating agricultural research and development is a proxy indicator to achieving food production. Such research and development can take the form of biofortification of food crops to produce crops with essential nutrients that are required for healthy growth, these include Orange-Fleshed Sweet Potatoes (OFSP) enriched with Vitamin A, rice enriched with iron and zinc, beans enriched with iron among others. Similarly, Rosegrant et al., (2012) recommend integrating livestock production into the agro-system to reap the linkages of food and feed supply. Animal source proteins are highly essential and such animal products have been proved to be expensive to small landholder farmers. Headey (2012) reveals that population growth is one of the main food

availability stressors in the long run and recommended family planning as a significant social development.

2.3.2 Food Access

Food access is physical obtaining of food from the available stock either from own produce, purchase or food aid (WFP, 2009 Pg.170). Food abundance (availability) is different from food accessibility. Though food may be abundant, it may still be unavailable to a portion of the population due to several factors like high costs, distance (World Bank, 2007). As described in Sen's thesis, whereas food availability means abundance for everybody, this doesn't automatically translate into food accessibility hence leaving the population in a portion of food and nutrition insecure status (Sen, 1981). This is evident from the findings of Barrett (2010) where nine percent of the people particularly in the developing countries were found to be malnourished though there was a 12 percent rise in worldwide food production from the 1990s, meaning that food insecurity was evident even in the periods of food plenty (Webb, 2010). To achieve access to food, it's a function of production – availability, and income – the purchasing power of which this income is allocated disaggregated across the household's activities (Hoddinott, 2012). Low income means limited choice on the available food, given the fact that protein food, especially of animal origin, are expensive, their availability still will mean no accessibility due to lack of income (Rosegrant et al., 2012). This leads to the consumption of available food but with limited dietary diversity pulling the indicator back to food and nutrition insecurity bracket.

Though price and purchasing power significantly determine food accessibility, other aspects like culture, religion, and social status have also been identified as potential determinants that influence the dietary preferences and hence have an impact on food access

(Atkin, 2013). Similarly, ethnic norms, discrimination and gender imbalances do affect food access in the same way (Dohrmann and Thorat 2007; Jayne et al., 2001). For instance, Thorat and Lee (2005) provides a case from India where the Caste system discriminates some social groups of people in their systems which has a negative impact on their income acquisition hence cannot have enough revenue-generating activities that could boost their income for a better diet.

Food access is further seen from a broad spectrum in an economic lens, and thus advocating for a need to control the economic parameters of an economy relevant to depict a better food price index for a good FNS status such as agro-import levies, inflation, and exchange rates as these will avert the negative impacts of food price volatility (Pangaribowo et al., 2013). Byerlee et al., (2006) provides a case on food access from an economics lens that geographical areas dominated by a given staple food like rice in South East Asia (SEA), wheat in Pakistan, and maize in most areas of Sub-Saharan Africa (SSA) in most cases match with other staple food poor countries who eventually suffer a double shock – world food price shocks and internal production erraticism. Timmer (2010; and 2012) contends that having a functional price regulation and social protection policy will ensure food access and FNS in general for the people.

Unlike food availability that quantifies the physical presence of food at home or in the market, measuring food access attracted a lot of research by development agencies, and many ways have been researched, shown to correlate with one another in results, and therefore validated and adapted for use (INDDEX, 2018). Three methods (see details in the next section on the measurement of food security) adopted in this research are:

- The Household Food Insecurity Access Scale (HFIAS) developed by a USAID funded program - FANTA between 2001-2006 that focuses on occurrence and frequency of occurrence of food insecurity situation in a household in the past four weeks (one month), classifying the household with more occurrences as food insecure (Swindale et al., 2006).
- The Household Dietary Diversity Score (HDDS) that measures the food groups consumed at household level in the previous 24 hours, classifying a household with higher numbers as food secure (Maxwell et al., 2013; Swindale et al., 2006).
- The Food Consumption Score (FCS) that quantifies the dietary diversity and food groups consumed in the previous week (7 days) basing on assigned weights with a more secure household scoring higher with reference to the cut off gauge (WFP, 2008).

2.3.3 Food Utilization

Food utilization is the body's ability to absorb the nutrients from the consumed foods to maintain a healthy state, hence this is the core FNS component that defines and measures nutrition security among households. In the general definition of FNS, the section of "safe and nutritious diets" defines food utilization (WFP, 2009 Pg.170). Food utilization is determined by the diet (the state of the foods' composition – carbohydrates, vitamins, proteins, fruits) of foods consumed hence availability and accessibility of one group of food does not necessarily translate into utilization. Similarly, additional parameters to ensure full utilization include access to good clean water, sanitation facilities, and care. Poor sanitary environment predisposes households to the risk of acquiring diseases and if combined with poor access to health care, child care, the principle of utilization will never be achieved in such situations (CFS, 2012; FAO and WSFS, 2009; IFRC, 2011, Hwalla et al., 2016).

To go further, the debate on food utilization is very interesting. Food availability, access, and utilization all have one common factor income that determines them - purchasing power of the household. However, though it influences more on availability and access, these two core principles do not guarantee utilization and a safe FNS status (Barrett and Lentz 2009). For instance, individuals' or a households' preference for hypocaloric or hypercaloric foods will not matter about their high income that would really guarantee access to diverse food diets (Pieters et al., 2013). On the other hand, high income – purchasing power does not guarantee the quantity or quality of the diet consumed especially if it's used on alcohols and or fast-foods (Banerjee and Duflo 2006). Similarly, an imbalance in the quantity of food shared during meals at home greatly creates nutritional disparity within the same household where others are given more food and sauce than other members. This is true for most developing countries where a household head if is a male and most adult males are given more food than the young ones hence creating imbalances in food intake likely to leave the marginalized hungry (Haddad et al., 1996; Thomson and Metz, 1998).

There is a correlation between HDDS and FCS when measuring food utilization for purposes of determining the households' nutrition security. Food utilization measurement takes the form of nutrition security and is measured by anthropometric indices (details in next section on the measurement of nutrition security) that measure the human bodies' external physical state and growth (Napoli et al., 2011). Physical state of the body is determined by the diet consumed, access to water, health environment, hygiene hence poor dietary consumption results into body micronutrient deficiencies hence causing various forms of child undernutrition including stunting, underweight, wasting, and maternal complications among WRA all of which undermine the success of achieving nutrition security (Napoli et al., 2011;

Ruel et al., 2010; Ruel, 2003; Savy et al., 2005). Most relief NGOs use anthropometric indices to ascertain the success of their interventions as these provide a clear sense of transition both short and long term from malnutrition (De Haen et al., 2011).

2.3.4 Food stability

Food stability is the ability of people to have access to quality nutritious food always (WFP, 2009) even in periods of shocks for instance due to bad climate or seasonality in agricultural production a period between production and harvest identified as the "hunger season" (Maxwell and Frankenberger 1992). Because all four pillars are necessary for FNS to be complete, food stability is often the last step to FNS completion. This shows the ability of the individual, household or a nation to recover from a shock, build resilience and sustain production even in shortfall periods. One-time availability, access, and utilization can indicate FNS at some level but rural communities in developing countries who rely on rainfed agriculture, seasonality easily translates them into hunger phases in-between season of production and harvesting. Its, therefore, argued that the four components be considered in strategy and policy design with proper assessment, programming, and capacity building during the intervention (Hwalla., 2016). Unless sustainability is achieved, it's easier to fall back into the food insecurity trap. Von Braun and Torero (2012) noted that the aspect of food stability with reference to food availability and access is in three lenses; production, prices and storage as important parameters.

Pangaribowo et al., (2013) affirm that investing in sustainable and resilient agro-production systems, promoting rural development and stabilizing market prices are the best components to achieve the stability factor of FNS. Pangaribowo et al., (2013), HLPE Committee of World Food Security (2012a), further recommends safety net and social

protection interventions for vulnerable groups like the disabled and elderly as buffers to safeguard their access to food not only in periods of shocks but throughout the year. An example of an effective safety net program is in Indonesia, through subsidization of rice farmers, the purchasing power of the poor was boosted towards good diets and health care (Pangaribowo, 2012). However, Carter (1997) contends that the strategy planned for implementation depends on the nature of the vulnerability to which an individual or household is exposed to, and the endowment to sustain the plan.

2.4 Measurement of Food and Nutrition Security

2.4.1 Food Security

To track success in achieving the SDGs set for 2030, it is crucial to measure the FNS progress. In the definition of FNS as prescribed by FAO (2009) declaration of the World Summit on Food Security (WSFS) that says:

> *"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life."*

The above description points to food availability, access, quality, preferences, and stability as already explained in the previous section on the four pillars of FNS. It, therefore, shows that FNS encompasses various components that no single indicator is good enough to measure; rather, a synergy of indicators can be used to capture all its dimensions (FIVIMS, 2002; Hoddinott, 1999). Barrett (2010) tells us that there is a clear order of evidence within these dimensions, for instance, food availability is essential to ensure food security, but it is not solely adequate to warrant food access, and that whereas food access is equally essential but

alone cannot guarantee good utilization – safety and nutritional aspect emphasized here. Food stability is a cross-cutting dimension between availability and access, and hence defines the variations and uncertainties that exist between them.

Measurement of FNS has evolved over time with changes in the conceptualization of the subject matter. The United States Department of Agriculture (USDA) worked with governments and agencies in developing countries to develop the Household Food Insecurity Access Scale (HFIAS), that has been validated and widely accepted for use as measure food security focusing on *food access* across different cultural settings (Swindale et al., 2006; Coates et al., 2007). This tool focuses on food access as the best measure of food insecurity and utilizes nine questions that are asked to the household member about the relative situation of food insecurity happening in the month (four weeks). For every occurrence of the situation is coded as 0 for no and 1 for yes, followed by the frequency question that measures the regularity of occurrence categorized as 0 for none, 1 for rarely, 2 for sometimes and 3 for often. Determining food security status is by summing up all nine frequency of occurrence responses, a sum greater than nine, categories the household as food insecure (Swindale et al., 2006).

Household Dietary Diversity (HDD) is another measure of food security focusing on *food access* just like HFIAS, initiated by Food and Nutrition Technical Assistance [FANTA] (Hoddinott and Yohannes, 2002). In this method, a household is asked about the foodstuff consumed in the 24 hours prior to the survey as well as the method of accessibility. To generate a more accepted diversity score, Hoddinott & Yohannes, (2002), Ruel, (2002), Swindale & Bilinsky, (2006), provides a list of different foodstuffs categorized in 12 groups as adopted from FAO Food Composition Table (FCT) for use in Africa. It's believed that the more diverse

the in consumption, the more food secure the household, and a more diversified diet is correlated with its caloric and protein adequacy (Swindale et al., 2006). The HDD determines the households' ability to access diverse food in relation to its socioeconomic status (Kennedy et al., 2011).

Linked to HDDS is the Food Consumption Scores (FCS) that quantifies the food groups on assigned an index multiplier to give a proxy indicator of the caloric consumption of a given household in the previous seven days (Harris, J., & Vhurumuku, 2002; INDDEX, 2018; Coates et al., 2007; Weismann et al., 2009; WFP, 2008). The FNS status is then determined based on the total sum of the FSCs compared on the standard gauge to determine the food security categories with a households' score of 35 and greater considered to be food secure with a diverse diet and high caloric intake.

2.4.2 Nutrition Security

As earlier indicated, nutrition security is mainly influenced by the food utilization component of the FNS. The of the HDDS and FCS indices are paramount measures of food access but determines the body growth which then directly relates to anthropometric measurements for both Women of Reproductive Age (WRA) and children of 0-5 years of age (Napoli et al., 2011; Ruel et al., 2010; Ruel, 2003; Savy et al., 2005). Anthropometric indices measure the body's physical proportions relating to heights, weights, and circumferences of various parts like head, arms, waist, and hips that are used to detect the nutrition and health state of the individual relating to undernutrition and obesity (Lele et al., 2016; WHO, 1995; 2003; 2006). Weights are mainly used to identify signs of undernutrition or overnutrition (obesity), heights for stuntedness, and arm circumferences provide additional nutritional indicators and health.

These anthropometric measures are combined to measure individual variables that are used to determine the health status of the individuals. These include; the Body Mass Index (BMI) measures weight for height to detect underweight or obesity among WRA, weight for age to detect underweight among children, height (recumbent length of infants) for age to detect stuntedness, and weight for height to detect wasting among children all with reference to their sex and the WHO reference population (Lele et al., 2016; WHO, 1995; 2003; 2006).

2.5 Food and Nutrition Security Intervention Programs

The agro-food sector has evolved and is still evolving to enable households to produce fortified nutritious foods crops, vegetables, and fruits as well as supplementing with animal sources proteins like milk, eggs, and meat. Many development agencies have partnered in research and development of micronutrient enriched crops specifically vitamin A, iron and zinc. Consultative Group on International Agricultural Research (CGIAR) through HarvestPlus developed a Biofortification Priority Index (BPI) for different regions of developing countries, the program focuses on key crops. Available to farmers are; bean and pearl millet fortified with iron, Cowpea, Irish Potato, Lentil Sorghum fortified with Zinc and Iron, Sweet Potato, Cassava, Maize, and Banana/Plantain fortified with vitamin A, and rice, maize, and wheat fortified with zinc (CGIAR, 2018). For the case of Uganda, HarvestPlus partners with Volunteer Efforts for Development Concerns (VEDCO), and the farmers through their groups and a total of 18,073 households in five districts received planting materials of OFSP, high iron beans, vitamin A-fortified cassava, grain amaranths, and vegetable seed kits all various breeds in 2015 (VEDCO, 2015). Sweet potatoes are the third most commonly consumed staple food crop in Uganda usually with beans, and the country ranks third of the 75

nations ranked by HarvestPlus for investing in OFSP production whereas high iron beans take the eighth position of the 81 countries ranked (HarvestPlus, 2015).

McDermott et al., (2013) provide a case study and a success story using Health Gardens Approach (HGA) implemented between 2007-2010 in a West African district of Kita, Mali. The region had already crippled by high rates of malnutrition, coupled with poor maternal and child care practices, Action Contre la Faim (ACF), adopted and modified the malnutrition framework of UNICEF (1990) and Black et al., (2008) to help the region back to life. ACF believed in complementary feeding initiatives like micronutrient supplementation, biofortification in crops, capacity building in agro-food and maternal health care, gender awareness, among others as engines to achieve household food and nutrition security. The Health and Nutrition Gardens initiative was implemented to 1,264 households in 36 villages between 2007 and 2010. In their evaluation research, the results showed an increase in vegetable production by +165 percent and from five to nine months in a year. The HDDS score improved and averaged between 5.3 to 6.6 of 12, this was considered pretty good according to the desert condition of Sahara region. There was an increase in the number of households consuming Vitamin A foods from 59% to 99%. On capacity building, 88% of program beneficiaries proved to gain on the dimension of malnutrition and how to deal with it compared to 68% non-program clients. Based on those achievements, ACF considered scaling up the approach to other parts of West Africa, South America, South Asia, and the Caucasus region who too were experiencing malnutrition. Case-study adopted from McDermott et al., (2013. p.670).

Another ray of collaboration has been seen in Kenya where communities been not only restored in a stable FNS status but also were moved forward to better livelihoods for long term sustainability by Global Communities. A case in this perspective was presented by Cracking the Nut Africa conference in 2014 where the; Global Communities' USAID-funded Protecting and Restoring Economic Sustainability to Ensure Reduced Vulnerability Plus (PRESERV+) Project worked on a broad range of the situation right from relief to recovery to improving the long-term food and nutrition security in the counties of Kitui and Tharaka, Eastern Kenya that were affected by weather vagaries that saw crop and animal failure (Campion 2014). The program worked on a model of integrated market-based approach, in the promotion food production to increase availability, access, reinstated the production of ancestral foods and adopted the kitchen garden approach to vegetable production to increase consumption of micronutrients and boost nutrition and market for income (Campion2014. Pg.15).

2.6 A Conceptual Framework for the Analysis of Food and Nutrition Security

The goal of this conceptual framework is to illustrate a path through which food and nutrition security are achieved. Using this framework, the Nutrition Education Center (NEC) can be evaluated in terms of fulfillment of Food and Nutrition Security dimensions. It examines the activities of the NEC as perceive to influence the Food Nutrition Security core principles in different dimensions. The framework describes a path of program evaluation starting with input referred here to as a participation in NECs' activities, outputs as measures of production (food availability and access), nutrition (food utilization) reflected by the anthropometric indices, and stability. These translate into outcomes broadly measured by Household Food Insecurity Access Scale (HFIAS), House Hold Dietary Diversity Score (HDD), Food Consumption Score (FCS), and Nutrition Security (NS) [determined by the anthropometrics of

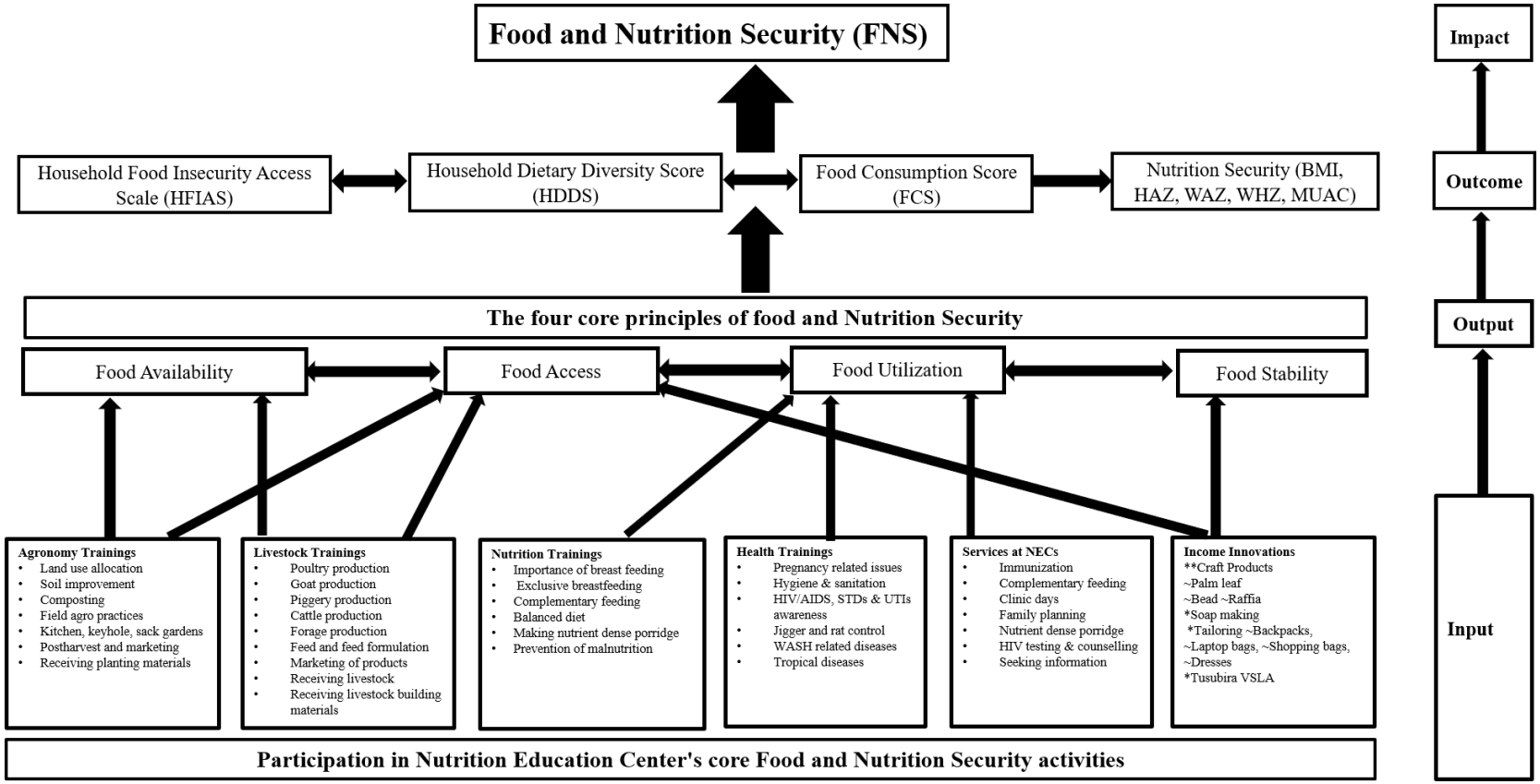

Figure 2.1 CSRL/ISU-UP NEC's Program Evaluation Framework

weight and heights that determines whether the caretaker/mother is healthy, underweight or overweight using their Body Mass Index, and whether children are stunted, underweight or wasted] translating to the overall goal of Food and Nutrition Security.

2.7 Participation in Nutrition Education Programs, and Food and Nutrition Security

The relationship between food, nutrition, livelihoods, and health are complex, global and rapidly growing (Waage et al., 2010). Nutrition Education Programs (NEPs) are an integral intervention in promoting FNS in communities. Most food security programs have emphasized production and accessibility, as well most literature shows that food is available and somewhat accessible, however, the nutrition component has been left out (Pangaribowo et al., 2013; Weingärtner 2010). Literally, achieving nutrition security with available food is a matter of knowing how to combine the available foodstuff to make a balanced diet, however, what seems simple has failed, and not are all necessary proteins, carbohydrates and fats available to everyone, this coupled with poor sanitation, has necessitated a need for a training program to create awareness. The NEPs need to be designed in a way that covers all the strategies that achieve FNS a whole with multiple synergies of interventions that promote agro-food production, water, health, hygiene and sanitation, nutrition and feeding as well as promoting nutrition education to build capacity of community members (Bhargava, 2001; Dewey, 2005; McDermott et al., 2013; Nemer et al., 2001; Penny et al., 2005; Victora et al., 2004).

2.8 Intervention Through Training in Rural Communities

Advocating for a sustainable agro-food sector is critical for the livelihood of the rural communities enthralled in poverty, food and nutrition insecurity (Bennell, 2010; Diao, Hazell and Thurlow, 2010; FAO, 2009). FAO (2010) noted that education (while referring it to agricultural training) in rural communities had not received enough attention in the past decades. Intensifying

the capacity building programs in agri-food production, nutrition, and health of these communities for self-reliance is necessary to make a positive impact. The training can help farmers in building capacity to boost their ability to make informed decisions about food production, income, and nutrition (Minot et al., 2002). These training are aimed at improving farmers' capacity in terms of knowledge and skills in managing agriculture and related enterprises that directly impact food production (agronomy and livestock) – availability, and access, nutrition, and feeding, and water, sanitation, health and hygiene that directly influence food utilization and income innovations that directly influence food access and stability.

Attaining a stable FNS status is within the means of developing nations but limited capacity has been found to be a graver challenge compared to others like limited technology, resources as well as climate change (Jana, 2009). A growing body of literature indicates that other than building capacity of individuals, all efforts to achieve sustainable development through public-private partnerships are worthless (Kandiwa et al., 2013; McDermott et al., 2013; Miruka et al., 2012; Muriithi et al., 2011). The good news is that capacity building has been considered among the topmost priorities of development agencies in addition to the mobilization of funds, and technology development and dissemination (Nazarene et al., 2007).

Participation of farmers in the trainings is a paramount factor, and this also helps them have direct access to the extension service agents that was identified as a problem in Uganda by their scarcity (UNFC, 2000) hence achieving FNS becomes a reality (Mulwa, 2004; Kandiwa, 2013). A typical community extension agent plays both back and forth roles; mobilization of community members, execute the training and monitor the application of learned skills on the ground. The training investigated in this research; agronomy, livestock, nutrition and feeding, health, water, hygiene and sanitation, and income innovations are broad and require multiple schedules so does

participation. Though it's the responsibility of farmers to efficiently contribute to food production, without assistance from extension agents of either government, NGOs, other stakeholders and or volunteers, this dream becomes hard (Kipkoech et al., 2007; Odame et al., 2009).

Participating in training help bridge the knowledge gap that exists between farmers, research, and education institutions. Extension agents close this gap and play the fundamental role of disseminating science-based knowledge to integrate with indigenous knowledge that in turn raises farm productivity (Aringa et al., 2011; Miruka et al., 2012). Participation does not only improve social capital through networks but also creates efficiency on the side of the trainers to address people of different socio-economic status that help pool ideas from a wide range for a common goal in a more creative manner (Tripp, 2012; Wang'ombe et al., 2013).

2.8.1 Agriculture and Food and Nutrition Security

Agriculture specifically crops, and animal production as already emphasized in this research provide almost 90 percent of the global caloric intake, and a major employer mostly in developing nations (Alder et al., 2012; Spielman and Pandya-Lorch, 2009). IAASTD (2009) indicates that about 2.6 billion rely on agriculture and related activities for a living. This confirms the claim put forward by Ellis (2000), Pumisacho and Sherwood (2002) that the agricultural systems are part of a broader livelihood system, and therefore need to be designed in a way to promote food production to reduce the global burden of malnutrition (Bernstein, 2002; Giovanucci et al., 2012; Iannotti et al., 2009; NRC, 2010; Uphoff, 2002; Welch and Graham, 1999).

2.8.2 Water, Sanitation, and Hygiene (WASH) and Food and Nutrition Security

Clean drinking water, proper sanitation and enhanced hygiene (WASH) are vital parameters reducing malnourishment. A mess in any of those three components increases the household's vulnerability to diseases including but not limited to diarrhea, dysentery, typhoid,

malaria all of which have a negative effect on immune systems thus predisposing the household of food and nutrition insecurity. The three WASH parameters are mutually interdependent on the WASH infrastructures that mainly include; latrines, tippy taps-hand washing facilities, bathrooms, kitchens, dish rackers – plate stands, and rubbish pits. These facilities determine the WASH status of the household and determine the rate of the households' predisposition to hygiene-related diseases mentioned above.

2.8.3 Frequency and Prevalence of Diseases in the Household

The health status of an individual determines his or her productivity thus directly impacts FNS. For instance, the time spent bedridden by the breadwinner of the household, and the spouse who contributes most of the labor in food production, and care for the children expose the whole family to a greater risk of food insecurity. Disease lessens the appetite for food despite its accessibility henceforth affecting utilization as absorption of energy and nutrients are inhibited (WFP, 2007). Health, food, and nutrition are codependent and this relationship results in a negative vicious circle described by UNICEF (1998) as follows:

> *"an individual who does not consume an adequate diet will have a lower capacity to resist infections, which will lead to longer, more severe and more frequent occurrences of sickness that, in turn, lead to a reduced appetite and malabsorption and further worsen the dietary intake" (UNICEF, 1998).*

Its, therefore, deemed relevant to keep a clean and healthy environment to reduce the risk of contaminations that predisposes households to diseases and poor health because better health enhances labor efficiency and productivity, saves resources that would be invested in treatment but rather spent on improving household diet (Rutten and Reed 2009; WFP, 2007). For school

going children, better health and nutrition status helps them have a settled peace of mind that in turn helps them perform well (Behrman, 1996; Bobonis et al., 2006; Halterman et al., 2001)

Tomkins and Watson (1989) tell us that access to health services is significant in prevention and treatment through immunization, drugs, vitamin supplementation among others. For diseases that have caused death lives of many individuals like HIV/AIDS in developing countries, affecting labor supply, food production and consequently leaving such families in food and nutrition insecurity, awareness campaigns must be sustained s Chawarika (2016) alluded for Zimbabwe.

2.8.4 Access to Clean Water

Water is part and partial of life (WHO and UNICEF, 2005) and forms an essential aspect in the attainment of a stable FNS status. Water has multiple functions that it serves; it can be for household domestic use – cooking, drinking, washing, bathing these of which these influence the personal health, hygiene and sanitation (Pangaribowo et al., 2013), or can be for crop through irrigation at various levels, animal for consumption, and can for industrial purposes at large. The quality of water available is very paramount in food, nutrition, and health, Ringler (2010) alludes that polluted water has numerous negative impacts on the population. In 2011, the deterioration of water quality in the urban areas of Zimbabwe threatened her FNS status as cholera and typhoid become widespread (WHO, 2011). In agricultural production, access to water increases food production through irrigation, for instance (Tesfaye et al., 2008) found out that 70 percent of farmers who used irrigation water were food secure compared to 20 percent who were food secure but did not use irrigation. The system of irrigation enables food production to be carried out throughout the year hence contributing to all the components of FNS.

2.8.5 Nutrition, Feeding, and Health and Food and Nutrition Security

During the World Economic Forum (WEF) in 2000, Brundtland who was the Director General of WHO avowed nutrition as a fundamental component in all development programs to lessen the global burden of malnutrition with all its manifestations (WHO, 2002). The hope was to uplift the overall nutrition and health status of individuals irrespective of their location and wealth. WHO (2003) revealed that over 50 percent of death on earth are related to poor nutrition, with an estimated toll of 30 million people mostly the poor in developing countries (Muller and Krawinkel, 2005; WHO, 2003). The birth of the Copenhagen Consensus in 2004 with an aim of redirecting investment of the world's leading economists, named malnutrition as No.2 and agriculture development as No.5 of the top 10 global challenges (Copenhagen Consensus, 2004). They affirmed that investing in the development of the dysfunctional agro-food system will synergistically reduce the global burden of food and nutrition insecurity. However, literature, statistics, and research present the problem still thriving as it was! For instance, in 2008, the number of overweights was far higher at 1.4 billion than the undernourished that who were estimated to be 925 million, a sign of prevalence of malnutrition more so depicting overweights higher than hungry people (WHO, 2008; FAO, 2010; IFRC, 2011).

Specific to Africa, there is limited indication of decrease in incidences of underweight (Lim et al., 2012; Stevens et al., 2012a) and micronutrient deficiencies, for instance, the prevalence of Vitamin A deficiency was estimated to be between 30 to 40 percent, and anemia - iron deficiency at 40 percent among non-pregnant Women of Reproductive Age (UNSCN, 2010a). The side effects of "Nutrition Transition" like overweight, obesity and several NCDs especially in the urban areas of Sub Saharan Africa are becoming more evident (Alder et al., 2012; Delpeuch et al., 2009; Morris, 2010; Stevens et al., 2012b).

According to Black et al., (2013) WRA who are malnourished stand high chances of giving birth to malnourished children due to limited growth of the fetus. Poor nutrition has negative effects throughout the life of an individual for instance, in early childhood, it limits the intellectual and social development which in turn has profound impacts ranging from death, reduced capacity to reason and learn as well as likelihood of acquiring Non-Communicable Diseases (NCDs) at an advanced age (Black et al, 2008 pg.443; Grantham-McGregor et al., 2000; Gundersen & Ziliak, 2015; Maluccio et al., 2005; Matorell et al., 2010; WHO, 2011a).

A close focus at infants, child malnutrition on a global scale remains one of the main burdens of public health anxieties. According to statistics released by UNICEF-WHO-World Bank Group (2018), (see table 2.1 below for details), on Global scale, the number of stunted children reduced from 198.4 million in 2000 to 150.8 million by 2017 with Africa named as the only region where the number had risen in this reference period. Sadly, the number of overweights increased across all regions thus no progress was made on this. The rate of child wasting is also high affecting 50.5 million children, and severe wasting affecting 16.4 million across the globe. On disaggregating data by income, the team noted that two-thirds of children who are stunted and three-quarters of all the wasted children live within the low-middle income nations through these countries hold about half of the children.

In Uganda, the situation is no better, the Demographic and Health Survey (DHS) in 2016 reported 2.2 million (one in every three) children under five years of age as stunted, amounting to 29 percentwise pointing out limited access to food, health and child care as the principal causes (EC, 2018; UBOS and ICF, 2017; USAID, 2018). Fink et al., (2014) reports that the risk of stunting is more likely to happen too early childhood mothers, of which Uganda has the highest fertility rate in East and Southern Africa with 54 percent (as of 2016) of adolescent girls bearing children

at the age of 19 years (USAID, 2018). Overweight is reported to have increased from three to four percent between 2011 and 2016 among children and from 19 to 24 percent among WRA.

Table 2.1 Child Malnutrition across the Globe between 2000 and 2017

Region	Units of measures	**Stunted**		**Overweight**		**Wasting**	**Severe wasting**
		2000	**2017**	**2000**	**2017**	**2017**	**2017**
World	Millions	198.4	150.8	30.1	38.3	50.5	16.4
	Percent	32.6	22.6	4.9	5.6	7.5	2.4
Developing Nations	Millions	195.3	148.0	24.4	31.2	49.6	16.3
	Percent	35.9	24.3	4.5	5.1	8.1	2.7
Africa	Millions	50.6	58.7	6.6	9.7	13.8	4.0
	Percent	38.3	30.3	5.0	5.0	7.1	2.1
Sub Saharan Africa	Millions	50.3	57.9	5.1	6.3	13.1	3.8
	Percent	43.3	33.9	4.4	3.7	7.7	2.2
Eastern Africa	Millions	21.5	23.9	2.2	3.0	4.0	1.0
	Percent	47.5	35.6	4.7	4.4	6.0	1.5
Low Income	Millions	35.1	37.8	2.6	3.4	7.9	2.1
	Percent	47.0	35.2	3.5	3.2	7.4	2.0
Middle Income	Millions	165.3	112.8	21.9	25.2	40.0	13.4
	Percent	35.4	22.4	4.7	5.0	8.0	2.7

Source: UNICEF-WHO-World Bank Group – Joint Child Malnutrition Estimates 2018 edition.

Micronutrient deficiencies especially iron resulting into anemia has been reported affecting more than 50 percent of children below five years, and one in every three women, this is probably because only 15 percent of the children are reported to be receiving the minimum acceptable diet, (EC, 2018; UBOS and ICF, 2017). It is sadly reported that even with an increase in iron supplementation from four percent in 2011 to 23 percent in 2016, the prevalence of anemia too

increased from 23 percent to 32 percent among pregnant mothers in the same reference period (UBOS and ICF, 2017, USAID, 2018).

Given the high population growth standing at 3.0 percent per annum (UBOS, 2016), European Commission (EC) (2018) reported that Uganda will neither meet its own target set for 2019/20 to reduce child stunting to 2 million (25 percent), nor will she meet the World Health Assembly (WHA) of 1.46 million by 2025. The 2016 projections indicate that over 2.3 million children will be stunted by 2025, an indication that more efforts needed from all partners to help scale up agriculture and livestock development especially for small landholder farmers, capacity building to create awareness especially in homes with children, prevention and treatment of acute malnutrition, scale up vitamin A supplementation, deworming, strengthening child and maternal health practices like encouraging child feeding, child care as well as maintaining health, hygiene and sanitation both personal and household as whole.

2.9 Household Socio-economic Characteristics, and Food and Nutrition Security

Besides participation in the NEC activities, the social demographic and economic characteristics are perceived to have an influence on food and nutrition security of households, as well have an influence on the participation in the program's activities. These are described as follows:

2.9.1 Access to and Use of Credit

Credit access and use can alleviate issues of food and nutrition insecurity, for instance, it can be used in procurement of farm inputs both for crop and livestock that directly increases food production, can be used to purchase food hence increases food access, but in general, it helps to raise the purchasing power of the household. In South Asia, wheat production has been boosted by accessibility to credit which enables farmers to do garden activities on time (Mittal & Sethi, 2009). However, limited access to credit and lack of collateral security for the bank loans have

been a problem to poor farmers which has limited the potential for agricultural development and modernization (Bshir & Azeem, 2008; Iftikhar & Mahmood, 2017; Yu et al., 2009). Further literature indicates that gender asymmetries that limit women from access credit limit their potential to exploit their abilities in food production (World Bank 2009; Deere and Doss 2006).

2.9.2 Household Income

Household income represents cash, in this respect that can be used in daily transactions. For this study, the main form of transaction is related to the purchase of food, farm inputs, vaccines, and drugs for both humans and animals all of which are related to impacting FNS. Income sources are varied, these can be on-farm from sale products or off-farm from other economic activities or employment. Several studies confirm that income is a major determinant of food access, and that income determines the households' dietary diversity (Hoddinott, 2012; Ruel, 2002). As the income of the household increases, the FNS of the household is likely to improve. A study in Ethiopia and Zimbabwe shows that participants who had higher and varied sources of income were more food secure (Chawarika, 2016).

However, a growing body literature suggests that greater wealth has caused poor health in what Popkin (2001, & 2002) termed as "Nutrition Transition" in developing nations. The assertion put forwards is a rise in income not only lead to greater accessibility to foods but also a shift to "western foods" characterized by high saturated fats, sugars, and refined food, and with low fiber. WHO (2011b) affirms that the shift in the pattern of consumption of the developing nations to "western food" has bred a new category of Non-Communicable Diseases (NCDs) that include but not limited to heart disease, stroke, cancer, diabetes among others. In India for example, Gaiha et al., (2011) show that a rising income was accompanied by an increase in diet-related diseases that killed 3.78 million in the 1990s and the death toll is estimated to about 7.63 million by 2020.

According to the WHO (2018) fact sheet, NCDs are reported to have claimed lives of over 41 million people estimating it to about 71 percent of the world's reported deaths.

2.9.3 Education Level

Education is linked to human capital development and social capital through networking therefore critical in the development of intellectual capacity that is significant in decision making (OECD, 2003; WFP, 2006). An individual's intellect derived from school determines the type of employment, income, and work productivity (Mukudi, 2003) all of which have a positive substantial impact on the FNS. Education helps in the dissemination of information related to health, hygiene and nutrition for instance, helps in making informed decisions of micronutrient nutrient intake – diets for the household, health and sanitation practices and food production decisions (Cutler and Lleras-Muney, 2006; Feinstein et al., 2006; Luo et al., 2012; Robeyns, 2006). From the caregivers' lens, education helps to raise their bargaining power which has a significant impact on the FNS in the household. The fact that most key decision makers are household heads who mostly men, a study has shown that women who participate in decision making because of their intellect have reported fewer incidences of underweight and wasting among their children (Shroff et al., 2011). Similarly, Thomas (1994) found out that an educated caregiver in a household can amicably resolve issues of discrimination that may arise within children based on age and sex.

2.9.4 Gender Roles

Gender in agricultural development, food and nutrition are greatly linked and have attracted a lot of attention of scholars and development agencies. Debate on gender issues aligns more on raising voices for women against their discrimination of various forms. Specific to this research, women are significantly recognized for their contribution in agro-food production. FAO (2011) reported that 79 percent of women in the developing nation go by agriculture as their major

activity, provide 43 percent of the agri-food labor force. This is a large share of labor has a direct impact on food production, Doss (2011), Marslen (2015) too confirms the FAO claim, and that on global scale women produce half of the world's food. In 2009, the report by the World Bank also indicates that women were actively involved in crop and livestock production and controlled of a share of their marketing (World Bank, 2009). Literature shows that women are more dedicated to looking after their families, making sure every member is safe by directly offering care, spending any little income of theirs on food (Hopkins et al., 1994; Hoddinott and Haddad, 1995). It was also found out that in times of shock, women offer most of their share of food to other household members (Quisumbing et al., 2008).

Despite the above rubicund picture, the productive potential of women has not been fully exploited due to gender-related issues that include but not limited to; limited access to land, credit, technology, market among others (Deere and Doss, 2006; FAO, 2011; Ransom et al., 2016; World Bank, 2009). Closing this gender disparity is significant to achieving a stable FNS status. HLPE (2012a) suggests that safety net programs that target women have a greater influence on the FNS owing to their special gender roles in food production, caring and food preparation hence determine the health status of the whole family. From the gender lens, capacity building has been recommended as a way of closing the knowledge gap and have a positive impact in decision making pertaining food production, consumption and family affairs (CGIAR-A4NH, 2012; FAO, 2011; Gillespie et al., 2012).

2.9.5 Membership to Community Groups

Social capital described as a spirit of togetherness in a community gained a lot of attention owing to its contribution to alleviating the shocks of food and nutrition insecurity. These social groups are of different types and they do serve multiple purposes. Woolcock and Narayan (2000)

point that one of the coping strategies for food and nutrition insecurity is determined by the households' resource base but goes further to attest that social network plays a very crucial role in providing support depending on its size. Sseguya (2009) found out that households who belonged to food security groups were found to be more food secure than their counterparts in Uganda. In India and Bangladesh, women in rural communities who are captivated by poverty form self-help groups to help each other in periods of shock (Lahiri-Dutt and Samanta, 2006; Pieters et al., 2013).

2.9.6 Land Access and Use

The land is by far the most precious gift of nature and a fundamental aspect of food production. Land productivity with reference to agro-food production systems is determined by its quality in terms of nutrients and the technology employed in farming (Wiebe, 2003). Though the land is subject to the law of diminishing returns (Shephard and Färe, 1974), it needs to be fed appropriately in all production stages. Food availability is determined directly by the quantity of land devoted to food production and indirectly to cash crops that can later be sold to raise income, boost the households' purchasing power as well as land devoted to livestock. Accessibility to land without putting it into use for some reason does not improve food production.

It is a common phenomenon in SSA that land is controlled by male household heads, and this gender disparity of land against women has limited their productive capacity yet they are more involved in food production for their families (World Bank, 2009; Deere and Doss, 2006). In Uganda, the proclamation of the 1995 Constitution was followed by enaction the Land Act in 1998 (Lastarria-Cornhiel, 2003). One of the core principles that guided the preparation of the act was to have a good tenure structure that could help boost agricultural production, providing for a rightful landholder with a right to sell land at his or her wish so that progressive farmers can have access to more land for more production (Rugadya,1999 pg.5). The strength in Section 40 of the 1998

Land Act with regards to spouse and adult dependents provides that, consultation on both if any must be made before any legal transaction is done on the land that provides a living to the family. Similarly, provisions of Section 28 are that any customary practices that repudiate women and or children from the use of land are worthless and annulled before the law (Lastarria-Cornhiel, 2003).

Nevertheless, the clause for marital co-ownership of property, after a hot debate and subsequent approval was excluded in the bill at the last stage of parliamentary voting in a technical abuse of legislative procedure (Matembe, 2002). Maria Matembe, a legislative member and Minister of Ethics and Integrity by then narrates that she was interjected by a member as she was about to read the clause into the microphone for a Hansard when she was told *"they were finished, no need to read them"* finally the clause was not read in the microphone and could not be included in the Hansard. This legislative maneuvering discriminated women based on technicalities as she quotes in her book entitled "Moment of Reality - The Land Act 1998":

> *"I want to make one thing clear. If this had not been an amendment to give women their due rights, if this had had to do with things that the male MPs consider important, Parliament would have found a way to bring the matter back for more review. They would have said, this is just a technicality, and the provisions would have found their way into that law (Matembe, 2002:)."*

The Land bill and the political legislative misconduct attracted other elites, Palmer and Oxfam who are Land Policy Advisors had this to say in their summary:

> *"You can see the tactics used by these male conspirators. The men had achieved what they wanted for themselves in the [1998] Land Act. The Baganda got their share. The Banyoro got their share. And after the women lost out…none of these men was ready to come our way with support…. As with so many things, the women*

were left out again. Justice for women? Not this time? But when? (Palmer & Oxfam, 2002).”

CHAPTER 3: STUDY AREA AND METHODOLOGY

3.1 Study Area Background

Located in southeastern Uganda (Figure 3.1), Kamuli district sits on an estimated area of 4,348km^2 unevenly distributed between land 77 percent, and water including lakes, rivers, swamps 23 percent (UBOS, 2002). The district has a total population of 486,319 people of which majority of them are young, making up 63.6 percent within the range of 0-19 years of age (UBOS, 2017). Agriculture is the main source of livelihoods with crop production practiced by 90.4 percent and livestock 65.7 percent of the entire population (UBOS, 2017). Agricultural production is done on a small-scale subsistence partly because of limited access to land with an average of two hectares per household (Kamuli District Administration, 2004). The main staple food crops grown include but not limited to maize, beans, and cassava; and for animals include chicken, goats, pigs, and cattle (Sseguya and Masinde, 2005; Sseguya et al., 2009). The agricultural productivity of the area has declined over time because of soil mining[2]. Similarly, natural disasters like pests and diseases, adverse weather, poor access and adoption of post-harvest technologies and poor extension services have also contributed to reducing productivity (Pender, Nkonya & Sserunkuuma, 2001). Over-reliance on nature, and with the declining land productivity increased the vulnerability of the population to poverty and food insecurity. As a result, over 50 percent of the rural dwellers were categorized as food insecure in Kamuli district (KDA, 2004; Sseguya and Masinde, 2005), and 80 percent of the entire rural population in absolute poverty in Uganda (WFP, 2009).

[2] Soil mining refers to the continuous cultivation of land without replenishing nutrients, farming in fragile areas like swamps, forests, hills with its associated adverse effects (NEMA, 2005).

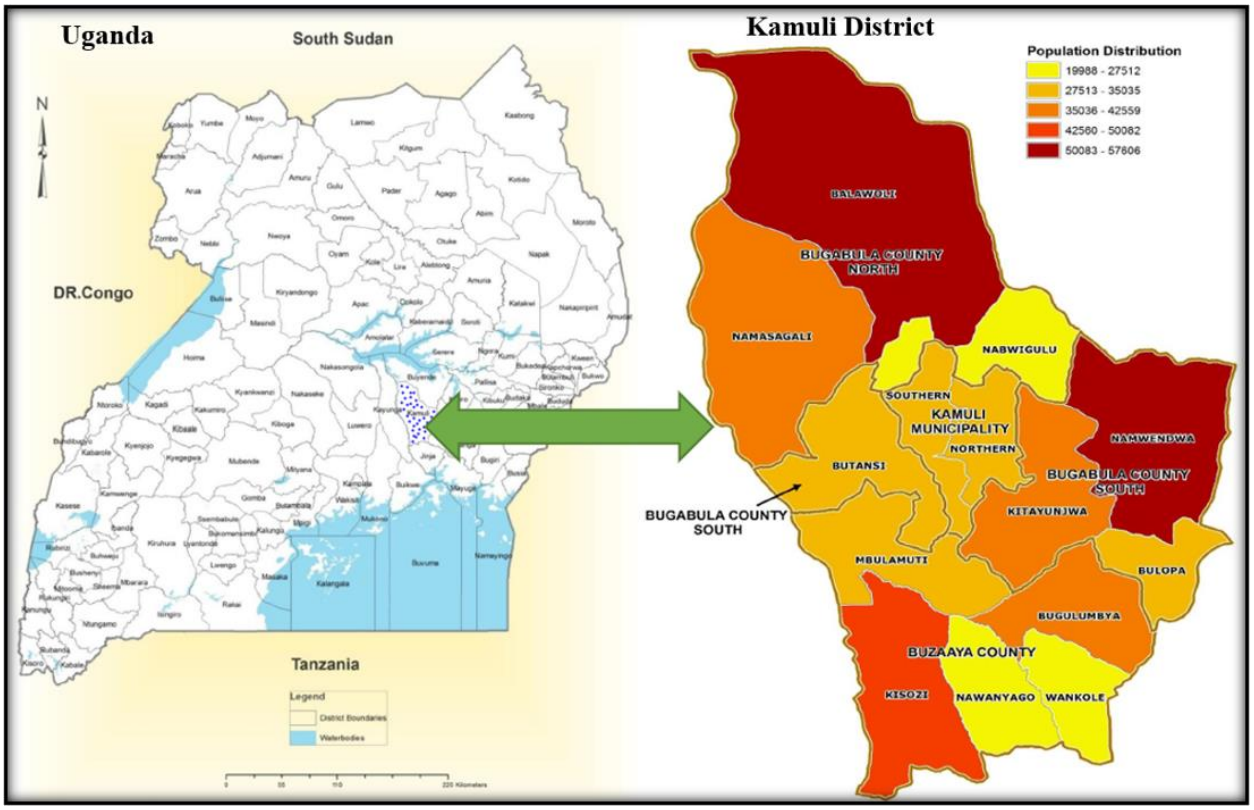

Figure 3.1 Location of Kamuli District in Uganda

Source: UBOS, (2017)

Over the years, the government has implemented initiatives to help reduce the dual problem of poverty and food insecurity but with less success, until the private partners joined the efforts in the 1990s (MAAIF and MFPED, 2000; KDA, 2004). One such partnership is the "Tapping philanthropy for development", an initiative launched in 2004 to help the poorest of the poor in the country (Butler and McMillan, 2015). This initiative involved a tripartite partnership between Iowa State University (ISU) through its Center for Sustainable Rural Livelihoods (CSRL), Makerere University (MUK), and a local Non-Government Organization (NGO) known as Volunteer Efforts for Development Concerns [VEDCO] (Butler and McMillan, 2015). Its main objective was to implement food security programs through community farmers' groups operating in three sub-counties of Butansi, Namasagali, and Bugulumbya in Kamuli (Mazur et al., 2006).

CSRL/VEDCO group model of operation was based on a belief that livelihood can improve through working with farmers in organized groups as attested by Mazur et al., (2006). Hence the groups that worked with the organization were required to have some formal organization with a fully functional constitution and elected leaders (Sseguya, 2009). The core objective of the organization and the groups in addition to improving food and nutrition security (generally improving livelihoods) was to supplement the existing extension staff in the district through their voluntarily trained Rural Development Extensionists (RDEs), and the Community Nutrition and Health Workers (CNHWs). The group model, operationalized as farmer-to-farmer extension service provision in addition to provision of inputs such as planting materials, animals, among others, the tripartite partnership was able to register success in a turning the of food security trends from 9 percent in 2005 (Sseguya and Masinde, 2005), to 53.7 percent by 2009 (Sseguya, 2009), promoted agro-based enterprises among the impoverished farmers, value addition, empowered women and generally improved the general livelihoods and welfare of rural farmers through the integrating the nutrition initiates into the food security programs (Sseguya, 2007).

However, in 2013 ISU severed its relationship with VEDCO and established its own NGO; Iowa State University - Uganda Program (ISU-UP) in Uganda to serve as the as a host for CSRL but continued its collaboration with MUK (Kugonza, Tobin and Deckers, 2018). The change in the structure of the initiative was also accompanied by a change in programmatic activities. For instance, in 2014, CSRL/ISU-UP embarked on a comprehensive action against hunger using a Field-Tested, Comprehensive Life-Span Approach to Capacity development (Fig.3). In this model, the center is expected to achieve its mission by training and development of activities that strengthen the capabilities of rural people to improve agricultural and natural resource management practices, build assets, diversify income sources, and achieve food security, good

nutrition, health, and build the next generation of development experts through service learning (https://www.csrl.cals.iastate.edu/transforming-lives).

The program utilizes this model that touches the lives of all people right from childhood. The rehabilitation programs of the Center focus on the mothers' welfare to ensure those at risk are properly cared for, after delivery, the program focuses on the welfare of the infants during their first 1000 days between birth and second birth and, on the welfare of the pre-school children. Both infants and pre-school (0-59 months of age), and their mother make up the core operationalization of the NEC activities. Proper care of children right from pregnancy is seen as a determinant to childhood development, and directly influences their cognitive and intellectual growth (activities in NEC are described in the case study that follows).

Figure 3.2 Life-Span Approach to Capacity development

Source: https://www.csrl.cals.iastate.edu/about-csrl

The program continues to impact the lives of children in primary schools (6-17 years) through its Nutrition Education Programs, and Service Learning. The program here utilizes the model of bi-national team projects where ISU-MAK students (both service learners and interns) work hand in hand to build capacity of children in agriculture in school gardens, livestock focusing on layer chickens, ducks, nutrition and feeding, water, health, hygiene, and sanitation, grain storage and postharvest handling technologies, agroforestry, as well as formal teaching of subjects including English, Mathematics, Integrated Science, and Agriculture. This method bridges the gap between theory and practicals.

The program also engages the Youths (18-35 years) in High School through its Youth Entrepreneurship Programs (YEP), building their capacity in agriculture and related sciences. Similarly, for Out-of-School youth in the same program (YEP) through its microfinance activities they build their capacity in livestock, crop, income innovation and are supplied with inputs as a startup to expand their livelihood strategies. In this same age cohort, the program touches the lives of Youth in Universities (ISU and MAK) through the Service Learning Programs where they engage in spearheading the activities of the program through bi-national team projects both in primary and high schools, as well as in the communities through field visits where they learn and exchange agriculture and social life-related ideas with rural farmers. Beyond the Youth are adults whose lives are changed through participating in programs including agronomy, livestock, income innovation. Through microfinance support, these farmers can increase food production both of animal and plant source, as well as building their capacity to manage their enterprise through training those programs (details to follow), and nutrition and feeding, water, hygiene, health, and sanitation-related programs.

The tripartite partnership of CSRL/ISU-UP-MAK-Government is tied with each stage of the program on the model. The NECs operate hand in hand with the Ministry of Health (MoH) through the district department of health and the Community Health Centers where Nurses and specialized doctors are programmed to work with the Community Based Nutrition Trainers and the program during immunizations, vaccinations, training of health, nutrition and feeding-related topics, and eye camps where members are checked for eye defects and given specialized contact glasses from the available program stock. The district water, and community development departments work hand in hand with the WASH program during citing, drilling of boreholes and training of the Water User Committees (WUCs) on maintenance and operation of the water wells. The department of agriculture is a partner in the agronomy and livestock-related activities. The departments of Education partners with the program to foster education in primary and high school and broadly Makerere University through Service Learning program so far, the longtime partner for the program. The program further works with other private partners especially in gender-related issues, child and orphanage homes among others.

3.2 Case Study: The Nutrition Education Centers of CSRL/ISU-UP

The Nutrition Education Centers (NECs) are a sub-component of the organization's Nutrition Education Program (NEP). The NEP has two components; the School gardens and lunch program that targets school going children through provision of school meals, agriculture-related knowledge and skills, and improved planting materials, and the Nutrition Education Centers (NECs) that works to improve the nutrition and health of children 0-59 months and Women of Reproductive Age (WRA). The NECs are used as rehabilitation homes for malnutrition cases to help in the provision of supplementary meals to children, expectant and lactating mothers, nutrition, health, sanitation and agricultural-related education to the mothers and caregivers aimed

at improving food and nutrition security individually and in their households (CSRL, 2018. Nutrition Education Center project profile).

3.2.1 A Brief History of the Nutrition Education Centers

Community members volunteer their homes for the program to set up these satellite centers (NECs) upon demand and availability of funds. The pilot center was established in 2011 at Jane Sabbi's home, a voluntary community health worker in the area (CSRL, 2011). By 2012, the center had grown to 80 mothers, with additional12 mothers who had graduated and formed a community group to create awareness about food and nutrition security in other communities (CSRL, 2012). Each center has a Community-based Nutrition Trainer (CBNT) who runs the daily activities at the center. In the period 2014 to 2017, more than 2,225 mothers, infants, and children benefited from the NEC's nutrition programs (CSRL, 2017). In 2017, 479 clients were served by the program, 131 of whom graduated after attaining the recommended health attributes (elaborated in graduation section), and 314 clients (123 children and 191 adults) received medical care with assistance from the program (CSRL, 2017). In 2018, based on the results of a rapid appraisal carried out in October 2017, and in a response to demand, a new NEC was opened. This satellite center serves 93 clients from seven villages within one-mile distance as opposed prior 2-mile distance to reach the formerly nearest center (CSRL, 2018). The program now operates nine NECs with ten CBNTs, one reliever and a supervisor, two quality assistants. These trainers are supervised by the program's community nutrition specialist based at Kamuli program office, and the overall program is managed by an associate director for community nutrition based at ISU (CSRL, 2018: ISU-Uganda Program Staff and ISU Based Advisors and Staff).

3.2.2 Operation of the Nutrition Education Centers

The NECs have an orderly manner of operation right from the admission of at-risk WRA, infants, and children to graduation and continued monitoring of graduands to minimize the risk of relapses. This order of operation is described as follows:

3.2.2.1 Admissions of clients

The centers admit two broad categories of clients – WRA, and infants and children who are subdivided into further categories. The nutritionally malnourished WRA are of two categories; at-risk pregnant mothers, and at-risk breastfeeding mothers. The infants and children (0-59 months of age) admitted at centers are of four categories: breastfeeding children on porridge; infants below six months of age on exclusive breastfeeding - these usually come along with their at-risk breastfeeding mothers; babies born at the NEC by at-risk pregnant mothers during rehabilitation and had not recovered to qualify for graduation; and the malnourished children. The malnourished children are further categorized into the following three groups depending on what the program does for them;

i. "Special case" children; these are admitted to the centers and are fed on a more specialized therapeutic nutrient dense porridge till they recover from their critical health condition after which they are enrolled to the usual nutrient dense porridge.
ii. "Extreme special nutritional case" children; these are picked up from their community by the program upon referral to the NECs, or recognition by the CNTs, and or program staff during their routine monitoring work. By their critical cases, these are taken straight away to the District Referral Hospital, and or the Regional Referral Hospital for children. Upon successful recovery and discharge from the hospital, they are admitted to the centers near their home for further monitoring and rehabilitation.

iii. Children who are picked up in the community and taken to "babies' homes". This may be for reasons including gender-related issues in the families that leave the children unattended to, health issues of the mothers (related to mental issues or others) that could not be advisable to continue breastfeeding and or take care of the child, the guardian's inability to take care of the child. The decision is upon the discretion of the program.

However, most of the clients get to the centers through referrals by the nurses at Health Centers, Village Health Trainers (VHTs), others are informed by their community leaders, fellow friends who are already at the centers, and others are identified by the trainers while doing their follow-ups in the communities. For those admitted at the NECs, on their first day, the CBNTs take notes of their biodata, dietary history and nutrition status using variables of weight, height, Mid Upper Arm Circumference (MUAC), clinical signs and symptoms of malnutrition, any immunization records the client has received if s/he is a child and the antenatal record for expectant mothers. Every admitted client (mothers only) is mandated to pay a commitment fee of 1,500 Uganda shillings an equivalent of 0.44 US dollars[3].

3.2.2.2 Training of clients

After clients have been admitted, they are taken through various training together with the existing clients, and Non-NEC clients are free to participate.

The purpose of the training is to strengthen their capacity in food and nutrition security, and in cross-cutting issues on gender, HIV/AIDS, STDs, UTIs among others. Each NEC trains once a week based on the monthly training schedule (table.3). These training are based on broad themes, topics and further broken into sub-topics. Most of the health-related topics are handled by

[3] One US dollar equivalent to 3,400 Uganda shillings (CSRL/ISU-UP 2018/19 Budget exchange rate).

the Nurses from the government Health Centers and are attached to a specific NEC depending on their vicinity, nutrition-related topics are handled by the program community nutrition specialist, and the CBNTs, agronomy, Post-harvest technologies, livestock, and community income innovations are handled by their respective program specialists.

Table 3.1 Nutrition Education Center Training Schedule for the Month of February 2019

Mondays		Tuesdays		Wednesdays		Thursdays		Fridays
Bugeywa Health Center	Nabirama Health Center	Bugeywa Health Center	Namasagali Health Center	Butansi Health Center	Namasagali Health Center	Butansi Health Center	Namasagali Health Center	Namasagali Health Center
Nakyaka NEC	**Kasozi-Nakanyonyi**	**Kabalira-Bugeywa**	**Bususwa NEC**	**Bubogo-Kiwungu**	**Kisaikye NEC**	**Naluwoli NEC**	**Kiconco NEC**	**Kakindu NEC**
4th A balanced diet (Food groups and their uses)	4th Immunization & Family Planning	5th HIV testing & Counseling	5th Personal Hygiene: Nails, Hair, bathing, washing	6th Immunization & Family Planning	6th Immunization & Family Planning	7th Indigenous chicken Management	7th Personal Hygiene: Nails, Hair, bathing, washing	8th Immunization & Family Planning
11th Agronomic practices of NEC produce	11th Effects of Gender-based Violence on Children	12th Agronomic practices of NEC produce	12th Immunization & Family Planning	13th A balanced diet (Food groups and their uses)	13th Agronomic practices of NEC produce	14th Immunization & Family Planning	14th Immunization & Family Planning	15th Indigenous chicken Management
18th Immunization & Family Planning	18th Agronomic practices of NEC produce	19th Immunization & Family Planning	19th Agronomic practices of NEC produce	20th Agronomic practices of NEC produce	20th HIV testing & Counseling	21st Agronomic practices of NEC produce	21st A balanced diet (Food groups and their uses)	22nd Agronomic practices of NEC produce
25th HIV testing & Counseling	25th Indigenous chicken management	26th Balanced diet (Food groups and their uses)	26th HIV testing & Counseling	27th HIV testing & Counseling	27th Balanced diet (Food groups and their uses)	28th HIV testing & Counseling	28th Agronomic practices of NEC produce	1st March End of the month meeting

Source: CSRL, (2019). Unpublished reports, Iowa State University, Ames IA.

3.2.2.3 Nutrition, feeding, and health training

These are aimed at building the capacity of participants in nutrition security. They focus on infant and maternal nutrition and related issues that include but not limited to; the importance of breastfeeding, exclusive breastfeeding, balanced diet, and complementary feeding, identification of clinical signs of malnutrition, and pregnancy-related issues. Training on cross-cutting especially gender-based violence, Sexually Transmitted Diseases (STDs) and Urinary Tract Infections (UTIs), and HIV testing and counseling.

Training on WASH is aimed at improving community health, promote and strengthen access to clean water and use of hygiene and sanitation facilities. Specifically targeting importance of the construction of latrines, bathroom, tip taps, plate stands, kitchens and rubbish pits at home as well as hand and body hygiene, jigger and rat control. Living in a hygienic environment reduces the occurrence of WASH-related diseases such as diarrhea, dysentery, typhoid among others.

The program recognizes water supply as a core principle in its mission of ending hunger and embarked on drilling of boreholes to supply safe drinking water, water in the production of food, and sanitary domestic uses. Some boreholes have cisterns constructed of 2000 liter capacity to collect spilled water that would otherwise be wasted. This water is used in irrigation of crops, watering animals, making bricks, used in construction among others. As of 2018, the program had 18 boreholes supplying clean drinking water to communities irrespective of their membership to the program (CSRL, 2017). At each borehole is a Water User Committee (WUC) that is composed of six members; chairperson, vice-chairperson, secretary, treasurer, defense and a member, with at least three females on the committee. These members are trained by the program WASH specialist in partnership with the program water consultant, district water engineer, district community development officer, and district health officer. WUCs are incharge of monitoring the

operations drilled wells, carry out minor servicing, and repair and enforce good WASH practices in their communities as well as the safety of the borehole tool kits.

3.2.2.4 Services provided at the NECs

These services are administered directly to an individual either from the NECs or within the community through the outreach program. Whereas some are only received by active NEC clients, most of them are open to the public. Those received only by active clients include eating of nutrient-dense porridge, receiving nutrient-dense flour especially for long distance clients moving over two miles to the NECs. Those open to the public include immunization outreach with each NEC hosting it once every month, clinic days, family planning services, HIV testing and counseling, seeking health and nutrition information, training.

3.2.2.5 Composite flour making and eating porridge

During the working days of the week, following a designed NEC Rota, mothers at NECs prepare porridge on which they feed on. The new mothers are taught how to cook the porridge to the right consistency by the trainer and fellow mothers. This porridge is made from a composite flour that contains millet, grain amaranth, soybean, maize, and silverfish which are ground together at a public maize mill. To the porridge, liquid milk is added at the time of cooking, however, the sugar is mixed within the flour before it is delivered at the NECs from the suppliers. Suppliers are program employees who are overseen by the community nutrition specialist of the program. Once the porridge is ready, each client is expected to take 1 cup while at the center and the other 2 cups are packed in a small jerrycan for the client to feed at home. Each cup is about 350 ml of porridge, and this gives the client 457 kilocalories, 17g of protein, for every 100g of porridge.

3.2.2.6 Agronomy and postharvest handling and technologies training

With over 94 percent of households relying on crop production in CSRL operational areas, an average greater than for the district and the country at large (USBOS, 2017), training these communities modern agri-food practices is critically significant. These training are aimed at empowering small landholder farmers in communities with knowledge and technologies on modern crop production, and post-harvest technologies. They focus on nutrient dense crops but not limited to what the program provides that include soybean, grain amaranths, millet, and various vegetables. The program uses kitchen, keyhole, and sack gardens as a demonstration at each center and farmers are encouraged to replicate the knowledge to each have similar gardens at home. For field crops, farmers have trained the different agronomical practices and constantly monitored by the program agronomist and CBNTs, such crops include nutrient dense crops maize, bananas, orange-fleshed sweet potatoes (OFSP), fruits all of which are a staple food in the local area. Promotion of beta-carotene-rich OFSP is beneficial to improve the provision of vitamin A in diets that help boost immunity (Odongo, et al., 2002; Hotz et al., 2012; Yanggen et al., 2006).

At the end of each growing season, small landholder farmers are faced with issues of poor storage facilities, inappropriate post-harvest and marketing practices. With a focus on grain crops, Brumn and Barnes in CSRL report, (2017), noted that:

> *"Post-harvest losses of up to 50 percent are not uncommon, primarily due to mold and weevil infestation. Often, farmers don't have a good way to dry their maize, they don't have a good way to tell when the grain is dry enough to store, and they don't have a good way to store it (CSRL, 2017)".*

The NEP through its training program brought together expertise from ISU and MUK, to help utilize local knowledge to foster solutions to reduce the severity of crop loss and enable

farmers to gain income in the sale of quality output to meet their household nutritional and dietary diversity needs. Training about appropriate postharvest practices for grains, common root crops, and vegetables especially amaranth, soybeans, maize, sweet potatoes, millet, tomatoes, cabbage, and onions are usually conducted at the NECs. These training are aimed at empowering the NEC clients and other smallholder farmers (all community members are usually invited in the training) in managing their crops postharvest to minimize food loses and wastage and maintain food safety. The program procured hermetic containers in which all the grains used at the centers (NECs) are stored such as maize, soybean, grain amaranths, and beans at schools. Farmers are encouraged to purchase them from the program at a subsidized and loan financing model together with tumplines to ensure quality output (CSRL, 2017). Supporting a diversity of crop production systems, coupled with proper postharvest management from the field to sale and consumption is a transition towards sustainable income and diets of rural communities.

3.2.2.7 Livestock production and management training

Learning about the modern principles of livestock production is important to the livestock communities that make up an average of 70 percent of rural small landholder farmers (UBOS, 2017) in the program area, an average still higher than the district and nationwide. The program introduced new breeds of animals and livestock forages some of which are not native to the area. The livestock breeds introduced include; commercial layer chickens for egg production for household consumption and income, exotic pig breeds mainly for sale, exotic and Mubende improved indigenous goats for crossbreeding to improve the genetic potential of indigenous goats, kuroiler crossed chicken to improve egg production and average slaughter weight, and ducks to improve on indigenous chicken eggs hatchability.

Farmers undergo a series of practical training for instance, in the case of commercial layer chickens, right from necessary husbandry practices; brooding to sale of eggs, for instance during brooding, farmers do this in a group at a central brooding site for the program monitored by the program livestock specialists and Community-based Animal Health Workers (CBAHWs) after which chicks are shared for rearing at individual household. Farmers are empowered with key knowledge and skills of management, feeding and feed formulation, forage management and their value addition through hay and silage making, livestock housing, and marketing. Whereas training is open to the public, livestock recipients either directly from the program or through roll-on program scheme are limited to graduated NEC clients, and farmers affiliated to the program's livestock project. The roll-on program involves program recipients sharing the offspring with fellow farmers, especially for pigs, and ducks.

The program further helps recipient farmers with the construction of livestock water tanks. These are of two types; "above ground" with a capacity of 6,000 litres, and "below ground" with a capacity of 20,000 litres, where water is collected during rainy season for animal use, crop irrigation and domestic use in addition drilling of boreholes and construction of cisterns for everyone in community to serve similar purposes. Further, the program carries out vaccination of the major common chicken disease for farmers rearing indigenous free-range chickens. The program does continuous monitoring and follow-ups of recipients to help them learn the techniques of managing these new breeds of animals, provide veterinary services through CBAHWs to all community members with livestock irrespective of their affiliation status to the program. The program believes that the integration of livestock in crop production is an assurance of a dietary diversity since animals are the principal sources of proteins and sustainable source of incomes.

3.2.2.8 Monitoring of clients

The CBNTs at all NECs take the anthropometric measurements for their clients monthly to help the program to keep track of the nutrition status of everyone throughout their stay at the NEC. The trainers also do follow up on the hygiene and sanitation situation and crop production at the household level. The program always advises its clients to have sanitation facilities like a pit latrine, a dish rack, garbage pit, kitchen and tip tap at their homes. Mothers are also encouraged to raise kitchen gardens, sack gardens, and keyhole gardens next to their kitchen and on it grow vegetable crops of different types including but not limited to onions, spinach, collards, amaranths, eggplants, and garden eggs to increases consumption of vegetables which in turn reduces micronutrient deficiencies at household level.

3.2.2.8 Graduation of clients

Graduation in the NEC context means discharging a healthy client whose nutrition status has improved greatly to normal nutrition health. For children who were enrolled as malnourished, the graduation criteria are their MUAC, which should have reached 13.7cm and above. For pregnant mothers and breastfeeding mothers, their graduation is based on the health and nutrition status of their children. To prepare clients for graduation, mothers are given a package which includes seeds of millet, grain amaranth, and soybean to take home and plant so that they will have food for their family and avoid relapses. After harvest, they can then be graduated from the NECs. They are always encouraged to keep some seed for planting. The mothers are also taught how they can make composite flour from which they can make porridge for their family members from their produce. On graduation day, they are awarded certificates for successfully completing the nutrition rehabilitation program. These certificates enable them to join other income generating programs like crafts, and livestock.

3.2.2.9 Community Income Generating Innovations project (CIGI)

The CIGI project started in 2015 as an income diversification strategy to help graduated mothers earn a living through different income generating activities being trained to them. The CIGI has three categories of groups, and these are Tusubila Crafts Group (TCG), The Tailoring Group (TG) and Tweyunge Soap Making Group [TSMG] (CSRL, 2018). Graduated mothers willing to enroll in CIGI projects are registered in only one of the three.

i. Those enrolled in the TCG are trained on making art crafts from local materials, which are then sold with the help of the program coordinator both locally and in the USA. Using the income earned, members are encouraged to join the Village Savings and Loans Association (VSLA) with the project itself that was officially registered in 2018 as a Community Based Organization (CBO) in the name of Tusubila Crafts Group (TCG) at both the Sub-county and District level. The TCG has three categories of products that mothers make, and these include; the bead products, which include bangles, bracelets, necklaces and purses, the palm leaf products (mats), and the raffia products (baskets). The TCG group has a total of 57 active members.

ii. The TG has four categories of products made that include backpacks, laptop bags, shopping bags, and dresses. The group also conducts a tailoring training to equip the members with the hands-on skill on how to sew using a sewing machine, so that if they can attain enough savings, they can purchase their own machines and do tailoring as personal business. The TG group has a total of nine (9) members, this group has fewer members because of the limited number of sewing machines for training and practice.

iii. TSMG is where graduated mothers are trained on how to make washing soap and herbal soap. This is produced at a relatively low input cost so that it is sold at lower prices

compared to the other soaps types in the market. The main market for this is mainly the local Community. The herbal soap treats people with skin infections and the washing soap can be used for hygienic roles in a home like washing, bathing, and cleaning utensils. This group has a total of 15 members, and it's the newest group that was started in the summer of 2018.

3.3 Research Design

3.3.1 Target Study Population

The target population for the study comprised of NECs' registered clients since 2014 with additional Non-NEC clients for purposes of comparison. A total sample of 400 households of NECs clients and 400 households of Non-NEC clients were eligible to be included in the study. An additional unknown number of children of 0-59 months of age whose heights and weights would be obtained were also eligible to be included in the study[4]. The children's participation was in the form of taking their weight, heights, Mid Upper Arm Circumference (MUAC) and age. This data was collected from children who are members of the households selected to participate in the study.

3.3.2 Recruitment Process

An announcement about the study was made through fliers that were posted in public places, visible to all the people in the communities. Further, households who were participating in any of the CSRL/ISU-UP programs including NECs, CIGI, YEP, Livestock, and Agronomy were informed about the study by the ISU-UP staff during their routine work.

[4] The number of children who were eligible in the study was unknown because households with children 0-59 months of age would be identified during data collection since these households were not known to the research team.

3.3.3 Sampling and Sample Selection

List of ISU-UP NECs' clients from eight (8) of the nine (9) centers was provided from Kamuli program Office. These centers include; Naluwoli, Nakanyonyi/Kasozi, Kiwungu/Bubogo, Nakyaka, and Bugeywa/Kabalira from Butansi Sub-County, Kiconco, Kakindu, and Bususwa from Namasagali Sub-County[5]. These lists formed the sampling frame from which 253 households were selected through random sampling technique. An additional 201 Non-NEC households were randomly selected to match every NEC household client to a Non-NEC household client in a quarter mile radius (from the NEC respondent). The Non-NEC clients were further sub-divided into two categories: Non-NEC clients who participate in open access NECs' FNS programs and activities (63 respondents), and Non-NEC households clients who do not participate in any of the NECs' activities (138 respondents). The overall total sample size surveyed was 454 households' respondents with 606 children of 0-59 months of age spread within the three categories respondents. During data collection, locating the NEC household clients' homes was led by CBNTs of their respective NECs.

3.3.4 Data Collection and Instrument

A questionnaire with both closed and open-ended questions was developed. Research Assistants (RAs) who had earlier completed the National Institute of Health (NIH) and had its a valid certificate and or Collaborative Institutional Training Initiative (CITI) training for research involving human subjects, with experience in data collection, data entry, and fluent in Lusoga dialect were recruited and trained on administering the survey. The training was completed in a

[5] The ninth center of Kisaikye was excluded because it was opened in 2018, that was too early to recruit such clients in an evaluation survey.

period of four days and a pretesting of the questionnaire was done in Buwuda – Kamuli Municipality, an area where the CSRL/ISU-UP is not implementing any livelihood programs.

A pretested questionnaire was then administered to the respondents using a face-to-face technique in the local language by RAs. Data on socio-economic and demographic factors at a household level such as gender, marital status, household size, age, level of education, occupation, income among others were obtained. Data on water accessibility, morbidity, WASH infrastructures, and their conditions, type of house, fuel used for cooking, lighting, and assets at home were also collected. Detailed data on livestock and crop production was obtained to ascertain the food production ability, food access and income from the sale of products.

To obtain information on access, and participation within the NECs' FNS programs, a checklist within the questionnaire was being used to determine who participated, the dimension of participation by asking the number of training modules participated in, and or services received. Those who participated in any training (s) were asked short response questions depending on the training they participated to ascertain their level of comprehension of the modules, the practice of what was taught. This was aimed at determining the quality of their participation in the training programs.

The food security status of respondents was assessed using the standard nine (9)-item indicator set for measuring household food security developed by the United States Department of Agriculture [USDA] (Coates et al., 2007; INDDEX Project, 2018; Sseguya, 2009). Information on household dietary diversity was collected using a food frequency questionnaire that was administered to determine the consumption frequency of each type of food based on the number of times it was eaten and how it was accessed per day in a week prior to the study. A 24-hour recall and a week's recall were used to capture the dietary diversity and food consumption scores

concurrently of the respondents respectively. In this 24-hour recall method, participants were asked by RAs trained in interviewing techniques, to recall the respondent's exact food intake during the previous 24- hour period and the previous seven days. The respondents were given the opportunity, without suggestion, to provide detailed descriptions of all foods and beverages consumed at the household level. This method was the most appropriate for assessing average intakes of foods and nutrients because of the large sample space of 201 from the Non-NEC household clients and 253 from the program intervention groups.

To assess nutrition security of household, data was collected on an anthropometric indicator that involved measuring of primary caretakers/WRA and children 0-59 months of age. The measurements included weight, height, MUAC for both categories and this was done by the Community Based Nutrition Trainers (CBNTs) who were paired with RAs. The data on indicators collected was then used to compute BMI indices for primary caretakers and the Z-scores for children that were used to classify their nutrition security and health state using WHO (2006) standard reference scale.

All information about each respondent was identified with a unique code only known to the researcher. Data was entered in excel by five data clerks trained by the researcher, these clerks went through training, participated in the development of the excel data temperate and pretested data entry using the pretested questionnaires for the RAs. Data was constantly monitored by the researchers as it was being entered as a quality control to ensure consistency and accuracy.

All data was cleaned and analyzed descriptively using IBM SPSS statistics version 24 statistical software to generate frequencies, mean, medians, modes, percentages for the research variables. Chi-Square analysis was used for categorical variables to determine the association between them, their significance levels and to determine the direction of their relationship based

on the percentages to draw meaningful conclusions. We also employed Analysis of Variance (ANOVA) for to determine whether there existed statistical differences among variables, and those found to be significant were further subjected to post hoc analysis to draw conclusions based on the direction of the differences. Also, a multinomial regression model was run to determine the level of significance of participation in FNS programs of NECs in conjunction with selected socio-economic and demographic characteristics of respondents towards the alleviation of food insecurity among the three categories; food secure, food insecure and extremely food insecure (details on the model in next section).

3.4 Research Variables

This study considered two variables; the dependent, and the independent. The dependent variables were two and these were food security status, and nutrition security status of households. The independent variables were also broadly two that included participation of households in NECs' food and nutrition security programs including agronomy, livestock, services, nutrition, WASH, and CIGI, and the household characteristics that included socioeconomic, spatial, demographic, the WASH, morbidity characteristics and trends that were believed to influence their participation in programs of CSL/ISU-UP's NECs as well as food and nutrition security of their households. The study also compared the Baseline data of 2015 with the Endline survey of 2018 to ascertain the changes experienced by households.

3.4.1 Measurement of the Dependent Variable

3.4.1.1 Household food security status

Households' food security status was determined using the following three methods: the Household Food Insecurity Access Scale (HFIAS) that distinguishes the food secure from food insecure, and extremely food insecure, the Household Dietary Diversity Score (HDDS) that

differentiates those in the good diet, average and poor diet categories, and the Food Consumption Scores (FCS) that shows the caloric intake and distinguishes households who are in acceptable, from borderline and poor categories. These measures capture overlapping but different dimensions of household food security as described below.

3.4.1.2 Household Food Insecurity Access Scale (HFIAS)

Measurement of food security under this method focused on food accessibility in a month prior to the survey and stress food accessibility in terms of meals eaten during periods plenty and scarcity to ascertain the changes in the consumption pattern during shocks, food sources and consumption frequencies. The questions for this measurement were based on the Household Food Insecurity Access Scale (HFIAS), a widely used food security across different cultural settings (Coates et al., 2007). This tool focuses on food access as the best measure of food insecurity and utilizes nine questions that are asked to the household member about the relative situation of food insecurity happening in the month (four weeks) prior to the survey. For every occurrence of the situation is coded as 0 for "No" and 1 for "Yes", followed by a frequency question that measures the regularity of occurrence categorized as 0 for "None", 1 for "Rarely", 2 for "Sometimes", and 3 for "Often" illustrated on table3.2.

Determination of HFIAS scores for each household depended on the responses on the frequency of occurrence of the situation (part b.). For the first part (a), responses coded as "0" for "No", meant that part (b) be coded as "0" as "None" for the frequency which increases the odds of a household being categorized as food secure. Emphasis was put on affirmative responses for "Yes" coded as "1" for part (a), and part (b) coded as either 1 for "Rarely", 2 for "Sometimes", and 3 for "Often". The coded scores were summed up across all the nine questions to generate a minimum of zero for none (most food secure) on all frequency questions and a maximum of 27

points (extremely food insecure) meaning that the household had a response of three ("Often") for all the frequency of occurrence questions. Thereafter, classification of households was done to generate "three tiers" of food security status based on guidelines of Coates et al., (2007); INDDEX Project, (2018); Sseguya, (2009). Tier one; Food Secure household in a range of between 0-9.0 points, Tier two; Food Insecure from 9.1-18.0 points, and tier three; Extremely Food Insecure from 18.1-27.0 points. The results were displayed as descriptive with frequencies, percentages, sums, means, medians, standards deviations, and graphs.

Table 3.2 Adapted Household Food Insecurity Access Scale (HFIAS) model

1 a	Did you worry that your household would not have enough food? 0=No (Go to Question 2)* 1=Yes (Go to part b.)*
b	How often did this happen?** 0=None (if Part a. is zero), 1=Rarely (once or twice in the past four weeks), 2=Sometimes (three to ten times in the past four weeks), 3=Often (more than ten times in the past four weeks)
2	Were you or any household member not able to eat the kinds of foods you preferred?
3	Did you or any household member have to eat a limited variety of foods?
4	Did you or any household member have to eat some foods that you really did not want to eat?
5	Did you or any household member have to eat a smaller meal than you felt you needed?
6	Did you or any other household member have to eat fewer meals in a day?
7	Was there ever no food to eat of any kind in your household?
8	Did you or any household member go to sleep at night hungry because there was not enough food?
9	Did you or any household member go a whole day and night without eating anything because there was not enough food?

*All questions had this response format indicated **All follow-up frequency questions were designed in this format.

3.4.1.3 Household Dietary Diversity Score (HDDS)

Food security status under Household Dietary Diversity Score (HDDS) method focuses on foodstuffs consumed at the household level in the previous 24-hours prior to the survey and how it was accessed. The foodstuffs were grouped into 12 categories with each category having different food types following guidelines from Swindale et al., (2006); Kennedy et al., (2011);

INDDEX Project, (2018). The food groups included: (a) Cereals that included; maize (eaten in any form), millet, sorghum, amaranth-grain, rice, bread, chapatti, and other cereals. (b) Roots and tubers that included; sweet potatoes, cassava, yams, pumpkins, orange-fleshed sweet potatoes (OFSP), and matooke. (c) Vegetables that included; cabbages, leafy amaranth, tomatoes, onions, eggplants, carrots, and pumpkins (leaves). (d) Fruits that included; mangoes, pawpaws, oranges, pineapples, passion fruits, jackfruits, and other fruits. (e) Meats, poultry, and offal that included; beef, chicken, pork, goat. (f) Eggs. (g) Fish and seafood. (h) Pulses, legumes, and nuts that included; beans, soybeans, groundnuts, sim-sim, and others. (i) Milk and dairy products that included; milk and ghee, and others. (j) Oils and fats that included cooking oil, (k)Sugar and honey, and, (l) Miscellaneous foods that included; sweetened sodas, sweets, tea, and iodized salt.

Each group was assigned a score of one (1) irrespective of the number of different food types consumed by the household, and zero (0) for to a food group whose different types of foods were not consumed at all. This generated a final score of zero (0) as a minimum, and 12 as the maximum. An interpretation of the score was that the higher the score, the more diverse the diet was, and the more food secures the household. A three-tier scales were generated in the ranges and interpretations as; 0-4 as poor diet, 5-8 as average diet, and 9-12 as good diet households. The average HDDS was also generated by dividing the total sum of the HDDS by the total number of households surveyed. This descriptive index was generated to help determine the number of households below and above average. Similarly, a variation in foodstuffs consumed was also calculated to determine what exact food was most and least consumed, to answer questions like does the diversity pattern conform to the principles of a balanced diet? and what was the most common method of accessibility to food across the surveyed team? This was done by generating frequencies, percentages, sums, means, medians, standards deviations, and graphs.

3.4.1.4 Food Consumption Scores (FCS)

The Food Consumption Scores (FCS) quantifies the foodstuffs consumed in specific food groups on an assigned index multiplier to give a proxy indicator of the caloric consumption of a given household in the previous seven days prior to the survey (Harris, J., & Vhurumuku, 2002; INDDEX, 2018; Coates et al., 2007; Weismann et al., 2009; WFP, 2008). In constructing this index, households were asked the foods eaten and the method of accessibility, these foods were then assigned into their respective eight (8) food groups with their assigned index multipliers. These groups include: (a) Main staples with a multiplier of two (2) per food item consumed, (b) Pulses with a multiplier of three (3), (c) Vegetable with a multiplier of one (1), (d) Fruits with a multiplier of one (1), (e) Meats/fish with a multiplier of four (4), (f) Milk with a multiplier of four (4), (g) Sugar with 0.5 multiplier index, and (h) Oil with 0.5 multipliers index each.

After adding the total of foods consumed per food group and multiplying them with their respective multiplier index, a weighted food score was then obtained by summing up all the scores across the eight groups. Classification of the household food security was based on the WFP, (2008) INDDEX, (2018) FCS scale. On the scale, a household in the range between 0-21.4 was considered poor, equivalent to extremely food insecure, a household in the range of 21.5-35.0 was on the borderline, equivalent to food insecure category, and a household with a score greater than 35.0 was considered acceptable equivalent to food secure (INDDEX, 2018; WFP, 2008). The results were displayed as descriptive with frequencies, percentages, sums, means, medians, standards deviations, and graphs.

3.4.2 Nutrition Security and Health Status of Households

The nutrition security and health status of households were assessed on the primary caretakers/mothers/women of reproductive age (WRA), and infants and children of 0-59 months of age. Anthropometric measurements were conducted to obtain data on children, and WRA who were also mothers or primary caretakers of these infants and children. Three measurements including weight, height, and Mid Upper Arm Circumference (MUAC) were taken. For purposes of accuracy and consistency, each measure was taken twice, and an average was computed as the final value for analysis. The details of measurement procedures are as follows:

3.4.2.1 Measurement of weight

The method of weighing used was adapted from Lee and Nieman (1996). Babies below six months were weighed using a hanging scale. The baby was made to sit in a bag which was then hooked onto the hanging scale. For children above six months but below two years and or could not stand, using a standing scale placed on a flat ground, the caretaker's weight was taken individually and recorded, then the total weight of the mother holding the child was taken and recorded, and the difference between these two values gave the weight of the child. However, caution was taken that the mother was not wearing shoes or heavy clothing that could add significant weight to the normal body weight. Children who had the ability to stand could stand straight on the weighing scale without their shoes, and their weight was read off the weighing scale. And for primary caretakers, a standing scale was used to measure their weight without their shoes or any heavy clothing. The weight of all subjects was recorded to the nearest 0.1 and in kilograms (kgs).

3.4.2.2 Measurement of height and recumbent length

Heights of children too young to stand were obtained by taking their recumbent length while lying straight on a Calibrated Height-Board (CHB) placed horizontally on flat ground without shoes or hat. Mothers and children who could stand had their heights taken by standing on the CHB. Values were read off the scale and recorded to the nearest 0.1, and in centimeters (cm). The relative height of the mother's hair, and or child especially baby girls was subtracted from the value to obtain the actual value as some of them had different hairstyles which had a significant effect on their heights.

3.4.2.3 Measurement of Mid Upper Arm Circumference (MUAC)

A MUAC tape was used to take the measurements for children, and primary caretakers independently. Prior to taking the reading, the left hand was made to hang relaxed alongside the body and a mid-point between the elbow and the shoulder was determined. A tape was then placed around the mid-point of the arm. Caution was taken to ensure that the tape was neither too tight nor too loose. Readings were taken from the window of the tape and or from the tape and were read off to the nearest 0.1cm and recorded for analysis.

3.5 Statistical Analysis and Interpretation of Anthropometric Indicators

3.5.1 The Health of Primary Caretakers Based on their Body Mass Index (BMI)

The BMI for caretakers was obtained by taking their weight in kilograms divided by height in square meters (BMI=Kg/m^2). The results were analyzed on indices of Underweight, Normal, and Overweight (Lele et al., 2016, WHO, 2003; 2006). Underweight were those with a BMI of <18.5kg/m^2, meaning that they were at risk and with clinical problems. Normal or health were those with a BMI of 18.5-24.95kg/m^2, and Overweight were those who had a BMI of ≥255kg/m^2. The overweight category can further be divided into four categories including Pre-Obese with a

BMI of 25.0-29.95kg/m^2, Obese class I (moderate) with a BMI of 30.0-34.95kg/m^2, Obese class II (severe) with a BMI of 35.0-39.95kg/m^2, and Obese class III (very severe) with a BMI of ≥40.05kg/m^2 (Lele et al., 2016, WHO, 2003; 2006). However, these classifications were not taken into consideration in this survey. The results were then displayed as descriptive with frequencies, percentages, sums, means, medians, standards deviations, and graphs. Chi-Square analysis was employed to determine the association between caretakers' health with their household, and their personal characteristics and reproductive practices. ANOVA and post hoc analysis was performed to determine the differences in the results among them to draw generalized conclusions based significances that existed and differentiated them.

3.5.2 Child Health Based on the MUAC Readings

These help to determine whether the infant or child or mother/primary caretaker is wasting. On a 3-color coded tape for children and that of mothers independently. A child with a measurement in the Green zone (≥12.5cm) meant that the child was well nourished and most likely had good weight-for-height (WHZ). Measurements in the Yellow zone (11.5-12.4cm) indicated that a child was at risk of wasting and was suffering from Moderately Acute Malnutrition (MAM) while those in the Red zone (<11.5cm) showed that they were suffering from Severely Acute Malnutrition [SAM] (Lele et al., 2016; WHO, 2003; and 2006). The MUAC readings of caretakers were not included in the interpretations since they are not commonly used, all research go by their BMI. Similarly, the MUAC for children are commonly used in emergency cases since their results are interpreted instantly without any reference, hence other indicators analyzed on reference standards with the WHO Anthro software provides the most appropriate findings, details as below.

3.5.3 Children Health Status Based on Z-scores of their Anthropometrics

The Z-scores on anthropometric indicators for infants and children are both age (in months) and sex-independent (Lele et al., 2016, WHO, 2003; 2006). WHO Anthro (version 3.2.2, January 2011) was used to convert the indices into their Z-score for age. However, before uploading data in the software, all children who had incomplete biodata including age, sex, weight, and or height were excluded as well as those diagnosed with oedema. There were no flagged children in the final data analyzed. To determine the presence of stunting, underweight, and wasting, the height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) were generated respectively. On the global standard scale for each indicator, children below minus three standard deviations (<-3SD), minus two standard deviations (<-2SD), and greater or equal to minus two standard deviations (≥ -2SD) are considered severely acutely malnourished (SAM), moderately acutely malnourished (MAM), and or properly nourished (health) respectively with reference to that specific indicator (WHO, 1995; 2003; 2006).

In this survey, we combined MAM and SAM into one indicator to measure the presence of malnutrition, hence children whose HAZ, WAZ, and WHZ were below -2SD from the median of the reference population were considered as stunted, underweight, and or wasted respectively. For overall health, the three indicators were combined to determine the rate of malnutrition, as with severe, moderate, mild or health. In this respect, all children whose Z-scores were below -2SD on all the three indicators were classified as SAM, those who had only two indicators below -2SD were classified as MAM, those who had only one indicator below -2SD were classified as mildly or marginally malnourished, and those who had all the three indicators above -2SD were classified as health. The results were displayed as descriptive with frequencies, percentages, sums, means, medians, standards deviations, and graphs. Chi-Square was used to determine the

association between the personal, caregivers', and households' characteristics believed to influence their health. ANOVA and post hoc analyses were also employed to determine the differences that existed among their health with reference to the characteristics mentioned above.

3.6 Independent Variables

3.6.1 Participation of Households in CSRL/ISU-UP's NECs' Activities

Household members' participation in the activities was determined in three categories: physical participation in the activity; the dimension of participation, and the quality of participation. The clients in relation to the NECs were also determined in three categories: Participants (NEC clients), Participants (Non-NEC clients), and Non-participants

3.6.1.1 Household client category based on by affiliation to NECs

Participants (NEC clients) are from households who are officially registered to any of the CSRL/ISU-UP NECs. These clients are currently attending, and or attended to (graduated or absconded) to the NECs for services and training up to a maximum of five times in a week starting from Monday and depending on the activities' monthly schedule. These were referred to as "Participants: NEC clients" for purposes of this research. Participants (Non-NEC clients) have attended or are attending to training, and or received/receiving services permitted by the NECs as open access to non-official members. For this research, these were called "Participants: Non-NEC clients". Non-participants are those who do not belong to NECs and have never participated in any activity. These were referred to as "Non-participants: Non-NEC clients". Each of these three was analyzed as a categorical variable of either "1" for Yes or "0" for No and presented as frequencies and percentages in tables.

3.6.1.2 Household members' physical participation in NECs' programs

This was determined by asking the respondent whether him or her, and or any member of the household has ever attended to any of the training, and or received, and or is receiving any of the services, and or participated, and or is participating in any the Income Innovation activities of the NECs since 2014. Responses were coded as "0" for "No" participation and "1" for "Yes" participation. The overall participation was determined across all three categories of clients, and for each of the six core activities of the NECs considered in the survey. Results were presented as frequencies and percentages in the analysis.

3.6.1.3 Dimensions of participation of households in NECs' activities

This was divided into two sub-categories. Category one tracked the number of training modules participated in, and or services received, and or income activities participated in. Category two tracked the number of times participated in the training modules, and or received the services, and or income activities participated in.

3.6.1.3.1 Dimension category one: Training modules participated in/services received

1. **Agronomy training:** All agronomy training of the program were narrowed to seven modules. These were: Soil improvement, Composting, Land use allocation and soils, Agronomical practices (sowing, nursery and seedbed preparation, fertilizer application), Kitchen, sack, and keyhole gardening, Postharvest handling and technologies, and Marketing of agricultural produce.
2. **Livestock training:** All livestock training of the program were also narrowed to seven modules. These were: Exotic chicken management, Local chicken management, Piggery management, Goat management, Forage management, Feeding and feed formulation, and Marketing of livestock and their products.

3. **Nutrition and feeding training:** All training in this section were narrowed to five modules, including the cross-cutting issues in gender-based violence (GBV), and gender mainstreaming. These were: Exclusive breastfeeding, Importance of breastfeeding, Balanced diet and complementary feeding - ekitobero as its locally called across all NECs, Identification of clinical signs of malnutrition, and Gender issues in relation to food and nutrition security of households.
4. **Water, health, hygiene and sanitation (WASH)**: All training in this section were narrowed to four modules. These were: Pregnancy-related issues, Hygiene, and sanitation (hand & body hygiene, construction of latrines, bathrooms, kitchens, plate stands, tippy taps, rubbish pits), Jigger and rat control, and Sexually Transmitted Diseases (STDs), Urinary Tract Infections (UTIs), and HIV/AIDS awareness.
5. **Services:** All services received at the NECs or in their outreach were also narrowed to seven. These were: Immunizations, Eating of nutrient-dense porridge, Complementary feeding (ekitobero in the local dialect), HIV testing and counseling, Clinic days, Seeking nutrition and health information, and Family planning.
6. **CIGI:** These project skills were narrowed to five. These were: bead products skills that included making-of bangles, bracelets, necklaces, and purses, sewing machine products that included making-of backpacks, laptop bags, shopping bags, and dresses, palm leaf products that included the making of mats, raffia products that included the making of baskets, and soapmaking.

3.6.1.3.2 Dimension category two: Number of training modules participated in/services received

In this dimension, participants were asked for an estimated number of times that they have attended to each of the modules described in dimension one above since 2014. Part one of the numbers traces individual module/service; a member who had 1-5 times was coded as "1", then "2" for between 5-10 times and "3" for >10 times. Part two of the numbers track overall participation in the activity by summing up part one numbers, this generates a minimum of seven (7) times and a maximum of 21 times of participation for agronomy, livestock, and services. For nutrition/feeding a minimum of five (5) times and a maximum of 15 times, for WASH, a minimum of four (4) times and a maximum of 12 times, and then CIGI, the minimum is five (5), and a maximum of 15 times of participation in the modules.

A three-tier categorization was then generated for each activity for the final analysis presented as "1" for Fair participation ranging from 1-7 times, "2" for Good ranging from 8-14 times, and "3" for Very good ranging between 15-21 times for agronomy, livestock, and services programs. For Nutrition and feeding, and CIGI, "1" for Fair participation ranging from 1-5 times, "2" for Good ranging from 6-10 times, and "3" for Very good between 11-15 times. And for WASH, "1" for Fair participation ranging from 1-4 times, "2" for Good ranging from 5-8 times, and "3" for Very good participation between 9-12 times. These three tiers were then analyzed generate frequencies and percentages for all the six core activities across all the clients who participated.

3.6.1.4 Assessment of household quality of participation

Determining the quality of participation was aimed at ascertaining the level of comprehension and knowledge that the client could have retained out the training or what can be/was put to practice. Other than services, the other five program activities were assessed. The

questions were set by the P.I and Co-P.I, basing on the activities' modules trained, modified by the CSRL/ISU-UP respective program specialists who conduct the training with other local government partners, and NGOs, and after which were approved the by the P.I and Co-P.I. The relative answers were agreed upon by both teams.

For agronomy, livestock, nutrition and feeding, and WASH, six (6) short response questions were set and for any correct/relative answer earned one (1) point each, a respondent earning a maximum of six (6) points in each category of activity. For CIGI, the clients were asked to mention the skills learned in each of the five (5) CIGI activities trained and participated in. Mentioning more than one skill in the same CIGI activity could not earn the client more points. A maximum of five (5) points was earned which translates to at least a skill in each activity. These final scores were descriptively analyzed to generate minimum, maximum, mean with an intent to determine the percentage of clients above 50 percent of the mean. Categorization was also done in three tiers as; above average (4-6 points), average (3 points), below average (1-2 points) for livestock, agronomy, nutrition and feeding, and WASH, for CIGI, above average (3-4 points), average (2 points), and below average (1 point).

3.7 Regression Analysis

To examine the relationship between participation in the food and nutrition security programs of the NECs and households' alleviation of food insecurity, we employed a multinomial logistic regression model. Logistic regression is a form of multivariate regression in which the dependent variable is categorical, and the independent variables are continuous or categorical, but for this study they were categorical. Multinomial logistic regression was chosen because the dependent variable had three categories; food secure, food insecure and extremely food insecure and it allows to compare the reference category in the dependent variable (in this case food secure)

with other categories (food insecure and extremely food insecure) regressed against the categorical independent variables. The multinomial model predicts the probability of an outcome (Y) happening with given known values for a predictor, which is not the case for a linear model that predicts the outcome (Y) from a set of predictor variables (X_n). The model was run at P-value of <0.05 to identify the level of significance of the variables and a less conservative P-value <0.1 because of categorization of variables that decreased the power of prediction as affirmed by Menard (1995).

Multinomial model lacks a provision to test for multicollinearity that describes the possibility of close correlations between independent variables that in turn lead to inaccurate results and wrong interpretations of the direction and influence of independent on the dependent variables. As a requirement to overcome this challenge, we followed the procedures suggested by Leech et al., (2005) to first run a linear regression between the categorical dependent variables and independent variables using two robust tools for detecting the presence of collinearity that includes the Variance Inflation Factor (VIF) and Tolerance Value. According to them, all independent variables with a Variable Inflation Factor (VIF) above 10 is a cause of concern indicating a high possibility of correlation and the factor measuring the thing. They further suggest having a close examination of variables with a VIF of close to 5 as though acceptable, and further those close to 2.5 for weaker models. To help in further examination of the variables, Leech et al., (2005) suggests examining the results in the Tolerance Value (TV) of the same linear model. In this, only variables that have a value greater than one and the adjusted R-square (i.e., $1\text{-}R^2$) be included in

the model. The final model was then ran between the categorical dependent variable of food security status (food secure as reference variable coded as "1", against food insecure coded as "2", and extremely food insecure coded as "3") regressed against the categorical independent variables all coded as dummy variables that included with "1" as the reference and "0" as otherwise.

3.8 Ethical and Logistical Consideration

Approval to conduct this research was obtained from the Office for Responsible Research at Iowa State University by completing and complying to protocol and guidelines of the Institutional Review Board (Appendix: 4). Oral consent was obtained from the Local government authorities that govern the communities where the research was conducted. Prior to the start of the interview process, a consent form would be read to the respondent in Lusoga dialect and verbal consent obtained indicating their willingness to participate in the study or decline to participate. The purpose and objectives of the study were explained to them. They were informed that there is no risk for taking part in this study and that their participation is entirely voluntary, and they could withdraw from the study at any time if they wished. They were further be made aware that all their responses will be kept confidential and only accessible to the researcher. Any names on the interviewing tool would not be made public and would not be included in the data entry and analysis. The participants were also be assured that refusal to take part in the study would not affect the usual services that they receive from the program if any. Any records identifying the participants would be kept in a secure location and confidential to the extent permitted by applicable laws and regulations and would not be made publicly available.

CHAPTER 4: RESULTS AND FINDINGS

4.1 Introduction

This chapter reports the results and findings of the survey in form of descriptive and inferential statistical analysis, crosstabulations to that determined associations between variables, and Analysis of Variance (ANOVA), as well as post hoc analysis for statistically significant variables. It was organized in a chronological order of the research questions starting with a description of the background characteristics of respondents; followed by participation in NEC activities, bivariate analysis – comparison of NEC participants and non-participants; Food and Nutrition security measures and trends and ends with bivariate analysis that tested whether participation in NEC activities were significant to food and nutrition security.

4.2 Characteristics of Households that Influence their Food and Nutrition Security

4.2.1 Demographic Characteristics

By gender, majority of the household heads 373 (82.2%) of 454 were male, only 81 (17.8%) were female-headed, with most of the household heads married (86.3%); 73.8% in monogamous, and 12.6% in polygamous marriages. Married household heads (90.0%) were more likely to have a good dietary diversity ($\chi^2 = 4.053$, df = 1, p = 0.044) than the non-married (83.5%). The relationship between the respondent and the household head shows that most respondents 320 (70.5%) were households' spouses, with only 113 (24.9%) as household heads, 2.0% siblings, 2.4% children, and 0.2% parent of the household head. Regarding religious affiliations, the predominant religious faith was Anglican with 46.7%, followed by Catholics and Muslims with 20.0 and 19.4 percent respectively, and other religions (13.9%) (SDA, African Tradition and Noa) religions account for the 1.8% altogether. The tribe of the household head that most dominated the responses were Busoga (88.5%), and as expected to be the natives of the area, they were more

likely to be food secure (92.4%) than non-natives (85.2%) with an associated significance value of ($\chi^2 = 5.665$, df = 1, p = 0.017). The other tribes that followed in numbers were Itesots (5.9%), and seven others within 0.2 to 1.5 percent coverage describing a multicultural and bilingual region.

Regarding age, the mean age of household heads was 40.2 years, and it falls within most (45.6%) of the respondents (36-59 age group), followed by 43.4% in the Youthful group within the range of 18-35 years, and 11.0% of ≥60 years. There was an association between the age group 36-59 years with participation in the FNS programs ($\chi^2 = 15.347$, df = 1, p = 0.004). There were more participants [NEC clients (49.05); Non-NEC clients (42.9%)] from this age cohort than non-participants (40.6%). We also found a significant difference in the age of the household heads with reference to participation status. The mean age of the NEC clients' participating household heads (38.32 ± 11.65^{a}) was different from that of the Non-NEC households (43.60 ± 14.57^{b}), the former was found to be more (likely) younger than the latter. However, no difference was found among the NEC clients and Non-Participants in the NEC programs ($41.17 \pm 15.54^{a,b}$).

Regarding membership among households, the 454 households had a total of 2,728 members (1,320 and 1,408 males and females respectively), giving an average household size of 6.0 members, which is above national level average household size of 4.7, according to the Uganda National Household Survey 2016/17 (UBOS, 2017). Households with members in range (≤5) of the National average were more likely to be food secure (49.5%) than their counterparts (46.7%), but this was not significant. However, with regards to food consumption in terms of caloric intake, it was significant ($\chi^2 = 4.632$, df = 1, p = 0.031). 53.9% were likely to have a better diet with high calories than 43.7% households with greater than five members. Because of food insecurity in high member households, we found an association between participation in the NEC programs ($\chi^2 = 3.953$, df = 1, p = 0.047) and the household members. There was a high likelihood of households

with ≥5 members (55.1%) participating in the FNS programs than non-participants (44.9%). This was further tested with ANOVA and was found that NEC (6.28±2.75[a]) and Non-NEC (6.38±3.21[a]) households had the highest mean greater than the average mean (6.01±2.71) of households and hence participated in the food security programs than their counterparts with lower household sizes (5.34±2.23[b]).

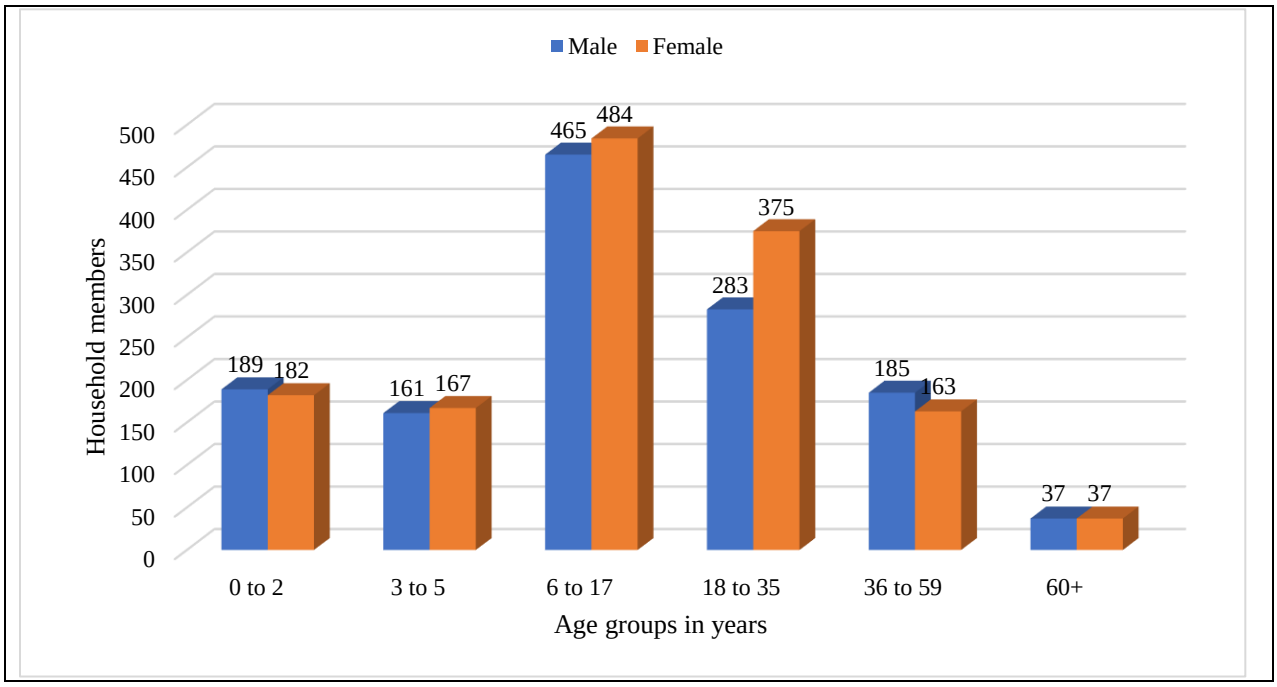

Figure 4.1 Survey Household Members by Age Group and Gender in Kamuli district, 2018

The population structure depicted in the figure above has a lot of implications on the status of food and nutrition security among households. The number of infants and children 0-5 years, combined with the school going children of 6-17 years, and the elderly of over 60 years of age make up a total of 1,722 members (63.1%). These three groups comprise of the dependents given their limited productive roles in farming which has been found as the main activity accounting for 79.3% of the households. This high dependency ratio can partially help to explain the high level of food insecurity observed among households at 53.7 percent in this survey. Similarly, households

with high numbers of 0-5 years children were found to be participating more in the program, this difference was found to exist among the NEC clients (1.75±0.94[a]) than the Non-NEC (1.16±0.95[b]) and Non-participants (1.32±1.09[b]). the number of children within the NEC clients' households were above the average (1.54±1.02), and this explains their high participation in the program to alleviate the problem of food and nutrition insecurity.

4.2.2 Spatial Distribution of Households

Most of the household heads (96.3%) were found to be living within Kamuli district, and only 3.7% live outside Kamuli in the neighboring districts. Those living within the area were expected to be more food secure, but it was not the case, however, they were found to have a better dietary diversity (98.0%) than their counterparts (94.9%) with a Chi-Square value of ($\chi^2 = 3.018$, df = 1, p = 0.082). There is almost an equal proportion in terms of years lived in the area where 50.9 and 49.1 percent have lived in the area where the household/home was located during a survey for less than 10 and greater than 10 years respectively. In terms of location by Sub-County, where CSRL/ISU-UP implements its livelihood programs, 57.5% of the respondents were from Butansi, and 42.5% from Namasagali. By participation in the program activities, from the results of the survey 316 (69.6%) of the 454 households participated in the FNS programs of whom 197 (62.3%) were from Butansi and 119 (37.7%) from Namasagali.

By Parish in the overall survey, of the 261 in Butansi Sub-County, 44.8% were from Naluwoli, 33.7% from Bugeywa, 20.7% from Butansi, and 0.8% from Naibowa. In Namasagali Sub-County, of the 193 overall respondents, 75.1% were from Bwiiza, 12.45 from Namasagali, 8.8% from Kasozi, and 3.6% from Kisaikye. Among the program participants category, of the 197 in Butansi Sub-County, 45.7% were from Naluwoli, 33.0% from Bugeywa, 20.8% from Butansi,

and 0.5% from Naibowa. In Namasagali Sub-County, Bwiiza had 82.4%, Kasozi (8.4%), Kisaikye (4.2%), and 5.0% were from Namasagali.

The concentration of CSRL/ISU-UP field activities determined the number of respondents in that area. In Butansi Sub-County most activities are within Naluwoli, Bugeywa, and Butansi Parishes, whereas Bwiiza is the most concentrated in Parish of Namasagali Sub-County. There was a direct link between households' participation in the programs and the location of the NECs in the areas where they live (see Table 3 in Chapter three). Five (5) of the oldest eight (8) NECs are located within Butansi Sub-County, disappointedly distributed with Naluwoli Parish having two inclusive of the pioneer (Naluwoli) NEC, Bugeywa with two, and Butansi with one. Namasagali has three (3) of the eight (8) oldest NEC, and one recently opened, also unevenly located with Bwiiza Parish having three (3), and Kisaikye with the newest center.

4.2.3 Socio-economic Characteristics

Households' membership to organization, programs or groups in the community is regarded as a vital component in achieving food and nutrition security and building social capital for community development (Titeca and Vervisch, 2008). Different groups play different roles in the life of household members depending on their goals. The survey results reveal that 85.7% of the households belong to at least an organization or a group in their community. We also found out that there was a significant association between food security measured by both the HFIAS (($\chi^2 = 4.699$, df = 1, p = 0.030), and FCS ($\chi^2 = 13.65$, df = 1, p = 0.000) methods and membership to groups. The former indicated that members were more likely to be food secure (89.5%) than non-members (82.4%), while the latter showed that 92.7% of members were more likely to have a better caloric intake than 80.5% of non-members.

Similarly, 88.0% of members were more likely to have a better dietary diversity than the 83.9% of household who do not belong to any groups though this method was not significant (χ^2 = 1.565, df = 1, p = 0.211). Considering CSRL/ISU-UP as an organization, 285 (73.3%) of the 389 households were registered clients and we found out a significant association between food security status and membership to the program. Program clients were likely (χ^2 = 4.732, df = 1, p = 0.030) to be more food secure (68.1%) than insecure (58.2%), and likely (χ^2 = 8.498, df = 1, p = 0.004) to be with a better (70.5%) caloric intake than being classified in the borderline-poor category. Although not significant, they were also likely (χ^2 = 0.455, df = 1, p = 0.500) to have better (64.5%) dietary diversity than average-poor (61.4%).

Household members belonged to multiple programs and groups within the community and with CSRL/ISU-UP programs as well. Classification by participation status in the NEC programs, considering CSRL/ISU-UP as a single group, we observed that all the three categories of participants were different from each other regarding the number of groups belonged to. NEC clients (2.34±1.00$^{\mathbf{a}}$) were found to be more likely to belong to more groups than the rest, whereas participants who are Non-NEC (1.89±1.21$^{\mathbf{b}}$) were likely to belong to more groups than Non-participants (0.93±0.90$^{\mathbf{c}}$). Classification by food security status, according to the HFIAS method, all the three groups: Food secure (2.14±1.17$^{\mathbf{a}}$), food insecure (1.69±1.13$^{\mathbf{b}}$), and extremely food insecure (1.11±1.03$^{\mathbf{c}}$) were significantly different from each other spreading around the overall mean (1.85±1.83). The food secure households were more likely to belong to more groups than the other two groups, and as well the food insecure were more likely to belong to more groups than the extremely food insecure.

Participating of households in the individual programs or groups or organization include; in general, of the 389 households who belong to any group, 73.3% registered with CSRL/ISU-UP,

65.6% with burials and festivals, 38.6% with VSLA, 10.3% with other farmers' groups, those in religious groups were 5.7%, 2.8, and 2.6 percent with cultural and marketing groups respectively and 0.3 with disabled association. Among the CSRL/ISU-UP group, of the 285 overall registered clients surveyed, 88.8% are NEC members, 21.1% belong to livestock, 10.5% to CIGI, and 3.5% to YEP. Each of the two categories groups had multiple memberships cutting across the different groups. Those who belonged to multiple groups under CSRL/ISU-UP were 20.4% (17.2% in two programs, 2.8% in three, and 0.4% in four programs), and 79.6% belonged to one program. In all groups/organizations, most members (over 70%) belonging to each were ordinary members as their role, only in marketing groups, community VSLA, Burials and Festivals were members of over 10% had executive roles.

Majority of the households in rural areas rely on agriculture as the main occupation and source of livelihoods accounting for 79.3%. The results of this study confirm the findings of the Uganda Bureau of Statistics (UBOS, 2009; 2016) that showed that rural households engage in small scale farming. Other important occupations included; boda-boda riding (4.4%), teaching (2.6%), trade and building each accounted for 2.4%, shopkeeping, and carpentry for 1.5% each among others with less than 1.0%. In this survey, two main agricultural related sources of income were traced; income from livestock since 2014, and income from the sale of crop production in season one of 2017 as a "reference" period. Detailed results from each economic activity are presented as follows.

4.2.3.1 Livestock production, integration, and sales among household

Data results show that 366 (80.6%) of the 454 households were involved in any form of livestock production either before joining CSRL/ISU-UP program for members in 2014 or after joining the program or both.

Table 4.1 Estimated Livestock Numbers Kept, and Sales, 2014-2018

Livestock breed kept	HH keep livestock		Livestock total numbers/heads			% of HH sold	Total sold	Sales revenue ($)[6]	
	Freq	Percent	Before	Current	Ass-ISU-UP			Total	Mean
Local cattle	163	44.5	389	252	-	19.4	157	27,667.6	389.7
Exotic cattle	17	4.6	36	25	-	1.6	17	5,088.2	848.0
Local goats	201	54.9	598	558	6	16.4	217	4,824.4	80.4
Exotic goats	24	6.6	68	41	20	2.2	43	2,082.4	260.3
Pig-all breeds	123	33.6	337	451	29	12.6	162	4,202.9	91.4
Local chicken	303	82.8	2404	2173	215	17.8	643	2,075.9	31.9
Layers	10	2.7	130	685	755	1.6	486	1,227.7	204.6
Broilers	02	0.5	110	200	-	-	-	-	-
Kuroilers	05	1.4	44	49	13	0.3	10	35.3	35.3
Ducks	38	10.4	127	116	-	2.5	28	102.1	11.3
Totals	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**45.6**	**n/a**	**47,306.6**	**283.3**

Source: Survey data of 2015 Baseline and 2018 Endline

Household involved in keeping livestock, most of them (74.3%) keep multiple breeds with majority 31.1% keeping two, 26.0 with three, 10.7, and 6.0 percent keep four, and five respectively. Non-NEC program participants were found to rear more breeds (2.51±1.58^{a}) than NEC clients (1.92±1.39^{b}) and non-participants (1.76±1.40^{b}). Whereas these last two groups had no differences, NEC clients had a mean close to the overall (1.95±1.44) hence rearing more breeds than non-participants. Of the 366 households who reported having reared any breed of livestock, only 45.6% reported having sold at least one of the 10 breeds.

However, we found no significant difference in sales (dollars) among the participants; NEC clients (230.46±327.36^{a}); Non-NEC (383.46±520.33^{a}), and non-participants (325.27±940.88^{a}) but

[6] Exchange rate: One United States Dollar was equivalent to 3,400 Uganda shillings, (ISU-UP Budget rate, FY2018/19).

NEC clients had a lower mean compared to the rest and the overall (283.27±579.82). Table: below shows a breakdown of livestock data by numbers before the launch of CSRL/ISU-UP program in 2014, the current numbers owned by survey time in 2018, and number associated to ISU-UP of any form. The table further breaks down the sales for each livestock by numbers, the household percentage of household who sold, total revenue and mean revenues from sales.

A reduction in the total number of livestock kept between before ISUUP and the current number columns are accounted for by the number of livestock sold as traced in this survey, and the number livestock consumed by the household, died or stolen but these were not collected. Most livestock breed associated with CSRL/ISU-UP were layer chickens, local chickens, pigs, exotic goats, kuroiler, and local goats in that order from high rank to lower by their numbers. These are the livestock breeds promoted by the program (small livestock) in addition to kuroilers and ducks. We found an association between program participants [(NEC clients (79.1%), Non-NEC (88.9%) with keeping of small livestock (χ^2 = 5.831, df = 1, p = 0.054) compared to Non-Participants (73.9%). Regarding sales, majority of the farmers (19.4%) reported having sold local cattle, local chicken at 17.8%, local goats (16.4%), 12.6% for pigs. In general, least sold breeds were ducks, exotic goats, exotic cattle, layer chickens, and kuroiler while no sale of broilers was reported.

4.2.3.2 Land accessibility and crop production

From the data analyzed, 433 (95.4%) of the households owned land with an average size of 3.54 acres. Households who used their land for crop production were 99.1% with an average farm size of 2.45 acres. Households who accessed land and or additional land through hiring/borrowing were 32.4% with a mean of 1.52 acres. However, there was no significant statistical difference among participants and non-participants in the program across the three different types above. Accessibility to land determines the household's option to participate, and

or not in crop production. Using 2017 season one as a reference (that runs from March through July), of the 454 households surveyed, only 396 (87.2%) of the households were able to participate in any form of crop production that directly increases food availability in their households.

We found a positive association between cultivation and food security ($\chi^2 = 13.085$, df = 1, p = 0.000), were 49.5% of household that cultivated were more likely to be food secure than the 24.1% food insecure. This season was chosen because it's the main crop growing season, and the year 2017 was chosen to as it would preferably reflect the contributions of the program since its operationalization in 2014. The table that follows below provides a snapshot of a specific crop produced by households in a three dimension; before the operationalization of ISU-UP programs (2014), and whether the crops were still being produced by the time of the survey with reference to season one of 2017.

Diversification of crops produced among farmers varied, a broad outlook shows that majority of the households (47.5%) grew between 4-6 crops, 26.8% between 1-3, 19.9% between 7-9, and only 5.8% grew 9-12 of the 12 crops traced in this survey. We further observed significant differences among clients where program participants: NEC clients (5.58±2.42^{a}); Non-NEC (5.26±2.70^{a}) were more likely to grow more than non-participants (4.04±1.79^{b}), and the overall mean was (5.11±2.40). Households who grow at least five crops (≥mean) were more likely ($\chi^2 = 17.177$, df = 1, p = 0.000) to be food secure (46.7%) than food insecure (26.6%).

Table 4.2 below shows in general that all crops were being produced by the households before ISU-UP in 2014, however, the number of households in production were less across all the crops compared to the reference season of 2017. By crop, maize was most produced across all the three phases with 93.4, 96.0, and 91.4 percent in periods before ISU-UP, reference season, and during survey time respectively. Beans and sweet potatoes were second and third most produced

crops respectively within the three time periods. Cassava and soybean had almost same number of households before ISU-UP but whereas cassava remained within 40's percent, soybean rose its bar to 61.1% in 2017, and slowly dropped to 57.1% by survey time. In general, most of the region's traditional staple food crops are those with 40 and above percent, save for grain amaranths that have picked up a non-traditional crop because of being promoted by the program as a nutrient dense crop almost mandatory to NEC clients to grow.

Table 4.2 Crop Production Before ISU-UP, in Season-1 2017, and during Survey Time

Crops are grown by households (n=396)	Before ISUUP (2014)		In Season-1 (2017)		Growing it by 2018	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Grain amaranths	72	18.2	173	43.7	161	40.7
Soy beans	166	41.9	242	61.1	226	57.1
High Iron Beans	10	2.5	44	11.1	37	9.3
Millet	87	22	115	29	103	26
Cowpeas	11	2.8	24	6.1	22	5.6
Collards	07	1.8	16	04	15	3.8
Onions	07	1.8	27	6.8	23	5.8
Egg plants	81	20.5	103	26	95	24
Pawpaw	36	9.1	38	9.6	34	8.6
Maize	370	93.4	380	96	362	91.4
Cassava	167	42.2	171	43.2	165	41.7
Ground nuts	118	29.8	121	30.6	108	27.3
Beans	261	65.9	274	69.2	257	64.9
Sweet potatoes	246	62.1	250	63.1	243	61.4
Rice	43	10.9	45	11.4	41	10.4

Production data for the reference season of 2017 are detailed in the table below. It describes the total number of households who got engaged in the production of a crop, the total land acreages

devoted to each with high possibilities of crop integration, outputs, sales made against the number of households who sold and the mean revenue from sales. The data shows that the number of households who produced each crop was far higher than those who sold after harvest. This buffers that claim that small landholder households produce for home consumption and surplus is for sale. Similarly, even for quantity sold when compared to output at harvest, the divergent very wide across all crops as shown in the table below.

Table 4.3 Crop Production and Sales in Season One, 2017

Crops grown (n=396)	Season-1 2017	Total acreage	Output (lb)	Qty sold (lb)	Who sold	Total Sales ($)	Mean ($)
Grain amaranths	173	49.0	6,517	2,663	62	712.9	11.5
Soy beans	242	94.6	20,225	7,246	72	1,271.5	17.7
High Iron Beans	44	16.7	1,850	90	05	16.8	3.4
Millet	115	41.2	15,991	6,757	17	1,027.9	60.5
Cowpeas	24	1.4	114	-	-	-	-
Collards	16	1.2	545	33	08	3.7	0.5
Onions	27	0.3	247	-	-	-	-
Egg plants	103	20.6	19,071	7,232	13	152.6	11.7
Pawpaw	38	3.1	6,816	221	01	8.8	8.8
Maize	380	414.7	444,837	153,799	177	11,278.5	63.7
Cassava	171	80.3	126,898	3,321	16	443.7	27.7
Ground nuts	121	44.1	16,793	3,389	19	547.6	28.8
Beans	274	116.5	34,775	6,690	45	1,289.1	28.6
Sweat Potatoes	250	119.7	177,491	7,166	14	302.1	21.6
Rice	45	33.1	50,241	23,968	21	4,355.9	207.4

The land acreage devoted to a given crop varied depending on the number of households engaged in its production, the use of the crop, and households' preferences among other reasons.

Most of the staple crops in the region are those with high acreages and double as food and cash crops that include maize, beans, cassava, sweet potatoes. Rice is regarded as high-value crop mainly for sale, and crops such as grain amaranths, soybeans, high iron beans, and millet are mainly promoted by the program as high nutrient crops to help in the fight against malnutrition. Vegetables are both practiced on a small, medium and large scale depending on the purpose to the farmer. Medium and large scale mainly grow for sale and small scale grow to supply households with micronutrients, and mainly done in the keyhole, sack, kitchen and or main gardens. Different crops yielded different amounts of dollars from sales, however, when pooled together and compared among the three categories of households, we observed a non-significant difference among them with reference to the mean revenue. The Non-NEC clients (107.55±132.96[a]) were however above the overall average revenue (82.27±116.97), while NEC clients (79.22±119.73[a]) and non-participants (75.62±98.66[a]) were below the average.

4.2.3.3 Postharvest handling technologies

Postharvest technologies are very significant in crop production to help farmers tell when crops are ready for harvest, how to harvest, dry and keep them either for home consumption or sale. The survey focused mainly on grain crops. On how grains are shelled after harvest, 63.0% of the 454 farmers shell by beating using hands, 33.0 shells by hand using fingers, and 11.5% reported using machines. After shelling, most farmers dry on bare ground (71.1%), 26.2 on tarpaulins, 3.1% on concrete, 1.1 on other means. To check for moisture content to determine dryness, all households reported using teeth (bite), and 36.6% just snap with hand. Only 444 (97.8%) reported having stored the harvest while others either did not have enough to store or sold off the harvest. The main storage among the 444 households was bags (91.7%), 13.5% jerrycans, 1.6 and 1.1 percent in metallic silos and plastic silos respectively and 0.7% in pots. The technologies observed

in the above have implication on the food security of households. The shelling mechanism (by hand) depict low harvest, and this confirms to the findings of this report where the harvest was low across all the crops and some farmers did not harvest at all at the end of the season. The cost of tarpaulins dictates farmers drying on bare ground that affects the quality of grains. The method of moisture testing and storage are not reliable, and this could probably explain the high infestation of weevils in stored grains among the household of over 50% as observed by Brumn and Barnes, (2017).

Further, households were asked to clarify on the changes they have gone through significant to food and nutrition security in terms of income, food supply, and area cultivated attributed to for each crop.

Table 4.4 Changes Experienced Attributed to a given Crop Grown in Season-1, 2017

Crops grown by household	Households grew crops Season-1 2017	Percentage changes attributed to each crop grown		
		Income	Food supply	Area cultivated
Grain amaranths	173	32.4	85.5	19.7
Soy beans	242	28.5	85.5	13.6
High Iron Beans	44	9.1	81.8	20.5
Millet	115	11.3	78.3	9.6
Cowpeas	24	-	79.2	16.7
Collards	16	18.8	68.8	-
Onions	27	-	59.3	-
Egg plants	103	11.7	71.8	2.9
Pawpaw	38	2.6	52.6	-
Maize	380	45.0	83.7	10.8
Cassava	171	8.2	71.9	4.7
Ground nuts	121	15.7	71.1	2.5
Beans	274	16.1	78.1	8.8
Sweet potatoes	250	5.6	70.4	5.2
Rice	45	46.7	66.7	8.9

In general, all crops scored highly in their contribution to food supply within their respective households producing them. Area cultivated all fell within the lower quantile probably because of limited land size, and access against the number of crops to produce by the household. All farmers who grew a crop and never sold anything at the end of the season never scored improvement in income. Similarly, there were households who felt despite producing the crop, it had done little or nothing to change any variable as either there was total crop failure or little harvest. In this instance, they declined to vote the crop for any either one or two variables.

4.2.3.4 Challenges in crop production

The 58 (12.8%) of the 454 households who were not able to cultivate any crop in the first season of 2017 were asked for what could have been the cause, similarly, those who cultivated were also asked for the challenges they faced in the season. Among the 58 (12.8%) who did not cultivate, majority (32.8%) had issues with inadequate land, sickness and physical inability (29.3%), inadequate seeds (20.7%), pregnancy, and not being at home with 5.2 percent, and among others (prohibited by husband, poor weather, infertile land). For the 396 who cultivated, their challenges included: soil infertility (54.0%), Striga weed (53.5%), pests (44.9%), water shortage/poor weather (37.6%), land issues (27.5%), theft and lack of market with 17.4 percent each, and diseases (8.8%). Whereas both categories of households have human-related problems such as sickness, inadequate seeds, poor market, most of them are linked to reliance on nature like poor weather, soil infertility, Striga weed, pests among others.

There is a connection between the findings of this survey and the assertions put forward by the IFAD (2001); Rahman and Westley (2001); National Academy of Science (2010). These found out that limited access to resources in form capitals including but not limited to land, finance, labor and information as constraints limiting the productivity of small-scale landholder farming hence

negatively affecting their livelihoods. The high level of poverty as exhibited in limited revenue from sales and limits farmers options to solve the problems they face especially those that require money to purchase inputs, as well as land to expand their farming areas. This claim is further confirmed by the similar findings of Smith, Alderman, and Aduayom (2006); Ssewanyana and Kasirye (2010) who also contend that poverty has remained a major challenge to rural Ugandan farmers.

4.2.3.5 Education background of the respondents

The survey reveals that 308 (67.8%) of the household heads were within the category of primary education, formally having spent 0-7 years of education, and 146 (32.2%) in the category of post-primary education, having spent 8-16 years or above of formal education. By participation category in the NEC programs, we found out significant differences among the households where, participants who are Non-NEC clients were likely to have spent more years in formal education (7.56 ± 3.71^{a}), than the NEC clients (6.87 ± 2.45^{b}), and Non-participants (6.65 ± 2.88^{b}). Although the NEC clients were close to the overall mean (6.90 ± 2.80), they were not significant from non-participants. For spouses, 295 (75.1%) were within the primary education category and 98 (24.9%) in post-primary. 387 of the 454 households had school going children or whom, 323 (83.5%) had their children attending school and 64 (16.5%) their children were not attending school. Among the spouse, we found no significant difference among participants and non-participants in the program.

Although the NEC clients (6.14 ± 2.42^{a}) were below the overall mean (6.39 ± 2.51) compared to Non-NEC (6.89 ± 2.80^{a}), and non-participants (6.67 ± 2.48^{a}). The level of education dichotomized as having completed the national exam or dropped out before completion shows that 52.2% of spouses of household heads and 56.8% of female household heads never completed their primary

education. Further, the survey reports that only 7.7% of spouses and 9.9% of female heads of households completed secondary education or joined higher learning. Further analysis shows that the percentage of male household heads who never completed their primary education was 33.3% compared to 52.2% of spouses, and those who completed their secondary and or joined higher education were 15.6%. This shows that men were more educated than their counterparts and spouses.

Education is a very significant factor in the food and nutrition security status of households. It is generally known that the level of education determines the kind of occupation that one holds. High education levels tend to lead to better-paying jobs that in turn raises the purchasing power of households to obtain the necessities of life, for instance, shelter, food, clothing, medication, education of children among others. In contrary, low levels of education tend to push the population to peasantry farming, characterized by low production and rampant food shortages. The results of this survey confirm that with 79.3% of households engaged in farming as the main economic activity, and the level of food insecurity was at 53.7%. Overall, the results of this study confirm the findings of the UBOS (2009; 2016) that shows that rural households engage in small scale farming. In relation to nutrition security, education of household heads and spouses in addition to influencing the economic status, it does influence the health behaviors and attitudes, and food choices that determine the dietary intake of the household thus impacting the nutrition security. This confirms the findings of Faith et al., (2004) who contends that knowledge is a significant factor in determining the dietary practices of households.

A cross-tabulation of the education of the household heads and spouses separately against HFIAS, FCS, and HDDS reveals that a high proportion of the households with low education (0-7 years – primary level) are food insecure, with a low food consumption score and a poor dietary

diversity compared to those with post-primary education. We found a significant difference between education of households' spouse with the household's caloric intake (FCS) where spouses with more years of education (6.68±2.63[a]) above the mean (6.39±2.51) were categorized into the acceptable FCS category, whereas no difference was observed among those in the borderline (6.30±2.39[b]) and poor (5.87±2.40[b]) caloric intake category.

4.2.4 Water Accessibility and Use

Households had multiple sources from where they draw water for domestic, animal and crop uses. Most households 88.3, 58.6, 23.3, and 13.0 percent use protected borehole, rainwater, unprotected boreholes, and surface water including river among others respectively. This survey further traced to only two main water sources per households categorized as primary and secondary. Among the primary water sources, most households (87.2%) among other water sources, rank protected borehole as their primary source of water whose water is used for both domestic consumption (99.3%) [cooking, drinking, washing, and other WASH related activities], irrigation (23.3%), and watering of their animals (67.8%). With regards to the proximity of households to primary water sources, 95.8% are within a 2km radius with a maximum of 5kms and a mean of 0.54kms. In terms of time, 62.6% spend <30 minutes for a round trip to fetch water from their respective primary sources with a maximum of 180 and a mean of 34 minutes.

Among the secondary water sources, 417 (91.9%) of the 454 households had alternative water sources, with whom 63.8, 13.7, and 12.9 percent ranked rain catchment using temporary containers, surface water, and unprotected boreholes among others as their main source. Regarding vicinity, 95% are within 2km radius with a maximum of 6kms and a mean of 0.3kms. Most households (87.3%) spend <30minutes for a round trip, with a maximum of 240 and a mean of 18 minutes. As the primary, secondary sources also served the same functions in varying proportions;

with whom 81.4% using the water for domestic purposes depicting a reduction of 17.9 for the same purpose with the primary source, 70.7% use it for watering livestock showing an increment of 2.9%, and 26.4% use water for irrigation similarly showing an increment of 3.1% across the two broad water source categories of primary and secondary.

There was a reduction in time taken for a round trip compared to the national average found out by UDHS in 2016 where 55.0% of rural dwellers were reported having spent more than 30 minutes to fetch water for a round trip (UBOS, 2018). In a similar report of UDHS, the number of households accessing improved clean drinking water sources rose from 70 to 78 percent between 2011, and 2016 respectively, this survey reported that those accessing protected boreholes (here considered as safe drinking water in the rural areas) as their primary sources were 87.2% and 99.3% using its water for domestic purposes, showing further improvement in Kamuli district. Data further reveals that at least every (100%) household gets water from a borehole (protected and or unprotected), most of which were sunk by the government (54.4%), CSRL/VEDCO/ISU-UP (22.7%), Plan International (8.4%), individual persons (4.2%), among other entities (1.0%), and with 9.3% of the respondents unable to recall the entity.

Statistics from National Population and Housing Census, 2014 Area Specific Profiles for Kamuli district showed that accessibility at district level was 85.6%, and specific to Bugabula South, and North where Butansi and Namasagali Sub-Counties are located, their accessibility was 86.2, and 85.3 percent respectively (UBOS, 2017). 45.8% of the households reported having stopped using any water, for reasons ranging from the far distance (22.2%), the source being contaminated and lacking a taste (12.4%), received a nearby water source (6.6%), and mechanical issues (1.8%). Significant to probe further are the 6.6% of the households who received a nearby water source, in addition to other entities who sunk boreholes, this can partially be counted on the

works of the CSRL/ISU-UP in sinking more boreholes and construction of underground water cisterns at every borehole to collect spillover water that is used in watering animals, irrigation, brick making among others. Specifically, 8.3% of the 60 program's livestock clients reported having received water tanks to help water their animals, and other domestic uses. Only 18.3% reported a water source being shared with animals.

Regarding division of labor on who collects water for domestic, livestock and agriculture-crop, overall, there was almost a balanced role between boys (51.0%) and girls (48.1%) aged 6-17 years, but with a wide disparity between men (45.9%) and women (70.3%) of ≥18 years of age regarding water collection. The productive gender role of women specifically in domestic activities is clearly depicted by their full engagement in water collection than men for domestic purposes (100 and 91.4 percent respectively). However, depending on the type of livestock, and crop under irrigation, men are more involved in their water collection than women (80% men and 70.5% women in livestock, and 31.1% men and 25.7% in water collection for crop irrigation).

Whereas each gender helps each other, women more in looking after small livestock like pigs, goats, chicken among others (kept by 361 of 366 households who were involved in livestock), men are more involved in large livestock (kept by 163 of the 366 households) especially cattle especially if the numbers are many and require constant tethering and moving around scavenging for pastures. This can help explain the difference in 80% and 70.5% role in livestock water collection. Similarly, water-intensive crops specially grown on a relatively medium to large scale are more likely to be managed by men for instance the early phases of rice growing and eggplants since these two crops according to the data are most grown (127 of the 396 households who cultivated in season one 2017) among those requiring a nursery bed establishment. This same instance can help explain the low rate of irrigation among households.

Supplementation of water to livestock and use of small-scale irrigation irrespective of the kind of crop irrigated is a move towards having food production throughout the year even during dry season hence reflecting a reduction of farmers' reliance on natural rains. Tesfaye et al., (2008) in their research on how small-scale irrigation affects household food security in Ethiopia found out that 70% of farmers who used irrigation water were food secure compared to 20% who were food secure but did not use irrigation. Similarly, the finding of the study confirms to the other studies on the gender roles of reported by UN organizations and individual researchers. For instance, in 2009, the report by the World Bank indicated that women were actively involved in crop and livestock production and controlled a share of their marketing (World Bank, 2009). FAO (2011) reported that 79% of women in the developing nation go by agriculture as their major activity and provided 43% of the agri-food labor force. This is a large share of labor has a direct impact on food production, Doss (2011), Marslen, (2015) to confirms the FAO claim, and that on global scale women produce half of the world's food.

4.2.5 Household Housing, Health, Hygiene and Sanitation Facilities

4.2.5.1 Housing and Kitchen facilities of households

All households possessed housing facilities in various ownerships, with majority 407 (89.7%) being owned by the family, 37 (8.2%) owned by the landlord (being rented), and 09 (1.0%) owned by the household's relatives including mother, grandfather, and sister. About the kitchen facilities, 392 (86.3%) possess kitchens, and 62 (13.7%) do not possess. The structural conditions of the housing and kitchens in terms of wall, roof, and floor are described as follows. For the main house, concerning the structure of the walls, most (70.3%) had plain brick walls, 17.8% mud poles, 9.7% plastered, and only 2.2 plastered and painted. About the roof, those who had very good iron sheets were 9.3%, good was 64.3%, 13.4, and 13.0 were grass thatched, and

dilapidated iron sheets respectively. Fewer household (27.8%) had cemented floors, the rest (72.2%) had rammed earth floors.

Regarding the kitchen, half the household of the households who possessed kitchens was of mad poles, nearly half (47.2%) were plain bricks, 1.8, and 1.0 percent were plastered, and plastered and painted respectively. Most kitchens (69.4%) were grass thatched, only 1.5% had very good and 17.9% good iron sheets, 9.4% dilapidated and 1.8% never possessed the roof. More rammed earth floors (97.2%) than cemented (2.8%) were observed in the kitchens. The structural characteristics of housing facilities and kitchen are typical of an evolving rural community moving from mad poles, and grass thatched to bricks and iron sheets with a slow pace in use of cement because of the cost whereas the bricks can be made locally.

Regarding the main source of fuel/heating used by households, in multiple responses on the options, 437 (96.3%) use firewood, 73 (16.0%) use charcoal, 20 (4.4%) use crop residues, and only 01 (0.2%) use manure. For lighting within the households, in similar multiple responses on options, 213 (46.9%) use kerosene, 195 (43.0) use solar, 36 (7.9) use battery, 08 (1.8%) use torches, and 05 (1.1%) use Hydro Electric Power (HEP). The uses of HEP in rural Kamuli is far lower than the national average reported by the UDHS of 2016 at 18% (UBOS and ICF, 2018).

4.2.5.2 Health, hygiene and sanitation facilities among households

Households' possession and condition of WASH facilities determine their health status and the rate of predisposition to hygiene-related diseases. In addition to a good diet, food utilization, and food and nutrition security, in general, is achieved with access to good and clean WASH facilities that exonerates the household form many diseases. In sum, 99.1% of the 454 households possess at least one of the six facilities considered in this survey including latrines, bathrooms, tippy taps, kitchens, rubbish pits, and dish rackers. Household who possessed above average (≥4

facilities of six) was 281 (61.9%). Whereas possession was high, the state of the facilities as evaluated during the survey in terms of their physical structure and strength, and general cleanliness was very low with only 55.5% in good condition. Possession and condition of facilities varied across the Sub-Counties where CSRL/ISU-UP implements that the livelihoods programs.

Table 4.5 Possession and Condition of WASH Facilities by Sub-County in Kamuli, 2018

Variable	Facilities	Butansi (n=261)		Namasagali (n=193)		Overall (n=454)	
		Freq	Percent	Freq	Percent	Freq	Percent
Any WASH	Yes	259	99.2	191	99.0	450	99.1
WASH by number	<4 facilities	80	30.7	93	48.2	173	38.1
	≥4 facilities	181	69.3	100	51.8	281	61.9
	Total	**261**	**100**	**193**	**100**	**454**	**100**
Household possess WASH facilities*	Latrine	256	98.1	184	95.3	440	96.9
	Bathroom	230	88.1	146	75.6	376	82.8
	Tippy Taps	139	53.3	67	34.7	206	45.4
	Kitchen	232	88.9	160	82.9	392	86.3
	Rubbish pit	145	55.6	85	44.0	230	50.7
	Dish rack	99	37.9	58	30.1	157	34.6
Overall condition	Bad	103	39.5	99	51.3	202	44.5
	Good	158	60.5	94	48.7	252	55.5
	Total	**261**	**100**	**193**	**100**	**454**	**100**
Condition of WASH facilities (categorized as good)*	Latrine	185	70.9	120	62.2	305	67.2
	Bathroom	155	59.4	105	54.4	260	57.3
	Tippy Tap	112	42.9	38	19.7	150	33.0
	Kitchen	166	63.6	121	62.7	287	63.2
	Rubbish pit	97	37.2	57	29.5	154	33.9
	Dish rack	63	24.1	42	21.8	105	23.1

*Totals not included because of multiple possession of facilities.

Overall, households in Butansi Sub-County from the results were better as expected (χ^2 = 14.465, df = 1, p = 0.000) in both possession (69.3%) compared to 51.8% of Namasagali, and general condition of all the WASH facilities (60.5%) than those of Namasagali (48.7%) as depicted in the table above with an association value of Chi-Square (χ^2 = 6.289, df = 1, p = 0.012). Possession was considered good at 4 of 6 facilities, and conditions as good when facilities were found clean, and in good structural shape. However, with almost half of the facilities in bad shape and or condition in general, this situation can help account for the high rate of WASH-related diseases within the households for instance, 95.6% of the households experienced a disease in a month prior to the study most of which are linked to the poor state of facilities.

Nevertheless, there was a general improvement in the possession of latrine facilities compared to the 2014 statistics of Kamuli district as revealed by NPHC area Specific Profiles where the possession of latrines was at 95.0% for the district, 94.7% for Bugabula South, and 90.1% for North (UBOS, 2017). The survey statistics show that the overall possession was at 96.9%, and for Butansi that is found in Bugabula South was 98.1%, and Namasagali within the North was 95.3%. Similarly, compared to similar report's (UBOS) findings, there was an improvement in the disposal of solid wastes showed by high numbers of rubbish pits possessed in good condition from 32.2% to 33.9% in general, 28.1% to 37.2% for Bugabula South (referencing it to Butansi), and 27.2% to 29.5% for Bugabula North (referencing it to Namasagali) Sub-Counties.

These improvements can partially be attributed to households' participation in the health, hygiene and sanitation training of the NECs, coupled with the constant monitoring of NECs' clients by the Community-Based Nutrition Trainers (CBNTs) for the NECs who constantly

monitor their clients to have the facilities constructed and maintained in good conditions. The table 4.6 below shows a comparison of possession and condition of facilities among participants.

Table 4.6 Possession and Condition of WASH Facilities among Participants

Variable	Facilities	Participants: NEC clients (n=253)		Participants: Non-NEC clients (n=63)		Non-Participants: Non-NEC clients (n=138)	
		Freq	Percent	Freq	Percent	Freq	Percent
Any WASH	Yes	249	98.4	63	100.0	138	100.0
WASH by number	<4 facilities	88	34.8	24	38.1	61	44.2
	≥4 facilities	165	65.2	39	61.9	77	55.8
	Total	**253**	**100**	**63**	**100**	**138**	**100**
Household possess WASH facilities	Latrine	244	96.4	63	100.0	133	96.4
	Bathroom	210	83.0	51	81.0	115	83.3
	Tippy Taps	120	47.4	32	50.8	54	39.1
	Kitchen	218	86.2	55	87.3	119	86.2
	Rubbish pit	142	56.1	30	47.6	58	42.0
	Dish rack	94	37.2	18	28.6	45	32.6
Overall condition of facilities	Bad	110	43.5	24	38.1	68	49.3
	Good	143	56.5	39	61.9	70	50.7
	Total	**253**	**100**	**63**	**100**	**138**	**100**
Condition of WASH facilities considered as "good"	Latrine	168	66.4	42	66.7	95	68.8
	Bathroom	148	58.5	38	60.3	74	53.6
	Tippy Taps	244	96.4	63	100.0	133	96.4
	Kitchen	155	61.3	41	65.1	91	65.9
	Rubbish pit	101	39.9	24	38.1	29	21.0
	Dish rack	62	24.5	14	22.2	29	21.0

A crosstabulation of the survey data shows that 143 of the 252 households who possess good condition WASH facilities participated in the health training, similarly, 101 of 154, and 243

of 440 who possess good rubbish pits and those who have latrines participated in the health training of the program. This can be part of implementing the lessons learned from the training.

4.2.6 Household Morbidity/Mortality/Diseases Statistics

The health status of household members determines their productivity and contribution to food production and similarly determines the nutritional status of their bodies. Healthy bodies have better biological functionality, able to utilize the consumed food into body nutrients for proper health growth. The prevalence of diseases of whatever form and its intensity is a deterrent to the attainment of a stable food and nutrition security status. Data reveals that 434 (95.6%) of the 454 households experienced at least a disease a month prior to the survey. The survey traced only the first six patients per household and a total of 2304 (87.6%) of the total household members (2629) in the 434 households that experienced at least a disease. Most households (58.3%) experienced two to three diseases, 18.9% four to six, 22.8% one disease, see table for details on occurrence per disease and alternatives available for households to treat the patients. Diseases in the "others" category included measles, kwashiorkor, marasmus, hernia, ulcers, pneumonia, jiggers, syphilis, diabetes, backache, and toothache.

Regarding the number of days of illness, whereas the maximum days across all age groups is between 21-30 days, on average, children under six years are more affected more so the males with an average of 7.0 days and females with 6.4 days. The average for breadwinners (most adult males) is lower than for the caretakers (most adult females) at 4.3 and 5.1 days respectively. Female school going children spend more days of illness than their counterparts with averages of 4.9 and 5.5 days at ages of 10-17 and 6-9 years for females respectively than 4.3 and 4.7 days for males. This data, in general, is saying that males have a weaker immunity below six years after which they become stronger as they age.

Table 4.7 Disease Occurrence and Available Alternatives for the Treatment of Patients

Measures	Diseases experienced, and possible solutions					
	Diarrhea	Malaria	Dysentery	Cough	Skin	Others
Household had disease	183	401	41	266	127	74
Percentage of occurrence	42.2	92.4	9.5	61.3	29.3	17.1
Maximum number of patients	6	6	5	6	5	3
Total patients in households	274	1023	55	658	199	95
Average number of patients	1.5	2.6	1.3	2.5	1.6	1.3
**For each disease, what are the alternative measures available to the household? (n=454)						
Buy Medicine	50.4	83.0	41.2	73.6	58.6	9.5
Give ORS	57.5	4.4	15.6	4.2	2.4	-
Go to Health Center/VHTs	58.8	84.6	62.1	76.9	65.0	9.3
Go to Mulago/Lubaga	25.8	40.7	37.2	34.4	29.1	3.3
Go to Jinja Referral Hospital	2.4	7.5	5.9	7.5	5.9	0.9
Give Herbal medicine	10.1	12.3	9.7	10.4	9.3	0.9
Go to Traditional Healer	0.7	0.9	0.7	0.9	1.1	0.9
Go to NECs	-	-	-	-	-	3.5
Go to Church	-	-	-	-	-	0.2
Do Nothing	3.3	0.9	4.4	4.6	4.2	6.6

*Household alternative solutions to disease included those who had no experience of a disease a month prior to the survey

Looking at the data in the table, with the high prevalence of disease at 95.6%, coupled with the maximum number of patients being 5-6 for every disease, it means almost every member of the household was infested with that disease since the households' membership survey average was also six. These results have a devastating impact on the members' productivity both agriculture for the parents which is the main activity and school going children. With 14.1% and 24.7% of most adult males and females spending more than five days bedridden (in a reference

timeframe of 30 days – a month), food production becomes very difficult to improve, and hence this disease effect can account for the low rate of food security with only 46.3 percent of the entire surveyed households being food secure. One probable reason for this high rate could be the poor state of WASH facilities. These diseases have a direct link to these facilities and given that the overall state of condition was just above average (55.5%), it highly exposes the household to the vulnerability of disease occurrence and circulation among members.

Regarding available households' alternatives to treatments, and or preventive measures, there exists a wide range of options between diseases and among the households. Whereas data showing that accessibility to Community Health Centers and or Village Health Teams (VHTs) was above average, accessibility to the district hospitals (Mulago-government and Lubaga-Mission Sisters) was below average and rarely suggested reaching out to the Regional Referral Hospital in Jinja. The low income of households was depicted by the inability to purchase medicine as this alternative is within averages. Whereas some alternatives seem to have been miss allocated to certain diseases, for instance, give ORS to cough, skin, malaria and another disease, other alternatives need further sensitization of the community, and the number of households doing nothing about the disease is striking.

The NECs through its WASH training programs help to sensitize the need for the facilities and maintenance of their hygiene to prevent the associated disease as a preventive measure. Similarly plays a curative role but specifically in curtailing the nutrition-related disease of kwashiorkor and marasmus, for instance, disaggregating data on "other diseases" category, 15 of the 18, and 13 of the 19 households who experienced kwashiorkor and marasmus respectively took their children to the NECs as an alternative. Through a partnership with the Ministry of Health (MoH), every NEC is allocated a nearby Community Health Center and the incharge dispatches

Health Centers' facilitators to work hand in hand with the CBNTs to train clients on WASH-related and nutrition-related disease as well conducting outreaches where clients are immunized (see table-in chapter three).

In such partnerships and efforts to improve the health and nutrition security in the community, households involved in this survey their children received vaccination from either the Health Centers or the NECs. Among the 546 children reported having received measles vaccine, 58.4 received from the Health Centers, and 41.6% from the NECs. 58.1 and 41.9 percent the children received DPT-3 vaccine from the Health Centers and NECs respectively. For deworming and Vitamin-A supplementation, 57.8 and 57.2 percent received it from the Health Centers whereas 42.2 and 42.8 percent received from the NECs. Basing on these results, it's established that at least 40 percent of the vaccinations, immunizations of the households surveyed were done at the NECs. This collaboration helps households access the services in a shorter distance for those living near the NECs irrespective of their affiliation to the program.

4.2.7 Assets Possession by Households

Assets possessed by households are considered as wealth, and security in times of acquiring loans either from the community savings schemes liken VSLA, microfinance institutions, and or commercial banks. The assets referenced in this survey are in two categories; agricultural implements, and home items. Households who possessed at least an agricultural implement were 449 (98.9%) of 454, and those who possessed at least a home items were less (419) representing 92.3% all the surveyed households.

Under agricultural implements, most possessed were hoes (96.0%) with a mean of 4.0, pangas (81.1%), axes (69.35), slashers (41.0%), 25.4 and 11.6 percent for spades, and rakes respectively. For home items, mobile phone, bicycles, and radios were most possessed in the

proportions of 82.6, 77.3, and 60.4 percent respectively, 12.4 and 9.1 percent were for clocks, and watches. Assets disaggregation is shown in the table below. Possession of items in the household is probably determined by their use and the unit price. This explains the high possession of hoes per household since traditional cultivation is the main method of crop production, similarly, the average household was established to have 6.0 members, and the mean hoe possession was 4.0 meaning that each member of the household has hoe other than the children. Least possessed assets; wheelbarrows and Ox-plough with only 3.1 and 2.9 percent probably attributed to their high unit cost and these are not necessities for all households. Similarly, by its use and complementarity with livestock production, households who possess Ox-plough are most likely to be those with cattle-oxen, and specifically likely to be those who use the assets for commercial purposes by tilling for other community households. For home items, phones, radios are essentials in communication, and bicycles are essential is fetching water, transport and as well used by students to go to school. Least possessed were motor vehicles with only 0.2% probably attributed to the high cost, and televisions (3.6%) attributed to lack of electricity in rural communities, and motorcycles (6.2%).

4.2.8 Household Food Consumption Between Seasons of Plenty and Scarcity

In a comparative method, food consumption trends between the periods of food plenty and food scarcity varied depending on food availability between the Baseline data of 2015 and Endline of 2018. Since most of the households are farmers, an overall main source of food was home gardens and accounted for 91.5, and 87.4 percent for baseline and Endline, of the household food supply. The households experience of food security on self-evaluation varied between the two time periods, the table below shows the outcome of the probed variables.

Table 4.8 Household Self-evaluation on Food Security, Baseline 2015 & Endline 2018

Variable	Indicator and measure	Baseline 2015		Endline 2018	
		Frequency	Percent	Frequency	Percent
Consider your Household…...?	Always food insecure	25	5.6	20	4.4
	Sometimes food insecure	317	71.2	355	78.2
	Food Secure	103	23.1	79	17.4
	Total	**445**	**100.0**	**454**	**100.0**
Do you experience food scarcity in this household?	Not at all	96	21.6	62	13.7
	Sometimes	331	74.4	374	82.4
	Most of the time	18	4.0	18	4.0
	Total	**445**	**100.0**	**454**	**100.0**
If yes, how long is food scarcity?*	0-2 months	255	57.3	280	61.7
	Over 2 months	190	42.7	174	38.3
	Total	**445**	**100.0**	**454**	**100.0**
The main month of food scarcity	April	163	36.6	207	46.5
	May	86	19.3	75	16.9
Main months of food plenty	July	66	14.8	225	50.6
	Aug	216	48.5	165	36.3
The main source of food	Garden	407	91.5	397	87.4
Did your household have a surplus for sale	Yes	318	71.5	140	30.8
	No	127	28.5	314	69.2
	Total	**445**	**100.0**	**454**	**100.0**
What is the main food reserve in this household?	None	8	1.8	27	5.9
	Food in Store/house	417	93.7	379	83.5
	Granary	12	2.7	3	0.7
	Food in garden	8	1.8	45	9.9
	Total	**445**	**100.0**	**454**	**100.0**

*The number of households who do not experience food scarcity are categorized among those of 0-2 months.

The period of food availability during plenty season across all households in the Endline survey of 2018 peaked in the month of July at 50.6% and August at 36.3% compared to a baseline that peaked in August at 48.5%, and July at 14.8%. These two statistics show an improvement in production between the two time periods. However, this period of food availability was short-lived only in the season of bumper harvest for the first main-rainy season of the farmers' calendar. Most food scarcity between the Baseline and Endline of 2015 and 2018 respectively were April with 36.6% and May with 19.3% for baseline, and April with 46.5% and 16.9% for Endline in 2018.

Whereas the food plenty months and percentages differed among the two time periods, the high percentage of food scarcity in depicts that there was more food scarcity in 2018 than in 2015 which affirms to the findings of this survey where 2018 has less food secure households (46.3%) than 2015 with 61.6%.

According to the results, months of food scarcity start from March and the probable reason for this that March is the main planting month of the season, April is a weeding season and May is when crops mostly flowering. This explains why these three months are a problem for farmers who entirely feed on gardens. Only 12.1% of the entire population did not mention any months they experience food scarcity in a year. Regarding a number of meals consumed during the periods of plenty and scarcity greatly, these varied. During the periods of plenty, all households consumed at least two meals in a day, however, the number dropped in seasons of scarcity to one meal by 3.3%, compared to none in plenty, two meals by 25.1% in scarcity compared to 8.8% during plenty, and 71.6% during scarcity compared to 91.2% during plenty for three meals a day in a household. By meal, during plenty season, households who had breakfast were 91.6% and dropped to 73.3% during scarcity, those who had lunch relatively remained constant at 99.6 and 98.2 percent in plenty and scarcity respectively, whereas households who had dinner dropped by 4.6% from 100% during plenty season.

4.3 Participation in the Food and Nutrition Security Programs of NECs

Overall, most of the households surveyed 316 (69.6%) of the 454 participated in the NECs' FNS programs which is equivalent to the overall CSRL/ISU-UP program activities' participants. Considering the participants sub-sample, disaggregating data by participation status shows that 80.1% of the participants are registered NECs clients, and 19.9% are Non-NECs clients.

Participation by households was multiple and varied among the six FNS programs considered in this survey both between NEC and Non-NEC client members. Among all the participants and programs, receiving of services from the NECs was the most participated in program with 89.6%, followed by participation in water, health, hygiene, and sanitation (WASH) trainings 79.1%, nutrition and feeding trainings 78.5%, agronomy trainings 69.3%, livestock trainings 55.1% and participation in income innovations participated by 9.5%. A breakdown of the disaggregated participation among the NECs and Non-NECs and their Chi-Square significances of association are shown in the table below.

Table 4.9 Participation in the Food and Nutrition Security Programs of NECs (n=316)

Food and Nutrition Security Programs of the CSRL/ISU-UP's NECs		CSRL/ISU-UP (n=316)		NEC clients (n=253)		Non-NEC clients (n=63)		P-Value (χ^2)
		Freq	Percent	Freq	Percent	Freq	Percent	Sig.
Training Programs or Service	Agronomy	219	69.3	198	78.3	21	33.3	0.513
	Livestock	174	55.1	137	54.2	37	58.7	0.000
	Services	283	89.6	253	100.0	30	47.6	0.000
	Nutrition	248	78.5	242	95.7	06	09.5	0.000
	Health	250	79.1	243	96.0	07	11.1	0.000
	CIGI	30	09.5	25	09.9	05	07.9	0.637
Number of programs participated in at the NEC	One	48	15.2	06	02.4	42	66.7	0.000
	Two	12	03.8	02	00.8	10	15.9	
	Three	39	12.3	33	13.0	06	09.5	
	Four	91	28.8	91	36.0	-	-	
	Five	105	33.2	101	39.9	04	06.3	
	Six	21	06.6	20	07.9	01	01.6	
	Total	**316**	**100**	**253**	**100**	**63**	**100**	

A crosstabulation between participation in the program and household affiliation status shows a significant association in four of the six programs at 1%. Non-NEC clients (58.7%) were more likely to participate in livestock trainings ($\chi^2 = 47.858$, df = 1, p = 0.000) compared to NEC clients. Whereas for services, NEC clients were more likely to participate in receiving services ($\chi^2 = 147.977$, df = 1, p = 0.000). Results show that 100% of NEC clients had received at least a

service from the program. Almost an equal number of those participating in the health training participated in the nutrition training for both categories of households. However, participation was significantly higher among NEC clients ($\chi^2 = 221.554$, df = 1, p = 0.000); ($\chi^2 = 220.217$, df = 1, p = 0.000) in nutrition (95.7%), and health (96.0%) programs respectively than Non-NEC clients. There was no significant association between the two categories of participants with agronomy and CIGI. Classification of participants by several programs participated in showed a significant association between household affiliation to program and the number of programs. The number of programs participated in by households was diversified in general, and for both NEC and Non-NEC clients, however, NEC clients (97.6%) were more likely to participate in more (≥2) programs ($\chi^2 = 210.790$, df = 5, p = 0.000) compared to Non-NEC clients.

4.3.1 Households Participation in NECs by the Program

4.3.1.1 Participation in livestock training at the NECs

The number of households who participated in livestock programs was 174 of 316 representing 55.1%. This was the fifth of the six in rank by several participants. Households participated in multiple modules with most 23.6% of them in all the seven considered in this survey, 18.4% in two modules, those who participated in six and three were relatively equal with 13.8%, and 12.6% respectively. Households who participated in four, five and one module were also in the same range with 10.9% in four and the others equal 10.3% each respectively. Livestock training participants were evaluated in terms of modules trained, times of attendance and quality of attendance as depicted in the table 4.10 below.

Table 4.10 Evaluation of the NECs' Livestock Training Participants (n=174)

Variable	Indicator and Measure	Frequency	Percent
Livestock Modules trained by participants	Exotic chicken management	126	72.4
	Local chicken management	136	78.2
	Piggery management	130	74.7
	Goat management	103	59.2
	Forage management	74	42.5
	Feeding and Feed formulation	102	58.6
	Marketing of livestock and products	74	42.5
	Total* multiple attendance	**n/a**	**n/a**
Number of modules attended to during training categorized	Above average (5-7 modules)	83	47.7
	Average (3-4 modules)	42	24.1
	Below average (1-2 modules)	49	28.2
	Total	**174**	**100**
Training attendance by the number of training	Very good (15-21 pieces of training)	04	02.3
	Good (8-14 trainings)	30	17.2
	Fair (1-7 pieces of training)	140	80.5
	Total	**174**	**100**
Quality of attendance assessed	Above average (4-6 points)	99	56.9
	Average (3 points)	37	21.3
	Below average (1-2 points)	38	21.8
	Total	**174**	**100**

From the table above, save for marketing and forage management, most of the modules were attended to by over 50% of the participants. When modules attended to were categorized, most of the participants were above average having participated in at least five of the seven modules. For attendance, most of the participants (80.5%) were in a fair category attending between one to seven times of 21 pieces of training, this is a low attendance compared to the period of consideration between 2014 through 2018. In the section that assessed the quality of attendance, 56.9% were above average with a mean and standard deviation of 5.25 ± 0.50^{b}, meaning the answered four to six questions correctly out of the six assessment questions. Those on average and below average were almost equal with 21.3 and 21.8 percent respectively with their means and

standard deviations as 4.87±1.17[a,b], and 3.57±1.56[a]. There were significant differences among the groups with a P-Value of ANOVA of (p=0.000), the superscripts a, b, and or a,b depict the differences among them but a group with 15-21 pieces of training was more likely to perform better than the group with 1-7 training, and these two were statistically different, however, there were no differences in performance between a group with 8-14 training with reference to groups of 15-21, and 1-7 livestock production and integration training between 2014-2018.

The design of the livestock modules was tailored towards meeting the goals of empowering small landholder farmers involved in the keeping of small and large livestock that can easily be sold to meet the urgent needs of the household and can be eaten to provide animal source proteins. Households therefore who participate in the CSRL/ISU-UP NECs' livestock program training are expected to be better than the general livestock keepers and are further better when registered with the livestock program of the CSRL/ISU-UP as whole to enjoy full benefits of that the program provides beyond training. The table below shows a comparison of the general livestock keeping households, with participants in livestock training and actual CSRL/ISU-UP program clients.

From the table, the number of CSRL/ISU-UP registered livestock clients (60 clients) are part of the 174 livestock training participants. There are more livestock trained clients at the NECs than what the actual number that the CSRL/ISU-UP livestock program provides a full package including inputs like building materials, animals (piglets, goats) and poultry (layers, kuroilers, ducks). Similarly, almost 50% of the overall livestock keeping households attend training on livestock production. In terms of receiving services from the program, whereas some services are open to the public, most of them are only limited to registered livestock program clients. The only open access service here are the vaccination and treatments as if not done, the disease can easily spread to affect the program clients in the same community with none clients.

Table 4.11 Comparison of Livestock Production among Households

Variable	Indicator unit	HH keep any form of livestock (n=366)		HH participated in training (n=174)		HH member of ISU-UP Livestock (n=60)	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Household keep livestock	Yes	366	100	164	94.3	60	100
	Local cattle	163	44.5	87	50.0	30	50.0
	Exotic cattle	17	4.6	9	5.2	3	5.0
	Local goats	201	54.9	82	47.1	37	61.7
	Exotic goats	24	6.6	16	9.2	10	16.7
	Pigs-all breeds	123	33.6	69	39.7	32	53.3
	Chicken-local	303	82.8	139	79.9	51	85.0
	Chicken-Layers	10	2.7	9	5.2	9	15.0
	Chicken-broilers	2	0.5	2	1.1	-	-
	Chicken-kuroiler	5	1.4	4	2.3	4	6.7
	Ducks	38	10.4	19	10.9	5	8.3
Household got other inputs and services from ISU-UP	Yes	45	12.3	40	23.0	43	71.7
	Forage seeds	15	4.1	14	8.0	14	23.3
	Water tank	5	1.4	5	2.9	5	8.3
	Water pump	1	0.3	1	0.6	1	1.7
	Building materials	5	1.4	5	2.9	5	8.3
	Vaccination	35	9.6	30	17.2	33	55.0
	Treatment	25	6.8	25	14.4	25	41.7
	A.I consultations	1	0.3	1	0.6	1	1.7
Income from sales 2014/2018	Yes, sold livestock	167	45.6	94	54.0	43	71.7
	≥500,000/=	84	23.0	54	31.0	28	46.7
	<500,000/=	83	22.7	40	23.0	15	25.0

With income, more program participants had more sales in number than non-program participants, however, non-program clients had more revenue. The probable reason could be in the breed of livestock sold. Program clients (81.0%) are more in small livestock that has a high per unit sale than large livestock, and this small livestock can easily be sold off for urgent cases than large livestock like cattle.

Statistically, participation in livestock training at the NECs was found significant to most of the food and nutrition security measures as summarized in the table below.

Table 4.12 Statistical Significance of Livestock Training to Food and Nutrition Security

Food and Nutrition Security status of households		Participation in Livestock training at the NECs						P-Value (χ^2)
		Never participated		Participated		Overall		
		Freq	Percent	Freq	Percent	Freq	Percent	
HFIAS	Food Secure	109	38.9	101	58.0	210	46.3	0.000
	Food Insecure	171	61.1	73	42.0	244	53.7	
	Total	**280**	**100**	**174**	**100**	**454**	**100**	
HDDS	Good Diet Diversity	105	37.5	95	54.6	200	44.1	0.000
	Average-poor Diet	175	62.5	79	45.4	254	55.9	
	Total	**280**	**100**	**174**	**100**	**454**	**100**	
FCS	Acceptable	95	33.9	98	56.3	193	42.5	0.000
	Borderline-poor	185	66.1	76	43.7	261	57.5	
	Total	**280**	**100**	**174**	**100**	**454**	**100**	
Caretakers' health status	Healthy caretakers	180	69.2	112	73.2	292	70.7	0.573
	Underweights	36	13.8	16	10.5	52	12.6	
	Overweights	44	16.9	25	16.3	69	16.7	
	Total	**260**	**100**	**153**	**100**	**413**	**100**	
Children's health status	Well Nourished	155	51.3	97	45.5	252	48.9	0.196
	Malnourished	147	48.7	116	54.5	263	51.1	
	Total	**302**	**100**	**213**	**100**	**515**	**100**	

Using the HFIAS method, Chi-Square shows that there was a significant association between participation in livestock training and food security status of participants ($\chi^2 = 15.777$, df = 1, p = 0.000). Households that participated in the training were more likely to be food secure (58.0%) than non-participants. Similarly, livestock training participants were more likely to have a better (54.6%) diverse diet ($\chi^2 = 12.728$, df = 1, p = 0.000), and a high (56.3%) caloric intake ($\chi^2 = 22.019$, df = 1, p = 0.000); than non-participants. However, there was no association between participation with the nutrition security of both primary caretakers and children.

4.3.1.2 Participation in agronomy training at the NECs

Households whose members participated in agronomy were 219 (69.3%) of the 316 overall program participants. This program was the fourth of the six in rank by several participants, and they too participated in multiple times and modules. Majority of the households 58.4% participated

in all the seven modules, 14.2% in six, those who participated in five and four modules were 7.8%, and 6.4% each, an equal number participated in three and two modules with 5.0% each and only 3.2% participated in only one module. Participants were evaluated in terms of modules trained, times of attendance and quality of attendance as summarized in the table below.

Table 4.13 Evaluation of the NECs' Agronomy Training Participants (n=219)

Variable	Indicator and Measure (n=219)	Frequency	Percent
Agronomy modules trained	Soil improvement	187	85.4
	Composting	182	83.1
	Land use planning	163	74.4
	Agronomical practices	197	90.0
	Kitchen, sack, and keyhole gardening	206	94.1
	Post-harvest handling technologies	187	85.4
	Marketing of crop produce	163	74.4
	Total* multiple attendance	**n/a**	**n/a**
Number of modules attended to during training categorized	Above average (5-7 modules)	176	80.4
	Average (3-4 modules)	25	11.4
	Below average (1-2 modules)	18	08.2
	Total	**219**	**100**
Training attendance by category	Very good (15-21 pieces of training)	14	06.4
	Good (8-14 training)	83	37.9
	Fair (1-7 pieces of training)	122	55.7
	Total	**219**	**100**
Quality of attendance assessed	Above average (4-6 points)	205	93.6
	Average (3 points)	08	03.7
	Below average (1-2 points)	06	02.7
	Total	**219**	**100**

From the table, all the training modules were well participated in with the lowest at 74.4%. On categorization of modules trained, the majority were above average with 80.4% having trained for five to seven modules. Evaluation by attendance shows that most of them (55.7%) fall under the fair category having attended for one to seven of the 21 pieces of training which are low just like in livestock. Assessment of quality of attendance shows that 93.6% are above average with a

mean and standard deviation of 5.43±0.76[a], with four to six out of the six possible points. Those within average and below average had their means and standard deviations of 5.18±0.74[a], and 5.00±1.16[a] respectively. There were no significant differences in the performance (ANOVA, p=0.197) across the three groups that attended to between 1-7, 8-14, and 15-21 agronomy and postharvest technology training between 2014-2018.

It's expected that households who attend these agronomy training in addition to performing well in their fields, they at least have one (55.3%) of the three vegetable gardens located around the vicinity of their households ($\chi^2 = 96.557$, df = 1, p = 0.000) compared to non-participants (11.9%). These help them reduce the cost of buying vegetables as well as increase the consumption of them to reduce micronutrient deficient for better health. The presence of these vegetable garden was so low among the households but most of them are within the participants for instance, of the 122 households who had kitchen gardens, 100 were within the agronomy participants, the only 24 sack gardens reported had 22 of them within the participants, and of the 19 keyhole garden, 15 belonged to participants. Similarly, household in addition to being expected to have grown crops in season one of 2017, they too were expected to have grown at least the average (≥5 crops) of the 12 crops considered in the survey, and this was right ($\chi^2 = 46.246$, df = 1, p = 0.000), 52.4% grew above average than 19.5% who grew less than average. It was also expected that household who had at least a graduated child from the NECs would have more of these vegetable gardens than still active household in the NECs, this was true though not significant ($\chi^2 = 1.669$, df = 1, p = 0.196). 49.6 percent of the former had at least one of three gardens than 41.4% of the latter.

However, regarding postharvest technologies, despite majority (71.1%) of the households drying their grains on bare ground, there was a significant association between drying on tarpaulins and participation in the agronomy and postharvest trainings ($\chi^2 = 29.884$, df = 1, p = 0.000) where

participants (37.9%) were more likely to use them than non-participants (15.3%%). Similarly, participants in the training are taught the importance of keeping harvest for future use as either food or sale, and it was established that 99.5% of the participants were more likely ($\chi^2 = 5.988$, df = 1, p = 0.000) to store their produce than 96.2% of the non-trainee.

Table 4.14 Relationship between Agronomy Training and Food and Nutrition Security

Food and Nutrition Security status of households		Participation in Agronomy training						P-Value (χ^2)
		Never participated		Participated		Overall		
		Freq	Percent	Freq	Percent	Freq	Percent	
HFIAS	Food Secure	86	36.6	124	56.6	210	46.3	0.000
	Food Insecure	149	63.4	95	43.4	244	53.7	
	Total	**235**	**100**	**219**	**100**	**454**	**100**	
HDDS	Good Diet Diversity	95	40.4	105	47.9	200	44.1	0.107
	Average-poor Diet	140	59.6	114	52.1	254	55.9	
	Total	**235**	**100**	**219**	**100**	**454**	**100**	
FCS	Acceptable	79	33.6	114	52.1	193	42.5	0.000
	Borderline-poor	156	66.4	105	47.9	261	57.5	
	Total	**235**	**100**	**219**	**100**	**454**	**100**	
Caretakers' health status	Healthy caretakers	146	69.5	146	71.9	292	70.7	0.852
	Underweights	27	12.9	25	12.3	52	12.6	
	Overweights	37	17.6	32	15.8	69	16.7	
	Total	**210**	**100**	**203**	**100**	**413**	**100**	
Children's health status	Well Nourished	106	46.1	157	55.1	263	51.1	0.042
	Malnourished	124	53.9	128	44.9	252	48.9	
	Total	**230**	**100**	**285**	**100**	**515**	**100**	

The Chi-Square analysis shows that there was an association between agronomy training and food security status of households under HFIAS and FCS methods of measurement. The participants were more (56.6%) likely to be food secure ($\chi^2 = 18.286$, df = 1, p = 0.000), and with a higher (52.1%) caloric intake ($\chi^2 = 15.768$, df = 1, p = 0.000) than non-participants. Similarly, undernutrition security, participants were more (55.1%) likely to have well-nourished children ($\chi^2 = 4.127$, df = 1, p = 0.042) than non-participants. There were no association between participation in agronomy training with food security under HDDS and nutrition security of caretakers.

4.3.1.3 Participation in nutrition and feeding training at the NECs

This program was the third most participated in after services and health and had 248 (78.5%) participants who participated in multiple modules. Majority of the households 194 (78.2%) participated in all the five modules considered in this survey, 9.2% in four, 6.0% in three, 2.0% in two, and only 4.0% participated in one module. Participants were evaluated in terms of modules trained, times of attendance and quality of attendance as showed in the table below.

Table 4.15 Evaluation of Nutrition and Feeding Training Participants (n=248)

Variable	Indicator and Measure (n=248)	Frequency	Percent
Nutrition and feeding modules trained	Importance of breastfeeding	235	94.8
	Exclusive breastfeeding	228	91.9
	Balanced diet/complementary feeding	238	96.0
	Identifying malnutrition signs	215	86.7
	Gender-based violence	211	85.1
	Total* multiple attendence	**n/a**	**n/a**
Number of modules trained in nutrition categorized	Above average (4-5 modules)	219	88.3
	Average (2-3 modules)	20	08.1
	Below average (1 module)	11	04.4
	Total	**248**	**100**
Training attendance by category	Very good (11-15 pieces of training)	210	84.7
	Good (5-10 pieces of training)	23	09.3
	Fair (1-5 trainings)	15	06.0
	Total	**248**	**100**
Quality of attendance assessed	Above average (4-6 points)	235	94.8
	Average (3 points)	12	04.8
	Below average (1-2 points)	01	00.4
	Total	**248**	**100**

All the modules designed in the nutrition and feeding program had excellent scores in participation by physical presence, by modules, and in assessment. A significant difference (ANOVA, p=000) was observed in the quality of attendance, and by their means and standard deviations, a group with 11-15 pieces of training was more likely to perform better (5.17 ± 0.84^{b})

than 1-5 training group (4.33±0.62[a]). The group with 5-10 pieces of training showed no difference (4.61±1.23[a,b]) with former and the latter groups. The Chi-Square analysis showed that there was an association between participation in the nutrition and feeding programs with the household's caloric intake measured by the FCS. Participants (47.2%) were more likely to have a better caloric diets (χ^2 = 4.127, df = 1, p = 0.027) than non-participants (36.9%). However, we found no association between participation in this program with other food and nutrition security measures.

4.3.1.4 Household participation in WASH training at the NECs

This program was the second most participated in among the six after services, with 250 (79.1%) participants of the 316. Four modules were considered in this survey and households participated in multiple times with most of them (72.8%) in all the four modules, 14.0% in three, 4.4% in two, and only 8.8% participated in one module. Participants were evaluated in terms of modules trained, times of attendance and quality of attendance as showed in the table below.

Table 4.16 Evaluation of WASH Training Participants (n=250)

Variable	Measure (n=250)	Frequency	Percent
WASH modules trained	Pregnancy-related issues	211	84.4
	Water, health, hygiene, and sanitation	248	99.2
	Jigger and rat control	201	80.4
	STDs/STIs/UTIs	217	86.8
Number of WASH modules trained categorized	Above average (3-4 module)	217	86.8
	Average (3 modules)	11	04.4
	Below average (1-2 modules)	22	08.8
	Total	**250**	**100**
Training attendance by category	Very good (9-12 training)	187	74.8
	Good (5-8 training)	41	16.4
	Fair (1-4 pieces of training)	22	08.8
	Total	**250**	**100**
Quality of attendance assessed	Above average (4-6 points)	250	100
	Average (3 points)	-	-
	Below average (1-2 points)	-	-
	Total	**250**	**100**

Participation in these WASH programs was excellent in all the stages of the evaluation. Whereas all participants were categorized as above average, significant differences were observed (ANOVA, p=0.015) with the group of 9-12 WASH training that had a means and standard deviation of (5.90±0.30[b]) different from the group of 1-4 training (5.68±0.57[a]). However, no difference in the quality of attendance in nutrition and feeding training was observed between the group of 5-8 training (5.80±0.51[a,b]) with the two groups of 1-4 and 9-12 pieces of training between 2014-2018.

It's hoped that participants in these training have better facilities at their households and are maintained in proper hygienic conditions than non-participants. Similarly, if facilities are well maintained, the rate of vulnerability to WASH-related diseases is reduced and hence hoped that participants have less likelihood of having such diseases. Tables: summarizes a comparison of WASH availability and condition among participants in the NECs health training and NEC clients against the overall surveyed households.

The table 4.17 is reporting that overall possession of WASH facilities are higher than the participants and NEC clients meaning, households without WASH facilities lie on both sides. However, participants and NEC clients have a higher number of households (65.6%) with facilities ≥4 by numbers, which is a positive impact of training and monitoring by CBNTs. However, there was a weak association between the number of WASH facilities and participation in WASH trainings ($\chi^2 = 3.239$, df = 1, p = 0.072), but there was no association with belonging to the NEC ($\chi^2 = 2.676$, df = 1, p = 0.102). Similarly, in overall quality of facilities, participants and NEC clients have better facilities (57.2%) than non-participants in health training though both are just above average, but no significant association was found between WASH facilities quality and

participation in the WASH training ($\chi^2 = 0.646$, df = 1, p = 0.422) as well as belonging to the NECs ($\chi^2 = 0.238$, df = 1, p = 0.625).

Table 4.17 WASH Facilities Comparison between Households

Variable of WASH	Indicator and measure	Overall n=454		Participants n=250		NEC clients n=253	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Any WASH	Yes	450	99.1	247	98.8	249	98.4
WASH by number	<4 facilities	173	38.1	86	34.4	88	34.8
	≥4 facilities	281	61.9	164	65.6	165	65.2
	Total	**454**	**100**	**250**	**100**	**253**	**100**
Household possess WASH facilities	Latrine	440	96.9	243	97.2	244	96.4
	Bathroom	376	82.8	205	82.0	210	83.0
	Tippy Taps	206	45.4	122	48.8	120	47.4
	Kitchen	392	86.3	215	86.0	218	86.2
	Rubbish pit	230	50.7	141	56.4	142	56.1
	Dish rack	157	34.6	93	37.2	94	37.2
Overall condition	Bad	202	44.5	107	42.8	110	43.5
	Good	252	55.5	143	57.2	143	56.5
	Total	**454**	**100**	**250**	**100**	**253**	**100**
The household condition of WASH facilities categorized as good	Latrine Good	305	67.2	169	67.6	168	66.4
	Bathroom Good	260	57.3	144	57.6	148	58.5
	Tippy Tap Good	150	33.0	87	34.8	85	33.6
	Kitchen good	287	63.2	152	60.8	155	61.3
	Rubbish pit	154	33.9	101	40.4	101	39.9
	Dish rack Good	109	24.0	62	24.8	62	24.5

From Table 4.18, in sum, there was a relatively high disease occurrence among participants and NEC clients. However, by disease, most serious WASH-related diseases including diarrhea and dysentery were higher among the overall households than the program's participants, meaning that non-participants were more vulnerable. However, the Chi-Square reported that there was no significant association between participation in WASH training and the occurrence of diarrhea among households ($\chi^2 = 2.279$, df = 1, p = 0.131), but found out a weak association with occurrence of dysentery ($\chi^2 = 2.745$, df = 1, p = 0.098), meaning that participants (7.4%) were less likely to

have experienced dysentery than non-participants (12.1%). Program participants, in general, have a higher recommended alternatives in treating their households patients for instance buying of medicine, giving of ORS, visiting health centers, hospitals among others which reduces the chances of having diseases in their households.

Table 4.18 Disease Occurrence Comparison among Households and Available Solutions

Variable for WASH	Indicator and measure for WASH	Overall n=454		Participants n=250		NCE clients n=253	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Any disease	Yes	434	95.6	243	97.2	246	97.2
Diseases reported having experienced in household	Diarrhea	183	40.3	95	38.0	100	39.5
	Malaria	401	88.3	223	89.2	226	89.3
	Dysentery	41	9.0	18	7.2	18	7.1
	Cough	266	58.6	148	59.2	153	60.5
	Skin	127	28.0	75	30.0	80	31.6
	Measles	14	3.1	5	2.0	4	1.6
	Other diseases	41	9.0	26	10.4	26	10.3
What the household did to help the patients	Buy Medicine	407	89.6	230	92.0	232	91.7
	Give ORS	273	60.1	155	62.0	157	62.1
	Health center/VHT	411	90.5	232	92.8	235	92.9
	Mulago Hospital	239	52.6	138	55.2	138	54.5
	Jinja Referral Hosp	58	12.8	42	16.8	36	14.2
	Herbal medicine	81	17.8	42	16.8	41	16.2
	Traditional Healer	10	2.2	4	1.6	3	1.2
	Do Nothing	40	8.8	21	8.4	23	9.1

In sum, referring to the food and nutrition security measures, there was an association between caloric intake measures by FCS with participation in WASH ($\chi^2 = 4.188$, df = 1, p = 0.041). Participants (46.8%) in this program were more likely to have a better caloric intake than non-participants (37.3%) but no association was found with other food and nutrition security measure.

4.3.1.5 Services from NECs

The provision of services program by the NECs was the most participated in the FNS program with 283 (89.6%) of the 316 households. Households received these services in multiples, most of whom 61.5% received all the seven services considered in this survey, those who received

six and five were almost the same 8.5% each, 7.8% received two services, the number of households who received one and four services were almost the same 4.2%, and 3.9% respectively. Whereas no assessment of the quality of services received was done, participants were evaluated in terms of the number of services received, and several times received the services as illustrated below.

Table 4.19 Evaluation of Services Received at NECs (n=283)

Variable	Services and Measures (n=283)	Frequency	Percent
Services received from NECs	Immunization	249	88.0
	Complementary feeding/Ekitobero	246	86.9
	Clinic days	246	86.9
	Family planning	204	72.1
	Nutrient dense porridge**	253	89.4
	HIV testing and counselling	219	77.4
	Seek health information	219	77.4
	Total* multiple attendance	**n/a**	**n/a**
Number of services received categorized	Above average (5-7 services)	223	78.8
	Average (3-4 services)	25	08.8
	Below average (1-2 services)	35	12.4
	Total	**283**	**100**
Number of times received services by category	Very good (15-21 times/rounds)	207	73.1
	Good (8-14 times/rounds)	41	14.5
	Fair (1-7 times/rounds)	35	12.4
	Total	**283**	**100**

**Services limited to only NEC clients - at risk WRA and malnourished children ≤59 months.

The provision of services, nutrition and health training are tailored towards improving the nutrition security of households hence achieving the core principle of food utilization. Most of the diseases handled at the NECs are related to poor nutrition and these are kwashiorkor and marasmus. As expected, the number of kwashiorkor cases were high (5.1%) at the NEC than among the households not participating at the NEC (2.5%) and the case with marasmus where had 5.1% and non-participants had 3.0%.

4.3.1.6 Community Income Generating Innovations training (CIGI)

This was the least participated in the program among the FNS programs of the NECs with 30 (9.5%) households of the 316 CSRL/ISU-UP NECs' participants. Participation was also in multiple modules with most households 40.0% in two of the five considered in this survey, 33.3% in three, and those who participated in four and one were equal with 12.0% each. Participants in this program were evaluated in terms of the number of modules/skills trained, learned, and attendance to training as illustrated in the table below.

Table 4.20 Evaluation of CIGI by NECs Participants (n=30)

Variable	Indicator and Measure (n=30)	Frequency	Percent
Modules/skills of CIGI trained	Palm leaf products	10	33.3
	Beads products	23	76.7
	Raffia products	30	100.0
	Sewing machine products	5	16.7
	Soap making products	6	20.0
	Total* multiple attendance	**n/a**	**n/a**
Number of skills learned in CIGI categorized	Above average (3-5 broad* skills)	14	46.7
	Average (2 broad* skills)	12	40.0
	Below average (1 broad* skills)	04	13.3
	Total	**30**	**100**
Attendance and participation in CIGI	Very good (5-10 pieces of training)	16	53.3
	Good (3-4 training)	08	26.7
	Fair (1-2 trainings)	06	20.0
	Total	**30**	**100**

By saying broadly it meant many skills are learned right from arranging raw materials to making the product itself in all stages. All CIGI participants participated in training and making of raffia products that include making of baskets, the skills learned and practiced by the 76.7% under beads products included making-of bangles, bracelets, necklaces, and purses. Other products and their corresponding skills included sewing machine products - backpacks, laptop bags, shopping bags, Palm leaf products that include making of mats.

Overall, participation in the food and nutrition security programs of the NECs had an association with the different measurements as summarized in table 4.21 below.

Table 4.21 Overall Participation in the Food and Nutrition Security Programs of the NECs

Categorized Food and Nutrition Security status of households by the method of measurement		Overall participation in FNS programs at the NECs						P-Value (χ^2)
		Never participated		Participated		Overall		
		Freq	Percent	Freq	Percent	Freq	Percent	
HFIAS	Food Secure	49	35.5	161	50.9	210	46.3	0.002
	Food Insecure	89	64.5	155	49.1	244	53.7	
	Total	**138**	**100.0**	**316**	**100.0**	**454**	**100.0**	
HDDS	Good Diet Diversity	55	39.9	145	45.9	200	44.1	0.234
	Average-poor Diet	83	60.1	171	54.1	254	55.9	
	Total	**138**	**100.0**	**316**	**100**	**454**	**100**	
FCS	Acceptable	48	34.8	145	45.9	193	42.5	0.028
	Borderline-poor	90	65.2	171	54.1	261	57.5	
	Total	**138**	**100.0**	**316**	**100.0**	**454**	**100.0**	
Caretakers' health based on BMI	Healthy caretakers	86	71.1	206	70.5	292	70.7	0.708
	Underweights	13	10.7	39	13.4	52	12.6	
	Overweights	22	18.2	47	16.1	69	16.7	
	Total	**121**	**100.0**	**292**	**100.0**	**413**	**100.0**	
Overall Children's health	Well Nourished	60	49.6	202	51.3	263	51.1	0.869
	Malnourished	61	50.4	192	48.7	252	48.9	
	Total	**121**	**100.0**	**394**	**100.0**	**515**	**100.0**	
		Still active*		**Graduated**		**Overall**		
Graduated Children's health	Well Nourished	173	49.1	84	51.5	263	51.1	0.886
	Malnourished	179	50.9	79	48.5	252	48.9	
	Total	**352**	**100.0**	**163**	**100.0**	**515**	**100.0**	

*Still active - children/caretakers who were attending to the NECs for rehabilitation (taking nutrient dense porridge).

The Chi-Square analysis shows that there was an association between participation in FNS programs and food security measured by HFIAS method ($\chi^2 = 9.214$, df = 1, p = 0.002), in that participants (50.9%) were more likely to be food secure than non-participants (35.%), further still, participants (45.9%) were more likely ($\chi^2 = 4.846$, df = 1, p = 0.028), to have a high caloric intake as measured by FCS than non-participants (34.8%). Participation and HDDS had no significant association ($\chi^2 = 1.418$, df = 1, p = 0.234) but participants (45.9%) were more likely to have a

better dietary diversity than non-participants (39.9%). Undernutrition security, there was no significant association between the caretakers' health, overall children and graduated children's health. However, children from participating households were more likely to be well nourished (51.3%) than non-program households (49.6%), and as expected, graduated children were more likely to be well nourished (51.5%) compared to active children (49.1%).

4.4 Food Security Status of Households in Kamuli District

In this survey, the status of food security among households was assessed using three methods to provide a comparison of results and determine the food security status since all the methods are expected to yield relatively same findings. These methods included the Household Food Insecurity Access Scale (HFIAS) developed between 2001-2006 by the USAID-funded Food and Nutrition Technical Assistance II Project (FANTA) based on nine (9) food insecurity occurrence questions asked to households based on food access situation within a 4-weeks period prior to survey (Coates et al., 2007; Sseguya, 2009; INDDEX, 2018). The Household Dietary Diversity Score (HDDS) which was also part of FANTA II to determine the household level food access based on 12 food groups consumed in a 24-hour recall prior to the survey (Swindale et al., 2006; Kennedy et al., 2011). And the Food Consumption Score developed by World Food Program in 1996 to assess the household caloric intake based on eight (8) broad food groups with assigned multiplier index based on nutritional value of the foods in the group with proteins food taking a higher weight (Coates et al., 2007; Weisman et al., 2019; WFP, 2008; INDDEX, 2018).

4.4.1 Household Food Security Status Based on HFIAS

The Food Security Status (FSS) varied among households and across participants in the Nutrition Education Centers' (NECs') Food and Nutrition Security Program (FNSP). Overall, of the 454 households surveyed, the households classified as food secure were 46.3%, food insecure were 45.4% and extremely food insecure was 8.4%. Disaggregating between CSRL/ISU-UP participants and non-participants in the FNSPs, of the 316 participant households, 50.9% were food secure, 42.1% were food insecure, and 7.0% were classified as extremely food insecure.

Table 4.22 Food Security Status by Participation in CSRL/ISU-UP's NECs, 2018

Food Security Status based on HFIAS	Overall surveyed households		Participants: NEC clients		Participants: Non-NEC clients		Non-Participants: Non-NEC clients	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Food Secure (FS)	210	46.3	121	47.8	40	63.5	49	35.5
Food Insecure (FI)	206	45.4	115	45.5	18	28.6	73	52.9
Ext. Food Insecure (EFI)	38	08.4	17	06.7	05	07.9	16	11.6
Total by FSS category	**454**	**100**	**253**	**100**	**63**	**100**	**138**	**100**
Overall HFIAS mean	**9.64±6.47**		**9.54±6.15[b]**		**7.19±7.33[a]**		**10.94±6.32[b]**	

*HFIAS - Household Food Insecurity Access Scale: (FS=0-9 points, FI=9.1-18 points, and EFI=18.1-27 points).

Considering household participation status, most of the food secure are program participants who are Non-NEC clients with their average in the category of food secure households. The NEC clients are close to average but, they all fall under food insecure. Non-program participants are less food secure with the highest mean above average. In general, households most households are food insecure referring to the overall mean which is above the food secure cutoff. The food security status differences among the three groups were statistically significant at 5% with a calculated P-value of ANOVA (0.001). An analysis means showed that there was no difference between NEC clients and Non-Participants, the significant difference was due to variation in mean for Non-NEC clients with this group being more food secure than the other two groups.

In a similar trend of comparison, most of the households when food insecure and extremely food insecure are combined, it totals to 53.7% of the entire survey population. This total is higher than that from the findings of CSRL/ISU-UP 2015 baseline at 38.4%, similarly higher than the findings of Sseguya (2009) at 46.3% although lower than the 2005 baseline of CSRL/VEDCO at 91.0% that that was presented in the findings of Sseguya and Masinde (2005). The trends of food security over the years are depicted in the figure 4.2 below.

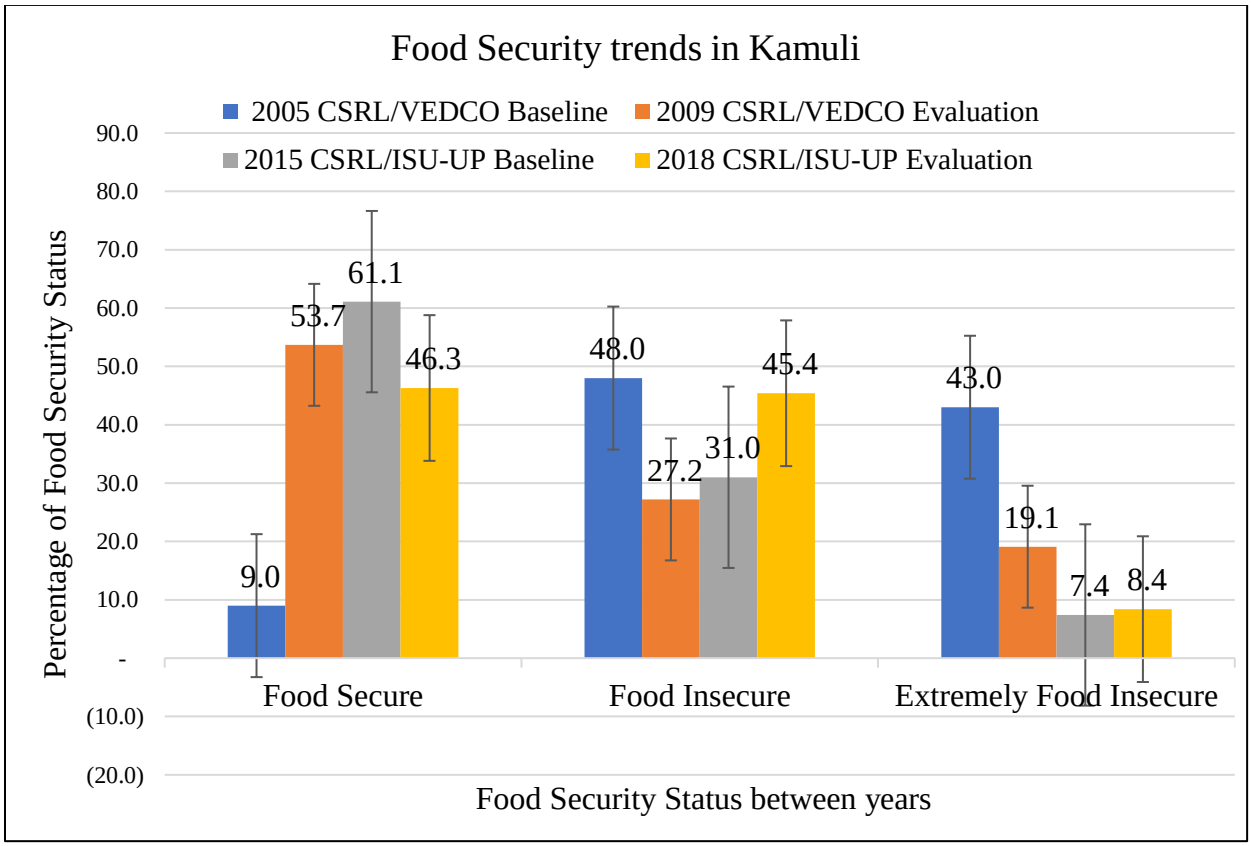

Figure 4.2 Food Security Status and Trends in Kamuli since Inception of CSRL 2005-18

From the figure above, its clearly seen that the first 10 years of the operationalization of CSRL's programs registered improvement in food security status with very high tides that shifted the lives of rural Kamuli from extremely food insecure to either food secure, or food insecure. However, the status changed with more households becoming food insecure between 2015-2018. The error bars show that among the food secure, the significant difference existed in 2005 with no

difference in 2009, 2015 and 2018. However, among the food insecure, there were no differences, and among the extremely food insecure, there were significant differences among 2005 with no difference between 2009, 2015, and 2018.

4.4.1.1 Variations in responses to the HFIAS questions among households

Whereas data has reported that majority of the households are food insecure according to that summation of the HFIAS scores, the frequency of occurrence of food insecurity situation varied among households in the three-food security statuses, and among the nine (9) question. With an emphasis on the occurrences of "sometimes" and "often" both of which have a higher multiplier that increases the vulnerability of households being in food insecure or extremely food insecure, it's important to understand which of the questions need urgent attention to be addressed in the program operations. The table summarizes the responses both in the Baseline and Endline of 2015, and 2018 respectively.

Table 4.23 Household responses to the HFIAS questions in Kamuli, 2018

Household Food Insecurity Access Scale Questions for developing countries (Coates et al., 2007)	Percentage frequency of occurrence of food insecurity situation							
	None		Rarely		Sometimes		Often	
	2015	2018	2015	2018	2015	2018	2015	2018
Qn.1. Worry that no enough food	36.2	28.9	25.2	16.3	30.6	46.7	8.1	8.1
Qn.2. Not able to eat preferred food	27.6	17.6	27.2	24.7	34.6	45.6	10.6	12.1
Qn.3.HH member eat limited variety	29.4	26.0	25.8	22.2	34.2	40.3	10.6	11.5
Qn.4. HH eat food did not want	27.6	18.5	25.8	22.9	37.8	49.3	8.8	9.3
Qn.5. Eat smaller meal than needed	43.4	33.9	21.3	17.2	29.7	39.2	7.6	9.7
Qn.6. HH eat fewer meals in a day	42.7	37.4	22.5	16.1	27.2	38.3	7.6	8.1
Qn.7. Ever no food of any kind	64.7	58.8	13.3	11.0	17.5	24.2	4.5	5.9
Qn.8. Go to sleep hungry, no food	65.8	74.7	18.0	10.1	14.4	12.6	1.8	2.6
Qn.9. Go whole day & night no food	75.5	83.0	12.4	7.5	11.5	7.0	0.7	2.4

*The frequency of Occurrence codes: None-No occurrence, Rarely-Once or twice in the past four weeks, Sometimes-Three to ten times in the past four weeks, Often-More than ten times in the past four weeks prior to the survey.

The general trend in the at-risk households (those with responses of "sometimes" and "often") shows an increase in the percentage of food insecurity occurrence situations between 2015 and 2018 across all the nine questions. The responses for "None" and "Rarely" were most likely to lead to the categorization of households as food secure. In both 2015 and 2018, fewer households went a whole day and night without food as well as going to sleep hungry. However, in both time periods, households reported not being able to eat the preferred food and eating a limited variety as the main food insecurity occurrence problems.

4.4.2 Household Food Security Status Based on HDDS

Household Dietary Diversity Scores/status (HDDS) is a proxy measure of food access based on food groups eaten by the household in the previous 24-hours, and how the foods were accessed. The Food Security Status (FSS) based on the HDDS varied among households and across participants in the CSRL/ISU-UPs' Nutrition Education Centers' Food and Nutrition Security Program (FNSP). Overall, of the 454 households surveyed, the number of households classified as having had a good dietary diversity (here referred to as food secure) were 200 (44.1%), those classified as having an average dietary diversity (food insecure) was 248 (54.6%), and those classified as poor (referred to as extremely food insecure) were 06 (1.3%). Disaggregating data between CSRL/ISU-UP participants and non-participants in the FNSPs, of the 316 participant households, 145 (45.9%) were classified as good, 168 (53.2%) were average, and 03 (0.9%) were classified poor.

Considering household participation status, most of the household with good dietary diversity are participants who are Non-NEC clients, the NEC clients are within the same mean as the overall, and the Non-program participants are below the overall mean. The dietary status differences among the three groups were statistically significant at 5% with a calculated P-value

of ANOVA (0.014). There were significant differences between Non-NEC clients and Non-Participants in that former was more likely to have good dietary diversity than the latter, but there were no dietary differences among the NEC clients and the other groups. However, all households irrespective of their participation status were within average dietary diversity status.

Table 4.24 Dietary Diversity Status by Participation in CSRL/ISU-UP's NECs, 2018

Household Dietary Diversity Status based on HDDS*	Overall surveyed households		Participants: NEC clients		Participants: Non-NEC clients		Non-Participants: Non-NEC clients	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Good Diet Diversity	200	44.1	110	43.5	35	55.6	55	39.9
Average Diet Diversity	248	54.6	142	56.1	26	41.3	80	58.0
Poor Diet Diversity	06	01.3	01	00.4	02	03.2	03	02.2
Total	**454**	**100**	**253**	**100**	**63**	**100**	**138**	**100**
Overall HDDS Mean	**8.33±1.70**		**8.33±1.60[a,b]**		**8.84±2.06[b]**		**8.09±1.65[a]**	

*HDDS – Household Dietary Diversity Scores (Good = 9-12, Average = 5-8, and Poor = 0-4 food groups).

Analyzing and comparing data between the Baseline of 2015 and Endline of 2018, this survey reports an improvement in the dietary diversity across the two time periods as shown in the figure 4.3 below.

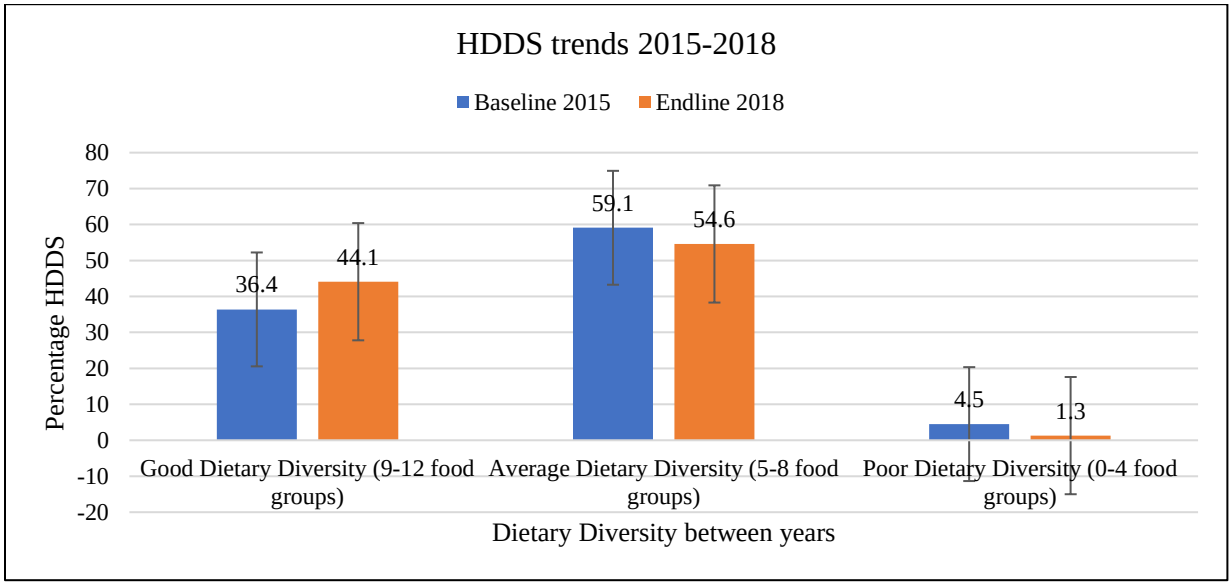

Figure 4.3 Dietary Diversity Status and Trends in Kamuli District, 2015-2018

There was a positive trend in a move of households from either poor diet or average diet to a good diet and a move from poor to average. There was a high reduction in the number of average diet households by 4.5 percent, and 3.2 percent for poor diets hence an increase in good diet cluster by 7.7 percent. Statistically, there were no significant differences between the years among the different dietary status.

This survey further reports that the foodstuffs/groups consumed in the 24-hour recall prior to the survey that was used to generate the Household Dietary Diversity Scores varied within the Baseline and the Endline data periods of 2015 and 2018 respectively. A comparative consumption trend across the two time periods is depicted in table below.

Table 4.25 Variation in Consumption of Food Groups in a 24-hour Recall, 2015-2018

Food Groups tracked in a 24-hor Recall	Baseline 2015		Endline 2018	
	Frequency	Percent	Frequency	Percent
Cereals	427	96.0	440	96.9
Legumes/Pulses/Nuts	385	86.5	413	91.0
Vegetables and greens	440	98.9	450	99.1
Tubers	375	84.3	376	82.8
Fruits	157	35.3	232	51.1
Meats and meat products	81	18.2	91	20.0
Fish and other sea foods	102	22.9	104	22.9
Eggs	90	20.2	108	23.8
Milk, and dairy products	267	60.0	269	59.3
Sugar and Honey	345	77.5	413	91.0
Oils and Fats	365	82.0	432	95.2
Miscellaneous foods	438	98.4	453	99.8

The table reports a general increase in consumption of all the food groups except tubers and milk whose reduction was 0.5 and 0.7 percent which may not be statistically significant. The finding of this survey reports that animal products that are the main sources of protein had the lowest consumption rate between the two time periods though there was an increase by 2018.

4.4.3 Household Food Security Status Based on FCS in Kamuli District, 2015-2018

The Food Consumption Scores (FCS) indices provide a proxy measure of the household caloric availability and intake based on eight food groups with each assigned a multiplier index based on the nutritional value of the foods (Coates et al., 2007; WFP, 2008). From the survey results, the Food Security Status (FSS) based on FCS varied among of households and across participants in the CSRL/ISU-UPs' Nutrition Education Centers' Food and Nutrition Security Program (FNSP). Overall, of the 454 households surveyed, the number of households classified in the acceptable category (here referred to as food secure) were 42.5%, those classified as being on the borderline (food insecure) were 41.9%, and those classified as poor (referred to as extremely food insecure) were 15.6%. Disaggregating between CSRL/ISU-UP participants and non-participants in the FNSPs, of the 316 participant households, 45.9% were classified as acceptable, 39.9% were on borderline, and 14.2% were classified poor.

Table 4.26 Food Consumption Status by Participation in CSRL/ISU-UP's NECs, 2018

Household Food Consumption Status based on FCS*	Overall surveyed households		Participants NEC clients		Participants Non-NEC clients		Non-Participants: Non-NEC clients	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Acceptable caloric intake	193	42.5	117	46.2	28	44.4	48	34.8
Borderline caloric intake	190	41.9	98	38.7	28	44.4	64	46.4
Poor caloric intake	71	15.6	38	15.0	07	11.1	26	18.8
Total	**454**	**100**	**253**	**100**	**63**	**100**	**138**	**100**
Overall FCS mean	**33.67±12.53**		**34.78±12.33[b]**		**36.04±13.53[b]**		**30.57±11.91[a]**	

*Food Consumption Scores: Acceptable (>35 points), Borderline (21.5-35 points), and Poor (0-21.5 points)

Most clients within the acceptable caloric intake category were NEC clients, however, by average, a program participant who is Non-NEC clients fall within the acceptable caloric intake whereas the NEC clients fall in the borderline category but above the overall mean. The Non-participants have a lower mean below the overall average but are within the borderline category.

The caloric intake differences among the three groups were statistically significant at 5% with a calculated P-value of ANOVA (0.002). Non-participants were different from the NEC and Non-NEC clients with the former being likely to have lower caloric intake than the latter two groups. There were no significant differences among the NEC and Non-NEC clients with regards to caloric intake. However, by overall mean, all households irrespective of their participation status were within the borderline category.

In a comparative data analysis between the Baseline of 2015 and Endline of 2018, this survey reports an improvement in the food consumption scores across the two time periods as shown in the figure below.

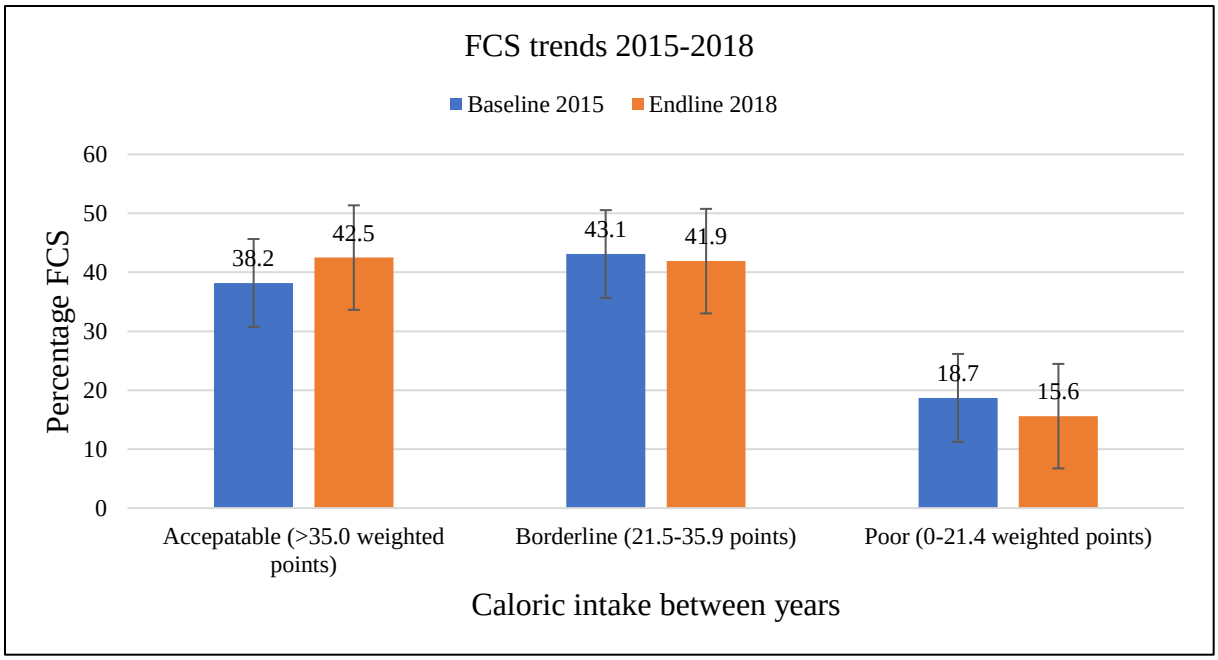

Figure 4.4 Food Consumption Status and Trends among Households in Kamuli, 2015-2018

The figure above shows an improvement in caloric intake by 4.3 percent, there was a reduction among the poor category by 3.1 and from the borderline by 1.2 percent. There are directs

link between improvement in HDDS with FCS, a poor diet directly results in a poor FCS. There was no statistical difference in caloric intake among households between 20015 and 2018.

This survey reports that the foodstuffs/groups consumed in the seven (7) days recall prior to the survey that was used to generate the FCS varied within the Baseline and the Endline data periods of 2015 and 2018 respectively. A comparative consumption trend across the two time periods is depicted in the table.30 below.

Table 4.27 Variation in Consumption of Food Groups in a 7-day Recall, 2015-2018

Food Group	Baseline 2015		Endline 2018	
	Frequency	Percent	Frequency	Percent
Main Staples	445	100.0	451	99.3
Pulses	429	96.4	436	96.0
Vegetables	443	99.6	451	99.3
Fruits	243	54.6	312	68.7
Meats/fish	311	69.9	321	70.7
Milk	321	72.1	333	73.3
Sugar	395	88.8	430	94.7
Oil	400	89.9	444	97.8

The table reports a general increase in consumption of all the food groups though in a relatively small margin between the Baseline, and Endline, 2015, and 2018 respectively depicting a relative increase in caloric intake. Low consumption is mainly in the animal source products just like the case with HDDS, staples, most pulses and vegetables are traditionally grown hence highly consumed than sugar that is only bought.

4.4.4 Methods of Food Accessibility and Sources within Households

Food consumption and accessibility are summarized in the appendix 2: for major foodstuffs eaten. The main means of food access varied but most was accessed through home production for

most vegetables, energy foods/carbohydrates/starch food, fruits, and proteins of plant origin whereas those of animal origin were accessed through purchases and their consumption was low.

4.4.5 Summary of Food Security Status among Households in Kamuli, 2015-2018

The three methods used in the assessment of housed of household food security status included: Household Food Insecurity Access Scale (HFIAS) that categories households as food secure, food insecure, or extremely food insecure on a 27-point scale with a higher score being extremely food insecure and a low score being food secure. The Household Dietary Diversity Score (HDDS) that categorizes households as either having good diets, average, or poor diets using 12 food groups with more food groups consumed regarded as a more diverse diet. And the Food Consumption Score that categorizes households as either falling in the acceptable range of caloric intake, borderline or poor using eight (8) food groups weighted on assigned multiplier index where the higher the weighted points, the better the households depicting a higher caloric intake. These three methods of determining food security status have a positive relationship in that they must relatively show a similar trend in the results. The summary if the descriptive statistics is as follows for both the Baseline of 2015 and Endline of 2018.

Table 4.28 Summary Statistics for Household Food Security Status 2015 and 2018

Survey year	Household Food Security Status Measures	Min	Max	Sum	Mean
Baseline 2015 (n=445)	Household Food Insecurity Access Scale	0.0	26.0	3758.0	8.4
	Household Dietary Diversity Score	1.0	12.0	3472.0	7.8
	Food Consumption Score	6.0	66.5	14535.5	32.7
Endline 2018 (n=454)	Household Food Insecurity Access Scale	0.0	27.0	4377.0	9.6
	Household Dietary Diversity Score	2.0	12.0	3781.0	8.3
	Food Consumption Score	1.5	72.0	15288.0	33.7

In the baseline year 2015, 61.6% of the total 445 households were categorized as food secure, a percentage above the average, given an overall mean of 8.4 on the HFIAS, majority lies with the food secure category of 0-9.0 on a 27-point scale hence conclude that results coincide. Whereas in 2018, 46.3% of the 454 households were categorized as food secure, and the HFIAS has an average of 9.6 which is slightly above the average for a food secure at 9.0 on a 27-point scale hence the results also coincide. For the HDDS, in 2015 36.1% had a good diet, and the average score here was 7.8 lower than the lowest point of 9.0 good diet category of the 12 food groups hence more people lie within average diet category. For 2018, with 44.1% categorized as a good diet, and an average of 8.3 was almost close to the lower threshold (9.0) for good diet category hence more households lie within the average diets.

Using the FCS, for the baseline, 38.8% were within the acceptable category, and an average of was 32.7 below the lowest weighted points of 35.0, the percentage itself is far from average meaning more households were in the borderline category. And for 2018, 42.5% categorized as acceptable, with an average as 33.7 close to the threshold of 35 means the households were moving towards acceptable caloric intake category. In sum, the 2015 cohort was more food secure but with relatively lower dietary diversity and caloric intake whereas the 2018 cohort was more relatively food insecure close to average but with an average diet and hence a better caloric intake than the baseline.

4.5 Nutrition Security Status of Households in Kamuli District

The nutrition security status of households was assessed on primary caretakers/mothers and or the Women of Reproductive Age (WRA), and infants and children of 0-59 months of age using anthropometric indices. Determination of these indices was based on taking three measurements including weight, height (recumbent length for infants), and Mid Upper Arm

Circumference (MUAC) of caretakers, and infants and children. For WRA, this survey used Body Mass Index (BMI) that was calculated by taking their weight in kilograms divided by height in square meters (BMI=Kg/m^2) and the results were analyzed on health status as either Underweight, Normal, and or Overweight using a reference standard scale adapted from Lele et al., (2016); WHO, (2003; and 2006).

For infants and children, their weights and heights were measured following World Health Organization (WHO) procedures and transformed into z-scores using the WHO Anthro software to determine the presence of stunting (Height-for-age), underweight (weight-for-age), and wasting (weight-for-height). These were then combined to determine overall nutrition status as either severely, moderately, mildly malnourished, or properly nourished. Also, the MUAC readings categorizing them as either Properly Nourished, Moderately Malnourished, and or Acutely Malnourished (Lele et al., 2016; WHO, 2003; and 2006).

4.5.1 The Socio-demographics of the Primary Caretakers

To better understand the interpretations of the nutrition security status of the mothers/primary caretakers/WRA, and infants and children, it was prudent to first examine the personal specifications of these groups. The specifications are presented here in two categories; the socio-demographics of the caretakers, and the reproductive characteristics of the actual mother of the infants and children. The total number of the primary caretakers were 443 in the whole survey among which 408 (92.1%) were the mothers of the infants and or children, 31 (7.0%) were grandparents, only one father (0.2%), and 03 (0.7%) were other relatives.

In terms of age, the number was almost the same for those with utmost and or above 30 years at 48.1 and 51.9 percent respectively. In the same variable, the minimum age was 16, a maximum of 85, mean of 33.40±11.91 and mode of 25 years. We found a significant difference in

age among the program participants and non-participants. The NEC clients were most likely to be younger (31.98±10.01[a]) than the Non-NEC (37.22±12.68[b]), But no differences were observed among the Non-participants (34.44±14.32[a,b]) with reference to the former and the latter group. In terms of marital status, most caretakers 386 (87.15) were married in either monogamous (85.2%) or polygamous (14.8%) arrangement and 57 (12.8%) were not married in the categories of singles who never married, divorced/separated or widowed. The most dominant religious faith among the caretakers was Angelicins with 207 (46.7%), 89 (20.1%) were Muslims, 83 (18.7%) Catholics, 58 (13.1%) Born Again, 05 (1.1%) Noah, and only 01 (0.2%) SDA.

With education, majority 344 (77.7%) were within the primary education category hence spent utmost seven (7) years in formal education and 99 (22.3%) in the post-primary education category. It was further found out that NEC clients (6.27±2.73) were likely to have spent fewer years in formal education than Non-participants (6.94±2.94) and the Non-NEC participants (7.23±3.29), though we earlier found out that household heads of NEC clients were more educated than the other two groups. Concerning knowledge about the existence of the CSRL/ISU-UP NECs, 328 (74.0%) of the 443 caretakers were aware of the programs, and among those who were aware of the programs' existence, 264 (80.5%) had at least a member of their household having attended to the NECs as either mother (241), children of the mothers (137), and or grandchildren (11). The responses here did not track a total number of children but only tracked at least a child in the household having attended to the NECs. The households by the survey time who were currently attending to the NECs were 107 of those who knew about the existence of the NECs among whom 70 had at least a mother, 34 had at least a child, 03 had at least a grandchild. These totals do not consider the total number of mothers, children, and grandchildren from each household of the caretaker, and more than one member of the household can be admitted to the centers.

4.5.2 Reproductive Characteristics and Practices of Mothers

The total number of mothers of infants and children of 0-59 months of age were 423, of whom only 408 were actual primary caretakers as earlier reported. Given the nature of extended families, and polygamous marriage as earlier reported, the survey tracked for the mothers in the household (since many children in the same household could belong to different mothers), and reports that mothers of child "one category" were 415 (93.7%), and mother of "child two categories" were 28 (6.3%), (there was no mother three/child three found), and this data was used to determine the number of children given birth by each of the mothers. Among the 423 mothers, 293 (69.3%) had pregnancy for their first birth at ≤19 years of age. The minimum age at first pregnancy was 12 years, mean at (18.94±4.00), and the modal age was 18.0 years. We found significant differences in the age at first pregnancy among the participants and non-participants. Non-NEC clients have had a higher age (20.36±4.14^{a}) above the mean whereas the NEC clients (18.83±4.07^{b}) and Non-Participants (18.55±3.67^{b}) were statistically the same and below the mean.

Among the 423 mothers, 33 (7.8%) were expectant mothers by the survey time of whom 14, and 19 mothers had the age of pregnancy in months below and above five respectively. There was no statistically significant association between membership to NEC and pregnancy as expected ($\chi^2 = 0.345$, df = 1, p = 0.558) but more pregnant mothers (7.9%) were likely to found at the NEC for services of porridge, immunization among others than at home (6.5%) as non-participants. About the number of babies given birth alive by mother one, 250 (60.2%) of 415 had 1-4 babies, 161 (38.8%) had above 4 babies, and 04 (1.0%) their babies were not alive at birth, whereas the maximum number of children was 10, the mean was four babies. For mother two, of the 28 mothers, 11 (39.3%) had 1-4 babies, 10 (35.7%) had over four babies, and 07 (25.0%) their babies were not alive at birth, the maximum was nine and mean was three babies. We found no

statistically significant differences among the participants and non-participants however, NEC clients being younger in age as earlier found out, had a relatively lower mean (4.12±2.44[a]) compared to the Non-NEC clients (4.37±2.67[a]), and Non-participants (4.13±2.53[a]) with reference to the overall mean (4.15±2.50).

The survey further tracked the antenatal clinic visits of the mothers, in general, using four antenatal clinic visits as minimum suggested by Lincetto et al., (2006. pg.51), with reference to the last four babies with the youngest child as the first to fourth child in descending order. Similarly tracked porridge consumption of the mother for each of those four children and the place of birth for every child. The results are summarized in the table 4.29 below.

Table 4.29 Maternity Practices of Mothers of Children

Variable	Indicator and measure	Children in descending order from the youngest							
		1st Youngest		2nd Youngest		3rd Youngest		4th Youngest	
		Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Number of Antenatal clinic visits	At least four	238	56.7	221	60.9	183	62.0	160	66.9
	Less than four	124	29.5	83	22.9	67	22.7	53	22.2
	No response*	58	13.8	59	16.3	45	15.3	26	10.9
	Total	**420**	**100**	**363**	**100**	**295**	**100**	**239**	**100**
Did mother eat porridge at NECs	Yes	115	31.8	57	18.8	40	16.0	39	18.3
	No	247	68.2	306	81.3	210	84.0	174	81.7
	Total	**362**	**100**	**304**	**100**	**250**	**100**	**213**	**100**
Place of delivery for the children by the mother	Health Center	177	42.1	165	45.5	144	48.8	115	48.1
	Hospital	183	43.6	156	43.0	115	39.0	96	40.2
	Traditional Attendant	16	3.8	10	2.8	8	2.7	5	2.1
	Home with relative	31	7.4	24	6.6	19	6.4	17	7.1
	Home with health nurse	8	1.9	6	1.7	7	2.4	3	1.3
	Others	5	1.2	2	0.6	2	0.7	3	1.3
	Total	**420**	**100**	**363**	**100**	**295**	**100**	**239**	**100**

*No response or doesn't know - was a result of the child's mother not being the actual response to that question.

There were no statistically significant differences in the number of times visited antenatal clinics for each of the four children among the participants and non-participants, but with reference to the youngest child, program participants: NEC clients visited more times (4.29±1.88[a]) compared

to Non-NEC clients (4.26±1.31[a]) though above the mean, as well as non-participant (3.92±1.26[a]) who were below the overall mean (4.18±1.67). There was a statistically significant association between place of delivery in relation to the mother being a NEC member. When delivery places are merged into three categories according to their risk factor, with Health Centers and hospitals as safe places, Traditional birth attendants and home with health nurse as risky, and home with and relatives and other means as highly risky, it was established that NEC clients for all the children went for safe places for their delivery. The first child, for instance, 89.2% of the mothers were NEC clients compared to 81.1% who also went to safe places ($\chi^2 = 8.729$, df = 2, p = 0.013).

4.5.3 Nutritional Health Status of Primary Caretakers

The nutrition and health security status based on the Body Mass Indices of the primary caretaker/mothers/Women of Reproductive Age (WRA) varied among of households and across participants in the CSRL/ISU-UPs' Nutrition Education Centers' Food and Nutrition Security Program (FNSP). Overall, of the 443 households who had primary caretakers, only 413 (93.2%) met the criteria for their anthropometry measurements to be taken. The 30 (6.8%) caretakers were either male, or overage of the WRA (grandparents), or not around by the time of the survey, and could not be traced even after a tried return to the households by the research assistants. In sum, the number of households with caretakers classified as normal (healthy) was 292 (70.7%), those classified as underweight were 52 (12.6%), and those classified as overweight were 69 (16.7%). Compared to the baseline data of 2015, those classified as normal were 187 (66.1%), underweight and overweight were equal in numbers with each having 48 (17.0%). Disaggregating data between CSRL/ISU-UP participants and non-participants in the FNSPs, of the 292 overall participant households who had these primary caretakers, 206 (70.6%) were classified normal (healthy), 39 (13.4%) were underweight, and 47 (16.1%) were classified as overweight.

Table 4.30 Health Status of Caretakers by Participation in CSRL/ISU-UP's NECs, 2018

Health Status of primary caretakers based on their BMI	Overall surveyed households		Participants: NEC clients		Participants: Non-NEC clients		Non-Participants: Non-NEC clients	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Normal (18.5-24.9)	292	70.7	175	71.1	31	67.4	86	71.1
Underweight (<18.5)	52	12.6	34	13.8	05	10.9	13	10.7
Overweight (≥25.0)	69	16.7	37	15.0	10	21.7	22	18.2
Total	**413**	**100**	**246**	**100**	**46**	**100**	**121**	**100**
Overall BMI mean	**22.2±4.1**		**21.9±4.4[a]**		**22.4±3.8[a]**		**22.5±3.3[a]**	

We found no statistically significant differences among participants with regards to their overall BMI. All mothers were within the normal BMI category depicting health mothers, however, as mothers drop below the mean, they tend to underweight, and tend to overweight as their BMI keep increasing above the mean. This scenario explains why the NEC clients category has more underweight whereas the Non-NEC and Non-participants have more overweight as depicted in the table 4.30 above.

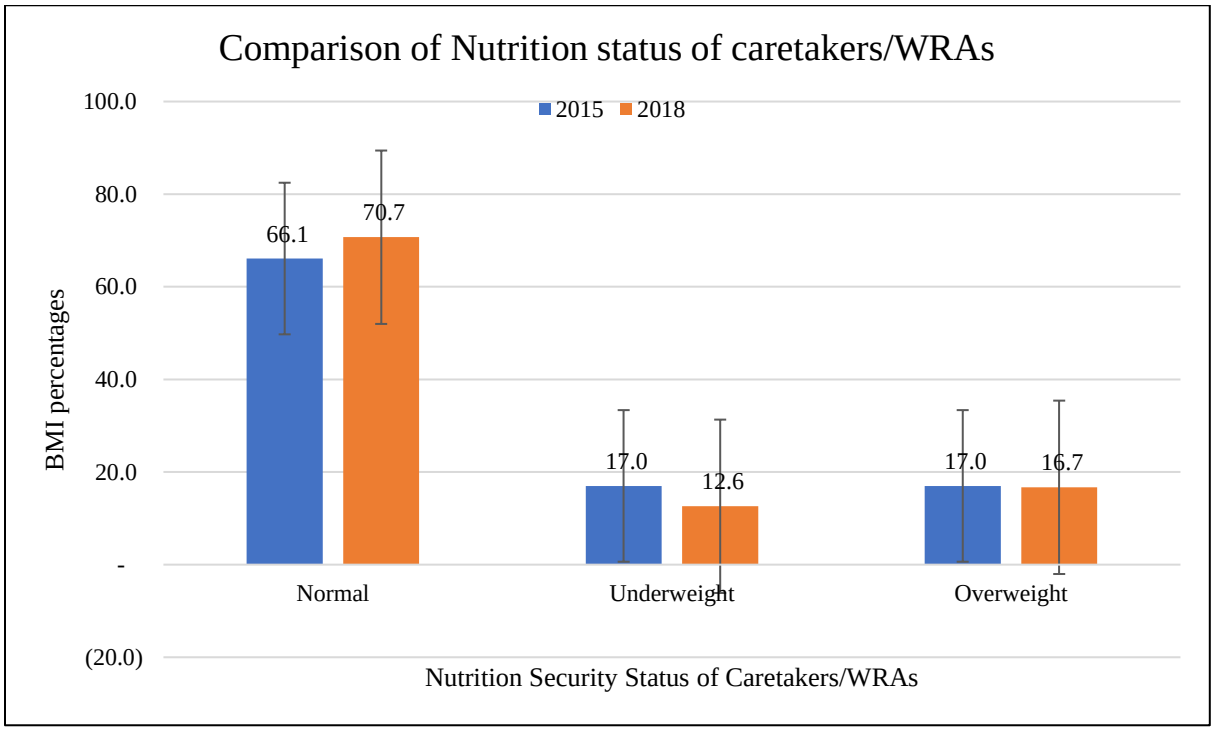

Figure 4.5 BMI Status of Caretakers between the Baseline of 2015 and Endline of 2018

From the figure above, although there was an observed improvement in the health status between 2015 to 2018, there were no statistically significant differences among the health status categories between the years.

4.5.4 Nutrition Security and Health Status of Children

About the children's biodata, of the 606 children of 0-59 months involved in the survey, only 515 (85.0%) had complete anthropometric indices, of whom almost the males were equal to the females in the proportions of 50.7 and 49.3 percent respectively. Most of them were within the age cohort of 48-60 months (23.7%), 22.5% in the 12-23 group, those in 36-47 and 24-35 were 20.4, and 22.1 percent respectively, 10.7% and 0.6 percent were from the groups of 06-11, and 0-5 months respectively. Most children (39.6%) had never attended to the NEC, 31.8% were actively attending, and 28.6% had graduated from the NEC. Most children (65.6%) were from households that participate in the NEC programs as clients, 23.5% were from Non-participants, and 10.9% were from participants who are Non-NEC clients. The nutrition and health status of the above children are summarized in table 4.31 below.

The survey results report that there were more stunted children (37.1%) than underweight (22.7%) and wasted (16.7%). We found no significant association between stunting, underweight and wasting with reference to the gender of the children, however, there were more boys who were stunted and wasted whereas more girls were found to be underweight. We found an association between stunting and age of the child, it was likely to be higher (42.1%) among the 24-35 age cohort than other groups ($\chi^2 = 12.040$, df = 5, p = 0.034). Similarly, underweight was found to be increasing with age and peaked at 32.4% within the 36-47 age group ($\chi^2 = 10.249$, df = 5, p = 0.068). There was no significant association between stunting, underweight and wasting with reference to participation status of households but more stunted (39.7%), and underweight (24.0%)

children were found within the Non-Participants, whereas Non-NEC clients had more (17.9%) of the wasted children.

Table 4.31 Health Status of Children (Stunting, Underweight, and Wasting Prevalence)

Variable	Malnutrition measures expressed in percentages	Stunting (HAZ)		Underweight (WAZ)		Wasting (WHZ)	
		Healthy	Stunted	Healthy	Underwent	Healthy	Wasted
Sex of child	Male (n=261)	62.8	37.2	77.4	22.6	81.6	18.4
	Female (n=254)	63.0	37.0	77.2	22.8	85.0	15.0
Age group in months	0-5 (n=3)	66.7	33.3	100	-	66.7	33.3
	6-11 (n=55)	83.6	16.4	81.8	18.2	81.8	18.2
	12-23 (n=116)	62.9	37.1	80.2	19.8	82.8	17.2
	24-35 (n=114)	57.9	42.1	74.6	25.4	81.6	18.4
	36-47 (n=105)	61.0	39.0	67.6	32.4	81.0	19.0
	48-60 (n=122)	59.8	40.2	82.8	17.2	88.5	11.5
Participation or affiliation status	NEC clients (n=338)	62.4	37.6	76.6	23.4	82.8	17.2
	Non-NEC clients (n=56)	71.4	28.6	83.9	16.1	82.1	17.9
	Non-Participants (n=121)	60.3	39.7	76.0	24.0	85.1	14.9
Graduation status	Non-NEC (n=177)	63.8	36.2	78.5	21.5	84.2	15.8
	Graduated (n=163)	60.7	39.3	81.6	18.4	84.0	16.0
	Active at NEC (n=175)	64.0	36.0	72.0	28.0	81.7	18.3
Totals	**Total (n=515)**	**62.9**	**37.1**	**77.3**	**22.7**	**83.3**	**16.7**

Regarding graduation status, there was more underweight (28.0%) within the active children at the NEC than the graduated and those who never been at the NEC ($\chi^2 = 4.665$, df = 2, p = 0.097). By mean comparison through ANOVA, we found similar significant differences where active children (-1.33±1.27^{a}) at the NEC were different from the graduated but the graduated (-0.93±1.26^{b}) and the Non-NEC (-1.05±1.41^{a,b}) were the same. Although no statistically significant association was found between wasting and stunting within the graduation category, the former was more within the active children (18.3%), and the latter within graduated. Children's nutrition status was expected to have an association with the mother's nutrition status, and from the analysis, more stunted children (44.6%) were found within the underweight mothers, ($\chi^2 = 7.027$, df = 2, p = 0.030) compared to 38.7% with healthy mothers and 25.8% with overweights. Similarly,

underweight mothers had more of the underweight children (27.7%) compared to health and overweight who had 24.4, and 12.9 percent respectively ($\chi^2 = 6.573$, df = 2, p = 0.037).

In the sum of the stunted, underweight and wasted children, there were more healthy children (51.1%) than malnourished (48.9%) but among the latter, 26.8% were severely malnourished 16.7, and 5.4 percent moderately, and mildly malnourished respectively. By gender, an equal proportion (each with 26.8%) of males and females were categorized as severe cases, but more females were health than the males. More than half of the 0-5 months were severely malnourished but its sample size too small, however, there were more severe cases across all the age groups than moderate and mild, whereas the 6-11 age cohort was more health than its counterparts. By participation status, Non-NEC clients had more severe (28.6%) and health (55.4%) cases than the others. There were more severe cases within the graduates (30.1) than the other categories and more healthy cases within Non-NEC children (52.2%) than the rest. Further details are within the table 4.32 below.

Table 4.32 Overall Malnutrition Prevalence among Children (n=515)

Variable	Malnutrition in percentages	Severe	Moderate	Marginal	All forms	Healthy
Sex of children	Male (n=261)	26.8	16.5	6.1	49.4	50.6
	Female (n=254)	26.8	16.9	4.7	48.4	51.6
Age group in months	0-5 (n=3)	66.7	-	-	66.7	33.3
	6-11 (n=55)	20.0	16.4	-	36.4	63.6
	12-23 (n=116)	28.4	13.8	6.0	48.3	51.7
	24-35 (n=114)	30.7	18.4	6.1	55.3	44.7
	36-47 (n=105)	18.1	21.9	9.5	49.5	50.5
	48-60 (n=122)	31.1	13.9	3.3	48.4	51.6
Participation or affiliation status	NEC clients (n=338)	26.9	16.3	6.2	49.4	50.6
	Non-NEC clients (n=56)	28.6	14.3	1.8	44.6	55.4
	Non-Participants (n=121)	25.6	19.0	5.0	49.6	50.4
Graduation status of children	Non-NEC (n=177)	26.6	17.5	4.0	48.0	52.0
	Graduated (n=163)	30.1	11.7	6.7	48.5	51.5
	Active at NEC (n=175)	24.0	20.6	5.7	50.3	49.7
Totals	**Total (n=515)**	26.8	16.7	5.4	48.9	51.1

Despite the variations in the proportion of severe, moderate, and marginal malnutrition statuses and healthy children, there were no statistically significant associations between the above health ranks with sex, age groups, participation status, and children's graduation status.

4.6 Factors Influencing Food Security in Kamuli District

A test for whether participation in the FNS programs of the NECs is significant to households' alleviation of food insecurity we employed a multinomial logistic regression model, combined with selected households' characteristics. In the process of testing for multicollinearity, all the FNS programs failed in either one or both the VIF and or TV criteria, for instance, participation in agronomy, and livestock training met the VIF but not the TV criteria, while participation in nutrition and health training met the TV but not the VIF, and participation in income innovations passed both the VIF and TV criteria but not the multinomial model criteria because of a few participants. In this instance, Leech et al., (2005) suggested merging the variables into one only if they are measuring the same effect on the dependent variable.

Since participation in all the programs was examining their influence on FNS, they have thus merged into one variable and a linear regression model was re-run to examine the criteria. Hence the final model was run on 10 independent variables against the categorical dependent variable of food security status (Food Secure=1-reference category, Food Insecure=2, and Extremely Food Insecure=3). Appendix: 3 shows the results of the linear regression model used in testing for multicollinearity with an adjusted R^2 of 0.155 hence the independent variables adopted in the model all had a TV greater than 0.835 (1 - R^2 [1 - 0.155 = 0.845]), and a VIF of less than 2.5 but greater than 1.0.

Table 4.33, the multinomial logistic regression was carried out at 1%, 5%, and 10% level of significance because of the high level of dichotomization of variables which reduces the predicting power. Other independent variables of household characteristics were dropped to overcome the problem of multicollinearity and the adjusted coefficient of determination R^2 at 95% levels of significances was 0.155 implying that the regression model explains 15.5% of the independent variables.

Table 4.33 Multinomial Logistic Regression of Food Security Status with Participation in the NECs' Programs, and Households' Characteristics in Kamuli, 2014-2018

FSS	Model Variables	B	SE	Sig.	Exp(B)	95% CI for Exp(B)	
						LB	UB
FI	Intercept	-1.15	0.269	0			
	Participation in NECs' FNS programs	0.413	0.233	.077***	1.511	0.956	2.387
	Age of household head	-0.281	0.237	.236^{ns}	0.755	0.475	1.201
	Education of household head	-0.077	0.226	.732^{ns}	0.926	0.595	1.441
	Land ownership in acreage	0.558	0.225	.013**	1.747	1.125	2.714
	Household keep livestock	0.67	0.284	.018**	1.953	1.119	3.41
	Time to collect water-round trip	0.35	0.221	.113^{ns}	1.42	0.921	2.189
	WASH facilities condition	0.785	0.216	.000*	2.193	1.437	3.349
	Days of illness of most adult male	0.527	0.332	.113^{ns}	1.694	0.883	3.247
	Number of meals eaten during scarcity	1.425	0.478	.003**	4.158	1.629	10.612
	Membership to burial/festivals groups	0.114	0.218	.600^{ns}	1.121	0.731	1.72
EFI	Intercept	-4.325	0.619	0			
	Participation in NECs' FNS programs	0.485	0.404	.230^{ns}	1.623	0.735	3.584
	Age of household head	-0.234	0.44	.594^{ns}	0.791	0.334	1.874
	Education of household head	0.323	0.46	.482^{ns}	1.382	0.561	3.401
	Land ownership in acreage	0.219	0.433	.614^{ns}	1.244	0.533	2.907
	Household keep livestock	1.014	0.449	.024**	2.757	1.143	6.647
	Time to collect water-round trip	0.993	0.396	.012**	2.7	1.242	5.872
	WASH facilities condition	0.19	0.407	.640^{ns}	1.209	0.545	2.683
	Days of illness of most adult male	1.942	0.456	.000*	6.972	2.855	17.026
	Number of meals eaten during scarcity	2.467	0.608	.000*	11.787	3.579	38.822
	Membership to burial/festivals groups	1.365	0.437	.002**	3.914	1.661	9.221

*Significance at 1% ** Significance at 5% *** Significance at 10%
FSS-Food Security Status, FI-Food Insecure, EFI-Extremely Food Insecure, ^{n}ot Significant

The constants; -1.150, and -4.325 defines the Food Insecurity and Extremely Food Insecurity levels of households that are not dependant on the variables entered. The critical P-values (0.01, 0.05, 0.1) are greater than the calculated P-value (0.000) for both models (Food Insecure and Extremely Food Insecure), therefore we reject the null hypothesis and conclude that our results are significant. From the model results, all independent variables except education and age of the household heads significantly affect the (in part or in combination, both at 1%, 5%, and or 10% level of significance for both or individual category) Food Security Status (FSS); Food Insecure (FI) and Extremely Food Insecure (EFI) with Food Secure (FS) as reference category.

From the model, households' keeping of livestock, and several meals eaten by the households during periods of scarcity significantly distinguish FI from EFI by varying likelihood odds of being FS. The conditions of WASH facilities possessed by households, the amount of land accessed by households, and households' participation in NECs' FNS programs greatly influence the likelihood of a household being FS than FI at different odds. Similarly, the number of days of illness of most adult males, membership of households in the communities' burial and festival groups, and time (round trip) spent to fetch water from the primary water sources significantly influence the likelihood of a household being FS than EFI at varying odds. The odds description are as follows:

At 5% level of significance, household who keep livestock were 95.3% likely to be FS than FI, and 75.7% likely to be FS than EFI. It can, therefore, be adduced that a unit increase in the keeping of livestock greatly impacts the life of households by contributing to the production of food in form of milk, eggs, meat, that can either be consumed and or sold to raise income to meet other necessities of the family. A crosstabulation of FSS against household keeping livestock

shows that 50.5% of the FS households were engaged in any form of livestock than the 28.4% FS who are not in livestock production.

The number of meals eaten by the households during food scarcity seasons exhibited a positive relationship between the likelihood of being FS than FI and EFI at 1% CI. For instance, a unit increase in the number of meals increases the odds of being FS than FI by 15.8% and 78.7% for EFI. Whereas this variable is significant to both the FI and EFI categories, its more for EFI.

This variable was dichotomized as; at least two meals against utmost one meal and a crosstabulation of FSS against the number of meals eaten during scarcity shows that (49.8%) of the were more likely to be food secure than the FI and EFI households who had at least two meals. Faced in this situation of utmost one meal - complete lack of a meal in the household is exposed the members to 100 % risk of malnutrition and death if not rescued in time. One meal in a day places the household head on a had drawing board as either to have it as breakfast, lunch or dinner but most importantly, whatever decision that passes, it all results into malnutrition, and the likely hood of this "golden meals" being nutritionally unbalanced.

The variables that were significant to FI but not to EFI are conditions of the water, sanitation, and hygiene (WASH) facilities and households' access to land. These variables exhibited a positive relationship between the likelihood of being FS than FI as explained below.

At 10% CI, participation in the NECs' FNP exhibited a positive relationship between FS and FI. The likelihood odds of being FS than FI linked to participation in the programs were 51.1%, meaning that for every unit increase in the households' participation in the FNS programs increases the chances of becoming FS than FI by the 51.1% ratio. This was significant because all the six programs of the NECs tackle FNS in a holistic model.

The conditions of WASH facilities were dichotomized into two as good against poor, and the odds of being FS than FI were 19.3% at 1% CI. Meaning that a unit increase in improvement of the facilities' conditions increases the chances of being FS than FI. The basic six WASH facilities considered in this survey were the presence and conditions of; kitchens, dish rackers/plate stands, rubbish pits/garbage pits, latrines, bathrooms, and tippy taps.

The other variable significant to FI but not to EFI was household land ownership and accessibility. From the model, the likelihood of households being FS than FI associated with land was 74.7%. This means that an increase in land access and ownership increases the likelihood of a household being FS than FI by 74.7%. Land access and ownership were dichotomized into two at ≥3.0 acres against less than 3.0 acres. Survey data shows that an average household owns 3.54 acres. Most households own 2.0 and 1.0 acres 19.2% and 14.3% respectively. Similarly, those who were able to put their land to use has in the survey's reference "season one" of 2017 used an average of 2.45 acres and most of whom 22.0% and 16.3% used 2.0 and 1.0 acres respectively.

On the side of EFI households, one of the most significant variables was the number of days of illness of most adult males in the household. This variable exhibited a positive relationship between the likelihood of being FS than EFI with odds of 97.2% at 1% CI. This variable was dichotomized as ≤5 and greater than five days of illness in a month prior to the survey, meaning that a unit increase in the number of days of illness for most household males increases the likelihoods of the household being EFI than FS at a very high rate expressed by the high likelihood odds. It is noted that the health status of the body determines its productivity in terms of food production in this respect, with most of the households (82.2%) being male-headed, and traditionally being considered as the breadwinners, this explains the high odds ratios.

The second most significant variable to EFI was the households' membership to Burial and festival groups within the community. This variable exhibited a positive relationship between being FS than EFI by the odds of 91.4%, meaning that a unit increase in membership to these groups increases the likelihoods of being FS than EFI by the above odd ratio. This variable was included because it's believed that social capital has a very significant impact on the households' FNS.

The last variable in the model significant to EFI category was time spent to fetch water for a round trip from the primary water sources of the households. This variable exhibits a positive relationship between being FS than EFI with odds of 70.0%, meaning that a unit reduction in the time spent to fetch water increases the likelihoods of a household being FS than EFI. This variable was dichotomized on less than 30 minutes to greater than 30 minutes for a round trip and 62.6% of the households reported spending less than 30 minutes.

CHAPTER 5: DISCUSSION OF RESULTS AND FINDINGS

5.1 Introduction

This chapter elaborates on the findings and results presented in chapter four with similar and or differing observation elsewhere. It provides reasoning for the cases observed in the survey based on the household characteristics, literature and authors intuition as a backup, and how the different food security programs of the CSRL/ISU-UP play their role within the outcomes observed. It begins with the discussions on food security situation in general, among the three groups surveyed and provides an insight on the progress made between the Baseline (2015) and Endline (2018) to give the program a visual picture what has worked and needs to be made better. In the same order, discussion on nutrition security based on the primary caretakers, and children. The chapter ends with the multivariate analysis of the factors that were believed to influence the food security status of the households in Kamuli combined with overall participation in the food security programs as a single variable.

5.2 Food Security Status and Trends

Overall, according to the HFIAS model, less than half (46.3%) of the households were food secure, the food insecure (45.4%) were nearly equal to the secure category whereas the extremely food insecure was 8.4%. The former and the latter make up a total of 53.7% generally categorized as food insecure, and this total was found to be higher than that from the findings of CSRL/ISU-UP 2015 baseline at 38.4%, similarly higher than the findings of Sseguya (2009) at 46.3% although lower than the 2005 baseline of CSRL/VEDCO at 91.0% that was presented in the findings of Sseguya and Masinde (2005). Despite the different trends of food security, statistically, there were no differences among the food insecure cohort between 2005-2018, however, among the food secure, differences were revealed between the 9.0% of 2005 (Sseguya and Masinde, 2005) from

those of 2009 (Sseguya, 2009), 2015 baseline, and the 2018 end line survey findings. Similarly, 2005 extremely food insecure were found to be significantly different from the rest of the years.

Regarding household participation categories in the food security programs at the NECs, most of the food secure were program participants who were Non-NEC clients, and these were significantly different from the NEC clients, and the Non-Participants. The overall mean of the participants who are participants-Non-NEC clients fell within the food secure cohort on the HFIAS model, whereas the NEC clients and Non-Participants were within the food insecure bracket. Regarding the whole program of CSRL/ISU-UP (merging the NEC clients, and Participants who were Non-NEC clients), 51.0% were food secure compared to the 35.5% food secure Non-participating household and these were statistically difference by mean comparison. These results agree with the findings of Sseguya (2009) where households who participated in the CSRL/VEDCO's programs in Kamuli district since 2004 exhibited a high proportion of food security status. This can, therefore, be adduced that participation in the program is one way for the households to reduce the burden of food insecurity within Kamuli district.

The above achievements were made possible through exploiting the benefits of a tripartite private-public partnership as described by Butler and McMillan (2015) who describe the multi-stages of lessons learned in a public-private partnership for rural Uganda. Practically in 2014, an embarkment of CSRL/ISU-UP on a comprehensive action against hunger using a Field-Tested, Comprehensive Life-Span Approach to Capacity development (see Fig.2 in chapter three) can account for this achievement (https://www.csrl.cals.iastate.edu/transforming-lives). As reported by IPC (2017), Busoga region where Kamuli if located was found to have problems of food availability and access, and CSRL's programs that are directly linked to increasing food production among households were found to be statistically significant. These included livestock integration,

and agronomy and postharvest technologies. Positive associations were established among the participants with reference to all the three food security measures; access (HFIAS), diversity (HDDS), and caloric intake (FCS) in the survey.

It was found out that households who participated in the above training programs acquired knowledge in production for sustainability, and some had received livestock inputs such as improved animal breeds like goats, pigs, poultry including layers, kuroilers, and ducks, construction materials, forage seeds, water tanks, among others. And those of agronomy had received improved planting materials of vegetables, high iron beans, grain amaranths, soybean, subsidized grain storage silos, among others. These households were found to be more food secure, with better diets and high caloric intake compared to non-participants. Further, these two programs were significantly found to be promoting the consumption of animal source proteins, a similar finding with Ampaire and Rothchild (2010). Also, consumption of micronutrients of plant origin through promoting the growing of nutrient-dense crops listed above, in addition to promoting the intensification land use in vegetable production through sack gardens, keyhole, and or kitchen gardens. This was sought to reduce the burden of land issues since it has undergone shrinkage from an average of 4.94 acres reported in 2004 (KDA, 2004) to 3.54 reported by this survey, and have vegetables within the vicinity of the home.

In terms of dietary diversity and caloric intake, the livestock and agronomy participants were significantly better than non-participants. The three food security measures are codependent, the HFIAS determines the results of the HDDS, and the later determines the results of the FCS. The structure of the two programs help to increase food access, and the nutrition and feeding programs though were not found significant help the participants learn how to make balanced diets that improve the scores of HDDS, and FCS. The poor food consumption in Uganda has been

historically reported, for instance, the Uganda Census of Agriculture (UCA, 2010), revealed that 57.0 percent of the 3.6 million households surveyed in 2008-09 could not maintain a normal consumption level in the previous 12 months. Similarly, FAO (2010) statistics, revealed that a lag phase in the farmers' calendar between planting and harvesting coupled with an inability to have proper storage facilities resulted into hunger, with reference to northern Uganda. UBOS and WFP (2013), through the Comprehensive Food Security and Vulnerability Analysis task force, showed that those who experienced poor food consumption were five percent, and 16 percent were at the marginal food consumption. Integration of animals with crop production helps bridge the lag phase since the former has continuous production than the latter.

Economically, the main activity was agriculture hence the main source of income was the sale of products. Livestock had more sales revenue reported than crop, however, program participants in these two had more sales hence likely to be regarded as better than the rest. 56.3% got revenue compared to 43.7% non-participants, and 55.7% got from crop sales compared to 44.3% non-participant. Referring to the findings of FAO (2010a) in Uganda where 27 percent of the total rural dwellers were below the poverty line yet their main expenses of approximately 63 percent was reported to on food in the same report, we can conclude that livestock and agronomy programs have contributed to the alleviation of poverty and food insecurity in Kamuli. Further, Christina Malmberg Calvo, World Bank Country Manager for Uganda was reported to have said:

> *"Most Ugandans are either poor or vulnerable to poverty. For every three families who escape poverty, two falls back in," "Bridging the regional divide is critical by spurring agricultural growth and improving education, health and basic infrastructure services (World Bank, 2016).*

UBOS (2017) through the UNHS of 2016/17 also reported that more Ugandans were falling back into poverty continuously and that the Eastern region registered the biggest increase from 2.4 to 4.2 million in 2012/13 and 2016/17 respectively both affecting the rural and urban dwellers. The programs' comprehensive action against hunger launched in 2014 already found a deteriorating economic structure. Investments in livestock, agronomy, and the evolving CIGI programs are one of the ways the program was found to be helping the rural communities find diversified sources of income that can be gained and put different uses in the households.

Further, the period specifically the 2015-2018 depicted a general reduction in the number of food secure from 61.1% (Baseline 2015) to 46.3% (Endline 2018) and a slight increase in the number of extremely food insecure from 7.4% to 8.4%. Although neither the food insecure nor the extremely insecure trends were statistically significant, the trend revealed by the results of this survey confirms the wave of increasing global food insecurity since 2015. For instance, "The State of Food Security and Nutrition 2018" on a global scale reported a continuous increase in number of hungry people from 794.6 million in 2015 to 804 million in 2016 and by 2017 it was estimated at 821 million people, and further reporting that the regions of Africa and South America being affected most relative to those Asia (FAO, IFAD, UNICEF, WFP and WHO, 2018). The report also reveals an observation that one in the nine rural based population relying on rain-fed agriculture are more affected. This survey reports that 79.3% of households rely on farming as the main livelihoods, though the number has decreased compared to the district average at 90.4% reported by UBOS, (2017) from the 2014 National Population and Housing Census (NPHS).

More evidence of food insecurity at national level was provided in the report released by the Integrated Food Security Phase Classification (IPC) that revealed that the percentage of food secure people drastically reduced from 83.0 in 2016 to 69.0 percent in 2017 (IPC, 2017). The

report estimates that approximately 10.9 million people are in a critically food insecure state. In the same instance, within the critical food insecure about 1.6 million people were found to be in a widening food consumption gap and with a worsening dietary diversity, and starvation (IPC, 2017). Specific to Eastern region of Uganda where Kamuli is located, the first two core principles of food and nutrition security (food availability and accessibility) were viewed as major obstacles to the population, whereas food utilization was classified as a minor limiting factor (IPC, 2017).

The poor yields caused by prolonged droughts, and occasionally flood during rainy seasons, crop and livestock diseases, together with low-income levels limiting the purchasing power and adoption of improved farming methods, seeds, livestock, post-harvest technologies among others can partially account for this food insecurity problem in Kamuli district. The survey results clearly explain this food insecurity situation. As earlier noted, that farming is the main occupation, home gardens (87.4%) are main sources (similar findings like for Sseguya, 2009; Malual, 2014), and in same instance the main food reserve for households was found to be food in store/house (83.5%), and with the main storage method as bags mainly for grain (89.6%). Given the challenges of storage as quoted from, Brumn and Barnes in CSRL report (2017), that:

> *"Post-harvest losses of up to 50% are not uncommon, primarily due to mold and weevil infestation. Often, farmers don't have a good way to dry their maize, they don't have a good way to tell when the grain is dry enough to store, and they don't have a good way to store it (CSRL, 2017)".*

The general trend in the at-risk households (those who had responses of "sometimes" and "often" on the food insecurity frequency of occurrence) shows an increase in the percentage of food insecurity occurrence situations between 2015 and 2018 across all the nine questions on the HFIAS model. This trend can support the claim that food insecurity has increased between the two

time periods as this report asserts as well as the general trend in the country (IPC, 2017), and globally (FAO, IFAD, UNICEF, WFP, and WHO, 2018). The most stressing situation among the "sometimes" category who are likely to be "food insecure" was a household member eating some foodstuffs that they did not really want to eat (49.3%). This situation is true for households who are food insecure and they have no choice other than eating what is available. This was followed by households worrying about having no enough food to feed its members (46.7%), a condition which is also true based on the poor output with reference to season one of 2017. Whereas households whose responses were "often" most likely to be categorized as extremely food insecure, face similar challenges as the former category but in varying proportions. Although going to bed hungry and spending the whole and night without a meal because there was no food in the households were least ranked, their occurrences are very disastrous to any member irrespective of the age. This is a point of action to help rural communities increase food production to increase their dietary choices and have reserve food, reduce reliance on food in the store/house as the main reserve observed in this survey that is believed to be short-lived.

5.3 The Nutrition Security Status of Household

5.3.1 The Nutrition Status and Health of Primary Caretakers

Overall, caretakers/mothers/WRAs were healthy with 70.7% classified as normal, 12.6 and 16.7 percent as underweight and overweight respectively. Among participants, there were no significant differences in their health though NEC clients were below the overall mean. This meant that they were more likely to be tending to underweight whereas Non-Participants were above the mean, tending to overweight, and the Non-NEC participants were within the mean. To focus further on underweights as the main nutrition concern in rural communities, there were associations though not statistically significant between food security (HDDS, and FCS) in relation

to the caretakers' BMI. Underweight mothers had a lower dietary diversity score compared to the others, and similarly, they had a lower caloric intake. The overweight had a higher HDDS and FCS which could probably account for their nutrition status whereas the normal were within the mean. But in all, all the three categories of caretakers were within the average and borderline ranges on the food security scales of HDDS and FCS respectively that specifically measure nutrient intake.

In a comparison, the general results show that there was an improvement more so in the reduction of underweight (from 17.0% to 12.6%) to normal health caretakers whereas a reduction in overweight (from 17.0% to 16.7%) was low but too registered progress between the Baseline in 2015 and Endline in 2018. But still, there was no statistical significance observed between the two time periods. These results relatively differ from the findings reported by USAID (2018) on "Uganda Nutrition Profile" in terms of the percentage of overweight mothers who were found to be on an increase from 2011 to 2016 in the range of 19 to 24 percent respectively. The probable reason can be the difference in sample space, variation in regions for instance, if the survey focused on urban dwellers, by the change of consumption patterns, they are likely to be overweight than rural dwellers who are likely to underweight for lack of food among other conditions.

The high prevalence of underweights can be attributed to early pregnancy and childhood bearing as reported by this survey right from the age of 12 years, with 69.3% having given birth by 19 years. This claim concurs with that put forward by Fink et al., (2014); USAID (2018), where they report that the risk of stunting was more likely to happen to early childhood mothers, of which Uganda has the highest fertility rate in East and Southern Africa with 54% (as of 2016) of adolescent girls bearing children at the age of 19 years. Similarly, these findings are like those of the Uganda Demographic and Health Survey (UDHS) where they found and reported that an average woman marries four years earlier than men and their median age at first marriage was

found to be 18.7 years, and first birth was 19.2 years (UBOS and ICF, 2018). Among the participant categories, the NEC and Non-participants had the lowest mean age at first pregnancy of (18.88±4.07[a]), (18.55±400[a]) respectively, and were significantly different from the Non-NEC who are participants (20.36±4.14[b]) in the program.

The other factor found statistically significant in relation to nutrition security was the education of household heads and spouses, and or primary caretakers. As reported in chapter four, NEC clients specifically the primary caretakers (6.27±2.73[a]) were likely to have spent fewer years in formal education than Non-participants (6.94±2.94[b]) and the Non-NEC participants (7.23±3.29[b]). In addition to influencing the economic status (Mukudi, 2003), education does influence the health behaviors and attitudes, and food choices that determine the dietary intake of the household thus impacting nutrition security. This confirms the findings of Faith et al., (2004) who contends that knowledge is a significant factor in determining the dietary practices of households. A cross-tabulation of the education of the household heads and spouses, and caretakers separately against HFIAS, FCS, and HDDS reveals that a high proportion of the households with low education of fewer than seven years were more food insecure, with a low food consumption score and a poor dietary diversity compared to those with post-primary education. This further confirms to the findings of Malual (2014); Sseguya (2009) who found out that higher education among households in Lira, and Kamuli districts of Uganda respectively were positively associated with food security.

5.3.2 The Nutrition Status and Health of Infants and Children

Children who had complete anthropometric data were 515 (85.0%) of the 606 children involved in this survey, with almost the same number of males (50.7%), and females (49.3%) an indication that Uganda is rapidly closing the gender gap. Most children (39.6%) had never attended

to the NEC, 31.8% were actively attending, and 28.6% NEC graduates. By participation category, most children (65.6%) were from households that participate in the NEC programs as clients, 23.5% were from Non-participants, and 10.9% were from participants who are Non-NEC clients. The nutrition and health status of the above children specifically focusing on the components of undernutrition are discussed as follows.

5.4 Stunting Among Infants and Children

In this study, we used height-for-age (HAZ) as an indicator of linear growth retardation among children. We found out that 37.1% of the children were stunted, a percentage found to be higher than the national average estimated at 29.0% (UBOS and ICF, 2018). According to statistics released by UNICEF-WHO-World Bank Group (2018), on Global scale, the number of stunted children reduced from 198.4 million in 2000 to 150.8 million by 2017, but with Africa named as the only region where the number had risen from 50.6 to 58.7 million in this reference period. In the same report, a similar situation was found for Eastern Africa where Uganda is located with stunting having risen from 21.5 to 23.9 million. In Uganda specifically, the Demographic and Health Survey (DHS) in 2016 reported 2.2 million (one in every three) children under five years of age as stunted, amounting to 29 percentwise pointing out limited access to food, health and child care as the principal causes (UBOS and ICF, 2018).

By gender, more males were stunted (37.2%) than females (37.0%) though the difference was not significant. This is also confirmed by the findings of Wamani et al., (2007) who contends that in Sub-Saharan Africa, more males under the age of five years are more likely to be stunted than females in their respective age groups. Byaruhanga et al., (2017) also found out that more boys of school going age in elementary school were found to be more stunted than girls.

Further still, the association found between stunting and the 24-35 age group, wherein this survey, stunting peaked in that age cohort. Similar findings were reported by UBOS and ICF, this report further confirms that rural children are 30% more likely to be stunted than 24% of the urban. The reason for stunting is probably because children in this age are prone to malnutrition since their nutrition requirements for growth and maintenance are high, yet their households have shown to be food insecure, with poor diets and low caloric intake. They too are in the period after being weaned from breastfeeding, hence they could find it difficult to survive while scavenging around as a common practice in the rural children for the meager available food in the household, and communities. In such instances, they are exposed to contamination from water and food and environment, these findings are consistent with those of Glover-Amengor et al., (2016); Victora et al., (2010). Similarly, the rate of stunting remained high up to the age of 60 months consistent with the findings of Leroy et al., (2014) who further contend that the situation could have been attributed to long term nutrition deprivations of the children during their first 1000 days after birth.

To summarize stunting, whereas no statistically significant differences were established between participants, there were more stunted children among the Non-Participants (39.7%), followed by NEC clients (37.6%), and less (28.6%) with participants of Non-NEC category. By graduation status, there were more stunted children among graduated children (39.7%), followed by those who never attended to the NEC (36.2%), and less with Actively attending children to the NEC (36.0%). In Uganda, stunting is by far the most serious undernutrition threat among children. Based on the the high population growth standing at 3.0 percent per annum (UBOS, 2016), the European Commission (EC, 2018) reported that Uganda will neither meet its own target set for 2019/20 to reduce child stunting to 2.0 million (25 percent), nor will she meet the World Health

Assembly (WHA) of 1.46 million by 2025. The 2016 projections indicate that over 2.3 million children will be stunted by 2025.

5.5 Underweight Among Infants and Children

We used weight-for-age (WAZ) as an indicator to determine the body mass of children in their respective age groups, an indication of acute and chronic undernutrition. The results showed that 22.7% of the 515 children were affected, still a proportion higher than the national average at 11.0% (UBOS and ICF, 2018). Though not statistically significant, more females were found to be underweight (22.8%) than males (22.6%). Just like stunting, underweight too was found to be increasing with age, and peaked at 36-47 months, there were significant differences observed where the cohort of 36-47 was most affected followed by 24-35. The former and the latter were statistically different from each, while both were different from the rest of the cohorts (excluding 0-5 for having no underweight and its sample was too small of only three babies), these showed no differences among them.

The reason for high proportions of underweight could be due to that fact that in addition to food insecurity of different forms, there were high prevalence of sicknesses which may have been aggravated by inadequate and poor sanitation facilities, a similar finding with Glover-Amengor et al., (2016). Through crosstabulations, we found significant associations between diseases like diarrhea, dysentery, cough and WASH conditions. There was no significant association between underweight with reference to participation status of households but more underweight (24.0%) children were found within the Non-Participants, whereas NEC clients had (23.4%) and Non-NEC clients (16.1%). Regarding graduation status, there was more underweight (28.0%) within the active children at the NEC than the graduated and those who never been at the NEC. By mean comparison, we found similar significant differences where active children (-1.33 ± 1.27^{a}) at the

NEC were different from the graduated but the graduated (-0.93±1.26[b]) and the Non-NEC (-1.05±1.41[a,b]) were the same. This is no surprise because it was expected to be at the NEC. Other than those children born from the NEC by mother already enrolled in the rehabilitation program, all other children are enrolled with various forms of undernutrition. Therefore, finding underweight at the NEC can be a function of how long the enrolled-underweight child has been at the NEC.

To differ from stunting that may have gene associations with the parents, underweight is more of nutrition deficiencies, and this explains why most of the households who reported having experienced kwashiorkor and marasmus among their children are at the NEC for rehabilitation. Literature has shown that Africa specifically, there is limited indication of decrease in incidences of underweight (Lim et al., 2012; Stevens et al., 2012a), the UDHS reports that underweight in Uganda has been decreasing but at a very low rate for instance in 2000, it was at 18%, and has kept a decreasing pace of approximately 2% for every 5 years (16% in 2006, 14% in 2011, and 11% in 2016%) reported by UBOS and ICF, (2018). This is an indication of the need to intensify and expand the intervention programs in the country to curtail the problem.

5.6 Wasting Among Infants and Children

We used weight-for-height (WHZ) to measure children's body mass in relation to their height or recumbent length (for infants). The overall wasted children were 16.7% of the 515 four times the national average at 4% reported by UBOS and ICF, (2018). Wasting was the lowest indicator of undernutrition among children compared to underweight and stunting. Wasting directly correlates with food insecurity, describing the failure to receive proper feeding especially in periods of food scarcity. This survey reported that most households (53.7%) were food insecure, relying on rain-fed agriculture (79.3%), with gardens (84.6%) as the main source of food. The

households' postharvest handling technology specifically relying on food in store/house as their main source, rarely having silos but the use of bags was a sign of poor harvest. Similarly, the high infestation of weevils among the stored grains of over 50% as attested by Brumn and Barnes (CSRL, 2017) shows further issues with the food supply. 38.3 percent of the households reported spending more than two months in food scarcity. This was true since only 50.6% and 36.3% reported July and August as the main food plenty periods, June as the third with less than 20 percent directly shows that food plenty exists only in the periods of the harvest of the main season.

Other than food insecurity, the prevalence of disease among the households including malaria, dysentery, diarrhea, measles, kwashiorkor, marasmus has been proved as another main cause of wasting among children under five years within this survey and this resonates with the findings of Goto et al., (2009) in Bangladesh, and Phillips., (2004) in Nigeria, UBOS and ICF, (2018).

By gender, it was found that more males were wasted (18.4%) than females (15.0%) and the difference among them was statistically significant which this matches the findings of Glover-Amengor et al., (2016), where they found that boys were more likely to be too thin for their weight than girls in Ghana. Wasting further depicted an "N" trend, it starts high and lowers, again rises, significant to note here is the rise (other than the age cohort of 0-5 months), between 6-11 months a window period when infants are beginning to eat solid foods to supplement on breast milk. This is a risk period of such children contracting diseases related to food contamination such as diarrhea, and a window of change in feeding habits to start up complementary weaning foods resulting in stomach complication. These findings echo those of Cohen et al., (1994). In its path, wasting relatively follows the path of underweight peaking at 36-47 months, a period when children adapting to leave independent with breastfeeding. Wasting was more among the Non-NEC

program participants (17.9%), and NEC clients (17.2%), and statistically lower among the Non-Participants. Significantly still, there were more wasted children among the actively participating children in the rehabilitation program than the graduated (16.0%), and those who never attended to the NEC (15.8%).

5.7 Overall Infants and Children's Nutrition and Health Status.

The three indicators of undernutrition are merged to determine overall nutrition status. As described in chapter three, children with none of the of three indicators are categorized as health or properly nourished, those with only one are mildly or marginally malnourished, those with two are moderately acutely malnourished (MAM), and those who exhibited all three are categorized as acutely severely malnourished (SAM). In sum, there were more healthy children (51.1%) than malnourished (48.9%) but among the latter, there were more severe cases (26.8%) than moderate (16.7%) and mild (5.4%). By gender in their cohort, females were more health (51.6%) than males (50.6%), severe cases were high in this group, but the proportion was the same at 26.8%, more females were moderately malnourished (16.9%) than males (16.5%), whereas the latter were mildly malnourished than the former.

By age group, 6-11 were more health (63.6%) than the rest, and more than half (66.7%) of the 0-5 months were severely malnourished but its sample size too small. There were more MAM cases in 36-47 group (21.9%), and the same case with marginal cases (9.5%). However, among all malnutrition categories, there were more severe cases across all the age groups than moderate and mild. By participation status, Non-NEC clients had more severe cases (28.6%) and health (55.4%) children than the others. Whereas Non-Participants had more MAM cases (19.0%), and NEC clients had more marginal cases (6.2%).

Regarding graduation status category, children who had never attended to the NEC were healthier (52.0%), there were more severe cases within the graduates (30.1) than the other categories, more MAM cases were within the actively attending children, and more mild cases in the graduates. Despite the variations in the proportion of severe, moderate, and marginal malnutrition statuses and healthy children, there were no statistically significant associations between the above health ranks with sex, age groups, participation status, and children's graduation status.

5.8 Association between Children's Nutrition Health and their Primary Caretakers

Children's nutrition status was expected to have an association with their primary caretaker or mother's nutrition status, practices, and other household characteristics. As reported in chapter four, the analysis proved an association that, more stunted children (44.6%) were found within the underweight mothers, compared to 38.7% with healthy mothers and 25.8% within the overweights. Similarly, underweight mothers had more of the underweight children (27.7%) compared to health and overweight who had 24.4, and 12.9 percent respectively. These findings are in conformance with the claim put forward by Black et al., (2013) that WRA who are malnourished stand high chances of giving birth to malnourished children due to limited growth of the fetus. Similarly, in Uganda, the UDHS reported that thin or underweight mothers were more likely to have stunted children (34%) compared to normal (29%) and overweight (23%) (UBOS and ICF, 2018).

As earlier discussed with the caretaker's BMI and food security, education of the primary caretaker has a positive association with children's nutrition status. Most caretakers were found within an average of six years of education. Those who had less than seven years of formal education were 37.2% likely to have stunted children compared to 31.1% with at least seven years, similarly, they were 22.0% likely to have underweight than 18.9%. Therefore, it can be adduced

that education has a direct influence on the nutrition status of the children. UBOS and ICF (2018) reported that the proportion of stunted children decreases with an increase in the education level of the primary caretakers. Shroff et al., (2011) affirms that women who participate in decision making because of their intellect reported fewer incidences of underweight and wasting among their children Similarly, Thomas (1994) found out that an educated caregiver in a household can amicably resolve issues of discrimination that may arise within children based on age and sex. Other studies in Nepal by Sah (2008), India by Chakraborty et al., (2006), Uganda by Turyashemererwa et al., (2009) also confirm that low education level of the caregivers significantly contributes to child undernutrition.

Also, the poor antenatal practices of mothers, with whom between 20-30 percent of them visiting the antenatal clinic for less than four times, a minimum suggested by Lincetto et al., (2006. pg.51), can be one of the causes of the poor health. These results differ from the finding at the national average where about 60% of women at least four antenatal clinic visits (UBOS and ICF, 2018), but this survey establishes a negative trend where visits were reducing right from 66.9% on the 4th child to 56.7% on first (youngest child) having completed four visits. The health care practices and quality during the antenatal period are very significant to the outcome of the pregnancy which improves the maternal health of mothers and improve child survival rate as further affirmed by Snyman (2007); The World Health Organization (2003, 1-2; 2005b:42). Lincetto et al., (2006) reports that about 25% of maternal deaths happen during pregnancy, in confirmation of this claim, this survey reports that 1.0% of 415 mothers under mother “one category”, and 25% of 28 mothers under “mother two category” had dead babies at birth.

In a similar practice that predisposes mothers to risks of nutrition and health insecurity was found to give birth using unrecommended way and places. Data reports that over 10 percent of

mothers gave birth by means or using or with the help of traditional attendants, home with relatives, with other means including own-help at birth. Given the early childhood age, all these means do not help in cases of complications where the mother fails to deliver normally, or in cases of HIV/AIDS mothers, the chances of transmission of the virus are high to the baby, the sanitation of place, there are chances of high contraction of tetanus. This survey reported earlier that only 55% of the households have at least recommended WASH facilities. In sum, these practices have long term effects on the health of the mothers and the newborn baby. However, the number of mothers who gave birth on the youngest child (87.6%) had help from skilled birth attended from either hospital, health centers or home compare to the national average established at 74% by the UDHS of 2016 (UBOS and ICF, 2018).

5.9 Factors Distinguishing Food Insecure from Extremely Food Insecure

Household who keep livestock were 95.3% likely to be FS than FI, and 75.7% likely to be FS than EFI. In a community setting, livestock is wealth and can be used as security in accessing credit facilities that can be used by the household in further production of food. Manure from livestock significantly contributes to soil improvement that is significant in crop production hence improving crop yields and food availability and accessibility. In related research, Ampaire & Rothschild (2010) in their research about pigs, goats, and chickens for small landholder farmers in Uganda found out that households who kept these small livestock breeds had evolving incomes and improved nutrition diets through consumption of chicken products.

Production from livestock is continuous than seasonal like the case for crops, therefore livestock integration help to bridge the food and income gap that exists in between planting and harvesting of crops. Revenue generated from livestock according to the survey results was far higher than that of crop sales and was significantly associated with all measures of food security.

It should be recalled that poverty was described as a rural phenomenon, with most rural dwellers (80%) being poor (UBOS, 2016), livestock rearing is therefore regarded as an important pathway out of poverty reduction as echoed by Ouma et al., (2013); Nabikyu & Kugonza, (2016); Dione et al., (2013; 2014); Mutua et al., (2010). More specific the keeping of small livestock such as chickens, pigs and goats due to land issues which are owned by the poor in rural areas and are gender friendly in favor of females (Paul Sillitoe, 2001; Mangheni., 2014; Mutua et al., 2010; Ouma & Kawuma, 2014; Dion et al., 2013; 2014), these can easily be sold off, and or eaten to improve nutrition security.

The number of meals eaten by the household exhibited a 15.8%, and 78.7% likelihood of being FS than FI, and EFI respectively. Dichotomized at ≤1, and >1 meal in the model, and with many households having reported fewer meals per day was an indication of food insecurity. The productive capacity of a human body has a positive correlation with food intake, at least a meal is required for the normal functioning of the members of the household. In support of the above claims, according to Black et al., (2013) WRA who are malnourished stand high chances of giving birth to malnourished children due to limited growth of the fetus. This survey already reported that underweight mothers were associated with stunted and underweight children, and this was because of underfeeding due to food scarcity and food insecurity. Further, poor nutrition has negative effects throughout the life of an individual for instance, in early childhood, it limits the intellectual and social development which in turn has profound impacts ranging from death, reduced capacity to reason and learn as well as likelihood of acquiring Non-Communicable Diseases (NCDs) at an advanced age as adduced by (Black et al., 2008; Grantham-McGregor et al., 2000; Gundersen & Ziliak, 2015; Maluccio et al., 2005; Matorell et al., 2010; WHO, 2011a).

Participation in the activities at the NECs exhibited a positive relationship between FS and FI, with 51.1% likelihood odds ratios. This was significant because all the six programs (agronomy and postharvest technologies, livestock integration, services, nutrition and feeding, WASH, and community income innovations) at these centers tackle food and nutrition security in a holistic model. For instance, these programs do not only end at closing the knowledge gap between the farmers and the program extension experts through constant training, they also give direct services (89.6%) of the 316 program participants received at least one of the seven services provided free of charge at NECs (see details on the services chapter four). The programs also provide free extension services, and planting and or livestock materials including breeding stock of animals themselves to farmers who have successfully participated in the training and depending on available resources. Ampaire & Rothschild, (2010) in their research on effects of training and facilitation of small landholder livestock farmers in Uganda found out that these trainings are significant but in them alone are not enough to boost production because of poor farmers' resources base necessitating further intervention in terms of supplies of inputs.

The operationalization of the livestock program responds to the recommendations of Ampaire & Rothchild, (2010) for instance, 60 (34.5%) of the 174 households who participated in the livestock trainings reported having received either poultry (layers, kuroiler, ducks), animals (pigs, goats), forage seeds, livestock building materials, livestock water tanks, vaccinations, treatments of their animals, livestock feeds, insemination consultations, marketing services or a combination of these inputs and services. This is only possible with participation in the program's activities. Similarly, 124 (59.1%) of the 210 food secure households participated in agronomy training, further crosstabulations show that 205 (51.8%) of the 396 who cultivated crops in the reference season one of 2017 participated in agronomy training, and 196 household who cultivated

crops in 2017 are part of the 210 food secure households. The program's seed package received by households registered with NECs including but not limited to grain amaranths, soybeans, high iron beans, millet, OFSP vines, collards, eggplants, spring onions, among others helps to boost crop production to increase food availability and accessibility. In related research, Sseguya (2009) found out that households who participated in CSRL/VEDCO food security programs in Kamuli district were more FS than FI and EFI with ratios of 63, 24 and 13 percent respectively.

Whereas agronomy and livestock directly impact food security, participation in receiving services, nutrition and feeding, water, health, hygiene, and sanitation directly impact nutrition security. Food security directly influences nutrition security, and the latter indirectly influence the former. Sickly as for the cases of MAM and SAM among children results into the spending of the meager resources in treatment and more time spent in hospitals to save children's lives. This, in turn, affects garden activities more so the mothers who are the primary cultivators of food crops, caretakers of small livestock as previously referenced. At no cost to the households, the NECs admits at-risk mothers, and malnourished children to receive services especially nutrient-dense porridge to rehabilitate (see chapter three for details). This explains why most of the kwashiorkor cases (protein food related deficiency) and marasmus cases (energy food related deficiency) were found at the NECs.

In this survey, caretakers reported having participated in the program were 292 (70.7%) of the 413, among whom 246, and 46 were direct admits to the NEC for rehabilitation (on nutrient-dense porridge), and Non-NEC participating in NEC programs. Among the infants and children, 458 (75.6%) of the 606 children were from participating households, of whom 397, and 61 were direct admits at the NEC for rehabilitation and 61 were participating in non-rehabilitation programs live livestock, CIGI. Among the graduation category, (515 of the 606 had complete anthropometry

data for analysis) overall, 338 (163 graduates, 175 active) participated in the rehabilitation. Therefore over 75% of the children had one of the three forms of malnutrition. The training on nutrition and feeding prepare the mothers to be able to prepare balanced meals for their other children and to continue feeding to avoid relapses. Given the high proportion of food insecurity, and with re-registration of relapsed children, the program developed the CIGI component to enable mothers to participate in such activities to earn income from local art crafts with a minimum purchase of raw materials. The program is evolving steadily since its inception in 2015. Only 30 clients were surveyed in this program, a cross tabulation shows that 53.3% of the mothers in this program were food secure compared to the 46.7% non-participants.

Literature shows that similar model of nutrition, feeding and agronomy training and practice had earlier worked for the West African country of Mali, Kita district. In the case study, McDermott et al., (2013 pg.670) provide a success story of Health Gardens Approach (HGA) implemented between 2007-2010. Just like Kamuli, the region had high rates of malnutrition, coupled with poor maternal and child care practices. Action Contre la Faim (ACF), adopted and modified the malnutrition framework of UNICEF (1990) and Black et al., (2008), and introduced complementary feeding initiatives like micronutrient supplementation, biofortification in crops, capacity building in agro-food and maternal health care, gender awareness, among others as engines to achieve household food and nutrition security. The Health and Nutrition Gardens initiative was implemented to 1,264 households in 36 villages between 2007 and 2010. In their evaluation research, the results showed an increase in vegetable production by +165 percent and from five to nine months in a year. The HDDS score improved and averaged between 5.3 to 6.6 of 12, this was considered pretty good according to the desert condition of Sahara region. There was an increase in the number of households consuming Vitamin A foods from 59 percent to 99

percent. On capacity building, 88 percent of program beneficiaries proved having gained the dimension of malnutrition and how to deal with it compared to 68 percent non-program clients. This case study depicts the way how the NEC operates its programs, from training in agronomy and nutrition to practice at the center where they have a keyhole, sack, kitchen gardens as demos, and prepare complementary feeding demos to demonstrated how a balanced diet is arranged and cooked right from the center.

The other factor that was significant to the FI category was the conditions of WASH facilities with 19.3% likelihood of being FS than FI. These facilities include kitchens, dish rackers/plate stands, rubbish pits/garbage pits, latrines, bathrooms, and tippy taps. The presence, structural and sanitary condition of these facilities, determine the general health and the rate of predisposition to WASH-related diseases including diarrhea, dysentery, typhoid, malaria all of which have a negative effect on immune systems thus predisposing the household of food and nutrition insecurity. Whereas specific diseases may be tied to a specific WASH facility when all are merged together, the impact is devastating to the household. In this survey, only 55.5% of the overall conditions of the facilities were categorized as good, this situation accounted for the high rate of disease prevalence and was significantly associated with dysentery. Save for the rubbish/garbage pits, the other five facilities are mutually dependent on water in their functionality. Therefore, anything that negatively affects the household water quality impacts the condition of the facilities negatively hence increasing the likelihoods of having a disease outbreak. Water has multiple functions that it serves and related to WASH, it can be for household domestic purposes like cooking, drinking, washing, bathing all of which influence the personal health, hygiene, and sanitation (Pangaribowo et al., 2013). The quality of water available is very paramount in food, nutrition, and health, as Ringler (2010) alludes that polluted water has numerous negative impacts

on the population, and in 2011, the deterioration of water quality in the urban areas of Zimbabwe threatened her FNS status as cholera and typhoid become widespread (WHO, 2011).

The third independent variable significant to FI but not to EFI was household land ownership and accessibility with 74.7% probability of being FS, consistent with the findings of Malual (2014) where households in Lira, Uganda who had more land were more food secure. Land access and ownership were dichotomized into two at ≥3.0 acres against less than 3.0 acres. Survey data shows that an average household owns 3.54 acres with a very wide range between the maximum of 300.0 and a minimum of 0.20 acres. In a comparative study, results show that the district has undergone land shrinkage since 2004 where the Kamuli District Administration (KDA) found out that the land average was 4.94 acres (KDA, 2004). Sseguya (2009) found out that 50% of the households owned ≤2.5 acres, and this survey has established that those owning ≤2.5 acres are 42.5%. The implication on lack of access (4.6% of 454 had no access) to land coupled with those a small land acreage depicted by the average of modal acreages limits the output. There is a clear constraint on the side of the households in terms of planning on how to allocate the land for the multiple crops (97.0% of 454 households grew 2-15 of the crops considered in season one of 2017 for this survey). Similar constraints are faced in the balance between crop and livestock integration where 332 of the 396 households who cultivated crops kept at least one of the 10 livestock breeds surveyed in this research. The results were seen with the integration and merge apportioning of land that resulted in some crops being planted but very low yields and others without any yield, for instance, 7 of the 173, 8 of the 242, and 5 of the 108 households who grew grain amaranths, soybean, and millet had zero harvests. This problem coupled with the possibilities of livestock (free range and tethering systems) destroying the crops can help account partially for

the high rate of food insecurity as attested by the 45.4 and 8.4 food insecure and extremely food insecure households.

On the side of EFI households, one of the most significant variables was the number of days of illness of most adult males in the household. This variable exhibited a positive relationship between the likelihood of being FS than EFI with odds of 97.2%. This variable was dichotomized as ≤5 and greater than five days of illness in a month, meaning that a unit increase in the number of days of illness for most household males increases the likelihoods of the household being EFI than FS at a very high rate expressed by the high likelihood odds. It is noted that the health status of the body determines its productivity in terms of food production in this respect, with most of the households (82.2%) being male-headed, and traditionally being considered as the breadwinners, this explains the high odds ratios. WFP (2007) affirms that irrespective of food availability and accessibility by the households, infestation by any kind of disease lessens the appetite for it henceforth affecting utilization as absorption of energy and nutrients are inhibited that in turn leads to poor productivity and death at severe cases. It's further affirmed by UNICEF (1998) that human body health, food, and nutrition are codependent and that this relationship results in a negative vicious circle that the organization describes as:

> *"an individual who does not consume an adequate diet will have a lower capacity to resist infections, which will lead to longer, more severe and more frequent occurrences of sickness that, in turn, lead to a reduced appetite and malabsorption and further worsen the dietary intake" (UNICEF, 1998).*

The second most significant variable to EFI was the households' membership to Burial and festival groups within the community. This variable exhibited a positive relationship between being FS than EFI by the odds of 91.4%. This variable was included because its believed that

social capital has a very significant impact on the households' FNS as significantly alluded by Obaa (2011); Sseguya (2009); Malual (2014) in their findings. Described as a spirit of togetherness, social groups like burial and festivals serve multiple purposes. Woolcock and Narayan (2000) point that one of the coping strategies for food and nutrition insecurity is determined by the households' resource base but goes further to attest that social network plays a very crucial role in providing support depending on its size. These groups in the local settings of Kamuli specifically the burial help members during funnel in the collection of food, firewood, water, and cooking that reduces the expenses of the household in feeding the community during the ceremony hence irrespective of the food security status of the household, the deceased is accorded a descent valediction. Regarding festivals, these are assets builders for the members, festivals follow a reciprocating cycle where members are given home assets ranging from cooking utensils to seating and bedroom items, as well as agricultural tools. These groups exhibit a high level of mutual trust in their operation as the recipients must return an asset equivalent to the value of the asset given to him or her by a fellow member.

Referring to results from the data, other than CSRL/ISU-UP programs, the burials and festivals are the highly belonged to community groups with 255 (65.6%) of the 389 households belonging to groups. In terms of ranking groups as coping strategies for FNS, in the first-choice category, it was voted third (17.2%) after Community VSLA (20.8%), and ISU-UP's NECs (43.2%), and in the second-choice category, voted first (40.1%) as second choice coping strategy. Disaggregating the group's data among the two choice categories, 156 (43.2%), and 81 (20.8%) of 255 bonafide members voted their group in first and second positions respectively. Literature asserts that poor people are more likely to be in groups than the rich (La Ferrara, 2002; Behera and Engel, 2006), this is true since Kamuli was ranked among the poorest districts of Uganda for CSRL

to opt for its sustainable livelihoods strategies in its communities (Butler & Lorna, 2015). Even in India and Bangladesh, Lahiri-Dutt and Samanta, (2006); Pieters et al., (2013) asserts that women in rural communities who are affected by poverty form self-help groups to help each other in periods of shock. Sseguya (2009) found out that households who belonged to food security groups were found to be more food secure than their counterparts in Uganda.

The last variable in the model significant to EFI category was time spent to fetch water for a round trip from the primary water sources of the households. This variable exhibits a positive relationship between being FS than EFI with odds of 70.0%. This variable was dichotomized on less than 30 minutes to greater than 30 minutes for a round trip and 62.6% of the households reported spending less than 30 minutes. The method of collection and the number of jerrycans of water collected for use has implications on the efficiency in households' activities and use of the water. The most used method of collecting water was found to be a combination of bicycles and hand/head (48.7%), followed by hand/head (37.2%), and bicycles alone (14.1%), collecting an average of 4.27 (20-litre-jerricans) per household, with a minimum of two and a maximum of 25 (20-litre-jerricans) of water. With the membership structure of the households surveyed where most of them are infants below five years, and children of school going age, water collection for domestic use becomes the work of the adults or straining the children after school. The distance looks manageable as the average was 0.54kms, with a minimum of 0.001 and a maximum of 5.0kms of one way but doubles for a round trip. This necessitates the use of bicycles. However, the bicycle coverage was limited to 72.4% and given the issues that arise with the frequency of breakdown, and more importantly, the perceived primary role of the bicycle adds more problems to the household. The results of this scenario are poor hygiene and sanitation resulting in a wide spread of WASH-related diseases, a situation which is already prevailing in this survey.

However, it's a great achievement to have a reduction in time taken for a round trip compared to the national average found out by Uganda Demographic and Health Survey (UDHS) and reported by UBOS where 55.0% of rural dwellers are reported having spent more than 30 minutes to fetch water for a round trip (UBOS and ICF, 2018), whereas the surveys data is reporting 38.2% for the same time in Kamuli district. In this case, the CSRL/ISU-UP through the NECs program of extending water to communities to serve the satellite centers that require large volumes of water daily to cook the porridge and maintain hygiene and sanitation of the WASH facilities and utensils at the centers as well these boreholes serving the entire community and schools is very significant. Similarly, each of the programs' Community-Based Nutrition Trainers (CBNTs) and Community Based Animal Health Workers (CBAHWs) are given bicycles as a means of transport that serves multiple purposes, hence increasing the asset base and more importantly contributing to a reduction in time spent to fetch water.

CHAPTER 6: CONCLUSION, RECOMMENDATIONS, AND FUTURE RESEARCH

6.1 General Conclusions

Several efforts have been advanced in by the government of Uganda with a focus to curtail the problem of food and nutrition insecurity, and poverty that had a long history right from the periods of political turmoil barely five years after independence. The confusion and anarchy that prevailed in Uganda severed the peace till the late 1980s when the country changed government and peace has since prevailed. During settlement, in 1992 the government received the relief from the World Bank following the adopting for the SAPs (Anderson, Feder & Ganguly, 2006), and the country registered a six percent growth per year during the first seven years (Kreimer, 200; Sharer, 1995). However, this growth did not translate into economic independence, and by 1996 the country was ranked among the Highly Indebted Poor Countries (HIPCs) that necessitated a new wave action by the World Bank for debt relief (World Bank, 1996 and 2018).

As a requirement for a debt waiver, a Poverty Reduction Strategy Paper (PRSP) in the names Poverty Eradication Action Plan (PEAP) was drafted, and a 20 years contract with World Bank was entered with the government between 1997-2017 which has been the engine of most her development efforts (MFPED, 2000, and 2001a). The broad PEAP had a sub-component of Plan for Modernization of Agriculture (PMA), that was aimed at steering the transformation of a small-scale substance into large-scale commercial agriculture (MAAIF and MFPED, 2000, p. 27). The PMA and the Ministry of Agriculture translated the goals of agriculture transformation through co-funded body between the private, government and the farmers called the National Agriculture Advisory Services (NAADS) whose model of operation was through "farmer to farmer" group formation at the village level in service delivery that officially began its operations in 2001. In the

same year of 2001, the comprehensive Uganda Food and Nutrition Policy was completed and approved in 2003 but was operationalized in 2007 to work for 10 years till 2017.

However, the initial programs (NAADS) did not achieve much in the first five years as illustrated in the evaluation report released by Oxford Policy Management (OPM) that pointed out three outliers that were under looked in its operationalization including poverty, gender, and environment (OPM, 2005). The country remained indebted with escalating levels of food and nutrition insecurity and poverty that further necessitated intervention by the international NGOs. One such intervention was the "Tapping philanthropy for development", an initiative launched in 2004 to help the poorest of the poor in the country (Butler and McMillan, 2015). Specifically, in Kamuli District, this initiative involved a tripartite partnership between Iowa State University (ISU) through its Center for Sustainable Rural Livelihoods (CSRL), Makerere University (MUK), and a local Non-Government Organization (NGO) known as Volunteer Efforts for Development Concerns [VEDCO] (Butler and McMillan, 2015). The operational areas of the partnership saw a change in livelihoods and a shift in the food security status from 9 percent in 2005, to 53.7 percent by 2009 (Sseguya and Masinde, 2005; and Sseguya, 2009) respectively.

In 2014 after CSRL severed its relationship with VEDCO in 2013 but continued its relations with MUK, embarked on a comprehensive action against hunger using a Field-Tested, Comprehensive Life-Span Approach to Capacity development that touches the lives of all people of all ages from childhood under its newly registered NGO – Iowa State University Uganda Program (unlike the first model of farmer-farmer group formation). By 2015, the food security of the area had further improved to 61.1 Percent.

The goal of this study was to establish whether participation in the training and service programs of the CSRL/ISU-UP Nutrition Education Centers' food and nutrition activities improve

the households' food and nutrition security status. Specifically explored three categories of client participants as; a participant who are NEC clients, participants who are Non-NEC clients, and Non-participants who are Non-NEC clients. Established the characteristics of these households as they are believed to influence their food and nutrition status, and their participation in the programs as well. We then examined the kind of food and nutrition activities of the NECs and their association with the food and nutrition outcomes. We measured food security on using three scales; the HFIAS, HDDS, and FCS, and nutrition security of primary caretakers, and infants and children that were then compared among the three categories of participants. Overall participation in the program activities was then used to run the multinomial regression in conjunction with the household characteristics to ascertain what factors significantly influence and distinguish food secure from insecure and extremely insecure households. We further merged the participants affiliated with the program to determine their food and nutrition security statistical differences from the Non-program program participants to ascertain the contribution of the program. Finally compared the overall status irrespective of household affiliation to the program between the baseline data of 2015 and the survey of 2018 to determine the improvements and their statistical significance.

On the HFIAS scale, we found out that participants who are Non-NEC clients were more food secure and significantly different from/than NEC and Non-participants who are Non-NEC clients, and the also found out that former and the latter were food insecure and had no statistical differences among themselves. On the overall, all participants in the NEC activities were more food secure and statistically different for the Non-participants who are Non-NEC clients. We further found out a reduction in the overall number of households who were food secure between the baseline data of 2015 and the survey data of 2018 irrespective of their affiliation to the program,

but these differences were not statistically significant. In a similar manner, merging all households as one irrespective of their affiliation to the program, they all fall in the food insecure category.

On the HDDS scale, we found out that participants who are Non-NEC clients had a more diversified diet in their households statistically significant and different from the Non-participants who are Non-NEC clients, but not different from the NEC clients. And whereas the NEC clients were the same as Non-NEC participant clients by the statistical score, the former is not any different from the Non-participant who are Non-NEC clients. On the overall, all NEC participants had more diversified diets and were statistically different from the Non-Participant who are Non-NEC clients. And between the baseline of 2015 and the survey of 2018, there was a general increase in dietary diversity score, but this was not statistically significant. Summing up all households irrespective of their affiliation to the program, they all fall with the average dietary diversity category on the scale.

On the FCS scale, the Non-NEC participant clients had a higher caloric intake and classified in the acceptable category, but where not statistically different from the NEC clients who were in the borderline category. However, the former and the later were both significantly different from the Non-participants who are Non-NEC clients. On the overall, all NEC activities participants had a better caloric intake in their diets than the Non-participants who are Non-NEC clients, and this was statistically significant. To compare the baseline of 2015 and the survey of 2018, there was an increase in caloric intake, but this difference was tested and did not yield statistical significance. However, all households in sum irrespective of their affiliation to the program, fall within the borderline category of the FCS scale.

As per nutrition and health status of caretakers, all were health irrespective of their affiliation to the NEC program, however, the NEC clients were below the overall mean, Non-NEC

who are participants were just within the overall mean, and the Non-participants who are Non-NEC were above the overall mean. In trying to determine the direction, it may be assumed that those below and above were tending to underweight and overweight respectively. However, the proportion of health caretakers among the NEC and Non-participants was equal and higher than Non-NEC who are participants. There were more underweight caretakers among the NEC clients, where the other two participants had almost equal proportions. There were more overweight caretakers among the Non-NEC who are participants, and Non-participants who are Non-NEC clients. A comparison with the baselines shows that there were improvements in the health of caretakers but was not statistically significant.

We found an association between underweight and age at first pregnancy of the mother. The NEC clients and Non-participants had the lowest age below the overall mean and were more likely to be underweight, and both showed statistically significant differences from Non-NEC who are participants. We also found out that education of the caretaker had significant differences in the NEC clients had a few years of formal education than the other categories and this could probably account for the high rates of underweight among the NEC clients. Literature has shown that education determines the economic status, the kind of job and so does the income, as well, well-educated caretakers can be able to have better-planned diets for their households taking into consideration the principles of a balanced diet.

Among infants and children, stunting (37.1%) was the most severe form of undernutrition, and males were more affected than the girls. It's also found that it increases with age and peaks at 24-35 months and remains high. Non-participants had a high proportion of stunted children, followed by NEC clients, and Non-NEC who are participants had the least. Among the graduation category, we found out that graduated children at the NEC where more stunted, followed by

children who have been to the NEC, and those who are active were less affected. We found significant associations between nutrition health of caretakers and that of children, the stunted children were significantly associated with underweight caretakers.

For underweight, this was found out to be the second severe form of undernutrition (22.7%) and affected more females than males. It was also found to increase with age and peaked at 36-47 months and significantly lowered afterward. Underweight cases were more among the Non-participants in the NEC, followed by NEC clients and Non-NEC who are participants had the least effect. Among the graduation category, we found out that the active NEC children were more affected, followed by those who never attended the NEC while the graduated were least affected. Just like stunting, underweight caretakers were significantly associated with underweight children.

With Wasting, it was found to be the least severe case of undernutrition (16.7%), affecting more males significantly than the females. Wasting unlike stunting and underweight, it started high and lowered with age, then increased (36-47 months) and lowered. Among participants, it was found highest among the Non-NEC who are participants, followed by NEC clients, and least affected the Non-participants. Those in the graduation category, it was more severe among the active children at the NEC, followed by the graduates and lest with Non-NEC children.

Upon constructing one overall undernutrition index; merging stunting, underweight and wasting together, Children who had all the three cases were 26.8% terms as Severely Acutely Malnourished (SAM), those who had two cases were 16.7% termed as Moderately, Acutely Malnourished (MAM), those who had one case were 5.4% termed as mildly/marginally malnourished, and all together all forms of malnutrition accounted for 48.9% and the Health children were 51.1%. Therefore, we found out more healthy children than malnourished though there were no statistically significant differences among them.

By gender, an equal proportion of males and females under SAM, more females were categorized as MAM, more males under marginal, and among all forms of malnutrition, males were more undernourished, and females were more health. By age group, most severe were 0-5 month, followed by 48-60 months, we found more MAM cases under 36-47 months, more marginal cases under same age group, the group most affected with all form was 0-5, and 24-35 month respectively, whereas 6-11 were more health. By participation, Non-NEC clients had more SAM cases, Non-participants had more MAM cases, NEC clients had more marginal cases, and Non-participants had most of all forms of undernutrition, whereas Non-NEC clients were more health, followed by NEC clients' children. By graduation category, SAM cases were more found under the graduates, active children at the NEC had more MAM, the former also had more marginal cases, and active children at the NEC had most of all the forms of undernutrition while those who have never attended to the NEC had most of the health followed by Non-NEC clients but not significantly different.

Overall participation showed that close to 7 in 10 (69.6%) of the households participated in the activities of the NECs, with most households among the participants categories (as either NEC or Non-NEC clients) receiving services, WASH programs, nutrition and feeding, agronomy, livestock, and income innovations programs in that descending order. Non-NEC clients were significantly likely to participate in livestock programs than NEC clients. Whereas the latter were more likely to participate in receiving services, WASH and nutrition, and feeding than the former. We found no significant association with agronomy and income innovations, but NEC clients participated in both more than Non-NEC clients. Further, by a number of programs, NEC clients were more likely to participate in ≥2 programs compared to Non-NEC clients.

By program beginning with livestock training, it was the fifth most participated in a program of the six programs surveyed. Almost three-quarters of the participants trained for ≥3 modules of the seven considered in this survey since 2014. By attending, over three quarters categorized as fair attendees in the livestock integration programs. In terms of quality of attendance, three quarters were within and above average. We found significant differences in the quality of attendance in that participant classified as good attendees were more likely to do better in the assessment of quality than the average and fair, whereas the former and the latter showed no significant differences.

We found significant associations between participation in livestock integration with food security, participants were more likely to be food secure (HFIAS), with better dietary diversity scores (HDDS), and high caloric intake (FCS) based on those respective food security measurement scales. Whereas no significant association was established with nutrition health of caretakers and children, participants had fewer cases of underweight and overweight, however, we found more cases of malnourished among participants suggesting further intervention within the children's health. In terms of income from sales, participants were found to be more likely to have more sales and more income than Non-participants involved in livestock production. Also, the former were more associated with small livestock breeds probably because they are promoted by the program they are associated with than Non-participants in the livestock programs.

With agronomy and postharvest technology training programs, these were the fourth most participated in a program of the six. Over 90 percent of participants trained for over three modules of the seven tracked since 2014. By attending, the majority of the attendees were classified as fair, and with the quality of participation, over 90 percent were categorized as above average having responded correctly to most of the assessment questions. There were no significant differences in

the quality of assessment since most of them had excellent scores. We found an association between participation in agronomy and have at least one of the three vegetable gardens including keyhole, kitchen and sack gardens locked within the vicinity. These gardens are sources of food and help increase consumption of micronutrients, in addition to reducing expenses in purchasing vegetables from the market. Also, participants were more likely to have cultivated crops in the first season of 2017, that was used in the survey as a reference season in the assessment of food production, sales, and practices of postharvest technologies all which influence food security.

We established a significant association between participation in the agronomy programs and food and nutrition security. Participants were found likely to be more food secure (HFIAS), better dietary diversity scores (HDDS), high caloric intake (FCS) on those respective scales, and with fewer malnutrition cases among their children. Although not significant statistically, we found out that participants had fewer cases of underweight and overweight among caretakers. With income, participants were established having had more sales income than Non-participants in the training and were also associated with better grain storage and drying technologies.

Participation in nutrition and feeding training programs were the third most participated in among the six programs with over three-quarters of the NEC activities participants. Over 90 percent of them trained for above the average number of modules. Over three-quarters of the participants were classified as very good attendees. This could probably be due to a high level of malnutrition linked to poor feeding mechanisms which are not the case with agronomy and livestock by the assumption that the farmers are aware of what to because of being traditionally cultivators. With the quality of participation, over 90 percent were above average, and we observed significant differences among them where those who attended more time above average were likely to do better in the assessment than the average and fair group. We established a significant

association between participation and food security measures by the FCS scale, participants were more likely to have a better caloric intake in their diets than Non-participants. This was a positive result since the training aimed at passing on the knowledge from experts on how to mix the available foodstuffs to make a balanced diet that could help reduces the cases of food-related malnutrition.

Participation in WASH training activities was the second most participated in the program of the NEC with all modules trained by over 80 percent of the participants. Over three-quarters of attendees trained for at least above the average number of modules, similarly categorized as very good attendees by attendance. By quality, all categorized as above average with no difference established. The was an association between the number of WASH facilities and participation in WASH training, participants were likely to have at least four of the six facilities tracked in this survey including kitchens, dish rackers/plate stands, rubbish pits/garbage bins, latrines, tippy taps, and or bathrooms. This is result depicting the impact of training and monitoring by the CBNTs. We also significantly established that participants were less likely to experience the occurrence of dysentery which is a WASH-related disease owing to lack of and poor maintenance of facilities. We finally found out that participants in WASH training had a better caloric intake, this is because food and nutrition security cannot be achieved with living in a healthy environment. WASH facilities are an integral part of the food utilization component that defines food nutrition security. Better health environment leads to better productivity of the members of the household with fewer risks of acquiring diseases related to WASH among others.

Participating in receiving services at the NECs was the first most participated in the activity and partly defines the role of the NEC as a rehabilitation center for undernourished cases of children and at-risk caretakers including expectant and breastfeeding mothers. At least three-

quarters of the service receivers were above average as per the number of services received. Regarding a number of times received the services since 2014, the majority had were categorized as very good receivers. As expected, there were more nutrition-related disease cases at the centers including kwashiorkor and marasmus undergoing rehabilitation than Non-participants. Also, there were more undernutrition cases of underweight among caretakers, more underweight and wasted children, and less with stunted cases at the centers undergoing similar rehabilitation. The graduated children exhibited fewer cases of underweight, but was highest in cases of stuntedness, and second among the wasted. Overall, any case of undernutrition among the graduates means the child underwent a relapse after completion of the rehabilitation program and being graduated a healthy child with completed health-related anthropometric attributed. This calls for an affirmative action between the program and the graduates to reduce the incidences of fallback.

Participation in income innovations was the sixth and least participated in the program of the centers. Born out the need to expand income sources among graduate mothers, this activity was found to be steadily growing, involving training clients using raw materials within their vicinity, employing their artwork in designing and making product boosted by the training and marketing of their products. Multiple skills under each category of products including palm leaves, beads, raffias, sewing machine, and soap making. Nearly 50 percent of participants had learned at least three skills in broad category-meaning more sub-skills are embedded under each product from raw material preparation to design and making a various product for instance under beads products included making-of bangles, bracelets, necklaces, and purses.

On the multinomial regression analysis, factors that distinguish and positively influence the household's food security included; households' keeping of livestock, and a number of meals eaten by the households during periods of scarcity significantly distinguish Food Insecure from

Extremely Food Insecure by varying likelihood odds of being Food Secure. Livestock keeping was associated with food secure, good diets, and high caloric intake households, as well as high sales revenue. Most important here is the caloric intake, the more animal protein source products consumed, the better the households' diets and better households' overall health. Given the fact already established from the survey and the literature, animal products are normally bought and hence less accessible to rural poor like the surveyed households by their lower income levels. Similarly, a number of meals consumed determine the households' productivity and health, with more meals equating to a healthy and productive population than hungry. Livestock production has an association here in that, production from animals is continuous than seasonal which is the case for crops.

The variables that were significant to Food Insecure but not to Extremely Food Insecure were; participation in the NECs activities, conditions of the water, sanitation, and hygiene (WASH) facilities and households' access to land. As already summarized earlier, different components of the program had significant associations with food security, disease, and WASH facilities. For instance, participation in livestock had positive associations with households being food secure, with diverse diets and better caloric intake, agronomy too had similar associations in addition to influencing nutrition security of children among other programs. WASH conditions determine the rate of predisposition to diseases. In this survey, just above 50 percent of the facilities were found to be in good health and structural condition, this helped to account for the high rate of diseases occurring in one month prior to the survey. Those who had good facilities were more health and nutritionally secure. And for land, this determines the number of acreages apportioned to crop and animal integration programs that influence food production and hence food and nutrition security.

Finally, the variables that were found to be significant to extremely food insecure but not to food insecure was the number of days of illness of most adult males, household membership to burial and festivals, and time is taken to fetch water from the primary source for around trip. The days of illness determines household members' productivity in agriculture which was found to be the main economic activity, and as well illness increases the cost of the meager resources could be used in production given the high levels of food insecurity in ate community. For a social network, research has proved over time that membership to food security groups and community groups increases the social capital, access to resources and credit that all contribute to household's welfare. Whereas time taken to fetch water determines how much time is allocated to other primary activities like garden work, housework including care for children. Also determines how much water can be collected for household use relating to domestic, animal, and crop all of which have influence in food and nutrition security of the households.

6.2 Recommendations for Program Improvement

The recommendations provided here are based on the gaps established in the findings and are linked to the program considered at the NECs that all influence the operational success of the centers in curtailing the long-term food and nutrition insecurities that exist in rural Kamuli.

Participatory planning involving community and local leaders, cultural and government officials in design of activities, and decision making to strengthen implementation, monitoring and evaluation. This model of planning will exhibit a shared responsibility between the program, and community and government that is likely to ease the implementation and participatory monitoring and evaluation of the program.

In the agronomy and postharvest technology training programs, the households were found to be faced with limited land acreages across all which they must apportion the different crops and

animal integrated together. The idea of having kitchen, sack, and or keyhole gardens was positively associated with food and nutrition security. However, the coverage of these intensive vegetable garden was found to be low among the households irrespective of their affiliation to the program. This supposes that there need to improve monitoring and enforcing having these gardens for their perceived benefits have been tested right. Similarly, the reference season one of 2017 saw many households growing crops and ending harvesting too little or to none for some crops though there were a few exceptional cases. Cited challenges were limited access to improved seed of staple crops, and farmers who wished to sell presented a challenge of the limited market. This can also be a gap to explore to help farmers access improved seed varieties of staple crops and link them to better buyers and reduce exploitation from middlemen. This will encourage them to produce more that will, in turn, improve food availability, accessibility and income. The postharvest section needs to intensify their action on encouraging farmers to buy and use recommended drying and storage facilities like silos. The few established were linked to the program, but their proportion was still very low. As production increases with time, the program should help farmers explore the options of value addition to increase the shelf life and unit price of the products.

The keeping and consumption of animal source proteins had positive associations with food security and income. The data revealed more association of participants who are Non-NEC members being more involved in production than the group of NEC members who are in the rehabilitation program with diseases related to protein deficiency. Similarly, the participants in the training had a higher proportion of more than twice those reached by the livestock program suggesting that more farmers are willing to join production but are constrained by start-up capital. This therefore requires expanding microfinance project to increase livestock distribution and continue to empower households in records keeping involving production and sales. Also, program

needs to encourage households during training to start with locally available breeds and break the waiting syndrome to be provisioned by the program which cannot reach everybody. The program's roll-on project needs to be intensified as it was rarely mentioned in the findings despite being asked among the livestock beneficiaries to help intensify the coverage in addition to provisions from the program.

There were gaps established related to WASH programs both in possession and general condition of the facilities. Irrespective of the household affiliations, just above half of the facilities were in good conditions that accounted for over 90 percent for households reporting WASH-related disease a month prior to the survey. More efforts in monitoring to ensure trained and participants in the program have the facilities in place, more coordination with the Water User Committees, and district department of health and community development can greatly make more partnerships for a common cause. The partnership of the program with other NGOs who are promoting the supply of water in the communities. Such a synergy can help improve the WASH facilities possession and condition.

Expansion of the income innovations program, though it did not have any significant association with any food or nutrition security indicator, the participants in this program had more food secure than non-participants and had more income accruing from their sales. Participation in the program was affected by the vicinity of clients to the venue, given time let the program be spread to the NEC centers or other suitable places the program would find better to involve more clients and expand the market search and products being made to relatively match the market.

Participation in health-related training, there is a need for more collaboration with health workers, Village Health Trainers to educate and encourage households to adopt improved maternity practices and monitoring of children. The survey revealed that that number antenatal

visits reduce with an increase in the number of children born to same mother (with reference to the last four children born to the same mother). Also encourages child spacing and family planning as well as limiting the number of children born. The dependency ratio was high given the low food and nutrition security, the burden of undernutrition was found to be shifted to the NEC services for rehabilitation as an association was established between membership to NEC as a component of CSRL/ISU-UP with several children of 0-59 months.

For children's health, the program has done well in rehabilitating and weaning them but there are high rates of fall back. The relapses are high sometimes surpassing the numbers in the rehabilitation center on some undernutrition indices suggesting a need for collaboration in the monitoring of the graduates between the program and the government through its VHTs. Also study the environment of the clients before weaning them and review the weaning requirements. More relapses means reviewing the program design in graduation, and undermine the program achievements, increases the costs and limit the expansion and sustainability as well increasing reliance on of the households on the program.

The proportion of severe cases of undernutrition were many and when merged (participant Non-NEC client and Non-participants) they double the number of NEC clients. This suggests that malnutrition that was existing by the survey was so alarming and within the operational areas of the program. This suggests a need for the program to expand within its operational areas probably the affected households have limitations with distance to reach the rehabilitation centers given the lack of transport means and poor weather roads.

6.3 Areas of Future Research

This research explored the impact of participation in food and nutrition security training programs, various dimensions of participation and quality. Further research needs to be conducted to explore the effectiveness of delivery of the trainings, selection criteria for the training modules, establish a link between the training and community needs, and monitoring methods as it could be affecting the implementation of the learned lessons by the members.

Research need to be done to ascertain more appropriate requirements necessary for graduation. This could involve time series data analysis of the caretaker and children's anthropometrics, and their household food security status over the time spent at the rehabilitation centers.

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APPENDIX 1: SURVEY INSTRUMENT

Impact of a Sustainable Rural Livelihoods Program on Food and Nutrition Security of Smallholder farmers in Kamuli district, Uganda 2018

- A consent and/or assent forms is provided to participant. (YES, NO).
- If participant agrees (YES) to take part in the survey, s/he is not expected to sign the consent form
- Proceed with survey if participant agrees to take part
- If the participant does not agree (NO) to take part in the survey, the survey is stopped.
- All respondents MUST be over 18 years of age

IDENTIFICATION PARTICULARS

Date of interview		Name of interviewer	
Name of Parish/Division		Village/Zone/Ward	
Questionnaire No.		**Questionnaire ID**	

Parish codes:

1=Naluwoli, 2=Naibowa, 3=Namasagali, 4=Bugeywa, 5=Bwiiza, 6=Kasozi, 7=Kisaikye, 8=Butansi

SECTION A: HOUSEHOLD PROFILE

1. Gender of Household Head ……. [1=Female, 2=Male]
2. Marital Status of Household Head ……..…. [1=Single never married, 2=Married (monogamous), 3=Married Polygamous (if female rank of wife…….), 4=Separated or divorced, 5=Widowed]
3. Age of household head in years……. Write date of birth (request for ID) ……/. ….. /…..…..
4. Main occupation of household head **(choose one)** …….
   [1=Farmer, 2=Teacher, 3=Driver, 4=Traditional Doctor, 5=Shopkeeper, 6=Boda-boda rider, 7=Mechanic, 8=Carpentry, 9=Tailor, 10=Builder, 11=Trader, 12=Clinical Doctor, 13=Fisherman, 14=Cook, 15=Chapatti maker, 16=Askari, 17=Doctor, 18=Butcherman, 19=Police, 20=Market vender]
5. Number of years lived in this community……Year settled here ……
6. Ethnicity……
   [1=Musoga, 2=Muganda, 3=Munyoro, 4=Mugisu, 5=Luo, 6=Iteso, 7=Banyara, 8=Baluri, 9=Langi, 10=Basamya, 11=Japadora]
7. Religion…….
   [1=Anglican, 2=Catholic, 3=Muslim, 4=SD Adventist, 5=Born Again, 6=African traditional, 7=Noa]
8. Where does the household head live?.....
   [1=In this village, 2=Kamuli, 3=Jinja, 4=Kampala, 5=Outside Uganda, 6=Buyende, 7=Mukono, 8=Luwero]
9. Relation of respondent to the Household Head…….

[1=Self, 2=Spouse, 3=Sibling, 4=Child, 5=Parent, 6=Grandparent]

10. Membership to any organization or affiliated to ISUUP? …… **0=No, 1=Yes**, if yes, which one(s)? see table

Group type	Name(s) of group	Status/role of household in the group. 1=Member, 2=Executive committee member, 3=Other	Of these, which two are most important to household food security
ISUUP group			
Other farmers' group			
Credit & savings group (VSLA)			
Religious/spiritual group			
Cultural group (e.g. arts, drama,)			
Burial or festivals group			
Marketing group/association			
Other (specify			

Codes for ISUUP groups – column-2:
[1=Nutrition Education Center-NECs, 2=ISU Tusubira Craft, 3=Livestock, 4=Youth Entrepreneurship Program-YEP]
Codes for ISUUP groups on food security – column-4:
[1=Nutrition Education Center-NEC, 2=ISU Tusubira Craft, 3=ISU Tusubira VSLA, 4=Livestock, 5=Youth Entrepreneurship Program-YEP]
Code for all group names – column-2 and 4:
[1=NECs, 2=ISU Tusubira Craft, 3=ISU Tusubira VSLA, 4=ISU Livestock, 5=YEP, 6=Other farmer groups, 7=Credit and Savings groups/VSLA, 8=Religious groups, 9=Cultural groups, 10=Burial & Festival groups, 11=Marketing groups, 12=Other community groups-Disabled]

11. Number of people living in the household

Age group	**Male**	**Female**	**Total**
0-2 years			
3-5 years			
6-17 years			
18-35 years			
36-59 years			
60+ Years			
Total			

12. Education level* (class completed) of ….

(a) HH head	(b) Spouse	(c) Most male adults (>18yrs)	(d) Most female Adults (>18yrs)

(e) If you have children of school going age, do all of them attend school? ……

[0=No, 1=Yes, 999=N/A]

13 Compared to the rest of the people in this village, do you consider yourself …
_____1. Poorer than most others?
_____2. Like most others?
_____3. Richer than most others?

14 Do you consider your household to be …?
_____1. Always food insecure (Not having enough to eat for more than six months)?
_____2. Sometimes food insecure (Not having enough to eat for at least one month but less than six

months)?
_____3. Food secure (Having enough to eat throughout the year)

SECTION B: WATER ACCESSIBILTY

15 Do you get water from the borehole?..... [0=No, 1=Yes]

16 If yes, who sunk the borehole?... **(choose all applicable)**.
[1=Government, 2=CSRL/VEDCO/ISUUP, 3=Well of Jesus, 4=Egypt-Uganda Cooperation, 5=Mosque, 6=Individual person, 7=Child fund, 8=Plan International, 9=I don't know, 10=Others]

17 What are your main sources of water for both domestic and agricultural use?

17. Water source **1.Primary. 2. Secondary**	0=No 1=Yes	**17.a.** Distance from Home in Km (round trip)	**17.b.** Time taken to collect water from source in minutes (round trip)	**17.c.** Cooking **0. No 1. Yes**	**17.d.** Drinking **0. No 1. Yes**	**17.e.** Bathing and other hygiene practices/ Washing cloths **0. No 1. Yes**	**17.f.** Livestock **0. No 1. Yes**	**17.g.** Agriculture/ Irrigation **0. No 1. Yes**	**17.i.** State the year you began using this source
Protected boreholes									
Unprotected borehole									
Cistern at the borehole									
Protected Shallow well									
Unprotected Shallow well									
Protected spring									
Unprotected spring									
Rain catchment (installed water tank)									
Rain catchment (temporary containers)									
Surface water (river, ponds, dam, canals)									
Others, specify……									

18 Have you stopped using any water source within the past 15 years? …… **[0=NO, 1=YES, 999=N/A]**

19 If Yes, what was the reason? **(choose all applicable). [1**=Source was far, **2**=Source was not clean, **3=**Source became contaminated, **4**=Source did not taste good 5=Source dried up, **6**=We received a closer source, **7**=Others specify…….]

20 Is your source of water shared with animals? ……. [**0. NO, 1. YES, 999. N/A]**

21 Who collects water for household use? Responses (0=no, 1=Yes, 999=N/A)

Person responsible	Cooking	Drinking	Washing	Bathing and other hygiene practices	Livestock	Agriculture
Men (18 and older)						
Women (18 and older)						
Boys						
Girls						

22 On average how many jerrycans (20liters) of water does your household use per day? ……..

23 What means of transport does your household use to collect water from the source? **(choose all applicable)**. [**1**=Bicycles, **2**=Hand/Head, **3**=Both]

SECTION C: Morbidity/mortality (Diseases)

24 In the **last one month** has anyone in the family had any of the following disease(s)? [**0=No, 1=Yes]**

Disease	**Age of Patient-1 ……...**	**Age of Patient-2 ……...**	**Age of Patient-3 ……**	**Age of Patient-4 ……...**	**Age of Patient-5 ……...**	**Age of Patient-6 ……...**	**Age of patient if they died**
Diarrhea							
Malaria							
Dysentery							
Upper respiratory/Cough							
Skin diseases							
Others, specify……							

25 What do you do when someone falls sick with or any of these diseases?

Disease	**Buy medicine**	**Give ORS**	**Go to Health center or VHT**	**Go to Mulago or Lubaga**	**Go to a hospital in Jinja**	**Give herbal medicine**	**Go to traditional Healer**	**Do Nothing**	**Others specify**
Diarrhea									
Malaria									
Dysentery									
Upper respiratory tract infection /Cough									
Skin diseases									
Others specify									

26 If a child **has ever** suffered from diarrhea did you ……[**1**=Stop feeding, **2**=Continue feeding]

27 Average number of days of illness for

Adult Males	Adult Females	Males 10-17	Females 10-17	Males 6-9	Females 6-9	Males under 6	Females under 6

SECTION D: MEASURES OF FOOD SECURITY

28 Do you own the house you live in?.....
[0=No, 1=Yes]

29 If NO, what is the ownership?.....
[1=Rented-Landlord, 2=My father, 3=My grandfather, 4=My mother, 5=My grandmother, 6=My sister, 7=My brother]

30 Observe the housing and indicate 0. No or 1. Yes. If there is no kitchen just indicate here NO KITCHEN;

Housing Questions	**Coding categories**	**Structure-1 (Main house)**	**Structure-2 (Kitchen)**
Type of walls **0. No, 1. Yes**	1. Brick walls (plain)		
	2. Brick walls (plastered)		
	3. Brick walls (plastered & painted)		
	4. Mud poles		
Type of roof **0. No, 1. Yes**	1. Iron sheet roof (good)		
	2. Iron sheet roof (very good)		
	3. Iron sheet roof (dilapidated)		
	4. Grass thatched roof		
Type of floor **0. No, 1. Yes**	1. Cement floor		
	2. Rammed earth floor		

31 What is the main source of fuel/heating for the household? **Choose all applicable**:
[1=Firewood, 2=Charcoal, 3=Crop residues, 4=Manure, 5=Other Specify……]

32 What is the main source of lighting/heating for the household? **Choose all applicable**:
[1=Kerosene, 2=Solar, 3=Hydro power, 4=Battery, 5=Other Specify……]

33 How many of each of the following ***Agricultural Implements*** do you possess?
Hoe__, Panga__, Rake__, Spade__, Axe __, Slasher__, Sickle__, Wheelbarrow__, Ox-Plough__

34 How many of each of the following ***Home Items*** do you possess?
Radio__, Watch__, Clock__, Bicycle __, Mobile Phones _, TV__, Motorcycle__, Motor Vehicle__

35 a). Livestock kept before and since **2014, [0=No, 1=Yes]**

Livestock kept	Total number of kept			Animal & product sales		Livestock program (Loan or roll on)		
	Before ISUUP	After ISUUP	Ass. ISUUP	Total sold	Total revenue	Loan amount	Loan paid	Total rolled on
Cattle (local)								
Cattle (exotic)								
Goats (local)								
Goats (exotic)								
Pigs								
Chicken (local)								
Chicken (layers)								
Chicken (broilers)								
Kuroiler chicken								
Ducks								
Others specify…								

b). Did you stop rearing any of the livestock you received from ISUUP? ……. [**0=No, 1=Yes]**

c). If yes, what was the reason for stopping? (**choose all applicable**)
[1=Water, 2=Soil fertility, 3=Feeding, 4=Pests (Specify), 5=Diseases (specify), 6=Markets, 7=Land issues, 8=Theft, 9=Loan issues]

36 Which other livestock input and services did you obtain from ISUUP? (**choose all applicable**)
[1=Forage seeds, 2=Water tank, 3=Water pump, 4=Building materials, 5=Vaccinations, 6=Treatments, 7=Artificial Insemination services]

37 a). Which of the following livestock trainings did you participate in?

Training participated in	**Times attended since 2014**
Exotic chicken management	
Local chicken management	
Piggery management	
Goat management	
Forage management	
Feeding and feed formulation	
Marketing of livestock	
Others (specify)……	

b). Basing on what you learnt in the livestock trainings, provide the most suitable response

Question	**Response**	**Score**
i) When does a layer chicken start laying?		
ii) What are some of the litter management practices?		
iii) Why do we vaccinate our birds?		
iv) How many months does a pig (gilt) take to go on heat for the first time		
v) What are some of the management practices for pigs?		
vi) How long is the gestation period of a goat?		

38 The following statements are about the food eaten in your household in the **past month (four weeks)**, and whether you were able to have or afford the food you needed.

[*Codes for part a:* **0. No 1. Yes**

Response categories for subsequent questions – part b: **1=Rarely** (once or twice in the past four weeks); **2=Sometimes** (three to ten times in the past four weeks); **3=Often** (more than ten times in the past four weeks). **999=N/A**

Questions referring to Respondent and/or Other Adults in the Household		**Code**
During the last four weeks (one month), because of lack of money or other resources…		
38.1a	Did you worry that your household would not have enough food?	
38.1b	How often did this happen?	
38.2a	Were you or any household member not able to eat the kinds of foods you preferred?	
38.2b	How often did this happen?	
38.3a	Did you or any household member have to eat a limited variety of foods?	
38.3b	How often did this happen?	
38.4a	Did you or any household member have to eat some foods that you really did not want to eat?	
38.4b	How often did this happen?	
38.5a	Did you or any household member have to eat a smaller meal than you felt you needed?	
38.5b	How often did this happen?	
38.6a	Did you or any other household member have to eat fewer meals in a day?	
38.6b	How often did this happen?	
38.7a	Was there ever no food to eat of any kind in your household?	
38.7b	How often did this happen?	
38.8a	Did you or any household member go to sleep at night hungry because there was not enough food?	
38.8b	How often did this happen?	
38.9a	Did you or any household member go a whole day and night without eating anything because there was not enough food?	
38.9b	How often did this happen?	
38.10–.15 Refer to the household's experience of feeding children living in the household who are under 5 years of a Do *not* ask if the household does not have any children under 5 years of age living there. ***** Codes for 38.10-. 15:** [*Codes:* **0. No 1. Yes,** for first part (a) and for second part (b) use: **[0=No/Never, 1=1-3X/Month, 2=1X/Week, 3=2-3X/Week, 4=4-6X/Week, 5=1X/Day, 6=More than 2X/Day**		
38.10a	Did your child/children eat a smaller amount of food than needed because there wasn't enough food?	
38.10b	If so, how often? ***	
38.11a	Did your child/children skip a meal because there wasn't enough food?	
38.11b	If so, how often? ***	
38.12a	Did your child/children not eat for a whole day because there wasn't enough food?	
38.12b	If so, how often? ***	
38.13a	Do both boy(s) **and or** girl(s) eat together in your home?	
	Do girl(s) **and or** boy(s) normally eat the same foods?	
	If not, why not? _____	
38.14	Under ideal conditions, what would a nutritious 'balanced meal' for your child/children look like? (list specific food items) ……	
38.15a	Do your child/children ever eat a balanced meal?	
38.15b	If so, how often? ***	

39 Do you consider your household to be……? **(Mark only one)**
[1=Always food insecure (Not having enough to eat for more than **six** months)? **2**=Sometimes food insecure (Not having enough to eat for at least one month but less than **six** months)? **3**=Food secure (Having enough to eat throughout the year)]

40 Do you experience food scarcity in this household?.....
[1=Not at all, 2=Sometimes, 3=Most of the time, 4=All the time]

41 If **yes,** on average how long (months) is a food scarcity period? State the number…….

42 In which month do you most experience food scarcity in this household? (indicate one month)

43 In which month do you most experience food in plenty in this household?..... (indicate one month)

44 What is the **main source** of food for your household? **(Choose only one)**
[1=Buy, 2=Own garden, 3=Relatives/neighbors, 4=Others (specify)……]

45 On average, how many meals does your household consume in a day during the season of plenty? [1=One, 2=Two, 3=Three and above].
State the meals eaten……

46 On average, how many meals does your household consume in a day during the season of scarcity? [1=One, 2=Two, 3=Three and above].
State the meals eaten……

47 Which type of meal does your family consume **(Circle all that apply**)?
[1=Breakfast, 2=Lunch, 3=Evening tea, 4=Dinner/Supper]

48 Does your household get surplus food for the market?.....
[0=No, 1=Yes]

49 Which type of food reserves does your household have? …….
[1=None, 2=Food in store/house, 3=Granary, 4=Food in the garden]

50 Please describe the foods (meals and snacks) that you ate yesterday and during the last week (7 days), whether at home or outside the home **(0. No; 1. Yes),**
and indicate **how it was accessed.**

***Codes for access: 1. Grown /Reared 2. Bought 3. Exchanged 4. Loaned 5. Gift 6. Food aid.** *Read EACH item to the respondent.*

[Household level: consider foods eaten by any member of the household, and exclude foods purchased and eaten outside of the home]

FOOD ITEM	Yesterday	Last Week	How Accessed*	**FOOD ITEM**	Yesterday	Last Week	How Accessed*
Cereals				**Other Vegetables**			
Maize (*any form*)				Tomato			
Millet				Onions			
Sorghum				Eggplants			
Amaranth Grain				**Fruits**			
Rice				Mango			
Bread				Paw paws			
Chapatti				Orange			
Other cereals				Pineapple			
Legumes and Nuts				Passion fruit			
Beans				Jackfruit			
Soybean				Other fruits			
Other legumes				**Animal Products**			
Groundnuts				Beef			
Sim –sim				Chicken			
Vitamin A rich Veg.				Pork			
Orange Fleshed Sweet Potatoes				Goat			
Pumpkins				Fish			
Carrots				Eggs			
White Tubers				Milk			

Sweet Potato				Ghee			
Cassava				**Other Products**			
Yam				Sugar			
Other tubers				Honey			
Matooke				Sweetened Soda			
Dark Green Leafy Vegetables				Sweets			
Cabbage				Tea			
Leaf amaranth				Cooking Oil			
Other dark green vegetables				Iodized Salt			

51 On average**, how many meals** were consumed daily in your household during the past month?

Adults……. Children under 5years…….

Section E: Land Access and Agriculture

52.1 a) In total, how much land (in acres) does this household (all members) have? …….. acres

b) Of the above land, how many acres are under use? …….. acres

52.2 a) How many acres did you hire/borrow this season? ……. Acres

b) If none, can you borrow/Hire land? …… **0. No 1. Yes**

52.3 Were you able to cultivate any food in the ***first season 2017*** *(last year)*? **0. No (answer .4 and skip .5), 1. Yes (Go to .5)**

52.4 If ***not***, what was the main reason?

[1=I have been prohibited by my husband, 2=The land is infertile, 3=Sickness or physical inability, 4=I didn't have adequate seeds and tools, 5=Poor weather, 6=Others, specify……. 999. N/A

52.5 If household cultivated food in first season, fill the table below

Crops planted	Did you grow it before ISUUP?	Who gave you seeds before ISUUP	Are you growing it now	Qty of seed from ISUUP	Acreage planted	Amount harvested	Amount returned	Unit of measure	Qty sold	Revenue from sales	What has changed 1=Income 2=Food 3=Area planted
Grain amaranths											
Soy bean											
High iron beans											
Millet											
Cowpeas											
Collards											
Spring onions											
Eggplants											
Pawpaw											
Maize											
Cassava											
Ground nuts											
Beans											
Sweet potatoes											
Rice											
Others …….											

52.6 ***What major problems do you encounter in crop production? Max=3.***

[1=Water, 2=Soil fertility, 3=Striga weed, 4=Pests, specify…, 5=Diseases, specify…, 6=Markets, 7=Land issues, 8=Theft]

53 a). Which of the following agricultural training practices did you participate in from ISUUP?

Training participated in	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10	**Training participated in**	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10
Soil improvement		Kitchen/keyhole/sack gardens	
Composting		Post-harvest handling	
Land use allocation and soils		Marketing of produce	
Agronomical practices (Seedbed preparation, planting, fertilizer application)		Others (specify)……	

b). Basing on what you learnt in the agronomy trainings, provide the most suitable response

Question	Response	Score
.i) When do you prepare land for next season?		
.ii) What is the spacing for amaranths?		
.iii) How do you make compost manure?		
.iv) Why do you have to rotate crops on your farm each season?		
.v) How do you tell that amaranths is ready for harvest?		
.vi) How do you dry your crops to ensure quality output?		

54 Do you have any of the following gardens? (**Choose all that apply**)
[1=Kitchen garden, 2=Sack gardens, 3=Keyhole gardens]

Postharvest handling of crops

55 How do you shell your crops? (**Choose all that apply**)
[1=Beating, 2=Hand, 3=Machine, specify…… (hand sheller, machine sheller)]
56 During drying of grains, what do you dry your grain on? (**Choose all that apply**)
[1=Tarpaulin, 2=Bare ground, 3=Concrete floor, 4=cloth, 5=Mats, 6=Iron sheets……]
57 How do you check the moisture of your grains to determine whether its dry? (**Choose all that apply**)
[1=Bite with teeth, 2=Snap with fingers, 3=Moisture meter, 4=Others indicate……]
58 Do you store your grains after harvest? 0=No, 1=Yes, **if yes**, where do you store your grains?
1=Storage in bags 2=Storage in metallic silos 3=Storage in plastic silos 4=Storage in drums
4=Storage in jerrycans, 5=On floor, specify…… (dry mud room, concrete floor), 6=Pots

SECTION F: FOOD, NUTRITION AND HEALTH

(COMPLETE THIS SECTION IF THERE ARE CHILDREN LESS THAT 10 years OF AGE IN THE HOUSEHOLD)

DEMOGRAPHIC DATA

59 Who is the primary care giver? …...
[1=Mother, 2=Father, 3=Grandparent, 4=Aunt, 5=Step mother]

60 Age of mother or primary caregiver of the children, ……
61 Level of education of mother or caregiver?.....(class completed)

62 a). Does the mother or caregiver know about ISU-UP's Nutrition Education Centers (NECs)?
[0=No, 1=Yes]
b). Has anyone in the household ever attended the **ISU-UP's NEC**? …… **0. No, 1. Yes.** Indicate who has attended…… When did they attend?.....

63 Is there anyone currently attending the **ISU-UP's NEC?..... 0. No, 1. Yes**. Indicate who is or has attending……

64 What services does/did the mother or caregiver receive/received at the NECs? **(choose all applicable)**

Services received at NEC since 2014	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10	Service received at NEC since 2014	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10
Immunization		Nutrient dense porridge	
Complementary feeding/ekitobero		HIV testing and counselling	
Clinic days		Seek health information	
Family planning		Training	

65 What trainings did/does the mother or caregiver receive(d) at the NECs? (**choose all applicable**). 999.N/A

Trainings received at NEC since 2014	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10	**Trainings received at NEC since 2014**	Numbers of Times: **1**. <5 **2**. 5-10, **3**. >10
Importance of breast feeding		Gender Based Violence	
Exclusive breast feeding		Identifying malnutrition signs	
Sexually Transmitted Diseases & Urinary Tract Infections		Hygiene and sanitation (hand & body hygiene, construction of latrines, bathroom, plate stand, tip taps)	
Complementary feeding/ekitobero		Jigger and rat control	
Pregnancy related issues		Other trainings, specify…….	

Identification of clinical signs of malnutrition, exclusive breast feeding, importance of breast feeding, balanced diet and complementary feeding, and pregnancy related issues

Hygiene and sanitation (hand & body hygiene, construction of latrines, bathroom, plate stand, tip taps), Jigger and rat control

Training on cross-cutting specially gender based violence, Sexually Transmitted Diseases (STDs) and Urinary Tract Infections (UTIs), and HIV testing and counselling.

66 Basing on what you learnt in the health and nutrition training, provide the most suitable response **(to be answered by the person who is or has attended the NEC)**

About health		
Question	**Response**	**Score**
a) When should you wash your hands?		
b) When should you start antenatal clinic during pregnancy?		
c) What are the methods of preventing malaria?		
d) Why is it important to have a pit latrine?		
e) Where should you place your plates after washing?		
f) What are the danger signs in pregnancy?		
About nutrition		

g) How soon after birth should a newborn baby be put on breast?		
h) For how long a baby should be exclusively breast fed?		
i) What are the three food groups based on their roles in our bodies?		
j) Name some of the foods that give us energy.		
k) Give an example of a balance meal by listing all the foods that can be served together for a meal to be balanced		
l) What are the ingredients in the porridge taken at the NEC		

67 What is the marital Status of the mother or caregiver?
[1=Married Monogamous, 2=Married polygamous, 3=Divorced/Separated, 4=Widowed/widower, 5=Single]

68 If it is a polygamous marriage rank the position of the wife? If it is a male/husband that you are interviewing find out the rank of the wife in that home. **Rank of wife at this home**…….

69 What is religion of the mother/caregiver?
[1=Anglican, 2=Catholic, 3=Muslim, 4=Born again 5. Noah, 6=SDA]

70 Is the mother or mothers of the youngest child pregnant?.....
[**0=No, 1=Yes]**

71 If yes, what is the age of the pregnancy? Mother 1……Mother 2……

72 Age at 1st Pregnancy of Mother……

73 What is the number of children delivered alive by this Mother 1……. Mother 2……

74 Did the mother take porridge from the NEC during the last 4 deliveries? **0. No. 1. Yes.**
[1st……. 2nd…….3rd…….…. 4th…….]

75 Number of times mother attended antenatal clinic during the last 4 deliveries?
[1st……. 2nd…….3rd…….….4th…….]

76 Place of delivery for the last 4 deliveries?
[1st…….2nd…….3rd…….….4th…….]
Codes for places: 1=Health Centre, 2=Hospital, 3=Traditional Birth Attendant (TBA), 4=Home with relatives/friends, 5=Home with qualified health personnel, 6=Others (specify)…… 999=N/A.

77 **Immunizations, de-worming and Vitamin A supplementation (For Children under 5 yrs./59 months) refer to clinic card**

	Y/N	Measles					DPT 3					De-worming					Vitamin A				
Child code		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Age of child (months)																					
Yes, with card																					
No with card																					
Yes, without card																					
No without card																					
Card not filled																					
Place received 1.NEC 2. Health/Center																					

78 Have any of your children suffered from Kwashiorkor (musana)?..... **0. No, 1. Yes**

79 If yes, where did you take the child for treatment? ……

80 Have any of your children suffered from Marasmus (bwayu/bwosi). **0. No, 1. Yes**

81 If yes, where did you take the child for treatment? ……

82 **INFANT FEEDING PRACTICES (*for children up to 5 years-start with the youngest*)**

	Child code	0 - 6months	After 6 months
82.1 Where any of your child/children exclusively breastfed for the first six months. Child=1, Child=2, Child=3, Child=4, Child=5			
82.2 At what age did you introduce other liquids/solid foods to this child? (tick appropriate column)	1		
	2		
	3		
	4		
	5		
82.3 Which of these drinks are/were given to the child at each age? (Ask about each of these specifically) 1. Water 2.Milk/milk tea 3.Juice 4. Cereal porridge 5.Black tea 6.Others (specify)……	1		
	2		
	3		
	4		
	5		
82.4 Within each age bracket, what foods, drinks, sauces are given to the child in a day? (Do not lead with these answers) 1.Cereals 2. Legumes, 3. Fish, 4. Milk and milk products, 5. Meat and meat products 6. Tubers like sweet potatoes 7. Fruits and vegetables 8.others (specify)	1		
	2		
	3		
	4		
	5		
82.5 How many meals did/does your child eat at each of these ages? 1. One 2. Two 3. Three 4. More than 3	1		
	2		
	3		
	4		
	5		
82.6 How is/was the child served food at each of these ages? 1.Alone (own plate) 2.Plate shared with other children 3.Plate shared with adult 4.own plate assisted with adult 5. Others (specify)	1		
	2		
	3		
	4		
	5		
82.7 Does/did your child sleep under a mosquito net at each of the ages?	1		
	2		
	3		
	4		
	5		

SECTION G: HYGIENE AND SANITATION

83 Observe and tick the presence of the following facility they are currently using

Facility	**Presence 0. No, 1. Yes**	**Condition: 1. Permanent 2. Temporary**	**COMMENT**
a. Pit latrines			
b. Bathroom/shower			
c. Kitchen			
d. Dug Rubbish pit			
e. Dish Rack			

84 Where do you dispose of your rubbish? **(circle all applicable)**
[1.Compost pit 2. Dug out rubbish pit, and then burn 3. Dug rubbish pit, without burning 4. In the garden 5. Bush 6. Public disposal area 7. Anywhere we find including on the road 8. In the river]

85 What type of hand washing facility (**used after using the latrine**) do you have in your household? 1. None 2. Tip tap near or within the latrine 3. Regular tap near or within the latrine 4. Others specify…….

86 Where do you dispose young babies' faeces? **(circle all applicable)** 1. Latrine 2. Left on the ground uncovered 3. Left on the ground covered with soil 4. Scooped and thrown in the bush 5. Scooped and thrown anywhere 6. Compost pit 7. Others, specify…….

87 Where does your family dispose off fecal matter? **(circle all applicable)** 1.Pit Latrine 2.Open hole 3.Bush/kapanga 4. Plastic bags 5. Rivers/canals/other water bodies 6. Dig a pit and use 7. Others, specify……

88 If using latrine, what type of latrine do you use? 1. Pit latrine (not improved) 2. Improved pit latrine (with slab and ventilator) 3. Composting latrine 4. Latrine draining to the river 5. Others specify

89 What is the distance of the latrine from the house?..... (estimate in meters)

90 If you use a latrine, who owns the latrine that the family uses? …….. 1. Family owned 2.Community Latrine 3. Neighbors 4. Bush (open air) 5. Others (specify)

91 Who helped to construct the latrine you use?..... 1. Own family 2. Neighbor 3. Government 4. Local government 5. NGO 6. Others, specify…….

92 If your family does not have a latrine, what is the main reason you don't have? **(circle all applicable)** 1. Lack space to construct 2. See no need since we have a lot of space to defecate 3. Cultural reason 4. Cannot afford 5. We have never seen the need 6. Others, specify…….

93 Observe condition of latrine; 1. Well-constructed 2. Poorly constructed 3. Has a door 4. Lacks a door 5. Permanent walls 6. Temporary walls 7. Clean 8. Dirty 9. Others, specify…….

(COMPLETE THIS SECTION IF THERE ARE CHILDREN 0-59 MONTHS OF AGE IN THE HOUSEHOLD)

Multiple questionnaires if a home has more than one mother with children aged 0-59 months

Questionnaire ID……

94 Mother or primary caregiver of the children, Weight-**1**……**2**…….. (**kg**). Height-**1**…….**2**……. (**cm**), MUAC-**1**……..**2**……(**cm**) Age of mother……. Date of birth…../…../……

95 Did you graduate from the NEC? 0=No, 1=Yes, 2=Still active

96 **a). ANTHROPOMETRY (for the child under 0-59 months only)**

Code of child	SEX, 1-Male, 2-Female	Date of birth	Birth weight	Age in months	MUAC-**CM**		WEIGHT-**KG**		HEIGHT-**CM**	
					1st	2nd	1st	2nd	1st	2nd
1										
2										
3										
4										
5										

b)	Observe if any sign of the following signs and tick signs observed on any of the children	1. Swollen feet/hands (both hands/feet), 2. Brown thin hair, 3. Cracked skin, 4. Swollen cheeks, 5. Cracked corner of mouth, 6. Swollen stomach (Distended stomach), 7. Thin limbs (hands and legs), 8. Sadness, 9. Wrinkled skin (wasting).

c) Enrollment of the child at the NEC

Code of child	Date enrolled at NEC	Date graduated	If taking porridge at home	Sources of porridge	Sources funds if porridge is purchased
1					
2					
3					
4					
5					

SECTION H: YOUTH ENTREPRENEURSHIP PROGRAM

Respond to this section if you are or have been a member of YEP both in school and out of school

97 Do you participate, or have you participated in Youth Entrepreneurship Program? 0=No, (**skip to 102)**,1=Yes

98 Have you been or are you a member of Namasagali College or Naluwoli Senior Secondary School Youth Entrepreneurship club? 0=No, 1=Yes. If yes, specify the year?.....

99 What is your status in YEP?..... 1=In-school, 2=Out of school

100 Which enterprises have you established with assistance from ISUUP?

Enterprise category	Year established	Youth category (1=in school, 2= out of school)	List of projects established	Assistance 1=Seeds 2=Fertilizers 3=Agrochemicals 4=Animal 5=Market 6=Buildings materials	Marketing 1=ISUUP 2=Group 3=individual	Number of youths you have employed so far	Total income from the enterprise	Main use if income		
								1st	2nd	3rd
Crop										
Livestock										
Trading										
Apiculture										
Others										

Codes for use of income: 1=Food, 2=Fees, 3=Medical, 4=Garden, 5=Clothing, 6=Building, 7=Livestock, 8=Others specify.....

101 How many youths have you assisted to establish enterprises like yours?

Enterprise category	Number of youths assisted	Enterprise category	Number of youths assisted
Crop		Apiculture	
Livestock		Others specify…	
Trading			

SECTION H: COMMUNITY INNOVATIONS FOR INCOME GENERATION

102 Do you or have you participated in ISUUP community income generating innovations (CIGI) program? 0=No, 1=Yes

103 If No, have you established or are engaged in any income generating activities including crops, livestock or formal employment with assistance from ISUUP? 0=No, 1=Yes

104 Select all the income generating activities that you engaged in through ISUUP?

Activity	Were you doing it before ISUUP? 0=No, 1=Yes	Year began	Which NEC were you at (see codes below if yes)	Times trained	Average monthly/ annual income obtained	Main use of income; (max-3)		
						1st	2nd	3rd
Crafts								
Soap making								
Flour making								
Formal employment, NEC trainer								
Formal employment, Flour making								
Formal employment, NEC trainer reviewer								
Formal employment, others indicate								
Crop, indicate type received								
Livestock, indicate type received								
Others …….								

Codes for use of income: 1=Food, 2=Fees, 3=Medical, 4=Garden, 5=Clothing, 6=Building, 7=Livestock, 8=Others specify.....
Code for NECS: **0= Was not part of the NEC**, 1=Naluwoli, 2=Kiwungu, 3=Bugeywa, 4=Nakyaka, 5=Kakindu, 6=Nakanyonyi, 7=Bususwa, 8=Kiconco

105 For each project engaged in, specify the skills learnt so far?

	Palm leaf products	Bead products	Sewing machine
1			
2			
3			
4			
	Raffia products	Crop production	Livestock production
1			
2			
3			
4			

Bead products include bangles, bracelets, necklaces and purses, sewing machine products include backpacks, laptop bags, shopping bags, Palm leaf products include mats and for raffia products they mainly make baskets

106 What were the main sources of income before community income generating innovations (CIGI) program?.....

107 What assets have you accumulated with income from community income generating innovations (CIGI) program? Specify the numbers 1=Building……. 2=Livestock…… 3=Savings……. 4=Land……. 5=Solar…… 6=Others indicate……

108 What investments have you made with income from community income generating innovations (CIGI) program……

109 What household needs did you contribute to before and after joining the community income generating innovations (CIGI) program? **Choose all applicable**

Household needs before joining CIGI	**Household needs after joining CIGI**

1=Food, 2=Rent, 3=Clothing, 4=Medical, 5= House & other constructions, 6=School fees, 7=Land purchases, 8=Land rent, 9=Garden inputs, 10=Goats, 11=Cattle, 12=Chicken, 13=Hair dressing, 14=Others, specify……..

110 What changes have you experienced in your household in terms of income, leadership, wellbeing, nutrition and health, food availability, etc. since you began working with ISUUP? **Probe for details?**

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Thank you for your cooperation

APPENDIX 2: MAIN FOODS CONSUMED IN KAMULI, 2018

Foods consumed by the households	Overall n=454		Food Value	How food was accessed in percentages				
	Frequency	Percent		Home	Bought	Exchanged	Loaned	Gift
Sim-sim	92	20.3	V	13.2	5.3	0.2	-	1.5
Carrots	19	4.2	V	1.5	2.4	-	-	0.2
Tomatoes	442	97.4	V	16.3	80.6	-	-	0.4
Onions	438	96.5	V	9.9	86.6	-	-	-
Egg plants	345	76.0	V	37.4	35.9	0.4	-	2.2
Cabbage	308	67.8	V	6.4	60.8	-	0.2	0.4
Leafy amaranths	223	49.1	V	42.1	4.8	0.2	-	2.0
Other green veges	243	53.5	V	50.2	2.4	-	-	0.9
Grain amaranths	179	39.4	P	31.1	4.2	0.2	-	4.0
Beans	418	92.1	P	79.7	9.5	0.2	0.2	2.4
Soybean	286	63.0	P	51.1	6.8	-	0.2	4.8
Ground nuts	334	73.6	P	48.9	19.2	0.4	-	5.1
Beef	173	38.1	P	0.4	37.2	-	-	0.4
Chicken	66	14.5	P	8.6	5.5	-	-	0.4
Pork	42	9.3	P	1.1	8.1	-	-	-
Goat meat	33	7.3	P	0.2	7.0	-	-	-
Fish/sea foods	224	49.3	P	-	49.3	-	-	-
Eggs	189	41.6	P	22.2	18.7	-	-	0.7
Milk	348	76.7	P	17.2	57.9	-	-	1.5
Sugar	435	95.8	O	-	95.4	-	-	0.4
Honey	27	5.9	O	0.4	5.5	-	-	-
Cooking oil	445	98.0	O	0.2	97.8	-	-	-
Iodized salt	454	100.0	O	-	100.0	-	-	-
Mangoes	60	13.2	F	10.1	2.2	-	-	0.9
Pawpaw	127	28.0	F	25.3	1.1	0.2	-	1.3
Oranges	142	31.3	F	27.1	3.1	0.2	-	0.9
Pineapples	67	14.8	F	2.0	12.6	-	-	0.2
Passion fruits	104	22.9	F	7.7	14.8	-	-	0.4
Jackfruits	237	52.2	F	45.2	3.5	0.4	-	3.1
Maize	443	97.6	E	91.0	4.2	0.2	-	2.2
Millet	202	44.5	E	34.8	7.0	0.2	-	2.4
Sorghum	96	21.1	E	17.0	4.0	-	-	0.2
Rice	339	74.7	E	13.2	59.0	-	-	2.4
Bread	193	42.5	E	0.4	41.6	-	-	0.4
Chapatti	290	63.9	E	0.4	63.4	-	-	-
Orange.F.S.Potatoes	112	24.7	E	21.6	2.0	-	-	1.1
Pumpkins	216	47.6	E	41.6	2.2	0.2	0.4	3.1
Sweet potatoes	363	80.0	E	68.7	7.9	0.4	-	2.9
Cassava	288	63.4	E	47.6	11.2	0.2	-	4.4
Yams	55	12.1	E	8.4	2.9	-	-	0.9
Matooke – plantain	226	49.8	E	33.7	15.2	-	-	0.9

Food Values: V=Vegetables, P=High Protein Foods, O=Others, F=Fruits, E=Energy-Carbohydrate-Starch Foods

APPENDIX 3: LINEAR REGRESSION TESTING FOR MULTICOLLINEARITY

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.417[a]	0.174	0.155	0.584

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.752	10	3.175	9.310	.000[b]
	Residual	151.085	443	.341		
	Total	182.837	453			

a. Dependent Variable: Food Security Status (FSS)

Coefficients[a]

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% C.I for B		Collinearity Statistics	
	B	SE	Beta			LB	UB	TV	VIF
(Constant)	2.759	.135		20.448	.000	2.494	3.025		
Participation in NECs' FNS programs	-.106	.061	-.077	-1.751	.081	-.225	.013	.968	1.033
Age of household head	.069	.062	.050	1.121	.263	-.052	.190	.943	1.061
Education of household head	-.016	.060	-.012	-.267	.790	-.133	.101	.971	1.030
Land ownership in acreage	-.114	.059	-.088	-1.924	.055	-.231	.002	.898	1.114
Household keep livestock	-.203	.071	-.126	-2.849	.005	-.343	-.063	.949	1.053
Time to collect water-round trip	-.148	.057	-.113	-2.589	.010	-.261	-.036	.978	1.022
WASH facilities condition	-.130	.057	-.102	-2.277	.023	-.242	-.018	.938	1.066
Days of illness of most adult male	-.327	.080	-.179	-4.082	.000	-.485	-.170	.966	1.036
Number of meals eaten during scarcity	-.411	.095	-.192	-4.338	.000	-.598	-.225	.954	1.048
Membership to burial/festivals groups	-.147	.057	-.115	-2.571	.010	-.260	-.035	.931	1.074

a. Dependent Variable: Food Security Status

APPENDIX 4: IRB APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 12/21/2018

To: Dorothy Masinde

From: Office for Responsible Research

Title: **Impact of a Sustainable Rural Livelihoods Program on Food and Nutrition Security of Smallholder farmers in Kamuli district Uganda**

IRB ID: **18-356**

Submission Type: Initial Submission **Review Type**: Expedited

Approval Date: 12/21/2018 **Date for Continuing Review: 12/20/2019**

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, including the **recruitment materials and informed consent documents that have the IRB approval stamp**.
- Retain signed informed consent documents **for 3 years after the close of the study,** when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study.
- **Inform the IRB if the Principal Investigator and/or Supervising Investigator end their role or involvement with the project** with sufficient time to allow an alternate PI/Supervising Investigator to assume oversight responsibility. Projects must have an eligible PI to remain open.
- **Immediately inform the IRB of** (1) **all serious and/or unexpected** adverse experiences involving risks to subjects or others; and (2) **any other** unanticipated problems **involving risks** to subjects or others.
- **Stop all human subjects research activity if IRB approval lapses**, unless continuation is necessary to prevent harm to research participants. Human subjects research activity can resume once IRB approval is re-established.
- **Submit an application for Continuing Review** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

IRB 03/2018

- Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

- Please be advised that your research study may be subject to post-approval monitoring **by Iowa State University's Office for Responsible Research**. In some cases, it may also be subject to formal audit or inspection by federal agencies and study sponsors.

- Upon completion of the project, transfer of IRB oversight to another IRB, or departure of the PI and/or Supervising Investigator, please initiate a Project Closure to officially close the project. For information on instances when a study may be closed, please refer to the IRB Study Closure Policy.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

IRB 03/2018