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**UPGRADING BUTTERNUT SQUASH (BNS) VALUE CHAIN TO
ENHANCE MARKET ACCESS FOR UPSCALING AND INCLUSION OF
SMALLHOLDER FARMERS.**

***A CASE OF SMALLHOLDER FARMERS IN SVELUGU MUNICIPAL OF THE
NORTHERN REGION, GHANA.***



A Research thesis submitted to Van Hall Larenstein University of Applied Science
In Partial Fulfillment of the Requirement for
The Degree of Master of Agricultural Production Chain Management- Horticulture chain

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Upgrading butternut squash (BNS) value chain to enhance market access for upscaling and inclusion of smallholder farmers

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DEDICATION

I dedicate this research to my supportive husband Alhaji Issifu Mumuni, my darling son Abdul Fatawu Mumuni and my beautiful daughter Sa-ada Mumuni.

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List of acronyms

CSA	Climate Smart Agriculture
DAEO	District Agriculture Extension Officer
EDIF	Export Development and Investment Fund
EU	European Union
FAO	Food and Agriculture Organisation of the United Nation
FBO	Farmer Based Organisation
FFS	Farmer Field School
GES	Ghana Education Services
GHS	Ghana Health Services
FGD	Focus Group Discussions
GlobalGAP	Global Good Agriculture Practices
GLSS	Ghana Living Standard Survey
IDI	In-depth Interview
ISO	International Standard Organisation
MoFA	Ministry of Food and Agriculture
N/A	Not Applicable
NGO	Non-Governmental Organisation
NRGP	Nother Rural Growth Programme
OECD	Organisation for Economic Co-operation and Development
OMAFRA	Ministry of Agriculture, Food and Rural Affairs
PERD	Planting fo Export and Rural Development
PJF	Planting for Food and Jobs
PESTEC	Political, Economic, Social, Technological, Environmental and Competitiveness
SADA	Savannah Agriculture Development Authority
PPRS	Plant Prtection and Regularatory Services
SARI	Savannah Agriculture Research Institute
SDGs	Sustainable Development Goals
SMA	Savelugu Municipal Assembly
SPSS	Statistical Package for Social Sciences
sq. km	Square kilometre
SWOT	Strength, Weaknesses, Opportunities and Treats
UK	United Kingdom
UN	United Nations
VHL	Van Hall Larenstein University
WTO	World Trade Organisation

Abstract

The Northern Rural Growth Programme introduced butternut squash (BNS) (*Cucurbita moschata*) to Northern Ghana as a high-value export commodity to promote the inclusion of smallholder farmers in the export value chain. As an export vegetable crop, BNS flourished well in 2013 and 2014. However, the quality of BNS was not sufficient to meet the rigorous export market quality requirements resulting in mass rejections and ban on its export in 2015. Currently, producers are faced with issues of low yields and limited access to market, consequently resulting in low incomes.

The objective of the research was to identify remote causes and upgrading strategies for the BNS value chain in the Savelugu Municipal for the Department of Agriculture for the development of interventions to improve the quality and increase the production of BNS to enhance market access amongst smallholder farmers.

The study population consisted of BNS out-grower farmers in the three communities of the Savelugu Municipal Assembly (SMA) namely, Gushei, Kukobilla and Naboo. A total number of 52 BNS producers, made up of 28 males and 23 females constituted the sample size for the survey. Eleven Key informants were interviewed based on their knowledge and participation in the BNS value chains. The grounded theory was used in analysing interviews, and the descriptive statistics were used to describe the results using Statistical Package for Social Science (SPSS version 25). The results revealed that farmers in the study area have a minimum age of 25 years and a maximum age of 70 years with a mean age of 42 years. While the maximum household size is 26, the minimum is 2 with a mean household size of 11. The study revealed that BNS farmers have a low level of education.

The results also revealed that, aside the core chain actors made up of input suppliers, out-growers, nucleus farmers and buyers (chain actor), other enablers and supporters currently involved in the BNS value chain include Environmental Protection Agency, Export Promotion Council and the Plant Protection and Regulatory Services. The study identified the BNS governance structure as the captive structure as BNS producers also referred to as out-growers are informally contracted by the nucleus farmer to produce and supply BNS. The study also revealed that collaboration between the core actors and key stakeholders in the BNS value chain is weak. The study also revealed that BNS is not one of the commodities included on MoFA's commodity profile and that there is no budget line to specifically fund the development of the BNS value chain, thus limiting MoFA's participation in the chain as a key stakeholder. Furthermore, the study revealed that financial service providers were completely missing from the BNS value chain. The study noted that though out-growers belongs to farmers' cooperatives referred to as Farmer Based Organisations (FBOs), these cooperatives are not involved in the pricing of BNS.

The study revealed that the trend of BNS production over three years indicate that supply has been unstable and insufficient for the domestic market. The study equally revealed that producers record low yields with a yield average of 1.7MT/ha even though the Waltham variety has a yield potential of 2.5MT/ha. Also, current productions volumes are low, 7.8MT for the year 2018 and does not meet the domestic requirement of 12MT. The study also revealed that 88.5% of out-growers are not aware of Global GAP standards. The study revealed that out-growers have the low technical know-how on Good Agriculture Practices (GAPs) for BNS production as well as post-harvest handling practices.

It recommended amongst others that The Municipal Assembly should lobby MoFA to include BNS seed in the Planting for Export and Rural Development (PERD) government flagship programme. MoFA should lobby investors and interested commercial producers to take up BNS production to meet market demand. Producers capacities should be improved on GAPs to be able to produce to specifications and meet domestic quantity requirements and Global GAP standards. A training programme should be designed in collaboration with the business advisory services and the department of cooperatives to develop the capacity of farmer cooperatives (FBOs) on development of business plans, basic bookkeeping, group dynamic, negotiation and lobbying skills for effective and efficient coordination of chain activities thereby increasing their bargaining power. The study revealed that facilitating women access to irrigation facility and management techniques as well as both input credit and financial credits enhances women effective participation in BNS production.

CHAPTER 1: INTRODUCTION

1.1 Background information.

Butternut squash was introduced into Ghana by the Export Development and Investment Funds project (EDIF) as a high-value exotic vegetable in 2010 at the request of Minor, Weir and Willis as marketing partners based in the UK. Ghana has a comparative advantage over the UK with regards to the production and supply of BNS to EU markets during the winter. The Northern Rural Growth Programme introduced butternut squash (*Cucurbita moschata*) to Northern Ghana as a high-value export commodity to promote the inclusion of smallholder farmers in the export value chain. As an export vegetable crop, butternut squash flourished well in 2013 and 2014. However, the quality of butternut squash was not sufficient to meet the rigorous export market quality requirements resulting in mass rejections and ban on its export in 2015. Currently, producers are faced with issues of low yields and limited access to market, consequently resulting in low incomes. Key stakeholders notably, the Ministry of Food and Agriculture has expressed worry on the issue hence has commissioned a study to identify the root causes and upgrading strategies to resume butternut squash export to the UK. Therefore, the objective of the research is to identify remote causes and upgrading strategies for the butternut squash value chain with the view to making recommendations to the Savelugu Municipal department of agriculture for the development of interventions to improve the quality and increase production of butternut squash to enhance market access for scaling up and inclusion of smallholder farmers.

Formally known as the Gold Coast, Ghana was named after the great medieval trading empire. Ghana was the first sub-Saharan African nation to have gained independence from Britain in 1957. Ghana located in the west coast of Africa bordering Burkina Faso to the North, Togo to the East, Cote D'Ivoire to the West and the Atlantic Ocean and the Coast of Guinea to the South. The current population is estimated to be 26,908,262 million. English is the official language and 52 other Ghanaian languages with hundreds of dialects spoken. There are six major ethnic groups namely, Akan (47.7%), Mole-Dagbani (13.9%), Ga-Adangbe (7.4%), Mole-Dagbani (16.6%), Guan (3.7%) and Gruma (5.7%) (WORLDATLAS, 2017). Ghana has a total land area of 238,533 km² with four agro-ecological zones namely, Forest, Transitional, Coastal making up the Southern zone, Savannah and Sudan Sahara constituting the Northern zone. The climate is warm and humid with a mean annual rainfall estimated at 1187mm and mean annual temperatures varying from 26.6°C in the South to 28.9°C in the North. Since its transition to multiparty democracy in 1992, Ghana is considered one of the more stable in West Africa (BBC News, 2018). Ghana's agriculture is mostly subsistence made up of 80% crops, 10% livestock and 10% forestry (ITA, 2019). The agriculture sector drives Ghana's economy, accounting for 19.7% per cent of the national GDP in 2017 (World Bank, 2018) and employing 44% of the labour force. According to FAO, Ghana as a middle income sub-Saharan African country experienced massive economic growth from 2005 to 2012. However, from 2013, due to changes in macro-economic challenges such as high budget deficient and inflation, economic growth significantly diminished though expectations remain positive because the country is richly endowed with natural resources coupled with institutional stability (FAO, 2015).

Figure 1 Map of Ghana

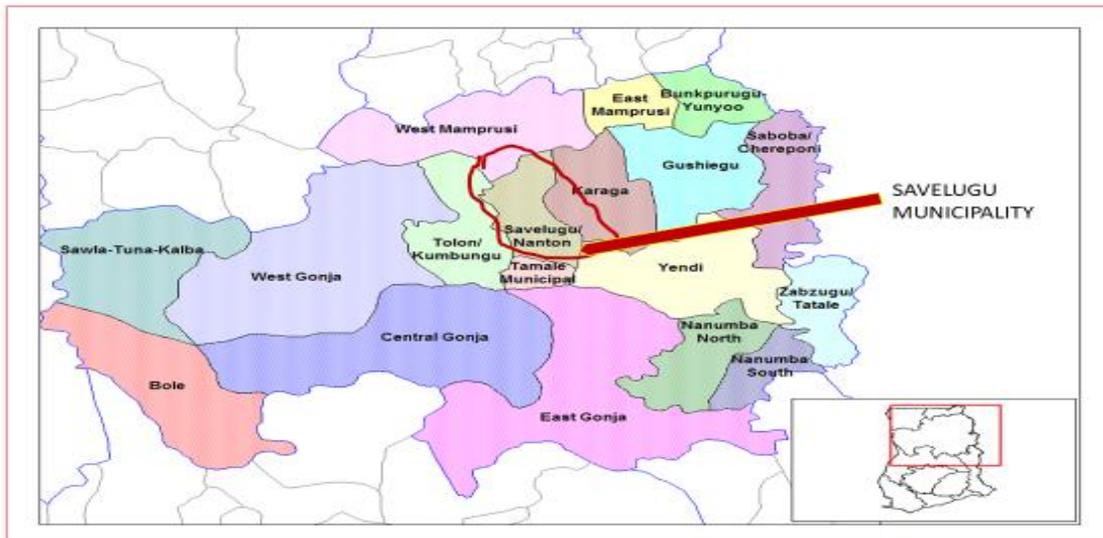


Source: (WORLDTLAS, 2017)

Description of Savelugu Municipal

The Savelugu Municipality was carved out of the Western Dagomba Municipal Council in 1988 under the Local Government Act 462, 1993 by Legislative Instrument (LI) 1450. Savelugu Municipality is located at the northern part of the Northern Region of Ghana with a population of 139,283 according to the 2010 population and housing census. With a growth rate of 3%, the population was estimated at 166,529 in 2016. Females constitute 51.5% of the population and males 48.5%. The population density in 2010 was 78 persons per sq. km and in 2016 it is expected to be 93 persons per sq. Km (GSS, 2010).

Figure 2: Map of Northern Region showing Savelugu



Source: SMA

1.2 Main Economic Activities

Agriculture is the main economic activity and with a projected 70% of the municipal population for farmers which stands at 114,586, consisting of 80,210 males and 34,376 females. The municipality is on annual basis able to produce enough of the key staple crops to feed its population and in some cases surpluses for other markets (MoFA/SMA, 2018). Rainfall is unimodal, mostly from late April–mid-October with annual precipitation of 1000-1200mm on average while the dry season commences late October –March annually (SMA, 2018).

Vegetation falls in the interior (Guinea) Savannah woodland which has the potential for a sustainable small and large scale/commercial livestock rearing as well as the cultivation of staples food crops like rice, groundnuts, yams, cassava, maize, cowpea, soybeans millet and sorghum. The predominant soil types are sandy, loam, sandy-loams, and clayey soils. Naturally, this provides the municipality an opportunity for the cultivation of a diversity of crop types be they upland crops such as maize, groundnuts, cowpea and soybeans or valley bottom crops such as rice (MoFA/SMA, 2018). Hence crops cultivated in the municipality include maize, rice, sorghum and millet for cereals; soybeans, groundnuts, cowpeas for the legume; yam, cassava and sweet potatoes for the root tubers. Tomatoes, pepper, okra, garden eggs, cabbage, lettuce, spinach, and *amaranthus* are some vegetables cultivated during the dry season (SMA, 2018).

The main threat to food security in the municipality currently is the Fall Army Worm (pests that attack maize), though the devastation is gone down with the few recorded rains, the extent of damage to some maize farms is quite of a high magnitude. In total about 1,112 farms were affected with a total area of 2,443.6 ha in mainly maize farms. AEA-farmer ratio (the number of farmers each Agriculture Extension Agent is supposed to provide extension services to; the required is 1 AEA:500 farmers) is inadequate, particularly due to retirements without the needed replacements and late release of funds for implementation of planned activities. Moreover, there has been declining yield levels of farmers due to soil fertility loss, low fertiliser usage and unreliable rainfall due to climate change phenomenon such as drought and floods (MoFA/SMA, 2018).

A key objective of Ghana's poverty reduction strategy is to increase rural incomes and employment opportunities by promoting agricultural diversification and export of high value commodities (MoFA, 2009). This objective is more relevant to the northern zone which had hitherto relied only on shea nut and cotton as their major export commodities. According to the NRG, these commodities have in recent times shown high susceptibility to very high price fluctuations (Northern Rural Growth Programme, 2013).

Even though smallholder agriculture is the main source of employment, income and food security for over 80% of the populace, farmers in northern Ghana face a number of challenges in agriculture production and food security. “The area is dry, arid, and compromised by water scarcity due to a short, three-month rainy season followed by an extended drought that limits farmers to a single growing season. Strong winds also create a bi-modal Harmattan season that impacts cropping systems” (Moore, et al., 2015). The Butternut Squash subsector in Northern Ghana greatly depends on the availability of water resources (the White Volta river basin, vast arable land, availability of labour force, and access to credit facility.

1.3 Butternut squash production

Butternut squash belongs to the Cucurbitaceae family (commonly referred to as the Cucumber or Gourd family in Ghana) and scientifically called *Cucurbita moschata*. The crop originated from Central America and is one of the most popular winter squash vegetables (Nutrition And You.com, 2019). Butternut squash (BNS) is planted in-situ and takes 85 to 90 days to reach maturity with a fruit weight ranging between 650g to 1000g (Butternut Squash Market: Global Industry Trend Analysis, 2012-2017). It can resist a wide range of pests and also withstand harsh environmental conditions with a relatively long shelf life of more than Five (5) months.

Table 1 gives a summary of BNS production process from climate requirement to storage as described by OMAFRA and adapted by Author.

Table 1: Butternut squash production.

Butternut squash production	
Ecology	Characteristics
Climate; Temperature	Grows in hot weather and cannot tolerate frost The seed will germinate at 15 °C but best at 29 °C - 32 °C Growth stops at 10 °C and may suffer severe injuries. Deep-rooted plants (1.2-1.8m) and cannot tolerate dry condition very well. Extended dry conditions will result in poor fruiting. The plant tolerates wet conditions fairly well but foliar diseases and fruit rot increases.
Soil	Grows well on most soils but sandy loam is ideal; crop rotation is recommended to avoid disease build-up and previous use of long-residual herbicide as well as heavy nematode infestation. Slightly acidic soil pH between 6.0-6.5.
Seeding rate	Seed requirement varies with type, cultivar and spacing. Most squash require 0.5-1kg/acre. Directly planted at the rate of 2-5 seeds/hill; plant spacing of 2mX2m and sown 1.15 inch deep.
Fertilizer	Nitrogenous fertilizer at the rate of 110 kg per ha (split application at 65kg pre-planting and broadcasted; the remaining applied as side-dress prior to vine run).
Irrigation	Moisture is required for the production of high yield quality BNS, applies 1.5 inches twice a week but on sandy soil, 3 to 4 inch twice a week is recommended.
Weeding	Plant cover the ground and shade up many weeds. Hand-weeding and hoeing are usually required.
Pests and disease	The only disease of significance is the Powdery Mildew while the Cucumber Beetle, in particular, requires vigilance and control.
Harvesting	It takes 90-110 days to reach maturity Harvest once fruits reach full maturity.

Curing	Curing is done by leaving the fruit on the field for 10 to 14 days under temperatures between 26-29 °C with a relative humidity of 80% (this can be achieved under artificial room temperature control). Curing is required to prolong the shelf life of BNS. Curing hardens the shell, heals superficial wounds and reduces water content and improves eating quality.
Storage	Place fruits in a single layer on shelves and leave small space in-between fruits; store under temperatures 10 ° C and 70%-75% relative humidity. Temperatures above 15 ° C promote high respiration and shrinking. Cold room storage is not suitable as it promotes fruit rot.

Source (OMAFRA, 2016).

1.3.1 Harvest and post-harvest Handling practices.

Butternut squash producers must ensure that desired colour and size are reached and harvest when rind becomes hard resisting denting. Harvesting should be done one or two times when fruits are fully matured and can store for several months without significant deterioration. Cut the fruit from the vine leaving a short stalk on the fruit while ensuring that the stem does not break off to avoid post-harvest decay on the point of detachment. Depending on the weather, cure fruits by leaving them in the sun for 1-2 weeks as this will harden the rind, reduce moisture content and slow respiration thereby prolonging the shelf life. However, prolonging curing under temperatures above 95 °F may cause sunburn. Remove dirt from fruits and sort out damaged fruit then perform a quality assessment before grading and packaging (Jim, et al., 2017). In marketing BNS, grade requirement must be met; BNS intended for the US market for grade No. 1: producers must meet basic specifications regarding maturity, variety, absence of cracks and breaks. Additionally, the product should be free from soft rot, dry rot, dirt, freeze and mechanical damages as well as insects and disease infestation. Grade No. 2 have less rigid requirements for maturity and damage level (George, et al., 2014). To access the export market, the specific market maturity and damage requirement must be fulfilled.

Nutritionally BNS contains low fat with high dietary fibre and rich in phytonutrients and antioxidants good for the maintenance of the human body. It improves the functioning of the nervous and immune systems due to the presence of a significant amount of potassium and vitamin B6. The nutrient content of the BNS is as shown in table 2.

Table 2: Intrinsic Qualities of butternut squash.

Nutrient	Content (g)
Moisture	82.5
Ash	9.9
Carbohydrate	5.5
Crude fibre	1.45
Crude protein	0.86
Crude fat	0.13

Source (Dari & Yaro, 2016).

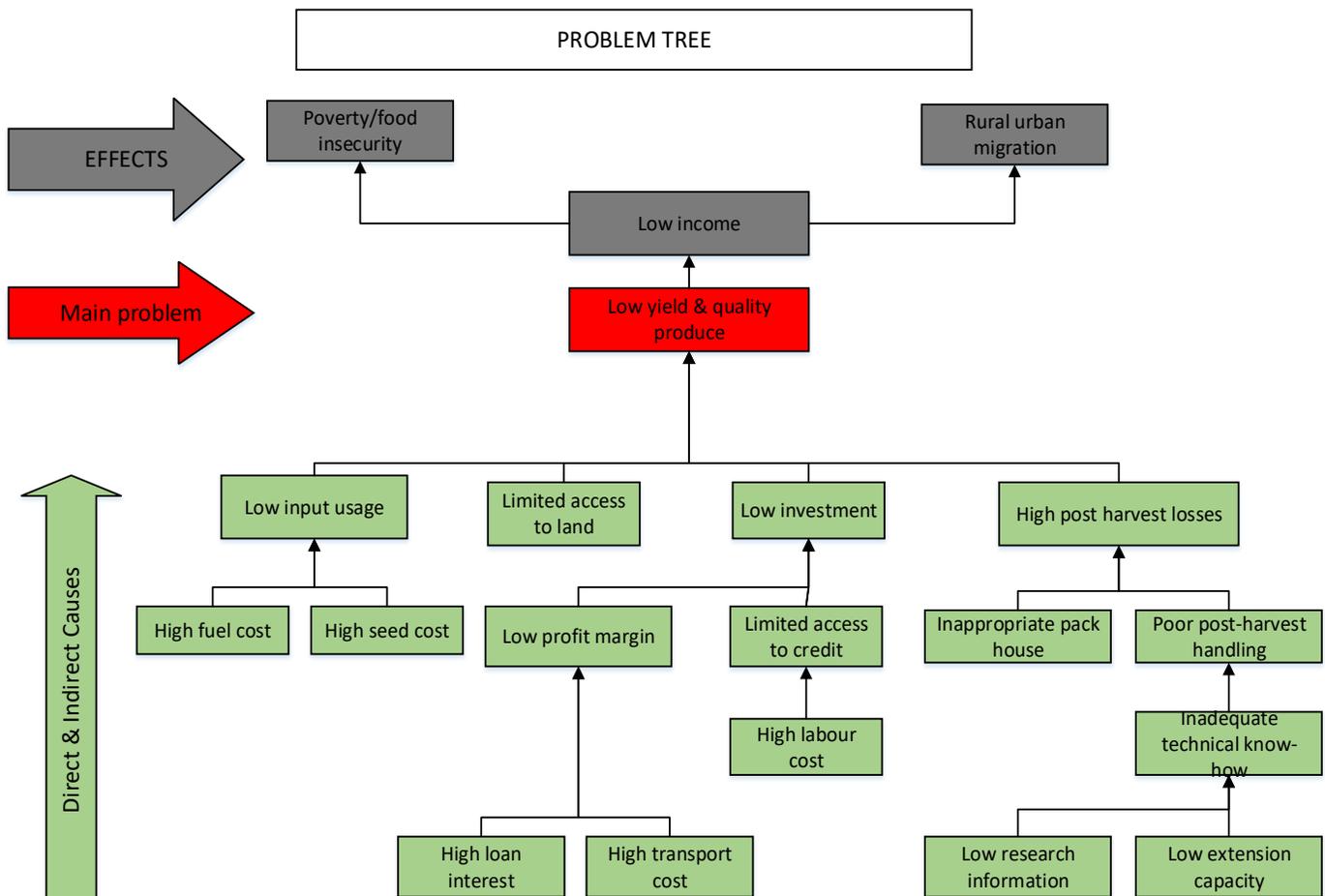
The nutritive value of the BNS indicates that persons who require low protein and fat intake for body maintenance can rely on BNS for effective results. (Dari & Yaro, 2016).

1.4 Problem statement

Butternut squash was introduced to Northern Ghana through the Northern Rural Growth Programme as a high-value export commodity to promote inclusion of smallholder farmers in the export value chain via the nucleus farming concept. Producers are faced with issues of low yields and limited market access consequently resulting in low incomes. The challenges bedeviling the sub-sector include inadequate land accessibility, low extension capacity and technical know-how as butternut squash is new coupled with little research information related to its production, quality standards and market requirements. The limitations are identified as gaps since butternut squash is exotic to Ghana and production requires a high level of technical and managerial skill to meet export requirements and market demand.

Figure 3 below shows the problem tree analysis of the BNS subsector in Northern Ghana. Low yields were identified as the main problem, with low input usage, high post-harvest losses and less cultivated area being the direct cause; poor post-harvest handling, inappropriate pack house, land tenure system, low investment, high cost of seed and high cost of fuel are indirect causes while low extension capacity, low research information and high interest on loan are the root causes.

Figure 3: Problem tree.



Source: Author own sketch, 2019

Ghana was banned from exporting five (5) vegetables to the EU market in 2014 because of pests infestation; a development resulting in the country losing more than US\$ 30million export value (Graphic online, 2014). Butternut squash as an export vegetable crop flourished well in 2013 and 2014. However, the quality of the product was not sufficient to meet the stringent export market quality standards resulting in mass rejections and ban on its export in 2015. Key stakeholders notably, the Ministry of Food and Agriculture has expressed worry on this issue hence has requested a study to identify the root causes and upgrading strategies to resume export to the UK.

1.5 Problem owner

The Department of Agriculture, Savelugu municipal and smallholder farmers are the problem owners. The core mandate of the department is policy implementation through extension and advisory service delivery in collaboration with stakeholder to contribute realising the ministry's objective of poverty reduction and increased food security for livelihood improvement. Smallholder farmers, on the other hand, have participated in the initial production and export to the UK hence are very enthusiastic and posed awaiting the resumption of the UK export value chain for inclusion.

1.6 Research Objective

The objective of the study is to identify remote causes and upgrading strategies for butternut squash value chain with the view to making recommendations to the Savelugu Municipal department of agriculture for the development of interventions to improve quality and production of butternut squash to enhance market access for scaling up and inclusion of smallholder farmers.

1.7 Research questions

Question1: What is the current structure of the BNS value chain in Savelugu municipality?

Sub-questions

Who are the stakeholders in the BNS value chain?

How are cost prices and value share distributed?

What are the strategies to market BNS?

What is the position of women in the value chain?

What opportunities and obstacles does the BNS offer to women in the upscaling inclusion in the chain?

Question 2: What are the production practices required to enhance product quality for market access?

Sub-questions

What are the current production system and practices in BNS cultivation?

What are the product quality specifications for smallholder farmers to reach the end market in the UK?

What capacity enhancement do farmers require to improve quality of butternut squash?

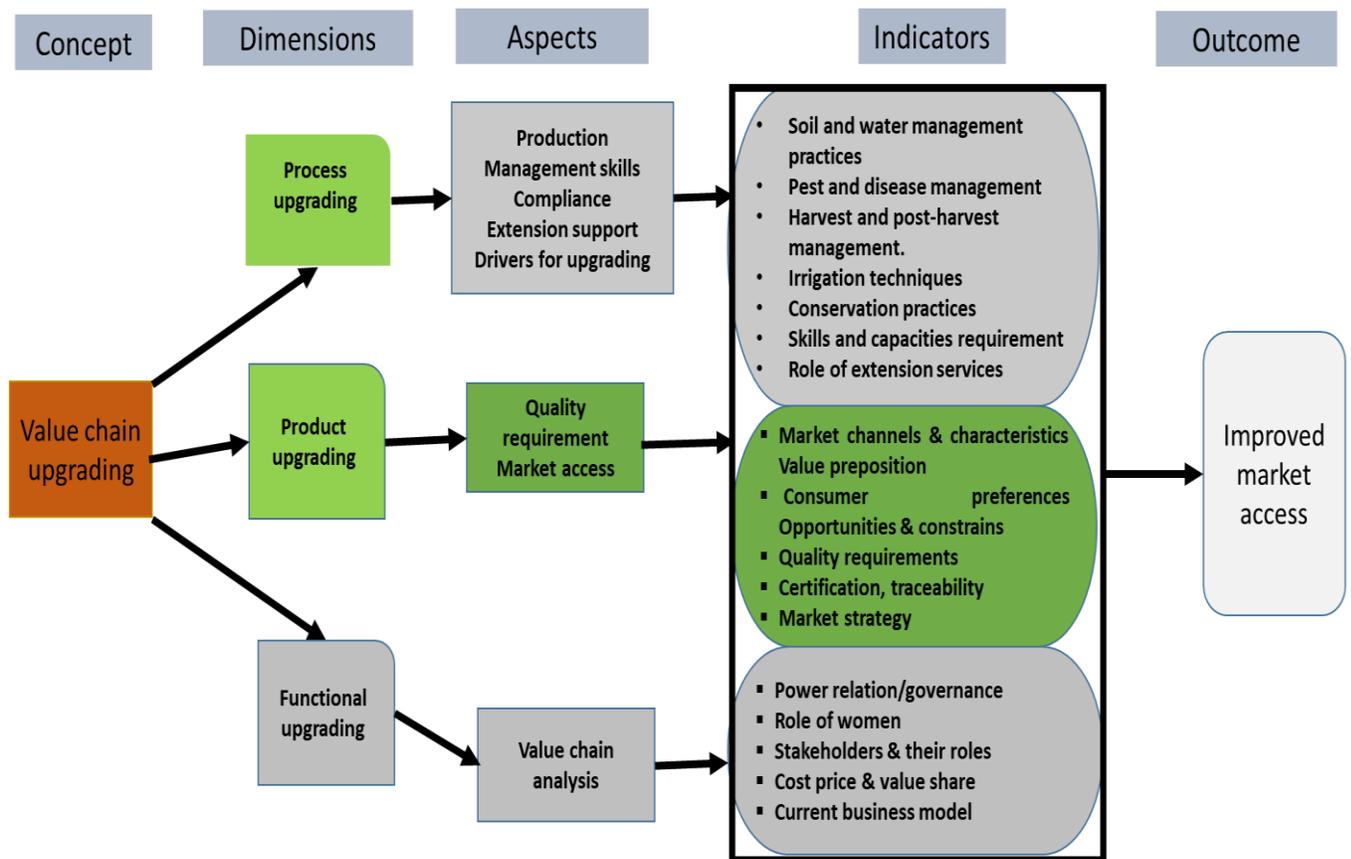
What is the role of extension services and the standard board in mainstreaming Global GAP in BNS production?

CHAPTER 2: LITERATURE REVIEW

2.1 Conceptual framework

The core concept of this research is identifying the upgrading strategy for BNS smallholder farmers through the process, product and functional dimensions of value chain upgrading. The process upgrading will analyse the production practices, managerial skills, compliance, capacities and extension support for technology transfer. Another segment will identify the market specification and product quality requirement in relation to farmers' capacity to meeting consumer demand. Also, value chain analysis will attempt to explain the roles, responsibilities and relationship among actors; including the position of women, opportunities and obstacles for upscaling inclusion. Lastly, marketing strategies and business model for possible upgrading of the BNS value chain are considered as depicted in figure 4 below.

Figure 4: Conceptual framework



Source: Author own sketch, 2019.

2.2 Value chain

Value chain is defined as a supply chain where different actors with common goal strive to increase their efficiency and competitiveness in a specific commodity by supporting each other via investing time, efforts, money as well as relationship and trust-building to satisfy the end markets thereby increasing their profit margins (KIT, Faida MaLi and IIRR, 2006). Series of activities performed by firms and workers to bring a product from conception to the end-user by undertaking activities such as planning, designing, research and development, production, marketing and distribution. Activities can be carried out by one firm or performed by different actors with a common objective (Gereffi, 2016). According to Bamber (2018), to understand the distribution of value creation and value capture along all chain activities, including stakeholders involved in the production of good and services, value chain analysis is used by the researcher. This research has provided a holistic view of the BNS value chain by examining the labour inputs, technologies, standards and the regulatory requirement for upgrading BNS targeting the UK market.

2.3 Chain governance

Governance refers to the complex system covering mechanism, processes, relationships and institutions through which individuals and groups articulate their interest, exercise their rights and obligations, and arbitrate their differences (FAO & SINER-GI, 2009). Governance goes beyond the power to control what is happening in a value chain but incorporates the rule that determines how chain activities are conducted as well as cooperation between all stakeholders. Furthermore, it addresses questions as Who is leading in a certain value chain? Is the chain consumer or producer driven? Who are the chain supporters, facilitators and influencers? Is the chain vertically integrated? (Trienekens, 2011). Answering these questions is of importance to the BNS value chain seeking to explore the UK market. Resources and Knowledge generation and distribution through the chain are determined by power lead firm who source products from a network in a cost-effective location to meet market demand (Bamber, et al., 2017). The relationship between smallholder under-resourced farmers and the firm lead with regards to support for improving the competencies and capabilities of farmers to produce to meet quality requirements will be established.

2.4 Value chain upgrading

Upgrading is the process of acquiring the technological, institutional, social and market capabilities that allow resource-poor smallholder farmers and rural communities to improve their competitiveness and move into higher value activities (Mitchell, et al., 2009).

Emerging domestic, regional and international markets coupled with increasing middle and high-income consumers offer smallholder farmers opportunities for upgrading which provides them yet another opportunity to increase efficiency and output to explore and access new markets through organised value chains (USAID, 2019). Modern markets have stricter food safety, social and environmental standards that products must comply with to meet consumers' requirements. Hence rather than focusing solely on production, trading and distribution, more attention must be given to value addition, quality improvement for compliance, increased competitiveness and cost-effectiveness (Trienekens, 2011). Increased competitiveness via skills development, quality compliance, capacity and productivity improvement are necessary for value chain upgrading (Bamber, 2018).

Mitchell et al. (2009) proposed seven upgrading strategies namely, vertical, horizontal, functional, product, process, inter-chain upgrading and the enabling environment to facilitate successful engagement of the rural poor into viable value chains after conducting action research across Africa and Asia on the Overseas Development Institute and the International Development Research Centre. This study focuses on product, process and functional upgrading.

- Product upgrading

Product upgrading entails improving product quality to meet food safety standards to comply with quality requirements for certification and traceability to enhancing market access; some standards are driven by retailers such as the supermarkets in response to consumer demand and preference (USAID, 2019).

- Process upgrading

Process upgrading is a process of improving value chain efficiency via increasing output volumes and or reducing cost per unit output and may include adopting and improving agronomic practices and technologies such as Climate Smart Agriculture, increased investment and improved irrigation systems resulting in increased yields and volumes to meet market demand and increase returns (Mitchell, et al., 2009).

- Functional upgrading

Functional upgrading involves acquiring new functions that increase the skill content of activities such as, moving to sophisticated products by taking up additional activities like sorting, grading and packaging for value addition, this may be stimulated by changes in end market or consumer preference (Riisgaard, et al., 2010).

2.5 Value share

Value share is the percentage of the final retail price that the actor earns and is calculated as the added value divided by the final retail price, then multiplied by 100. It is not a straightforward calculation as it requires information about costs and revenues. Once the cost and revenue of each actor in the chain is determined, then the profits and margins are calculated to ascertain the added value. Even though the value share of trading in African is said to be relatively large in comparison to developed countries, these large margins do not inevitably result in higher profit due to the high transaction costs, overhead costs and risks (KIT and IIRR, 2008).

2.6 Market segmentation

The market for BNS could be segmented according to form, packaging, distribution channel and region. By the form, it could be fresh, frozen or puree; it could also be packed in trays, tetra packs and glass bottles or through the distribution channel. BNS market could be divided into direct and indirect with subdivision into departmental stores, modern trade formats and online retail. The Middle East, Asia Pacific, Africa, Latin America and North American are identified as regional segmentation with North America ranked first in processing and third in fresh butternut squash production. Manufacturers are attracted to produce and distribute butternut squash due to its numerous benefits (OpenPR, 2019).

2.7 Market Access

Market access is an umbrella term for measures used by countries to put restrictions on imports (Ahmad, 2013). As tariffs, sanitary and phytosanitary requirements including certification are restrictions being enforced by both developing and developed countries. Developing countries agricultural sectors face market access problem in OECD markets as regional trade agreements result in progress stagnation in multilateral trade negotiations. Thus, violating basic WTO tenet of most favoured nations, therefore, posing a potential threat to the multilateral system and a potential stimulus to further multilateral collaboration. Furthermore, trade barriers in terms of sanitary and phytosanitary requirements contribute to market inaccessibility (Ng & Constantine, 2013). Expanding exports to developed and regional countries could reduce poverty and boost the growth of poor developing countries but for the increasingly stringent barriers by both industrial and developing nations (Lankes, 2002).

2.8 Market Channels

A market channel refers to a value chain or supply for product and services intended for sale in a particular market, and it bridges the gap between producers and the market. Furthermore, the position of a company in a channel depends on the market requirement, product type and services delivered to which market; is there single or multichannel strategy including levels of the company in the channel (Trienekens, 2011). Do producers supply directly to consumers, retailers, or is through middlemen, lead firms and cooperatives?

2.9 Exporting vegetables to the UK

Ghana has two types of exporters classified based on the business models. Type one exporter consists of small ad-hock exporters that purchase fresh vegetables and supply importers in the UK via air (Trade-type). While type two exporter is made up of companies highly integrated hence, are involved from production to exporting large volumes of fresh produce to the UK market. These companies are said to hold a varied portfolio of Asian vegetables (Integrated type). Type two exporters drive the sector (Saavedra, et al., 2014). Butternut squash was introduced into Ghana by the Export Development and Investment Funds project (EDIF) as a high-value exotic vegetable in 2010 at the request of Minor, Weir and Willis as marketing partners based in the UK. The request was as a result of the fact that Ghana has a comparative advantage over the UK with regards to the production and supply of BNS to EU markets during the winter (Ghana News Agency, 2011). The first production was piloted in three regions namely; Central, Eastern and Brong Ahafo regions. The nucleus farming system was identified as the approach to employ as to facilitate inclusion of smallholder farmers and to ensure best practices are observed for compliance with quality requirements and customers demand.

2.10 Quality requirements

“Quality is the totality of features and characteristics of product services that bear on its ability to satisfy stated or implied needs” as cited by international ISO standards 8402 in (FAO & Siner-GI, 2009). According to Saavedra, to protect consumer health, environment, as well as plant control, horticultural produce entering the UK must meet established legal standards. The General Food Law (Regulation (EC) No. 178/2002) prohibits the introduction of unsafe food to the EU market and is the basis of the EU safety regulation; hence, exporters must comply with the food regulations which includes traceability to access the EU market. Other regulations include (EC) 852/2004 it covers all aspects of the food supply chain; (EC) No. 396/2005 covers Maximum Residue Limits (MRLs) guiding pesticides usage (Saavedra, et al., 2014).

Non-legal requirements are private standards by supermarket buyers requiring stringent quality system, traceability and additional certification from supplies. The widely used private standard was the EUREPGAP until it evolved into Global G.A.P. in 2007 with the objective: to ensure the safety of fresh fruit and vegetable for human consumption. Additional requirements by the UK supermarket include Tesco ('Nature Choice'); Marks and Spencer (Field to Fork). However, with the Global G.A.P. compliance and certification, it is not difficult to meet the additional requirement for certification (Saavedra, et al., 2014). Meeting these export quality requirements is a challenge to the BNS producers and is evident in the ban imposed on exports to the UK.

2.11 Stakeholders

Stakeholder as a person or group who has an interest vested or otherwise in an enterprise and whose support is required in order for an enterprise to be successful (Rouse, 2007). Additionally, Res Involve Engagem defined a stakeholder as an individual, group or organization that has an interest in an organization, deliver services hence interested in the outcome (Engagem, 2017). Furthermore, a corporation of potential beneficiaries and or risk bearers that contribute either voluntary or involuntary to its wealth by creating capacity and activities (James , et al., 2002). The common goal is that the corporation improves their livelihood; consequently, they share common risk and a possibility of gaining benefits, experiencing losses or harm as a result of corporate transactions. Therefore, key stakeholders supply resources, place something valuable and have the power to influence the

corporate performance either favourably or unfavourably. The identified gap in relation to BNS in Savelugu has to do with weak stakeholder collaboration; this research will identify and map key stakeholders in the BNS value chain showing their roles and responsibilities as well drivers for Strengthening collaboration.

2.12 Marketing strategy

Marketing refers to all activities needed to sell a given product and is usually written out in as a plan aimed to reach consumers according to market opportunities while considering the potentials and limitations of the product including the producers involved. While the strategic aspect of marketing gives the road map and direction that addresses questions related to who to sell to? And where to sell? It involves all the operations and tasks needed to meet consumer's demand. The operational aspect deals with how to sell and when to sell? And this is commonly referred to as the market mix (FAO and Siner-GI, 2009). The operational plan organises the marketing strategy to sell the product. New marketing strategies require alternative institutional arrangements to raise new demand for and overcome barriers to economic transactions for market access (Vermeulen, et al., 2008). The marketing mix consists of establishing the means to achieve the operational objective in the selected market by combining four operating factors namely product, price, place and promotion. With regards to the marketing strategy, the research will establish the current business model for butternut squash as well as the futuristic business model and strategy that will enhance access to the UK and by extension EU market.

- Product

In marketing, product characteristics are considered and categorised as: the attribute of the product referring to both intrinsic and extrinsic qualities; the brand of the producing firm including labelling, certification, traceability and its guarantees product conformity including the level of quality amidst packaging. Appropriate branding, packaging and labelling, is important to build a reputation and image of the firm and meeting consumer need. Identifying how BNS is cultivated and presented to the market in terms of both intrinsic and extrinsic qualities is key to accessing the UK market.

- Price

Price is not just a determinant of profits or losses in relation to selling but also determines the type of consumer and competition the firm will attract. Hence a key factor to be analysed since an error in pricing can limit the benefit from a firm's activities. Of equal importance for this research are factors considered in pricing with regards to target market and quality as well as competition from national, regional and global market pricing vis-a-vis transactional costs and comparative advantage.

- Place

The place refers to the selection of the distribution channel, the geographical location to sell the product and through whom the product will be sold. Usually, the distance market offers potentials as consumers' value products and is willing to pay higher for perceived "niche" and "gourmand" products. Nevertheless, there is increased cost and cultural differences as the physical distance between production and consumption increases. Considering the current production system and the target market, is production on conventional or organic and CSA practices targeting a niche market? Answering these questions will help the BNS smallholder producers position themselves well in the export market.

- Promotion

To increase consumers' willingness to purchase and pay for a product, regular communication with both current and potential clients on the quality and characteristic of the product. Even though important, promotion is one of the costliest factors of the marketing mix. Moreover, to minimise cost, it is advisable that promotion strategies and communication activities are managed collectively.

2.13 Traceability

Traceability is the ability to trace the history, application or location of a product. A traceability system has a varying degree of complexity and allows clear identification of the origin and movement of a product from production to the end user to ensure compliance and to intervene in an event of non-compliance (FAO & SINGER-GI, 2009).

2.14 Competitors

Small scale growers in the production of fresh fruit and vegetables have contributed to rural development and poverty reduction. Stricter standards and quality requirements by both private and public standards resulting in powerful supermarkets increasingly dictating and taking charge of supply chain management. Thus, exporters need to build stronger relationships with all chain actors to ensure compliance as to access the EU market. The Ghanaian fresh fruit and vegetable producers over the years have a direct business transaction with the UK. Global G.A.P. certification can facilitate the sector to increase export volumes and achieve economies of scale needed for cost-effective production. Shifting the basis for the overall competitiveness of Ghanaian fruits and vegetable sector by producing for a higher-level segment of the EU market may contribute to maintaining high export growth (UNCTAD, 2008).

2.15 Certification

Certification is a written assurance that an entity's systems are in compliance and conformity with requirements specified in a standard or other framework of reference provided by a third party (the official certification body) (FAO & SINGER-GI, 2009). The EU is demanding food safety compliance when importing fresh agricultural produce to EU markets. Hence various legal and buyer requirements must be met, and there are opportunities to distinguish one's entity by applying additional niche market standards. These standards are categorised into: (a) food safety, (b) product quality and (c) social, environment and business compliance (Peperkamp, 2018). Since certification is key to conducting global business and exporting, this research seeks to find out BNS producers' awareness on this requirement and the processes involved in getting different certification to facilitate market access to the UK.

2.16 Contract farming

The agreement between a farmer or a group of farmers and a contractor for the supply of product under forwarding agreements frequently at pre-determined prices. It involves the growing and marketing of farm product under selective market quality, grade, size, inspection, timing, and both the grower and the contractor (buyer). The nucleus farming equally involves an agreement between a contract farmer and smallholder farmers to supply specific product on contractual agreement to increase volumes. These smallholder farmers are often referred to as out-growers. Here, out-growers are usually provided with technical assistance in GAPs to enable them to produce to meet the required specifications. Out-growers are generally smallholders using their own land and labour for production but in a commercial relationship for output marketing and input supply (Hall, et al., 2017). BNS value chain in Savelugu operates under the concept of nucleus farming with the lead firm sourcing from smallholder out-growers; the terms of engagement as well as relationship needs to be established to identify capacity gaps and upgrading strategies for upscaling smallholder inclusion.

2.17 Extension and technical support

The ministry of food and agriculture (MoFA) is responsible for the provision of extension and advisory services under the public extension system. Field extension Agents are responsible for technology transfer on Good Agricultural Practices (GAP) via individual and group farm and a home visit, conducting farmer training, demonstration and FFS with technical backstopping by a district agricultural officers who are higher in rank. There is a collaboration with research through the RELC as well as NGOs involved in extension service delivery (Moore, et al., 2015). Education affects the way people think and solve problems (Eisemon, 1992) and people who have at

least primary education tend to earn more money, save more money, have better health and adopt technologies more readily than their uneducated counterparts (FOA, 2005). For BNS producers to meet quality specification, access to timely and relevant extension services on GAP is key; low extension coverage has been identified as a challenge in the Savelugu Municipality but does BNS producers lack access to technical support and what measures should be put in place to bridge the gap?

2.18 Women Inclusion

Even though vegetable production gives the highest income per hectare in comparison to other crops grown by farmers in the northern region of Ghana, it requires fertile land, high labour and substantial outlay on input; hence average plot for commercial vegetable production is under a hectare for all except the most commercial farmer. Women and youth play a vital role in vegetable production and marketing from proving labour through to retailing (DAI, 2014). Feed the Children added that women in northern Ghana have access to land through their husbands, these lands are less fertile resulting in low yields and income. Enhancing the capacity of women and youth by increasing access to productive resources is key to upscale inclusion for poverty alleviation more so if Ghana wants to move beyond aid. Improving women opportunities in the agricultural sector will enhance their livelihoods and the community at large. Hence, there is the need to promote access to productive resources in agriculture land, input, credit and technical know-how to enable women to increase their livelihood security (Feed The Future, 2018). The position of women in the BNS value chain and their level of involvement will increase their livelihood security and poverty reduction. This research seeks to find out hindering and supporting factors that support women participation in the BNS value chain.

2.19 Climate Smart Agriculture (CSA)

The FAO defined CSA as an approach for developing agricultural strategies to secure sustainable food security under climate change (FAO, 2019). They are agricultural practices that sustainably increase productivity and system resilience while reducing greenhouse gas emission (FANRPAN, 2013). Butternut squash thrives well in well-drained soils; monthly average temperatures between 18oC – 27oC and good and has been revealed that the development of the fruit can be greatly influenced by the environment (Choure, 2019). Hence integrating CSA will enable development of suitable indigenous strategies to mitigate the negative effects of climate change on Butternut squash is essential for adapting upgrading, branding and competing with regional and international competitors for value chain sustainability to improved food security and livelihoods. According to FAO, climate CSA contribute to the achievement of SDGs categorised in three dimensions namely, social, economic and environment by mutually solving food security and climate change (FOA, 2013). Since butternut squash production in Savelugu is under dry season and irrigation using water from the White Volta river, this research will find out CSA practices; specifically, land and water management practices producer are employing to reduce water contamination, siltation of the river and soil degradation.

CHAPTER 3: RESEARCH METHODOLOGY.

3.1 Research Approach.

The selection of the research approach is a very critical decision made when conducting a study. Apart from the information, it provides about the research design, it also gives the researcher the opportunity to critically assess how the various approaches adopted may contribute to or limit the study from achieving its objective. The study will use both qualitative and quantitative approaches (Creswell, 2009). This follows advice by Punch that, to maximize the research value, the researcher should blend both approaches as much as possible (Punch, 2000).

3.2 Study area description

Three communities in the Savelugu Municipality were selected, and a survey was administered on butternut squash farmers using structured questionnaires, and In-depth Interview (IDI) conducted based on the already prepared checklist for supporters (key informants) in the butternut squash value chain, and finally a stakeholder meeting was organised with selected chain actors.

3.3 The study population

According to Burn and Grove, a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study (Burns & Grove, 1993). The study population consisted of butternut squash out-grower farmers in the three communities of the Savelugu Municipal Assembly (SMA) namely, Gushei, Kukobilla and Nabogo. In all, a total number of 52 butternut squash producers, made up of 28 males and 23 females constituted the sample size for survey administration. Four (4) AEAs were recruited from the department of Food and Agriculture to support in the administering of survey questionnaires. Three (3) women opinion leaders were interviewed on factors supporting or hindering women inclusion in the BNS value chain. A total of twelve 12 stakeholders made up of 9 males and 3 females participated in a stakeholder meeting. Seven 7 Key informants were interviewed based on their knowledge and participation on the BNS value chains. Two of my colleagues from APCM supported in recording interviews with Key informants.

3.4 Secondary Data/desk study

Secondary data was obtained from journals, various publications of the Ghana Living Standard Survey (GLSS), Food and Agriculture Organization of UN, commodity and exchange market surveys as well as the United Nations Human Development Reports. Other relevant literature and information were extracted from textbooks, periodicals, research reports both (published and unpublished), internet, and from newspaper articles.

3.5 Structured Questionnaires

Structured questionnaire was the main research instrument for the collection of quantitative data (survey). However, to ensure validity of the questionnaire, pre-testing was carried out. This provided useful feedback and information for the amendment of some of the questions in order to generate the desired outcomes. Five (5) questionnaires were pretested in a neutral community. Three communities from the Namely Nabogo, Kokobila and Nabogo all in the Savelugu municipality were selected because they are communities that make use of the White Volta river basin for irrigated agriculture during the dry season. Additionally, these are communities where butternut squash is still being cultivated.

Table 3 below give a summary of primary and secondary data collection process indicating the strategy, purpose, data collecting tools as well as the respondents.

Table 3: Overview of data collection process.

Overview of primary and secondary data collected			
Secondary data collection			
Strategy	Purpose	Data collection tool	Respondent
Desk Study	To review literature on core concepts, dimensions and chain context	Google scholar, Greeni search engine and Books,	N/A
Primary data collection			
Survey	To generate quantitative data on production, quality requirement, market access, opportunities and obstacle for inclusion	structured questionnaires	A total number of 52 Butternut squash smallholder farmers made up of 28 males and 23 were interviewed.
Case study Interviews	IDI: In-depth Interviews with Key Informants interviewed based on their knowledge and participation on the BNS value chains.	Semi-structured questionnaires and check list	7 Key informants made up of 6 males and a 1 female.
	Stakeholder meeting: The objective of the meeting was to obtain primary data on the role of stakeholders in the BNS value chain, the proposed business model for BNS, SWOT and PESTECH analysis of the BNS value chain including the market segmentation and value proposition for butternut squash.	Chain map SWOT PESTECH Stakeholder matrix	1 Stakeholder meeting; 1 ADVACE USAID 1MoFA 1 Retailer 2 DAEO 4 Butternut squash producers 1Wholesaler 1Nucleus farmer 1 GASIP

Source: Author own sketch, 2019.

3.6 Data processing and Analysis.

The survey questionnaires were each given a code for identification and data from the survey was compiled by coding responses for every single question, and then the Statistical Package for Social Sciences (SPSS version 25) software was used to generate simple distribution tables, graphs and charts for interpretation and analysis. These tables and graphs provided means summarized on the data presented. Additionally, the multivariate cross-tabulation chi-square and other relevant tests were used to establish the relationship between the dependent variables and the independent variables.

Furthermore, information gathered from the semi-structured interviews from stakeholder meeting as well as individual in-depth interviews was analysed using the grounded theory as well as triangulating with concepts identified from the literature review, amongst respondents and quantitative and qualitative approaches. Finally, other qualitative data was generated and analysed using PESTEC, SWOT, stakeholder matrix and the chain map.

Table 4 below gives an overview of the strategy to employ for data collection, the purpose and analytical tools to be used in analysing data.

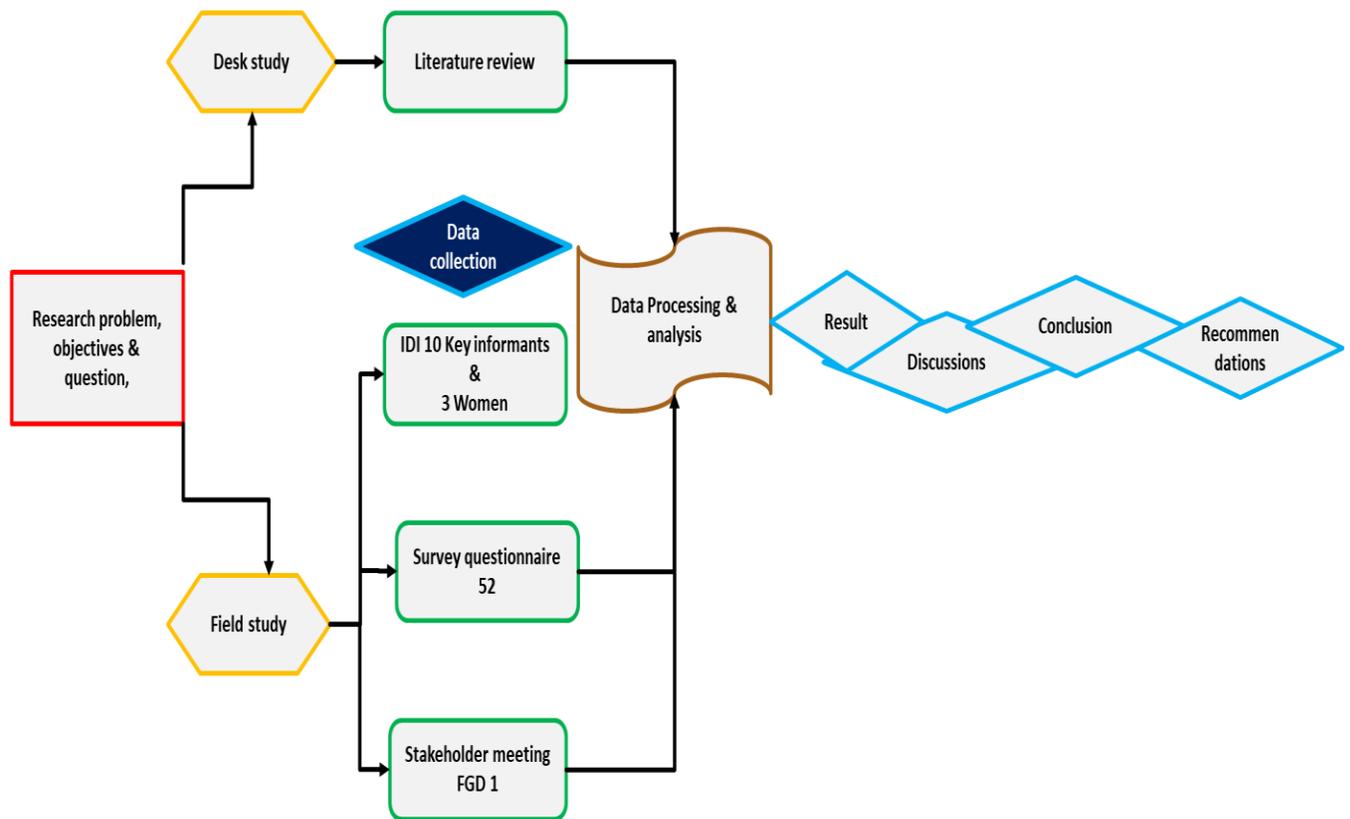
Table 4: Overview of data Analyses.

Data Analyses		
Strategy	Purpose	Analytical tool
Desk research, interview and survey	Stakeholder analysis	Stakeholder matrix, Power interest grid
	Chain context analyses	PESTEC and Chain mapping
	Diagnosis of opportunities and obstacles	Problem tree and SWOT
	Analysis of marketing strategy	Marketing matrix (Product Place price and promotion)
Case study Interview	Qualitative analyses of information from key informants	Grounded theory Chain mapping
Survey	Quantitative analyses of data obtained from respondents	Statistical Package for Social Sciences (SPSS version 25)

Source: Author own sketch 2019.

Figure 5 below is a pictorial overview of the research processes from inception to submission of the thesis. It includes the planning, design, field activity and reporting and sharing of the result.

Figure 5: Research framework.



Source: Author own sketch, 2019.

CHAPTER 4: RESEARCH FINDINGS.

4.1 Butternut squash Smallholder Farmer Socio-demographic characteristics.

4.1.1 Sociodemographic of respondents.

Table 5 below shows the sociodemographic characteristic of the survey sample of 52 respondents; it indicates a minimum age of 25 years and a maximum age of 70 years with a mean age of 42 years. While the maximum household size is 26, the minimum is 2 with a mean household size of 11.

Table 5 Socio-demographic characteristic of respondents.

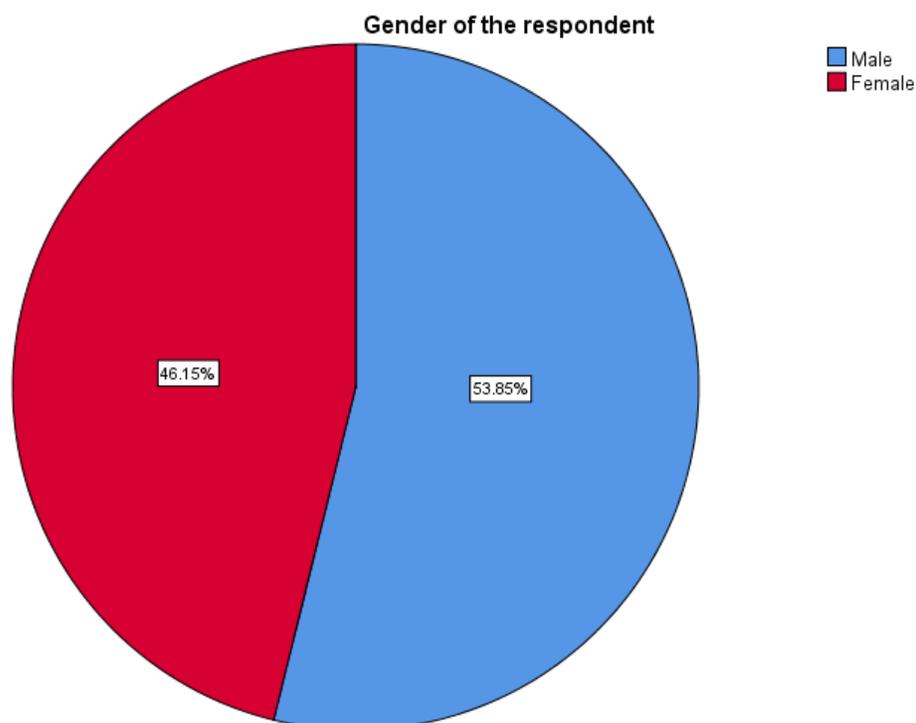
	N	Minimum	Maximum	Mean	Std. Deviation
Age of respondent	52	25.00	70.00	42.3654	12.38916
Household size	52	2.00	26.00	10.8846	5.29763
Valid N (listwise)	52				

Source: Field Survey, 2019.

4.1.2 Gender of the respondents.

Figure 6 below shows that males slightly dominate in BNS production since 53.85% of the sample size are males while 46.15% are females.

Figure 6 Gender segregation of the respondents.

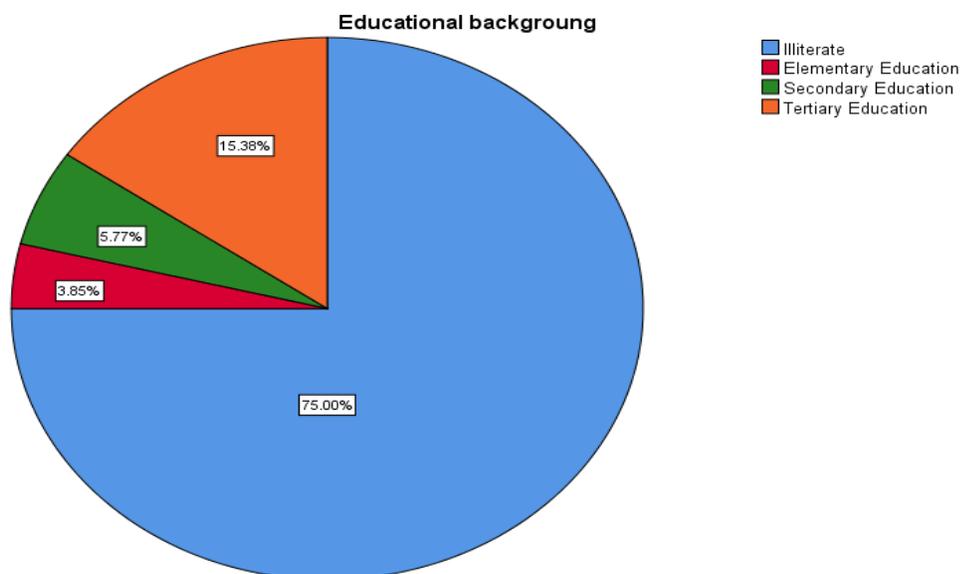


Source: Field Survey, 2019.

4.1.3 Formal educational background.

Figure 7 below is a graphic representation of educational background of respondents during survey; it shows that 75% out of the 52 respondents have not received any form of formal education; while 15.36% have higher tertiary education with 5.77 % educated up to the secondary level and only 3.85% have primary education.

Figure 7 Educational background of respondents



Source: Field Survey, 2019

4.1.4 Production and productivity.

Table 6 below shows the production and productivity of butternut squash in yields per hectare and area of cultivation in hectares. While the minimum landholding size is 0.5 hectare, the maximum landholding is 6 hectares with a mean of 1.05 hectares; the maximum yield per hectare is 2.5kg and a minimum of 1.4kg per hectare with a mean yield of 1.78kg per hectare. The table also displays the sum of 54.5 hectares and a sum of 92.7 MT per hectare, and this translates to a total yield of 5.1MT for the 52 respondents.

Table 6 Production and productivity of butternut squash (hectares and metric tonnes).

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Hectares on cultivation BNS	52	0.50	6.00	54.50	1.0481	0.07649
Yield per hectare of BNS	52	1.40	2.50	92.70	1.7827	0.25493
Valid N (listwise)	52					

Source: Field Survey, 2019.

4.2 Stakeholders analysis in the BNS value chain.

Role of stakeholders.

During the stakeholder meeting, the roles of actors in the BNS value chain were identified. Aside the core chain actors made up of input suppliers, out-growers, Kokobila Nasia Farm (KNF) as the nucleus farmers and buyers (chain actor), other enablers and supporters currently involved in the BNS value chain include Environmental Protection Agency, Export Promotion Council and the Plant Protection and Regulatory Services.

4.2.1 Core Actors in the butternut squash value chain.

4.2.1.1 Input Suppliers.

Input supplying is being carried out by private input dealers. The hybrid seed varieties (Waltham from the USA and Pluto from South Africa) are costly and currently selling at Two Thousand Five Hundred Ghana Cedis (GH¢ 2,500/ha) per hectare and is sold by KASMED SEED COMPANY. Fertilizer is also sold by private input dealers at fifty per cent (50%) subsidy under the Planting for Food and Jobs programme. But other required inputs for production are sold at regular prices. It should be noted here that, notwithstanding the fact that input dealers are available and have been identified, the nucleus farmer acquires all the required inputs and supply to the out-growers; this was confirmed during the interview with Key informant 1 and the survey result shows that 100% of the respondents indicated that they get their input supplies from the nucleus farmer.

4.2.1.2 Producers.

Butternut squash producers are mostly smallholder farmers referred to as out-growers with the average landholding of 0.5ha. Producers supply butternut squash to the nucleus farmer (Kokobila Nasia Farm) who equally produces BNS on a land area of eleven 11ha and supply to domestic retailers. Producers have access to only one market channel and the off-taker is the nucleus farmer.

4.2.1.3 Collectors.

The collector in the BNS value chain in the Savelugu municipal is the nucleus farmer, and the location of producers who are scattered along the White Volta river basin ranges from the shortest distance of 3km to the longest of 10km. The collection mostly takes place after harvesting then BNS is aggregated on the field and sold to the nucleus farmer. The collector invests in the production by way of supporting out-growers with input credit in the form of seed, fertilizers and pesticide. In some cases, the nucleus farmer provides producers with ploughing services on credit. Thus, there is a strong bond between the nucleus farmer and the producer and coordination by the nucleus farmer is further strengthened with technical support on production to ensure good quality BNS production. Side selling of BNS is not possible within the terms and conditions hence the nucleus farmer retrieve the credit advanced to producers at this point and only pays the excess.

4.2.1.4 Primary Processing.

The primary processing of BNS is carried out by KNF after purchasing from out-growers who only do physical sorting out of good looking and appealing BNS for the nucleus farmer. All other post-harvest activities such as carting, cleaning, sorting, grading and weighing, sterilization, curing and packaging are executed. In all, sixty temporal labourers, out of which 90% are women are engaged to work during this period, and labour requirement could run for six months during the dry season. Since production is well expanded and staggered, being engaged and earning extra money by these women has provided the opportunity for women to contribute to their household financial needs. Thus, improving the livelihoods of their families and also reducing the seasonal rural-urban migration of these women who are usually engaged in dehumanizing jobs in the cities. Little value is added

to BNS as the primary processing only enhances the supplier's capacity to meet market quality requirements and demand. Therefore, increasing the bargaining power and competitiveness of supplier.

4.2.1.5 Wholesaling.

Wholesaling of the BNS is done by the nucleus farmer who equally carries out distribution to the domestic supermarket (ShopRite and Max Mart) which has three branches in the capital city Accra and also distributes to 20 women fruit vendors located in Accra the capital city.

4.2.1.6 Retailers

Retailing at domestic markets is mostly carried out by the supermarket (ShopRite) with a little number of women (20) playing retail roles in their open fruit stands scattered at different locations in the capital city. The major retailer (ShopRite) confirmed that KNF is the major supplier of butternut squash and that ShopRite alone requires 12MT a year. According to the retailer last year and this year KNF could not supply the required quantity and the supermarket had to import BNS from South Africa to make up for the shortfall.

The picture below displays an interview session with Key Informant 4 the marketing and sells officer at ShopRite supermarket; major domestic retailer of butternut squash in Ghana.

Figure 8 Key informant interview with retailer.



Source: Field Survey, 2019.

4.2.1.7 Exporters.

The role of exporting is currently not done since the export chain is currently dormant; however, during the exporting period, the role was being played by the Oxford Fruit Company located in the United Kingdom (UK) in collaboration with KNF for further processing and distribution to retailers.

4.2.1.8 Consumers.

The vegetarian association living in Ghana has been identified as one group that consume BNS. Other domestic consumers are expatriates, Europeans and Asians living in Ghana as well as hoteliers and restaurant operators. Butternut squash consumers are classified into high and middle-income consumers. Demand from the Ghanaian community is quite low due to limited knowledge of the nutritional content and utilization of butternut squash. According to the retailer, consumers are not currently concern with the system of production thus ShopRite retails conventionally produced BNS.

4.2.2 Supporters, facilitators and enablers.

4.2.2.1 Ministry of Food and Agriculture (MoFA).

The MoFA is the public extension services institution with the core business of general extension service delivery; collaboration with other state institutions and NGOs on agriculture. The responsibilities of the ministry also include implementing government policies on agriculture. MoFA is the mandatory institution responsible for ensuring the producer's capacity is improved to implement GAPs.

4.2.2.2 Northern Rural Growth Programme (NRGP).

The Northern Rural Growth Programme (NRGP), GhanaVeg now HortiFresh and SADA (all NGOs) were mentioned as key stakeholders during the stakeholder meeting as organizations that played vital roles to ensure the inclusion of the smallholder farmers (Out-growers) in the BNS value chain through extension delivery, producers' capacity development, coordination and market linkages.

4.2.2.3 Food and Drug Authority (FDA).

Food and Drug Authority (FDA) is a state regulatory body responsible for testing the intrinsic quality of BNS to ensure conformity and compliance with food safety and quality requirements for certification, and the various standards, as well as buyers, required specification.

4.2.2.4 Plant Protection and Regulatory Services (PPRS).

The Plant Protection and Regulatory Services is a subsidiary of MOFA that enforces and ensures compliance with Phytosanitary rules and regulation for food safety and exports of agricultural produce; as well as Global GAP certification requirement to export agricultural commodities. To address this challenge in Ghana, PPRS occasionally organises an awareness creation amongst exporters of horticultural commodities on the harmful effects of pests as well as their dynamics to help recognise minor and major pests across several seasons and cycles.

4.2.2.5 Ghana Export Promotion Council (GEPC).

The Ghana Export Promotion Council was also mentioned as one of the key stakeholders that support the exportation of fruits and vegetable; therefore, to access the EU market, an exporter needs certification from the GEPC to export BNS. The Ghana Export Promotion Council (GEPC) and the Ministry of Trade and Industry (MTI) are enablers responsible for creating a conducive environment for a smooth business transaction.

4.2.2.6 Transporting.

Transportation is carried out by private transporters using cargo container trucks. Financial support is based on actors' personal arrangements with financial institution, however, the KNF support out-growers with hybrid seed for repayment after harvest.

4.2.3 Analysis of stakeholder role in the butternut squash value chain using the Stakeholder matrix.

Key actors in the butternut squash value chain have been identified as core chain actors and are made up of input suppliers, out-growers, collectors, processors and wholesalers. Other enablers and supporters in the BNS value chain include the Environmental Protection Agency, the Export Promotion Council and the Plant Protection and Regulatory Services and Non-Governmental Organizations. Using the stakeholder matrix, the roles of chain actors and enablers, facilitators and supporters are summarised below.

Table 7 Stakeholder matrix of the butternut squash value chain.

Stakeholders	Roles	Participation
Input suppliers (Private input dealer)	Supply seed, fertilizers and other agro-inputs and equipment to producer	KASMED SEED COMPANY KNF buy and supply BNS seed and fertilizer to out-growers.
Producers	Producer and supply BNS to Nucleus farmer	Only BNS that meet quality specification and required grades are collected
Collectors (KNF)	Source for butternut squash from producers	Multiple role being played by KNF as the lead firm
Processors (KNF)	Perform curing, sorting, grading, weighing and packaging.	
Wholesalers (KNF)	Buy BNS from out-growers and distribute	
Exporters	Buy good quality BNS from nucleus farmer for export.	This role is currently not functional
Retailers	Buy good quality BNS from nucleus for sell in the supermarkets	Current buyers are supermarkets and roadside fruit vendors
Consumers	End users of BNS buy from supermarkets and vendors	Middle and high income earner(Vegetarian association in Ghana, Asians and Expatriates)
NGOs (GRFP. GhanaVeg, SADA, EDIF)	Chain facilitators: Deliver extension services to out-grower Training of out-growers and Linking actors to other stakeholder in the chain.	Played key role in facilitating smallholder inclusion in the BNS production. But have limited coverage and staff and are temporal.
PPRS	Enforcement of sanitary and phytosanitary regulation to ensure food safety	Currently not playing active role due to the absences of exports.
GEPC	Certifies BNS intended for exports	Currently not playing active role due to the absences of exports.
FDA	Testing the intrinsic quality of BNS for compliance with food safety regulations	Very active playing essential role

MoFA	Chain facilitator: Public extension service delivery Training of farmers Coordinating stakeholders' activities and linkages	Currently not playing active role
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Source: Field Survey, 2019.

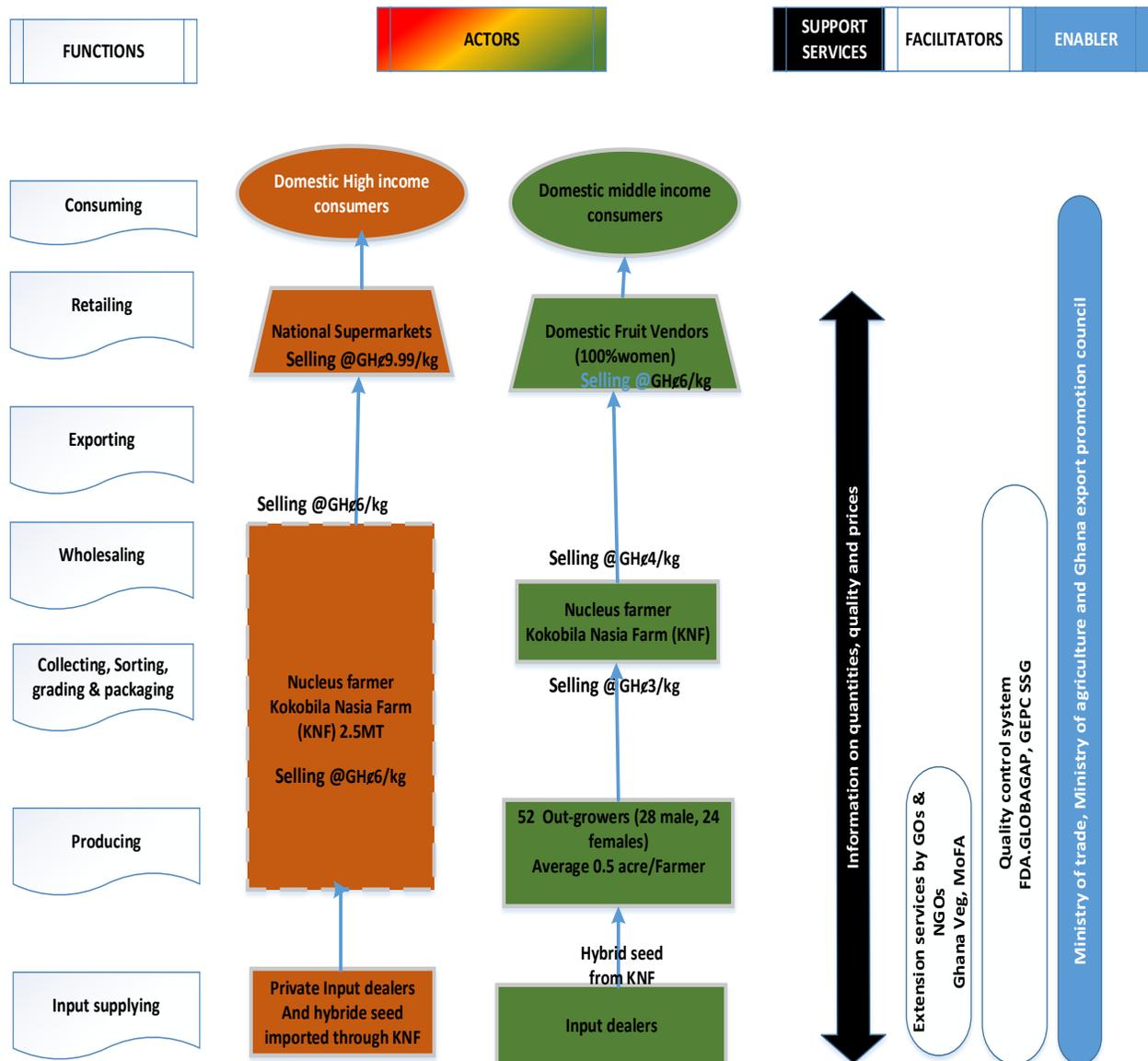
4.2.4 Value chain map.

During the stakeholder meeting as part of the field data collection process, the current Butternut Squash value chain map of the Savelugu municipal was discussed and sketched. From the figure below, it shows that the chain represents the captive chain structure vertically integrated from input dealers through the nucleus farmer to retailers. The current chain map depicts an entire domestic chain indicating the selling prices from each actor; and supporters on the horizontal integration. The main actors on the vertical integration are input suppliers, producers (farmers), processors, wholesalers, exporters, retailers and consumers who are directly involved and owned the produce at each level.

From the value chain map below, producer's sells a kilogram of butternut squash at 3 Ghana cedis while the nucleus farmer sells the at 6 Ghana cedis and the retail price is 9.99 Ghana cedis per kilogram. The results from the survey indicated that KNF and the out-growers supply a total quantity of 7.8MT to domestic supermarkets and wayside vendors in 2018.

From the current value chain, financial institutions as well as micro-financial institutions are clearly missing from the chain.

Figure 9 Current Value chain map.



Source: Field Survey, 2019.

4.3 Cost price and value share for Butternut squash actors.

4.3.1 Cost Price and Value Share of the butternut squash.

The table below is a representation of cost price, added value, selling prices as well as profit share at each stage of the chain. The actors at each stage of the chain make a profit after adding value to the product. As in the case of most vegetables, very little value is added to BNS and additionally, out-growers have no bargaining power and this was confirmed by the nucleus farmer saying, *“the nucleus farmer determines the price of the BNS, and there is no contractual agreement on prices between the nucleus farmer and the out-growers and the purchasing price has remained the same over three years”*.

The above statement was equally supported by the survey result as 88.5% out of the 52 respondents stated that their associations are not involved in price negotiation, thus making them price takers. According to the retailer, though Shoprite request for quantities but does not go into contract on pricing with suppliers. However, negotiation on prices and pricing takes place after harvesting.

Cost price and value share were generated from a cost benefit analysis of butternut squash during the stakeholder meeting. See annex 2 for details.

Table 8 Cost price and value share.

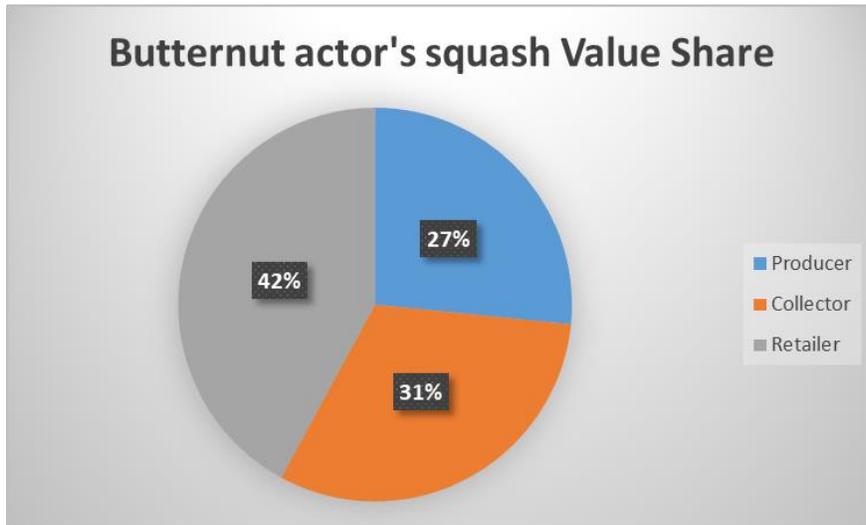
Chain Actor	Cost Price	Selling Price	Added Value (Selling Price - Previous Actors Selling Price)	Profit	Butternut actor's squash Value Share (Profit Value /total profit X 100)
Produce	1.3	3	3	1.7	26.6
Collector	1	6	3	2	31.3
Retailer	1.3	9.99	3.99	2.69	42.1
Total			9.99	6.39	100.0

Source: Field Survey, 2019.

4.3.1.1 Butternut squash actor's profit share.

The figure below depicts the butternut squash actors' percentage value share as shown in table 8 above, but presented in a graph and it indicates that the retailer gets the highest profit share of 42% while the collector's profit share is 31% and the profit share for the producer in the butternut squash chain is 27%.

Figure 10 Butternut squash actors' value share.

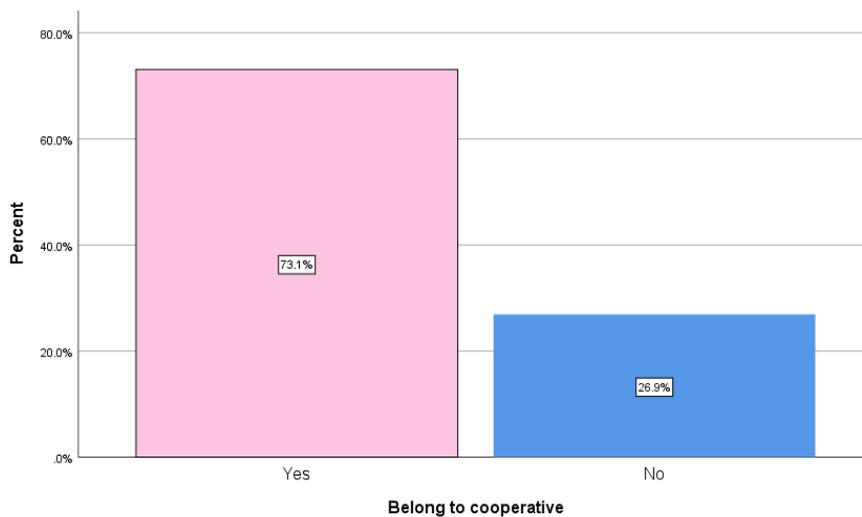


Source: Field Survey, 2019.

4.3.2 Assessing Farmer Cooperative (Farmer-Based organization)

The figure below shows that 73.1% of the 52 respondents belong to a cooperative, while 26.9% do not belong to a cooperative.

Figure 11 Producers belonging to farmer cooperative.

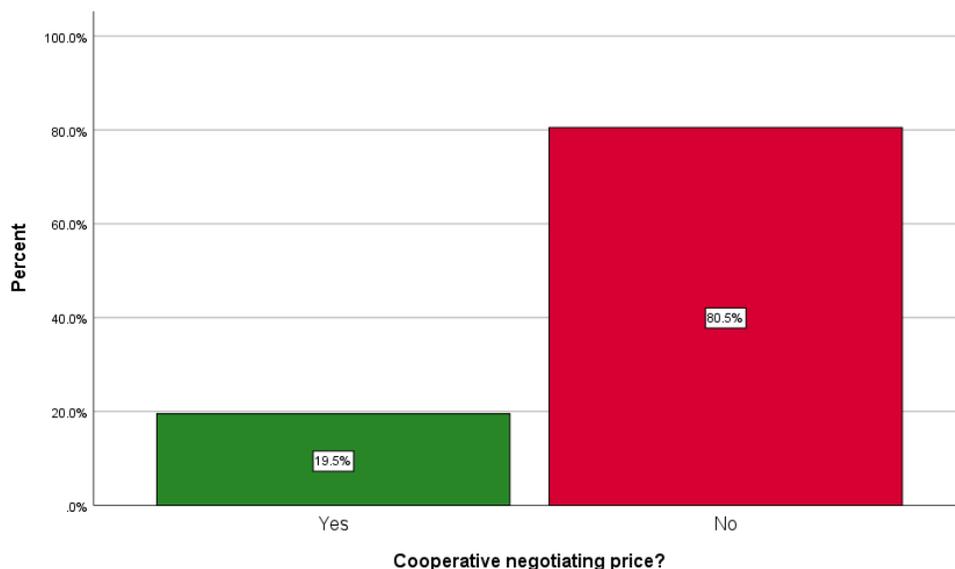


Source: Field Survey, 2019.

4.3.2.1 Cooperative involvement in pricing butternut squash.

The figure below shows that 19.5% of respondents indicated that the cooperatives are involved in butternut squash price negotiations, as much as 80.5% indicated that the cooperatives are not included in negotiating butternut squash prices.

Figure 12 Involvement of cooperatives in pricing.

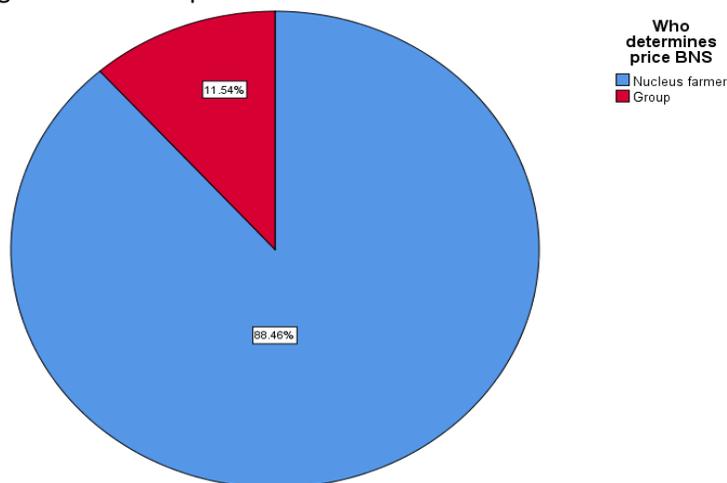


Source: Field Survey, 2019.

4.3.3 Butternut squash Price determination.

Figure 13 below shows that while 88.5% of respondents have indicated that the nucleus farmer is the sole determinant of the producer selling price, only 11.5% indicated that the group is involved in producer selling price determination.

Figure 13 Pricing of butternut squash.



Source: Field Survey, 2019.

- Rating the level of satisfaction on price.

Figure 14 below indicate that as 17.3% are very offered by the nucleus farmer, 44.2% of respondent are satisfied; while 38.5% are not satisfied with the price.

Figure 14 Price satisfaction

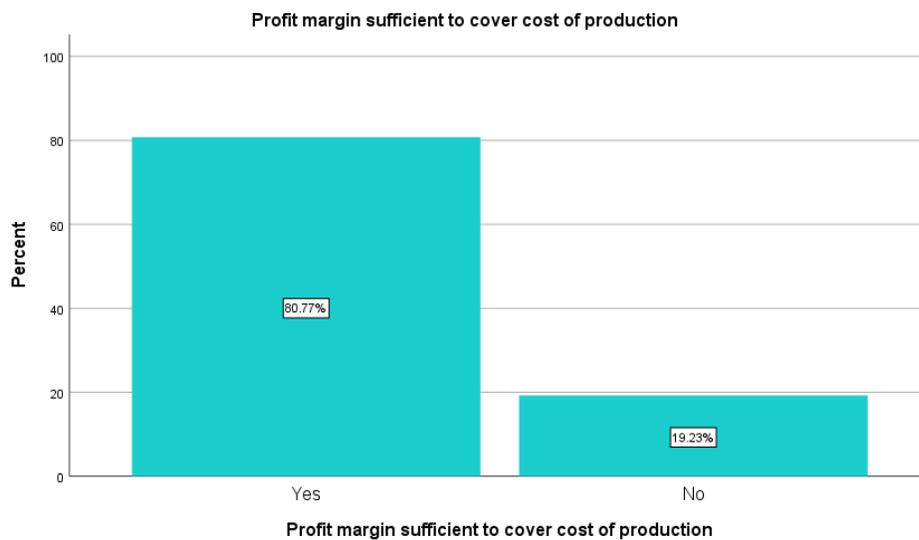


Source: Field Survey, 2019

- Rating the ability of producer to break even.

Figure 15 below shows that whereas 80.8% of respondents indicated that profit margin is adequate to cover the cost of production, 19.2% are of the view that the profit margin is not sufficient to cover the cost of production.

Figure 15 Ability to break even.



Source: Field Survey, 2019.

4.4 Marketing strategies to market butternut squash.

Commenting on the issue of suitable marketing strategies to facilitate access to the EU market, the nucleus farmer stated that, "Butternut squash export period was short-lived because the production of 60 tonnes (3 containers) could not meet the export demands of 100 tonnes per month (5 containers of 20 tonnes each). Thus, under the above conditions, production was reduced to a lower scale limited to the domestic supermarkets, restaurants, hotels, and roadside vegetable sellers leading to the challenge of oversupply that could not be absorbed by the domestic market". He added that, to regain access and enter the export market, remobilization of the investment support from interested investors to pool resources and start production is key; personal commitments of producer, lobbying the ministry of Food and Agriculture to motivate producers through awarding the best BNS farmer during the National Farmers Day celebration as in 2016 as well as exhibitions on its utilization to create awareness and increase local consumption of BNS.

Key informant 2 stated that *"the UK market alone requires up to ten 40-footer-container of BNS during the winter season and the opportunity coincides with the dry season in Ghana and therefore the need to explore this through improved irrigation infrastructure which is a challenge to cultivation in Northern Ghana during this period"*. Thus, to utilise this opportunity, there is a need to study the market trend as competition to supply the UK market is keen since the crop is cultivated in many countries around the world. The competitors have the comparative advantage of being very close to the UK and also have long years of expertise in the production and marketing of BNS. Key informant 2 emphasized the need *"to study and understand the production practices of BNS, including Post-Harvest, quality control strategies and requirements. Also, the crop must be commercialized and not seen to be cultivated by the resource-poor (peasant) farmers. Else they must be supported and empowered to be able to apply all the technologies and certification processes to produce optimum quality fruits for the domestic and export markets"*.

Key informant 3 expanded on the above and is of the view that the entire chain has to look at market requirements to guide production parameters and actions of other stakeholders in the organization of BNS business model concerning out-grower scheme and application of GAPs, post-harvest handling, quality control, packaging, certification, advertisement and Marketing. He stated that *"for export, the package is also expected to collect out-growers' data as well as farm locations for GPS coordinates to develop codes and enforce traceability, monitoring and supervision of fields operations, the area under cultivation, yields and acceptable chemical levels"*.

Producers capacities should be improved on GAPs to be able to produce to specifications and meet domestic quantity requirements and Global GAP standards. According to the nucleus farmer, although the export niche market is good and fashionable, it can equally be expensive in terms of certification requirements; therefore, it is essential to consider the domestic niche market for a start. The local supermarket such as Shoprite sometimes pays better than what the export market does in foreign currency. According to key informant 5, *"although butternut squash is within the same cucurbits crop family grown and utilized by local farmers in Ghana, it is a new commodity in the Ghanaian markets with limited information and knowledge on its utilization by the majority of the populace"*. Additionally, there is the need to conduct sensitization, awareness creation and educational drive on the nutritional values and economic potentials to improve utilization and marketing of the commodity. Also, the collaboration between KNF and GhanaVeg is to create awareness on BNS production and utilization amongst the general public and to increase the demand of BNS to trigger consumption and increase smallholder farmer participation in BNS production.

According to key informant 4, *timely delivery and meeting the required quantities with good quality butternut squash is paramount to sustaining and increasing access to markets. Currently, quantities supply to Shoprite is not sufficient and not delivered at the right time to enhance business growth. Thus, the situation calls for effective collaboration and planning to develop strategies on efficient production and marketing systems to ensure constant supplies.*

4.4.1 Butternut squash market trend.

The trend of butternut squash production over three years indicate that supply has been unstable and insufficient for the domestic market. The domestic market demand for butternut squash is 12MT per year while the supply was 5.6MT in the year 2016, it decreased to 4MT in the year 2017 but picked up to 7.8MT in the year 2018 as depicted in the figure below.

Figure 16 Butternut squash production trend in the Savelugu municipality: 2016 - 2018.

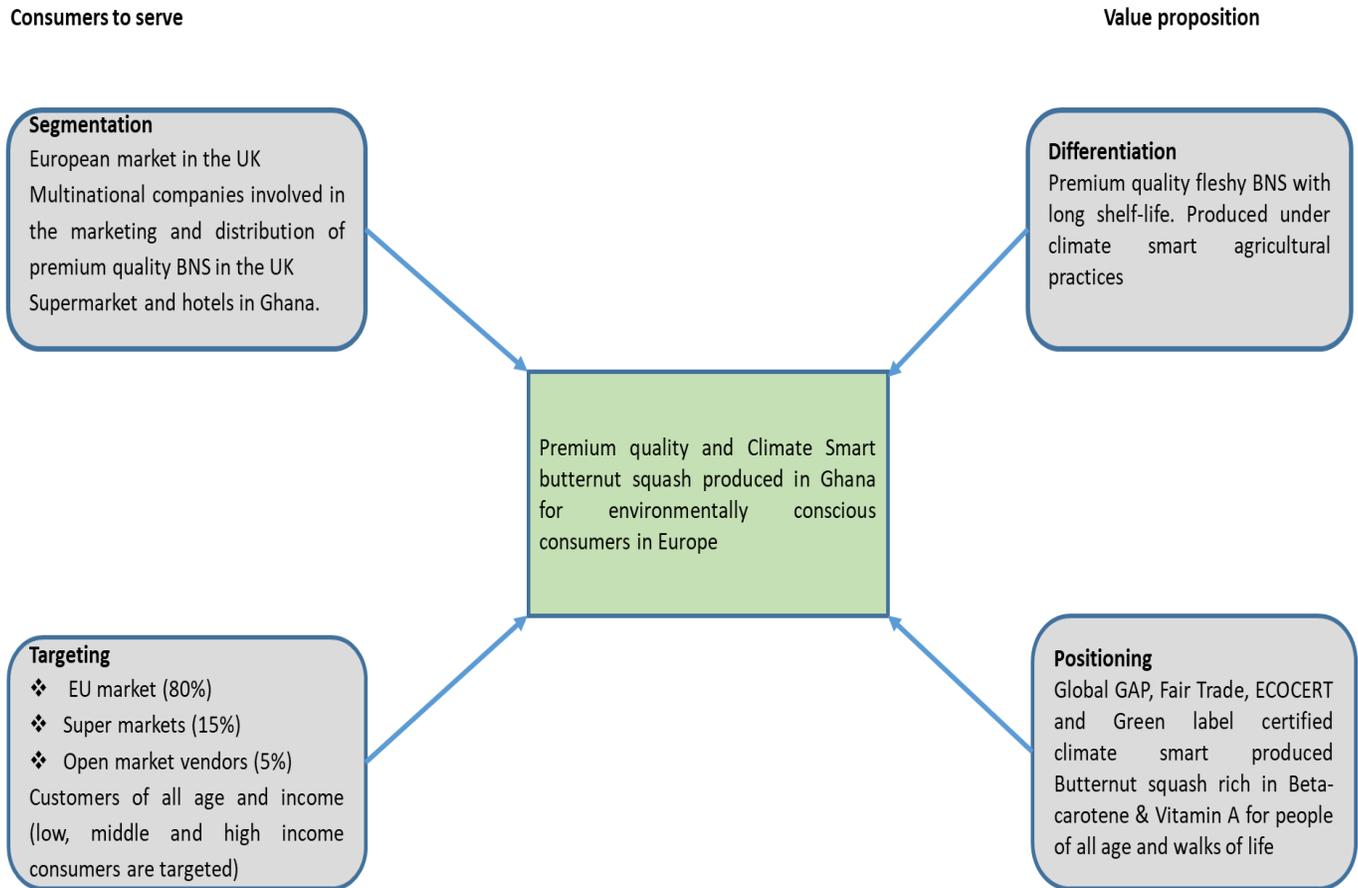


Source: Field Survey, 2019.

4.4.2 Butternut squash Market segmentation, Targeting and Positioning

During the stakeholder meeting, participants identified and came up with the figure below-depicting consumers of premium quality BNS, market segmentation and target as well as the value proposition which consist of the product differentiation that makes BNS unique commodity positioning with legal certification.

Figure 17 Butternut squash market segmentation.



Source: Field Survey, 2019.

4.4.3 Proposed business model for butternut squash producers.

During the stakeholder meeting, actors came up with a business model and a marketing proposition identifying customer segmentation and value proposition to improve quality and enhance market access and inclusion. While 80% of the marketable BNS targets the export market per the proposed Canvas business model, 15% targets the domestic supermarkets and 5% targets the roadside fruit vendors.

Table 9 Butternut squash Canvas business model plan.

<u>Key Partners</u>	<u>Key Activities</u>	<u>Value proposition</u>	<u>Customer Relationships</u>	<u>Customer Segments</u>
Input suppliers (seed, fertilizer, chemicals) Financial Institutions Department of Agriculture, Farmer Based Organisations, NGOs EPA Transporters PPRS GAIP GHS (Nutrition service)	Training for farmer groups on GAPs. Linking of farmers to market, processors and other forms of utilisation. Exploring export potentials Facilitation of access to land and irrigation facilities especially for women Training of producers of Global GAP standards Training of farmers cooperatives on business development, lobbying and negotiation skills	Fresh premium quality fleshy BNS rich in Beta-carotene and vitamin A with long shelf-life	Informal business relationship (open to general public, keeps in touch with loyal customers) Formal contracts with out-growers Food bazar Orders through phone calls and use of digital platforms Promotions (Adverts)	Super markets (15%) Road side vendors (5%) Export EU/UK (80%)
	<u>Key Resources</u> Capital Human resource (labour, knowledge and skills) Technology Means of transport Pack house		<u>Channels</u> Home and farm visits, Group meetings Conferences Field days and demonstrations School feeding programme Innovative platforms (digital presence like WhatsApp)	

<u>Cost structure</u> Transport Production Fuel Certification Levies Promotions and communications	<u>Revenue Streams</u> Farmers own savings, loans Central government budgetary allocations Private extension services Private Investors NGOs	
<u>Social cost.</u>	<u>Environment benefits</u> Create Climate Smart Agriculture Minimise toxic emission Improve soil health Minimise water and air pollution Increase vegetation cover	<u>Social benefit</u> Increase the income of small holder farm families Employment for the farmers in the BNS value chain Poverty reduction to achieve some of the SDGs Reduction in rural-urban migration

Source: Field Survey, 2019.

The study revealed that butternut squash producers do not have a business model and a marketing strategy to facilitate market access. During the Stakeholders meeting, producers are proposing to re-positioning themselves and are offering the national and international markets with premium quality butternut squash rich in Beta-carotene and vitamin A; produced under Climate Smart Agricultural practice for people of all walks of life. Also, it shows that the target is to improve the capacity of chain actors to produce good quality BNS thereby strengthening market linkages to revitalise the export market to the UK. Thereby increasing participation and production volumes to meet the huge market demand. Finally, effective communication and advertisement through food fairs, food bazaars, conferences, exhibition during farmers the national farmers’ day celebrations as well as the use of digital presence and electronic media were equally identified by stakeholders as means of promoting BNS utilization amongst the Ghanaian community.

4.5 Opportunities and obstacles to women inclusion in the BNS chain.

For the nucleus farmer, the culture and tradition of northern Ghana portray the man as superior to the woman, therefore, the man has access and control to farmland. Getting access to land is the first obstacle to overcome to engage in farming and should be given priority. There is a common perception that women do not own lands in their matrimonial homes as they are viewed as strangers and have no inheritance except in their parental homes. The husband may make land accessible for the wife to cultivate. *“Access to labour also becomes an issue with women in production, since tradition requires that women give the men a helping hand on their farmland before working on her farm. Fortunately, that perception is changing, and women are now more recognized though slowly”* said by key informants 1 and 2. Some NGOs and other concerned stakeholders undertake sensitization exercises for women to take up their rightful leadership positions

According to Key Informant 2, in terms of legislation, there is currently an ongoing discussion on the affirmative action bill; the bill when passed will create room for women participation in agriculture, it will equally address issues of funding women-related activities in agriculture, and from the policy side, governments are becoming conscious that women are supposed to be given equal rights in terms of their participation in development. *“Hence, gender inclusion is not an issue of option but that of right”* as stated by Key informant 2.

Since butternut squash is rich in Beta-Carotene and Vitamin A, a joint programme with Orange Flesh Sweet Potatoes (OFSP) to promote both crops will improve infant nutrition and increase women participation. *“Gender and crosscutting issues are being taken up with support from the Netherlands Embassy with the inclusion of 30-40% women participation in nutrition programmes. There are opportunities for proposal to access 50% matching grants to support women-led demand-driven innovative activities from the innovation fund”*. key informant 5.

4.5.1 Interview with women opinion leaders on women inclusion.

According to Key Informants 9,10 and 12, women are aware of BNS productions in their communities and added that women have access and control to fertile land for butternut squash production. Key informant 9 stated that *“women have access and control to fertile land for BNS production; can’t you see that land has been released for BNS cultivation for the past three years and the women still cultivating BNS on the same parcel of land”*.

Commenting on women’s access to productive resources, Key informants 9 and 10 said, women are not able to fully participate in BNS cultivation because the irrigation facility is expensive as well as the high cost of seed, and even when women get access to input credit like the other women have, you still require fuel to be able to produce. Key informant 11, added that women have no access to labour without money to engage labourers’ services.

According to Key informants 9, 10 and 12, women have inadequate knowledge on BNS cultivation, and that the initial adopters where take through butternut squash cultivation step by step and the yield were good, but now is not that good. Key informant 9 added that women lack knowledge on how to operate and manage the water pumping machines and that extra labourer is required for the operation and management of the water pumping machine, therefore, increasing labour cost.

On the issue of women access to credit, Key informants 9, 10 and 11 stated that women have limited access to financial credit and that is because women have no access to the financial institutions due to high-interest rates on loans and collateral security demands by the banks. Key informant 11 added that even though women can access input credit, but the women are shying away because of fear of default in repayment.

According to Key informants 9, 10 and 11, to increase women participation in the BNS production, it is important to facilitate access to irrigation facility, and training of women in irrigation management techniques as well as training on agronomic practices required for butternut squash cultivation. Key informants 9, 10 and added that accessing both input credit and financial credits are essential to enhance the effective participation of women in BNS production. Key informant 11 stated that women training on how to gain extra profit by giving the women market information and negotiation skills are key to enhancing women inclusion in BNS cultivation”. Key informant 11 stated that "women adopt technologies better by seeing and doing what is being taught, but when the trainers come and talk to women are taught in the classroom, they forget the processes".

4.5.2 Factors to consider enhancing women inclusion.

On the part of out-growers, the factors to consider enhancing women inclusion in the butternut squash chain are shown in the table below that depicts an equal percentage ranking of 28.3% for facilitating access to credit; facilitating access to irrigation facilities and training of women on Good Agriculture Practices (GAPs) and 15.2% ranking is indicated for facilitating access to land.

Table 10 Ranking factors to consider for Women inclusion.

Factors to consider	Frequency	Ranking (Percentage)
Facility training on Good Agriculture Practices	52	28.3
Facilitate access to credit facility	52	28.3
Facilitated access to irrigation facility	52	28.3
Facilitate access to land	28	15.2
Total	184	100.0

Source: Field Survey, 2019.

4.6 Current production system and practices by Butternut squash.

4.6.1 Production practices.

With regards to production practices, Key informant 2 mentioned that Butternut squash production is conventional and performs better on sandy-loam soil with a pH of 6.02 – 6.5.and can be cultivated throughout the year as it requires a minimal amount of water. It is possible to cultivate BNS three times a year in the transitional and Savannah Ecological zones under rain-fed and irrigation facility. From the survey result, 100% of the 52 respondents confirmed that their production is conventional. None of the despondences is into organic production.

Kay Informant 4 also, attested to the fact that, currently, there are no organically produced BNS perhaps in the future; even though consumers are concerned about the quality of produce, there is less risk concerning chemical usage in Ghana since the traditional way of production is largely by the use organic manure.

4.6.1.1 Seeds and seed variety.

On the issue of seed and seed variety used, the nucleus farmer said, the main variety of BNS cultivated at the peak of production was a hybrid variety, called Pluto imported from South African. A kilogram (1kg) is being sold at Two Thousand, Five Hundred Ghana Cedes (GH2, 500.00). However, UK buyers preferred an American variety called Waltham and that is the current variety used in BNS production in the Savelugu municipal. Key informant 1

4.6.2 Irrigation management practices.

While 88.5% of the 52 respondents indicated that the White Volta river basin is their source of water for irrigation, 11.5% get water from dugouts within the community, also, while 63.5 % use small diesel water pumping machines in extracting water for irrigation, 32.7% rely on electric-powered machines in conveying water for irrigation but only 3.8% irrigate their fields manually as shown in the table below. Additionally, 78% are using spring irrigation technology and 21.2% use farrow irrigation system in watering butternut squash fields. The table equally indicates that while 88.5% of the 52 respondents are using fossil fuel in pumping water for irrigating butternut squash fields, 11.5% combine the use of fuel and solar energy.

Table 11 Type of irrigation technology practice by producers

	Frequency	Percent	Valid Percent	Cumulative Percent
White Volta river basin	46	88.5	88.5	88.5
Dugouts	6	11.5	11.5	100.0
Irrigation scheme use.				
Flood/farrow irrigation	11	21.2	21.2	21.2
Spring irrigation	41	78.8	78.8	100.0
Drawing water to BNS field				
Manual watering	2	3.8	3.8	3.8
Small diesel water pumping	33	63.5	63.5	67.3
Big mechanised pumping machine	17	32.7	32.7	100.0
Source of energy for powering water pumping machines machine.				
Fuel	46	88.5	88.5	88.5
Fuel and Solar	6	11.5	11.5	100.0

Source: Field Survey, 2019

4.6.3 Cropping systems practiced by butternut squash producers.

The table below shows that 84.6% of respondents are practising mono-cropping, while 11.5% are practising crop rotation and 3.8% practice mixed cropping. 53.9% are practising bunding as an agricultural conservation practice to retain moisture in the soil, 46.1% are not bunding. Also, 63.5% are using compost on butternut squash fields while 36.5% are not using compost. The table indicates that as 51.9% are practising crop rotation, 48.1% are not practising crop rotation. As the majority (92%) of those practising crop rotation rotates BNS with other fruits and vegetables, only 8% use leguminous crops in rotation. Furthermore, 63% are aware of buffer zone protection while 36% are not aware. As much as 97.7% are willing to protect the White Volta river basin. Finally, while 71.2% are of the view that it is possible to adopt Climate-Smart Agriculture practices, 3.8% believe that CSA is impracticable.

Table 12 Current Production Practices.

Production system.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Conventional	52	100.0	100.0	100.0
Cropping system of BNS.				
Mono cropping	44	84.6	84.6	84.6
Mixed cropping	2	3.8	3.8	88.5
Crop rotation	6	11.5	11.5	100.0
Compost produce and use on BNS.				
Yes	33	63.5	63.5	63.5
No	19	36.5	36.5	100.0
Practice of bunding on the field BNS.				
Yes	24	46.2	46.2	46.2
No	28	53.8	53.8	100.0
Practice crop rotation.				
Yes	25	48.1	48.1	48.1
No	27	51.9	51.9	100.0
Kinds of crops in rotation.				
Legumes	2	3.8	8.0	8.0
Fruits and Vegetables	23	44.2	92.0	100.0
Total	25	48.1	100.0	
System	27	51.9		
Knowledge of buffer zone protection.				
Yes	33	63.5	63.5	63.5
No	19	36.5	36.5	100.0
Practice of bunding on the field BNS.				
Yes	24	46.2	46.2	46.2
No	28	53.8	53.8	100.0
Willingness to protect river basin.				
Willing	43	82.7	97.7	97.7
Very willing	1	1.9	2.3	100.0
Total	44	84.6	100.0	
System	8	15.4		
Possibility to adopt CSA practices.				
Not possible	2	3.8	3.8	3.8
Possible	37	71.2	71.2	75.0
Very possible	13	25.0	25.0	100.0

Source: Field Survey, 2019.

4.6.3.1 Seeds and seed variety.

On the issue of seed and seed variety used, the nucleus farmer said, the main variety of BNS cultivated at the peak of production was a hybrid variety, called Pluto imported from South African. A kilogram (1kg) is being sold at Two Thousand, Five Hundred Ghana Cedes (GH2, 500.00). However, UK buyers preferred an American variety called Waltham and that is the current variety used in BNS production in the Savelugu municipal. Key informant 1

4.6.3.2 Climate Smart Agricultural practices.

Commenting on CSA, the Municipal Director of Agriculture said, Climate-Smart Agriculture and conservation practices such as the use of short duration improved varieties, tie ridging were necessary to conserve water, as well as tree planting for buffer zone protection. These practices are being piloted and farmers have shown their readiness to cooperate with extension officers in this regard. So far, the adoption levels are high among producers.

The nucleus farmer confirmed that, producers are into conservation practices and that the KNS has taken a MoFA-African Development Bank Initiative under the Savana Investment Program on conservation agriculture. Consequently, in the year, 2018 Kokobila was amongst four pilot farms to undertake zero tillage conservation technologies. Under the programme, conservation practices are carried out with communities, and BNS fields are equally covered. Conservation agricultural practices also include tree planting as a live fence and/or boundary trees around the farm as well as creating a hundred metres (100m) buffer zone from the rivers. The most relevant component of conservation agriculture is the maintenance of vegetative cover and crop residue on the savannah lands for four to five years. Below is the assessment of out-growers' awareness of CSA practice during the survey.

4.6.3.3 Management of crop residue.

From the table below 55.8% of the 52 respondents leave the crop residues on the farm after harvest, 17.3% use the crop residues in feeding livestock and 9.6% plough back into the soil with while 1.9% use the crop residues in composting.

Table 13 Crop residue management.

	Frequency	Percent	Valid Percent	Cumulative Percent
Leave on the farm	29	55.8	55.8	55.8
Animal feeding	9	17.3	17.3	73.1
Plough back into the soil	5	9.6	9.6	82.7
Use for composting	1	1.9	1.9	84.6
Animal feeding and ploughing back into the soil	5	9.6	9.6	94.2
Leave on farm and plough back into the soil	2	3.8	3.8	98.1
Leave on farm and animal feeding	1	1.9	1.9	100.0
Total	52	100.0	100.0	

Source: Field Survey, 2019.

4.6.3.4 Management of surplus produce.

The table below shows that 63.5% of the 52 respondents share surplus produce with friends and for home consumption as 23.1% apart from sharing with friend use for livestock feeding. while 11.5% only share to friends and as low as 1.9% used for composting.

Table 14 Management of surplus.

	Frequency	Percent	Valid Percent	Cumulative Percent
Give to friends	6	11.5	11.5	11.5
For home consumption and give to friends	33	63.5	63.5	75.0
Home consumption, give to friends and livestock feeding	12	23.1	23.1	98.1
Home consumption, give to friends and composting	1	1.9	1.9	100.0
Total	52	100.0	100.0	

Source: Field Survey, 2019.

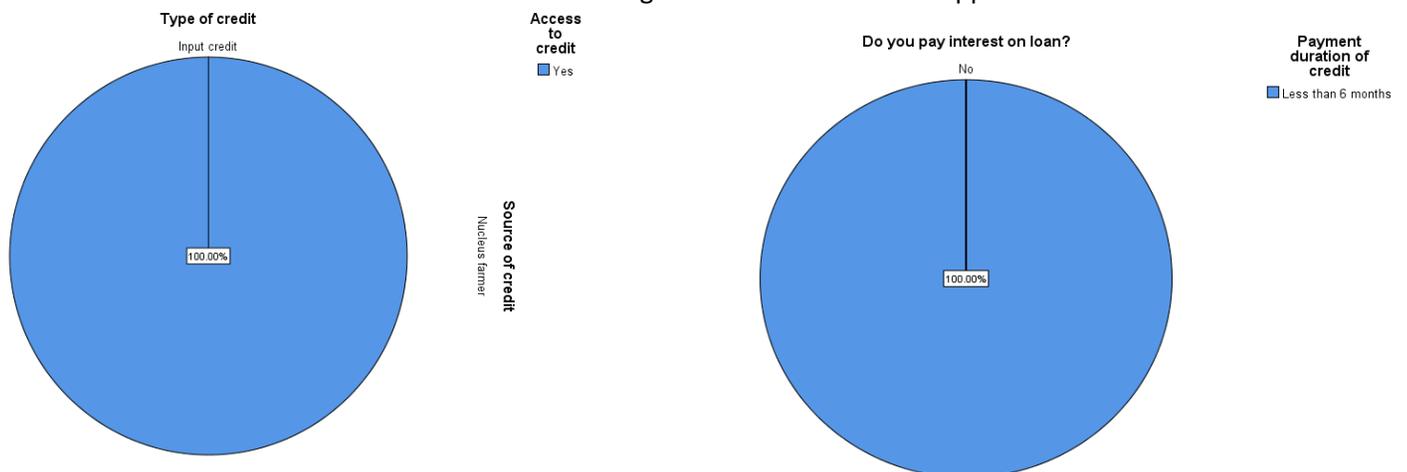
4.6.4 Out-growers scheme.

The nucleus farmer explains the nucleus farmer out-grower concept under butternut squash production, stating that, “the out-grower in BNS production is made up of poorly resourced smallholder farmers in communities around the White Volta river basin of the Savelugu Municipality. The nucleus farmer, (KNF) provide out-growers with improved seed, fertilizer and chemical as input credit under contractual agreement to be repaid after harvesting. The understanding is that the nucleus farmer purchases the produce after harvesting. The nucleus farmer equally plays the role of extension service delivery on technical capacity development of farmers; to produce quality BNS that meet quality specification and market requirement. During the piloting stage, out-growers were taken through Farmer Filed School under the supervision of a private agronomist in collaboration with NRGF.

4.6.4.1 Access to credit

The result from the survey confirmed the role of the nucleus farmer as shown in the analysis below. The result indicated that 100% of the 52 respondents have access to input credit provided by the nucleus farmer. Additionally, the credit repayment duration is less than six months and there is no interest on the loan as indicated in the table below.

Figure 18 Access to credit support.



Source: Field Survey, 2019.

4.6.5 Relationship between BNS Yields and Production Activities.

The study sought to determine the relationship between BNS yields and Production Activities. The table below shows the results of the Pearson product moment correlation coefficients of the relationship between BNS yields and Production Activities.

Table 15 Pearson Correlation Matrix of Yields of BNS and Production Activities.

Variables	Y	X1	X2	X3	X4
Y	1.00				
X1	.280*	1.00			
X2	.374**	.358**	1.00		
X3	.311*	.202	.356**	1.00	
X4	.331*	.147	.300*	-0.72	1.00

Source: Field Survey Data 2019.

P<0.05(2-tailed) P<0.01(2-tailed)

Y = Yields of BNS

X1 = Educational Background

X2 = Acreage

X3 = Variety of BNS

X4 = Fertilizer Type

The Pearson product moment correlation presented in table 15 show that, there was positive relationship between yields of BNS and some production activities. at alpha 0.05 and even under 0.01 alpha level. The yields of BNS has positive and low relationship with educational background($r=-.280$), positive and moderate with acreage($r=.374$), positive and moderate with variety ($r=.311$ and positive and moderate with fertilizer type ($r=.331$). This means that the more farmers are educated and serious with these activities the more their yields are improved. This also implies that production activities with some level of education are important in improving farmers BNS yields.

4.7 Quality specifications for smallholder farmers to reach the end market in the EU.

4.7.1 Quality specification and market requirement.

Speaking on quality specification, the nucleus farmer stated that, for BNS producers to access the EU market, it is important to produce good quality BNS that meet Global GAP standards, and that different buyers have different requirements in terms of grading. A company that is a hundred per cent into processing may require larger sizes as grade three (Grade 3); the size, shape and colour are all important physical features. As per the laydown laws, an importer is required to have registered with a certification body to qualify to lift consignments out of Ghana.

“SGS South Africa (Pty) LTD System and Service Certification (SSC) business Division” is a registered South African certification body that supervises operations such as fertilizer applications and agrochemical usage to ensure adherence and compliance with standards, and to give approval for obtaining Global GAP certificate. To be Global GAP certified, there are two levels of inspection: level A for the nucleus farmer and level B for the out-growers. According to the nucleus farmer, the export grade requirements are as follows:

- Grades requirements by export market
- Grade 1: Small size 500g – 800 g
- Grade 2: Medium size 800 – 1000 g
- Grade 3: Large size 1.0 -1.5kg (Key Informant 1)

Speaking on the quality specification, key informant 4 emphasized that, the physical appearance is of paramount concern for retailing at Shoprite since that is what is appealing to the consumer. Additionally, for retailing, BNS should be free from contaminations such as diseases, pests, bruises, soils; and should have uniformly smooth shining skin with a yellowish appearance and sizes above 500g; *“this is because customers who patronize the BNS are the restaurants and the expatriates who are attracted by good looking and healthy BNS, and Shoprite purchases grade 1 and 2 BNS. Shoprite is discussing with Ghana Green Label concerning supporting and funding the certification of Shoprite’s farmers. Although the arrangement is yet to be concluded, nevertheless, producers are encouraged to register with the scheme as Shoprite has now made it a requirement to supply the company”*.

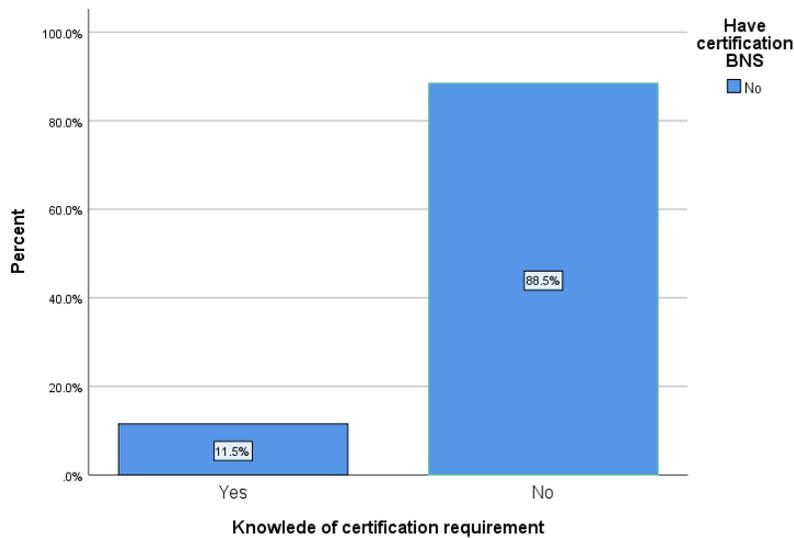
The plant control unit of the PPRS (Key Informant 3) added that, exports to the UK as the target market must comply with the EU standards since it is using the European Union Single Market standards. Thus, butternut Squash destined for export should be substantially free from pests in general but particularly insect pests such as Fruit Fly, Whitefly and *Thrips*. Nevertheless, *Thrips* and whiteflies can be ridden off during post-harvest handling through proper washing with pressurized water or cold water as they are just surface pests. However, in the case of fruit borers, preventive measures and treatment should be carried out on-farm right from the vegetative stage through flowering to fruiting. This can be done using pheromone traps alongside other systems approaches to monitor the population dynamics of the pests to guide and put in the necessary control measures.

BNS fruits are usually in contact with the soil during maturity; hence, harvested fruits may carry soil nematodes that can affect the export. The EU categorizes all these pests and contaminants as harmful, consequently the presence of these pests in any export consignment will be rejected or treated and released or destroyed all at the expense of the importer or exporter.

BNS exports as from 14th December 2019, will be required to be accompanied by a phytosanitary certificate from the PPRS since EU has included BNS as a commodity to enforce quality control. Hence for BNS producers to access the niche market of the UK and other EU markets they must subscribe to at least Global GAP, TESCO and BRC (British Retail Consortium) certificates”.

On the part of out-growers, the majority (88.5%) are not aware of the certification requirement for smallholder farmers to access the EU market. Only 11.5% of the 52 respondents are aware while 100% do not have any certification, as shown in the figure below.

Figure 19 Awareness on certification requirement.



Source: Field Survey, 2019.

4.7.1.1 Assessing out-growers’ capacity to meet quality requirement.

Assessing producers’ capacity to meet quality specification, the survey results revealed that 100% of respondents have received training on GAPs to produce to specification, majority (98%) were trained by the nucleus farmer and 88.5% indicated that it was through Farmer Field School and demonstration (11.5%) as shown in figure X below respectively.

On the issue of quality requirements, whereas 36.5% of out-growers, rated their ability to meet quality specifications as good, as much as 63.5% are of the view that their ability to meet specification is satisfactory as shown in the figure below.

On the issue of quality requirements, whereas 36.5% of out-growers, rated their ability to meet quality specifications as good, as much as 63.5% are of the view that their ability to meet specification is satisfactory as shown in the figure below.

Table 16 Assessing farmers ability to meet quality specification.

Assessing farmers ability to meet quality specification				
	Frequency	Percent	Valid Percent	Cumulative Percent
Receive training.	52	100.0	100.0	100.0
Yes	52	100.0	100.0	100.0
Training provider.				
Private service provider	1	1.9	1.9	1.9
Nucleus	52	98.1	98.1	100.0
Training on quality.				
Field demonstration	6	11.5	11.5	11.5
FFS	46	88.5	88.5	100.0
Ability to meet quality specification.				

Yes	52	100.0	100.0	100.0
Rating the capacity to produce.				
Satisfactory	33	63.5	63.5	63.5
Good	19	36.5	36.5	100.0

Source: Field Survey, 2019.

4.8 Capacity enhancement producers require to improve quality of BNS.

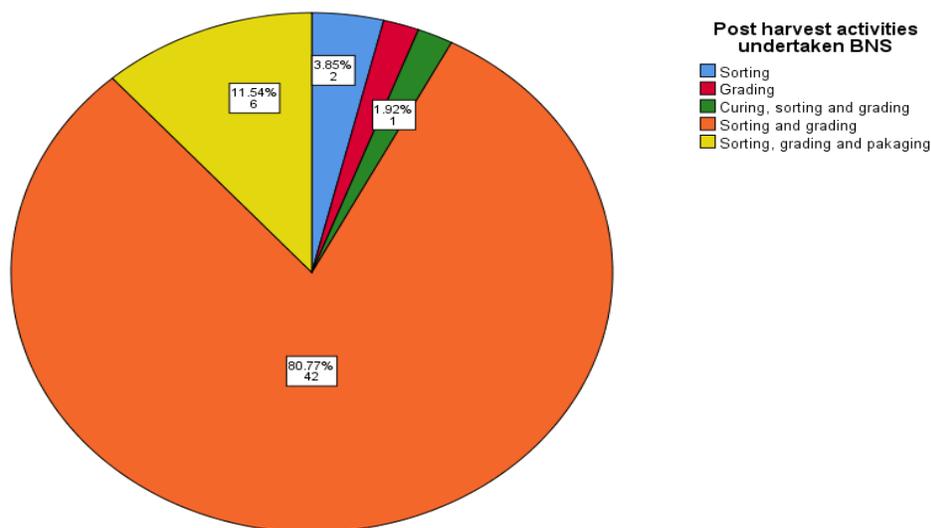
4.8.1 Capacity enhancement requirement for producers.

Speaking on the subject of the required capacity enhancement needed for out-growers to improve the quality of BNS, key Informant 1 stated that producers' capacity should be developed on (i) Good Agricultural Practices needed for BNS; (ii) harvest and post-harvest handling practices; (ii) pests and disease management particularly (Integrated Pests Management) to avoid exceeding the acceptable chemical levels; (iv) Irrigation management techniques and finally (v) facilitating access to a warehouse. Apart from agreeing with the above assertion, Key Informants 2 and 4 added that out-growers should be conversant with the basic Global GAP standards and BNS market requirements since this will guide them to produce butternut squash that meets the quality requirement. Key informant 4 stated that, *"having access to improved seed is crucial to meeting quality requirement"*.

4.8.1.1 Harvest and post-harvest handling practices.

Assessing the out-growers post-harvest handling activities for quality improvement, the survey result revealed that, 100% of the 52 respondents do sorting and grading before selling the butternut squash; 80.77% of the respondents indicated that they carry out grading and sorting while 11.77% perform sorting, grading and packaging and 1.9% perform curing, grading, sorting and packaging.

Figure 20 Post-harvest activities.



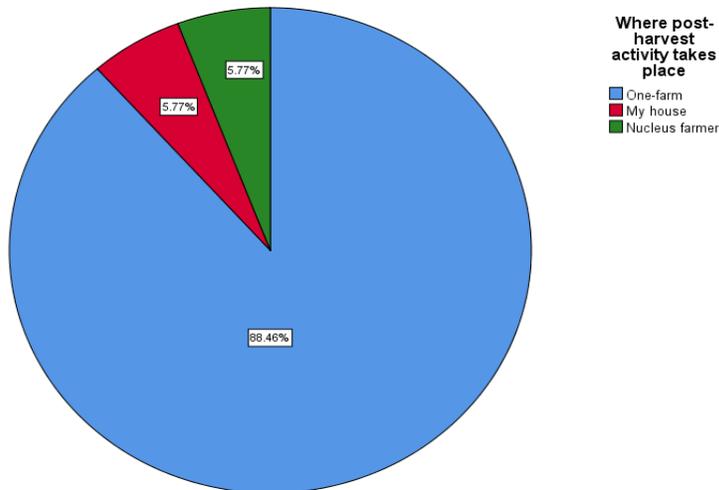
Source: Field Survey, 2019.

4.8.1.2 Access to a warehouse.

In assessing out-growers access to a warehouse to handle post-harvest activities to preserve and enhance the product quality, the survey results revealed that while 88.5% of respondents carry out post-harvest activities on-

farm, only 5.7% conduct post-harvest activities in their house and 5.7% carry out post-harvest activities on the Nucleus farmer's shed as shown in the figure below.

Figure 21 Place where post-harvest activity takes place.

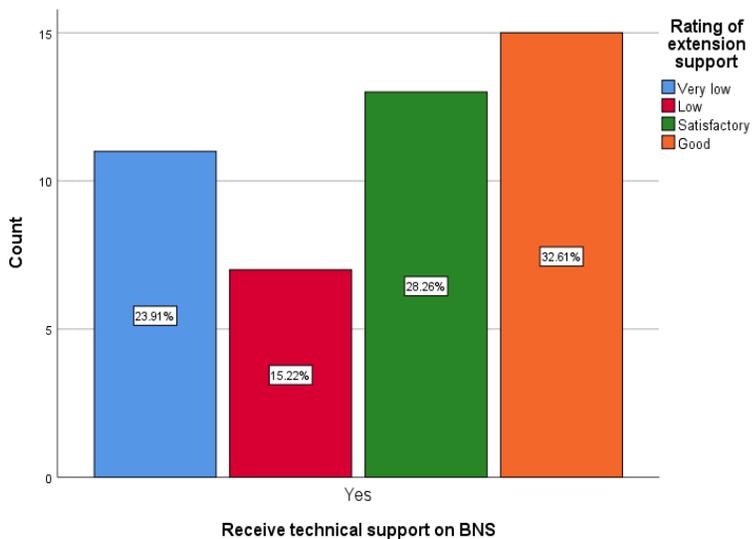


Source: Field Survey, 2019.

4.8.2 Assessing out-growers access to technical support

On the part of the out-grower, the survey results show that 100% of the 52 respondents have received technical training from the nucleus farmer. While 32.1% of respondents rated extension service delivery as good, 28% rated it as satisfactory, and 15.2% rated the extension service delivery as low.

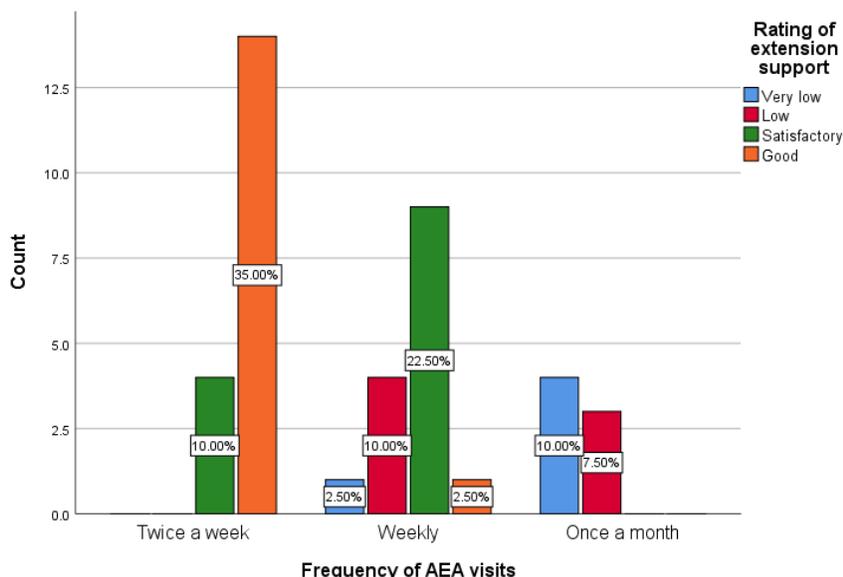
Figure 22 Access to technical support.



Source: Field Survey, 2019.

Rating the frequency of visit by the extension provider, whereas 35% of the 52 respondents rated the twice a week visit as good 22.5% rated the weekly visit as satisfactory while 10.5% rated the once a month visit as very low as shown in the figure below.

Figure 23 Rating the frequency of visit



Source: Field Survey, 2019

4.9 Role of extension services in mainstreaming standards in BNS production.

According to the nucleus farmer, the introduction of BNS was mainly through the private extension service (NGOs) hence has not yet been mainstreamed into the Public Extension Services of the MoFA. This situation has slowed down BNS production much more beyond the early adopters over the past seven years. The Savannah Agriculture Development Authority (SADA) was part of the drive to promote BNS, but due to inadequate collaboration with the MoFA, the intervention could not stand the test of time.

The Municipal Agriculture Extension Officer (Key informant 8) confirmed the above statement on MoFA's participation saying that the AEAs have not received training on BNS production, and there is no production manual on butternut squash. MoFA office in the municipality has not taken producers through formal GAPs training; since the training was conducted by NRGF.

key informant 7 stated that "since it is the policy of the government to promote agriculture commodity exportation, the DAO, as part of its responsibility ensures that smallholders' farms are visited frequently to advise them on the quality specifications and guide them in the implementations". Also, the district extension officer was involved in supervising farmers, particularly in Kokobila during the FFS. These were the initial out-growers when butternut was being introduced into the area; however, there is no officer in charge of BNS production. Hence, "there should be a conscious effort and political will to promote this valuable horticultural crop with vegetables under the flagship PFJ programme. The Government initiative on PERD is an opportunity that will contribute to improving the extension service delivery on GAPs to address identified issues on quality of BNS".

Commenting on the issue of mainstreaming Global GAP standards into butternut squash production, Key informant 3 stated that PPRS is a directorate under the MoFA, though under-resourced, the staff are doing their best to effectively carry out its mandate of plant inspection and regulatory activities. Besides, exporters and farmers, are to do due diligence in complying with the regulatory standards at sites of production. However, PPRS found out that there are challenges on the part of the exporters and farmers to meet the requirements, therefore the need for more education and capacity building on standards at the field levels. PPRS has enough staff and some district agriculture offices now including the Savelugu Municipality have been assigned field officers to help mainstream Global GAP and other standards for commodities intended for exports.

Key informant 5 was of the view that "*because the butternut squash concept is based on the nucleus farmer concept whereby the nucleus farmer has to provide inputs and support BNS production to meet quality and market requirement, MoFA was sitting aloof without intervening*".

4.10 Opportunities and constrains hindering butternut squash production

4.10.1 Challenges affecting BNS production.

Livestock destruction of BNS is one of the biggest challenges to BNS production, as animals are not confined during the dry season in the Northern Region of Ghana and for that matter Savelugu district as stated by Key informant 1. Key informant 6 confirmed this and added that, free cattle-grazing has compelled the Savannah Agribusiness and Services Ltd to move some of the production sites to Wiechiau in the Upper West where the gravity irrigation systems are used and therefore saving cost from pump irrigation in the case of Kokobila. Limited credit support due to non-involvement of financial institutions affects expansion and timely implementation of GAPs. Additionally, key informant 1, 2 and 7 identified lack of storage infrastructure and limited access to market as limiting factors to sustainability and upscaling of the BNS value chain.

Key informant 6 emphasized that even with the domestic supermarket, low-quality fruits poses a challenge and the needed infrastructure to ensure Post Harvest handling and certification to back contractual agreements are missing.

Key informant 4 identified the irregular supply of the BNS to Shoprite as the main challenge emanating from limited access to seed, and the alternative is to fill the shortfalls with imported BNS from South Africa at a higher cost and expense of the consumer. All 8 Key informants are of the view that out-growers have limited understanding of the required agronomic practices hence the huge gap in their capacity to meet quality specification and access the EU market.

According to Key informant 7, "there is no programme specially designed for BNS producers to meet the required standards, and that no training programmes have been designed to train AEAs and producers in this respect". Key informants 1, 2, 5 and 7 stated and reiterated the fact that there is no specific policy on BNS and that BNS is not one of the commodities approved under the MoFA commodity profile, thus insufficient attention is given to it. Also, the nucleus farmer lamented that the challenge is the poor compliance on the part of producers due to weak enforcement of sanctions thus many of the out-growers are not paying attention to these agreements resulting in low returns for each partner. Key Informant 3 also revealed that currently, there is no direct cargo airline that operates from Ghana to London direct. British Airways has a daily flight to London and is a passenger and not cargo, and by their rules, they have to take all passengers and their luggage before considering cargo goods.

4.10.1.1 Ranking of factors hindering butternut squash production

Ranking factors limiting butternut squash production, out-growers ranked the high cost of labour first with a score of 27.6% followed by the high cost of seed with a score of 19.9%, then limited access to market scored 7.7% while the high incidence of pests and disease scored the least 7.1% as shown in the figure below.

Table 17 Factors limiting butternut squash production

Challenges	Frequency	Ranking (percentage)
High incidence of pests and disease	11	7.1
Lack of storage facility	15	9.6
Lack of irrigation facility	13	8.3
High cost of seed	31	19.9
Limited access to land	13	8.3
Inadequate technical support	18	11.5
Limited access to market	12	7.7
High cost of labour	43	27.6
Total	156	100

Source: Field Survey, 2019.

4.10.2 Opportunities facilitating butternut squash production.

According to Key informant 2, although there is no specific policy on butternut squash, it is covered under the non-traditional export crops and the policy objective of FASDEPII on improved growth, income and production for international markets. BNS can also be covered under the government flagship programme on Planting for Export and Rural Development, but in collaboration with the MLGRD, MoFA and the GEPA. The National Entrepreneurial and Innovation Programme supporting small-scale businesses is extended to agriculture and to promote BNS to the Ghanaian farmers as commercial crop while targeting women and young entrepreneurs for domestic and export markets.

According to Key informant 5, "Horti-Fresh provides agronomic training for MoFA staff such as college tutors and AEAs on relevant topics for further impacting of knowledge to improve the capacity of horticulture in Ghana. Horti-fresh offers demand-driven technical support to companies with good innovative concept paper after assessment by Horti-fresh".

According to Key informant 4, Shoprite is rolling out a program dubbed "Growing Program" for producers of vegetables in the southern part of Ghana and that the programme will be extended to cover the Northern regions. This program involves monitoring and visiting farmers to discuss production challenges and also to observe whether the GAPs are conformity with standards and certification procedures. The "Growing Program" is to also to assist in enforcing traceability systems and private standards that will guide the purchase of quality BNS. Also, to ensure consistency of supply of BNS to Shoprite, it is discussing the possibility of financing productions indirectly through the provision of certified seeds to producers.

Speaking on available opportunities, Key informant 3 mentioned that "the Tamale Airport has been upgraded into an international airport to shorten the time of flights to Europe and support exports; thus, PPRS planned to station phytosanitary inspectors at the airport to enforce certification, quality control and inspections to facilitate international flights and exports of horticultural commodities". The Turkish cargo airline that goes to London daily transit through Istanbul, and the advantage that butternut squash is hardy with long shelf life.

4.10.3 PESTEC and SWOT analysis of the butternut squash value chain.

During the stakeholder meeting, participants analysed the strengths and weaknesses of the BNS value chain; as well opportunities available for upscaling and market access while recognising the threats which affect the sustainable development of the BNS value chain using PESTTECH.

Table 18 PESTEC analysis of the butternut squash value chain in northern Ghana

PESTEC	SWOT ANALYSIS			
	Strength	Weakness	Opportunities	Threats
Political		Low technical know-how by producers	The district has suitable climate that favours vegetable production Government flagship programme on PERD Fertilizer subsidy	No specific policy on butternut squash Weak collaboration between BNS producers and MoFA Low capacity of the Department of Food and Agriculture (extension services) Limited capacity of extension staff
Economical	The district has large number of women and youth interested in BNS production	High cost of inputs High cost of water pumping machines High cost of transport High post-harvest losses	There is high market demand for BNS both nationally and internationally Huge market in Europe at Winter BNS has long shelf life	Initial investment capital is very high Inadequate credit for producers High interest rates on loans
Sociological	Availability of traditional Farm Yard Manure and compost.	Low investment by smallholder farmers		Land tenure issues (limited access to land by women) High Rural urban migration Non utilization by indigenes
Technological		Low capacity in handling and use of small scale irrigation equipment	The availability of newly constructed pack house	Inadequate incentive. Little research information on butternut squash

Environment	Protection of buffer zone resulting in reduced river siltation Northern Ghana particularly the Savelugu Municipality has available farm land The district has water resources (White Volta river, and dugouts)	Little area under cultivation	MoFA Africa Development Bank on conservation agriculture of the savannah land scape	Use of overaged water pumping machines leading to increased emission and pollution
Competitiveness	Ability to produce during the winter	Low yield and volumes	Closeness to Europe Availability of the Tamale international airport Unmet national and international demand	Lack of direct cargo freight to Europe

Source: Field Survey, 2019.

CHAPTER 5: DISCUSSIONS.

5.1 Process upgrading.

According to Mitchell et al. (2009), process upgrading is a process of improving value chain efficiency via increasing output volumes and or reducing cost per unit output and may include adopting and improving agronomic practices and technologies such as CSA, increased investment and improved irrigation systems resulting in increased yields and volumes to meet market demand and increase returns.

The study has revealed that BNS production in the Savelugu Municipality is 100% conventional with a total landholding of 54.5ha currently under production with an average yield of 1.7MT/acre which is below the average yield of 25MT/ha (Kerr, 2014). Result from the survey revealed that, out-growers and for that matter producers have inadequate technical capacity to implement GAPs leading to the poor quality produce and low productivity of BNS, and this was confirmed by the survey result that indicated that as much as 48% of out-growers recording yields less than the average yields 1.7MT per acre. Results from the study supported the finding saying that lack of commitment and diversion of fertilizers for maize farms accounts for low production recorded by out-growers.

The study revealed that BNS farmers have a low level of formal education. This might affect their level of understanding issues. Eiseimon (1992) indicated that education affects the way people think and solve problems. According to the World Bank, 1998 formal education increases farmers' capacity to create or innovate. According to FAO 2009, People who have at least primary education tend to earn more money, save more money, have better health and adopt technologies more readily than their uneducated counterparts. The high illiteracy rate unskilled labour amongst BNS farmers and should, therefore, be taken into consideration when designing programmes and technologies in the study area to make the exchange of information effective and efficient.

Conservation agriculture practices such as bunding, buffer zone protection and composting are being implemented as stated by Key informants 1, 6 and 7 and supported with the result from the survey that 65.5% out-growers are aware of buffer zone protection, 48% are practising bunding, 97.7% are willing to protect the river basin from siltation by planting suitable hedges, shrubs and trees and 96% are ready to integrate CSA into BNS production. This is supported by FAO (2013) that CSA contributes to the achievement of the SDGs categorised in three dimensions namely, social, economic and environment by mutually solving food security and climate change. (FOA, 2013). Adopting these conservational agricultural practices apart from reducing the cost of production and improving the ecosystem, offer out-growers the opportunity to increase the area of cultivation thereby increasing production and volumes to deliver the required quantities.

Technical support in terms of extension service delivery is solely provided by the nucleus farmer as revealed by the survey results. This is supported by MoFA Director who confirmed that MoFA is not actively involved in extension service delivery to BNS out-growers, as the AEAs have not received training on BNS production and there is no training guide on BNS production; hence the AEAs have limited knowledge on GAPs on BNS production. Thus, to increase production, smallholder farmer inclusion and enhance market access, effective, relevant, efficient and timely extension delivery by MoFA is essential since private extension service providers have limited coverage and staff for effective extension service delivery. Involvement of MoFA as a lead facilitating agency is necessary for the sustainability of the BNS value chain. Capacity building programmes for AEAs and subsequent training and sensitization of out-growers on GAPs will improve producers' capacity to produce good quality butternut squash and achieve potential yields of the chosen variety.

It was noted from the study that, KNF could not supply the 12MT per year requirement of ShopRite, and this was confirmed by Key Informant 1 saying that, KNF deliver only 5.6MT in the year 2018. The inability of out-growers to supply required volumes could be attributed to low investments by producers due to the high cost of production arising from the high cost of seed.

The survey revealed that butternut squash is cultivated during the dry season, and the majority of out-grower (88.4%) depends on the White Volta river basin for watering crops. 63.5% use diesel pumping machines and the spring irrigation technology to water BNS. During the stakeholder meeting, out-growers lamented on the high fuel use that could be attributed to fuel misuse arising from low technical know-how on irrigation techniques and poor maintenance of water pumping machines. The survey revealed that few (11.5%) out-growers are using solar energy to power pimping machine. Meanwhile, there is abundant sunlight during the planting season and out-growers can take advantage of and rely on solar energy to reduce the negative impact of farming on the environment while integrating CSA practices in BNS production. This was concurred by FANRPAN (2013) that CSA is agricultural practices that sustainably increase productivity and system resilience while reducing greenhouse gas emersion.

5.2 Product upgrading.

The study depicts that quality requirement for butternut squash is the physical appearance, it should be free from contaminations, diseases, pests, bruises and soils; and should have uniformly smooth shining skin with a yellowish appearance. This is supported by study the recommendation that, BNS intended for the US market for grade No. 1: producers must meet basic specifications regarding maturity, variety, absences of cracks and breaks; the product should be free from soft rot, dry rot, dirt, freeze and mechanical damages as well as insects and disease infestation. (George, et al., 2014). While acknowledging the fact grade requirement depends on the buyer, the producer must strive to meet these requirements to access both domestic and international markets.

The study notes that lack of infrastructure and basic facilities required to perform post-harvest handling activities that will enhance the out-growers' capacity to meet quality specifications was a challenge, and this was confirmed by the survey result as 88.5% of out-growers only carry out sorting and grading on-farm before selling to the nucleus farmer. This is in contrast with the recommendation by Jim et al. (2017) that dirt should be removed from the fruits and sort out damaged fruit then perform a quality assessment before grading and packaging. Therefore, to help address this problem, the newly constructed warehouse should be operationalised with effective and efficient management to facilitate appropriate post-harvest handling of butternut squash to reduce post-harvest losses and increase the marketability of BNS.

The Study results show that 88.5% of out-growers are not aware of Global GAP standards and only the nucleus farmer has been Global GAP certified. Also, the majority 98% of out-growers have received training on quality specification requirement, and 88% of the training was through the FFS. The study revealed poor quality butternut squash export intended for the UK market was rejected in 2015 resulting in the Ghana government sanctioning BNS exportations. The nucleus farmer, apart from confirming that diversion of input results in low quality and yields of BNS, added that producers must first acquire Global GAP and phytosanitary certification. The survey result also revealed that the majority (100%) of out-growers are not Global GAP certified, and therefore, do not qualify for Phytosanitary certification. Thus, making it difficult for BNS producers to enter the EU market as recognised by Ng and Constantine (2013), that trade barriers in terms of sanitary and phytosanitary requirements contribute to market inaccessibility.

The study revealed that butternut squash producers do not have a business model and a marketing strategy to facilitate market access. During the Stakeholders meeting, producers are proposing to re-positioning themselves and are offering the national and international markets with premium quality butternut squash rich in Beta-carotene and vitamin A; produced under Climate Smart Agricultural practice for people of all walks of life. Also, it shows that the

target is to improve the capacity of chain actors to produce good quality BNS thereby strengthening market linkages to revitalise the export market to the UK. Thereby increasing participation and production volumes to meet the huge market demand. Finally, effective communication and advertisement through food fairs, food bazaars, conferences, exhibition during farmers the national farmers' day celebrations as well as the use of digital presence and electronic media were equally identified by stakeholders as means of promoting BNS utilization amongst the Ghanaian community. Vermeulen et al. (2008) concurred that new marketing strategies require alternative institutional arrangements to raise new demand and overcome barriers to economic transactions for market access.

5.3 Functional upgrading.

The current BNS value chain map depicts a single market channel commodity chain. The chain equally describes a captive value chain structure, where out-growers are contracted to produce BNS for the nucleus farmer. Aside from cultivating BNS, the nucleus farmer also performs multiple functions of collecting, processing, wholesaling and distributing to the retailers (supermarkets and roadside vendors). The nucleus farmer holds the power in the chain as a lead-farmer. Information on quantities, quality specifications time and place of BNS supply pass through the nucleus farmer to out-growers. The result revealed that out-grower gets information on the quality requirement, training and marketing as well as input credit support from the nucleus farmer. The study confirmed that the nucleus farmer provides input credit and technical support out-growers to attain quality specification and meet market demand. This concurs with Bamber, et al, (2017) who notes that resources, knowledge generation and distribution through the chain are determined by power lead firm who source products from a network in a cost-effective location to meet market demand.

The survey shows that the butternut squash farmer cooperatives are dormant and cannot coordinate the activities of the chain due to limited capacity. It has been revealed that 73% of out-growers belong to registered farmers' cooperative known as Farmer Based Organization (FBO) and that 80.5% of the cooperatives are not involved in price negotiation with the nucleus farmer, and there is no formal contractual agreement between out-growers and the nucleus farmer though the nucleus farmer supports out-growers with input credit (100%). The nucleus farmer confirmed KNF determines the selling price. Consequently, making out-growers price takers since they have no bargaining power. For the out-grower to get a true price for butternut squash, it is important to strengthen the cooperative's capacity in business development, lobbying and negotiating skills as well as basic bookkeeping.

From the survey, another problem affecting the butternut squash value chain is limited access to credit support emanating from the weak collaboration and linkages between the cooperative and financial institutions. It is noted that 100% of out-growers get input credit from the nucleus farmer. Hall et al. (2017), made similar observations saying that out-growers are generally smallholders using their land and labour for production but in a commercial relationship for input supply and output marketing. BNS out-growers mainly rely on diesel pumping machines for irrigating BNS, apart from the high cost of labour they require fuel and occasional servicing of the pumping machines. Thus to obtain financial credit is necessary to facilitate timely implementation of GAPs. Consequently, strengthening the linkages and collaborations with financial institutions and other key stakeholders is important to facilitate out-growers access to financial credit. There is the need to developing the capacity of the cooperatives to establish Village Savings and Loan Associations to help the cooperative to grant loans to members to support the production cost of out-growers.

Generally, women in Ghana are viewed as not involve in production due to limited access to land and input resource needed for production. However, the results from the survey have revealed that 46% of out-growers are females and that they have access to land provided by their families. The study confirms that women have access to land in some parts of Northern Ghana but have no control over the land since they do not own the land. This was affirmed as a fact that women inclusion in butternut squash should be viewed as a right. Feed the Children (2015), concurs that,

though women in northern Ghana have access to land through their husbands, these lands are less fertile resulting in low yields and income. Survey elaborates that increase women participation in BNS production, out-growers facilitating access to land, labour, irrigation facility and training of women on GAPs will enhance inclusion.

The study revealed that 45% of women are involved in BNS production; also, during primary processing all post-harvest activities are carried out simultaneously, and they include, carting, cleaning, sorting, grading, sterilization, curing, weighing and Packaging; these activities expand for a period of six months and requires casual labourers of 60 of which 90% are women. Hence proving labour enables the women to make extra money consequently, contributing to their household financial needs thereby improving the livelihoods of their families and also reducing the seasonal rural-urban migration. Women are involved in retailing of butternut squash in the capital city.

Reflection as a researcher.

One major challenge that interfered with data collection was the raining season, even though this was expected, and measures were taken to minimise the impact on the field activity, yet the total number of questionnaires administered were 52 instead of the targeted 75. In addressing the challenge, five field enumerators were recruited to assist in administering the survey questionnaires. Although respondents were cooperative, as predicted, they demanded financial compensation. But with regular visits and explanations through sensitization meeting on the objective of the research, respondents resorted to accepting snacks in the place of money. Also, in some instances, survey questionnaires were administered at night; this was a worrying trend as we invaded on respondent's privacy.

Making arrangement and schedule for stakeholder meeting was quite challenging because some key stakeholders had difficulties making time for the meeting. Stakeholders were very cooperative and participated fully without making financial demands and even hosting the meeting venue and paying for their transportation to and from the meeting venue. This outcome could be attributed to involving some key stakeholder during the proposal development through to the field data collection, thus winning their trust and support as well as the relevance of the research to the target group. A skill that I have acquired through mentorship by my lecturers and will be utilised in my future carrier as a facilitator to increased participation and ownership of interventions by beneficiaries.

The most challenging moment during the research was getting my commissioner and the nucleus farmer to discuss and agree on my scheduled period for data collection; I nearly gave up on seeking to get his permission before rolling out my plans. Suddenly, I remembered that as a facilitator and a leader, one most important virtue of a researcher is patient and thinking outside the box. When I heard the death of his brother, I decided to seize the opportunity to get through this challenge; I then travelled to his home town to attend his brother's funeral. That was when I had the opportunity of discussing with him and scheduling a meeting. As if that was not enough, the scheduled meeting was held at night in a restaurant without the commissioner. Looking back on the situation, I believe my patience has paid off since I had good feedback from stakeholders and generated quality information that has contributed to finalising this research work. It is worth mentioning that the situation has increased the cost of the research.

Another topic that was considered sensitive had to do with discussing the marketing and pricing of BNS during stakeholder meeting since the only buyer will be participating in the meeting. And other participants may not be willing to openly contribute during the meeting. Consequently, measures were put in place to avoid causing harm to such and to protect them from the consequences as advised (Laws, et al., 2013). However, marketing issues were openly discussed, with the only buyer alluding to the fact that the nucleus farmer has the final say in price determination and that, the farm gate buying price has been the same for the past three years. This development was not anticipated though it aided the smooth discussion of the topic.

Making appointments with the key informants was the most effortless since all the eight key informants even though have busy schedules, nevertheless, considered the limited period available for the researcher for field data collection, hence immediately agreed with the proposed scheduled period by the researcher. I was happy with this development even though it was the most expensive part of my research because I had to travel over 800km from my district to the capital city where I stayed with a colleague who helped in recording the interview process. The outcome of the IDI supported the result from the survey as well as backing from the literature review, thus validating and giving relevance to my research work. Also, my ability to conduct the research and come out with the research findings on BNS makes me feel fulfilled and ready to impact my acquired knowledge and skills to the communities through action research thereby, contributing to improving livelihoods and alleviating poverty.

Data processing and analysis proved to be quite challenging and difficult for me since this is the first time, I am conducting a Masters' research. I tried reaching out to my colleagues at this point, but everyone was busy with their thesis; on the 24th of August, I broke down in tears as a result of my helplessness. However, the next morning, I looked through the mini-thesis report, then knowledge and experiences acquired during the course research in practice were brought to bear as I employed the grounded theory in analysing the qualitative data. The use of structured survey questionnaires coupled with the use of SPSS aided the quantitative data analysis. I intend to use these skills and experience in evaluating projects and programmes in my districts, as well as in my consultancy career as a value chain specialist.

Finally, getting to separate myself as a MoFA staff and a field extension worker from my role as a researcher was quite challenging at the farmer level. However, respondents opened up to the recruited field enumerators, thus, I ended up backstopping and supporting the enumerators when necessary. The interview with key informants was when I managed to fully play the role of research as a neutral person interviewing them, thus, generating useful information for validating the quantitative survey data; the lesson I learned here is that using multiple research approaches is the best method of dealing with conflict of interest and bias in conducting research thus increasing the validity and reliability of the research findings. I intend to apply this multiple research approach in my future endeavour as a change agent.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

The objective of the study was to identify remote causes and upgrading strategies for butternut squash value chain with the view to making recommendations to the Savelugu Municipal department of agriculture for the development of interventions to improve quality and production of butternut squash to enhance market access for scaling up and inclusion of smallholder farmers. This required answering the two main research question. As such, this chapter presents the conclusion on the current structure of the BNS value chain in Savelugu municipality and production practices required to enhance product quality for market access.

6.1 Current structure of the butternut squash value chain.

1. Butternut squash production in the Savelugu municipality consists of stakeholders performing different roles. The study identified and categorised key stakeholders into core chain actors made up of input suppliers, out-growers, collectors, processors, wholesalers and retailers; and other enablers and supporters in the BNS value chain include the Environmental Protection Agency, the Export Promotion Council, the PPRS and NGOs.
2. The stakeholders perform different functions; while core actors are directly involved with BNS, supporters and enablers are chain facilitators. The study has revealed that collaboration between the core actors and key stakeholders in the BNS value chain is weak a situation which could be attributed to the dormancy of the export market channel.
3. The study identified the BNS governance structure as the captive structure as butternut squash producers also referred to as out-growers are informally contracted by the nucleus farmer to produce and supply BNS. The study revealed that the nucleus farmer plays multiple functions including collecting, processing, wholesaling as well as the distribution of BNS to retailers. Also, the nucleus farmer holds the power in the chain as the lead firm and is the source of information to out-growers on quantities, quality specifications time and place of BNS supply pass through the nucleus farmer to out-growers. Additionally, the study also revealed that the nucleus farmer provides input credit to out-growers and determines the selling price. Hence, out-growers are price takers as they have no alternative market channel.
4. The study identified the NRGF, GhanaVeg, SADA, EDIF as facilitators actively involved in playing crucial roles in facilitating the inclusion of the smallholders into BNS production through the Public-Private Partnership approach; thus suggesting that to increase smallholder participation and inclusion in the butternut squash value chain, stakeholder collaboration between actors and facilitators must be strengthened.
5. The study also revealed that BNS is not one of the commodities included on MoFA's commodity profile and that there is no budget line to specifically fund the development of the BNS value chain, thus limiting MoFA's participation in the chain as a key stakeholder. Furthermore, the study revealed that financial service providers were completely missing from the BNS value chain; a situation which could be attributed to the fact that out-growers can access input credit from the nucleus farmer.
6. The study noted that though out-growers belongs to farmers' cooperatives also referred to as FBOs, these cooperatives are not involved in the pricing of BNS. The study equally revealed that the retailer (supermarket) takes a higher profit share of 42% while the out-growers take the least profit share of 27% and that 80.5% of the cooperatives are not involved in price negotiation with the nucleus farmer.

7. The study has revealed that women in the study area have access to land for BNS production. The study revealed that facilitating women access to irrigation facility and management techniques as well as training on agronomic practices will increase their participation in the BNS production. Also, access to both input credit and financial credits enhances women effective participation in BNS production. Also, training women on how to gain extra profit by giving them market information and negotiation skills increase women inclusion in BNS cultivation. This could be done by providing more non-formal and awareness creation strategies for women to appreciate the nutritional benefits of BNS.

6.2 Production practices required to enhance product quality for market access.

1. The study revealed that butternut squash production is conventional, and the Waltham variety of butternut squash is produced. Conservation agriculture practices such as bunding, buffer zone protection and composting are being implemented by butternut squash producers. Currently, 97.7% of producers are willing to protect the White Volta river basin from siltation by planting suitable hedges, shrubs and trees in the protected area while 96% are ready to integrate CSA practices into BNS production. By adopting these conservational agricultural practices as CSA, apart from reducing the cost of butternut squash production, improves soil health and nutrients as well the ecosystem, it offers out-growers the opportunity to increase the area of cultivation thereby increasing production and volumes to deliver the required quantities. Therefore, in designing a programme on butternut squash production, CSA practice should be considered.
2. The study equally revealed that the majority (88%) of BNS producers get irrigation water from the White Volta river basin and 65% use the spring irrigation technology in watering crops. The study equally revealed that even though there is abundant sunshine to support the used of solar-powered water pumping machine, only 11.5% of producers use solar. The study also noted that irrigation the spring irrigation technology is relatively expensive, and that out-growers have inadequate knowledge in irrigation management and maintenance of water pumping machines; consequently, limiting smallholder and women participation in butternut squash production due to high cost of the initial investment required to cultivate BNS making the irrigation facility inaccessible.
3. The study revealed that out-growers have low technical know-how on GAPs for BNS production as well as post-harvest handling practices emanating. Also, the majority (88.5%) of out-growers only carry out sorting and grading on-farm before selling to the nucleus farmer at the farm gate due to the lack of appropriate infrastructure to perform recommended post-harvest activities. A situation that impacts negatively on the quality of butternut squash the out-growers' ability to meet quality specifications.
4. The study equally noted that extension service delivery on GAPs to BNS producers was solely carried out by the nucleus farmer. And this was attributed to the fact butternut squash introduction was a private-led initiative; thus MoFA was not fully involved. Although 100% of out-growers indicated that there had received technical backstopping in terms of the monitoring visit, some out-growers were visited only once a month as revealed by the study. It should be noted here that the only provider of technical support had one agronomist to attend to all the out-growers. Also, MoFA the public institution responsible for agricultural extension delivery should play the lead facilitation role in ensuring that the appropriate and required GAPs in BNS production are delivered. The study also recognised that the government flagship PERD is an opportunity for MoFA to be actively involved in the BNS value chain.

5. The study also revealed that 88.5% of out-growers are not aware of Global GAP standards and only the nucleus farmer has been Global GAP certified thus saddled with the responsibility of ensuring that the out-growers are closely supervised and monitored to produce to quality specifications and requirements. Also, the majority (98%) of out-growers have received training on quality specification requirement, and 88% of the training was through the FFS. The study equally revealed that out-growers' fields have been mapped to aid traceability and supervision as required by the certification body (SGS South Africa), and that majority 87% of out-growers are aware of grade requirement for the marker, grading is based only on visual observation rather than the use of a weighing scale. Hence to access the UK market, BNS producers must acquire the knowledge and skills necessary for certification requirement as per the UK standards.
6. The study equally revealed that producers record low yields with a yield average of 1.7MT/ha even though the Waltham variety has a yield potential of 2.5MT/ha. Also, current productions volumes are low, 7.8MT for the year 2018 and do not meet the domestic requirement of 12MT. The study revealed that BNS farmers have a low level of formal education. This might affect their level of understanding issues. The high illiteracy rate suggests unskilled labour amongst BNS farmers and should, therefore, be taken into consideration when designing programmes and technologies in the study area to make the exchange of information effective and efficient.

6.3 Recommendations to the Savelugu municipal Department of Food and Agriculture

1. MoFA should design a programme for the capacity building of Agriculture Extension Agents (AEAs) to facilitate the training of smallholder farmers through the Farmer Field School (FFS) and demonstrations on GAPs for butternut squash production. As well as facilitate the development of a production manual on Butternut squash to guide extension delivery on Good Agronomic Practices, and posters on the do and don't on harvest and post-harvest practices could equally be developed to guide producers.
2. MoFA should strengthen the collaboration with the EPA and the farmers' cooperatives to facilitate producers' access to support through the Sustainable Land and Water Management project to enable the production of CSA BNS for the niche market in Ghana and the UK. The collaboration between these stakeholders and producers when strengthened will equally promote producers' sensitisation drive on the need to use solar water pumping machines for irrigating butternut squash fields as it has the potential of reducing the use of diesel pumping machines thereby, reducing emissions and cost of production.
3. The Savelugu municipal assembly and MDoA should put an effective management system in place to operationalise the newly constructed pack-house; as well as the PPRS unit should also sensitise and train producers on the certification process and the need for Global GAP certification to access the EU and other international markets, as this will increase the producers' ability to produce good quality butternut squash that meets quality specifications and market requirement.
4. There is the need for MoFA to consider butternut squash under the Research Extension Farmer Linkages Committee to facilitate the initiation of appropriate research on butternut squash to make the necessary recommendation for butternut squash production in northern Ghana. Linking up with RELC will equally promote sensitization, awareness creation and educational drive on the nutritional values and economic potentials of butternut squash through the Women in Agriculture Development (WIAD) desk of MoFA to increase utilization and enhance market demand for BNS to trigger consumption and increase women participation in BNS production.

5. Stakeholder collaboration between the financial service providers particularly, micro-financial services providers and the out-growers should be strengthened by MoFA as to facilitate access to financial credit by the out-growers to facilitate the timely implementation of recommended GAPs. As well as designing a training programme in collaboration with the business advisory services and the department of cooperatives to build the capacity of farmer cooperatives (FBOs) in the development of business plans, basic bookkeeping, group dynamic, negotiation and lobbying skills to promote effective and efficient coordination of the BNS value chain.
6. MoFA should take the lead role and lobby investors and interested commercial farmers to take up butternut squash production as this will facilitate the inclusion of smallholder producers into butternut squash cultivation, increase investment in the sector thus increasing production volumes to meet market demand.
7. MoFA should facilitate the formation of a district value chain committee to serve as a platform for information and knowledge sharing on best practices, available market opportunities and lobbying investors to support activities of the chain; as well as linking up with the Municipal Assembly to lobby MoFA and facilitate the inclusion of butternut squash seed in the Planting for Export and Rural Development (PERD) government flagship programme. Thus, facilitating women access to seed and increase women and smallholder participation.

6.4 Recommendations to producers.

The canvas business model in 4.4.3 is proposed to butternut squash producers in the Savelugu municipality. Currently, the butternut squash producers do not have a business plan, thus activities are carried out randomly. Hence using the recommended canvas business strategy is to ensure that producers' stay focus as to effectively and efficiently implement plan activities to help realise the objective of accessing the UK market.

Proposed value chain in annexe recommended for the BNS stakeholders in the Savelugu municipality. The chain displays the insertion of the export market channel to facilitate the inclusion of the smallholder farmer. The chain targets 150 producers made up of 78 males and 72 females. While 80% of the marketable BNS targets the export market per the proposed Canvas business model, 15% targets the domestic supermarkets and 5% targets the roadside fruit vendors. The chain also displays the cooperative as the link between the butternut squash producers and the different market channels. See annexe 1.

Collaboration between producers and the Plant Protection and Regulatory Services (PPRS) should be strengthened to enhance the training of producers on food safety regulations traceability as well as Global GAP standards requirements.

There should be a formal contractual agreement between potentials investors and farmer cooperatives to improve transparency commitment and struts for the sustainability of the butternut squash value chain.

6.5 Consideration for future research.

Base on the result of this study and the gaps identified, the following areas are proposed for future research to develop and consolidate the current findings.

- What is the perception of producers on the current irrigation technology and practices as well as the irrigation system that facilitate smallholder and women participation in the production of butternut squash?
- What is the role of municipal assembly in facilitating smallholder farmers access to input credit and other productive resources needed inclusion?

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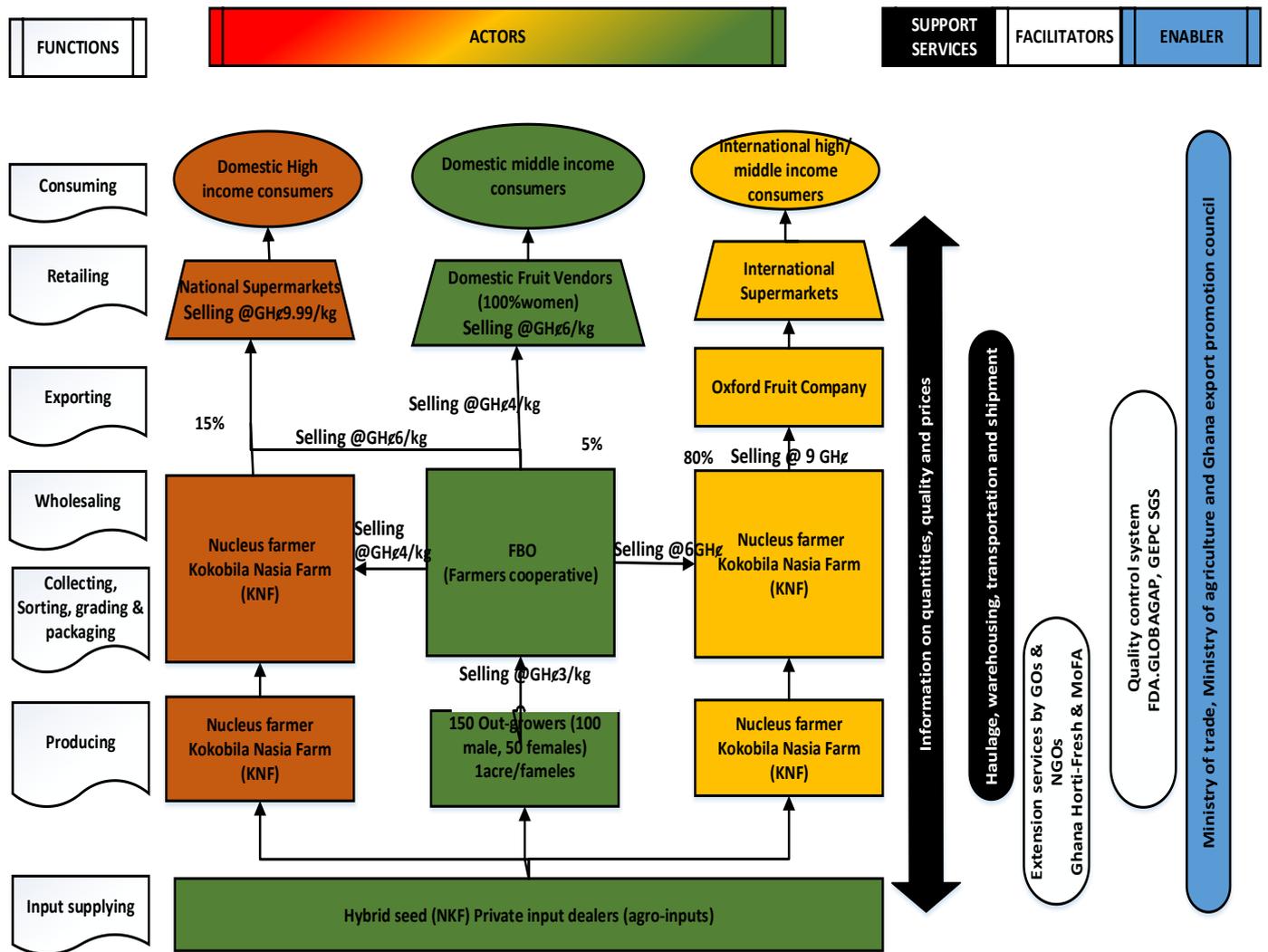
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Annexes

Below is a proposed value chain recommended for the butternut squash stakeholders in the Savelugu municipality. The chain displays the insertion of the export market channel to facilitate the inclusion of the smallholder farmer. The chain targets 150 producers made up of 78 males and 72 females. While 80% of the marketable BNS targets the export market per the proposed Canvas business model, 15% targets the domestic supermarkets and 5% targets the roadside fruit vendors. The chain also displays the cooperative as the link between the butternut squash producers and the different market channels.

Annex 1 Proposed butternut squash value chain Map



Source: Field Survey, 2019.

Annex 2 below is the cost benefit analysis of the BNS that was calculated to aid the analysis of valued addition and profit share of actors in the butternut squash value chain.

Annex 2 Butternut squash cost benefit analysis.

Activity	Cost in Ghana Cedi (GH₵)
Land preparation	
Land clearing	100
Ploughing	250
Harrowing	80
<i>Sub-total</i>	<i>430</i>
Inputs	
Seed	2,400
Fertilizer	380
Irrigation	600
<i>Sub-total</i>	<i>3,380</i>
Labour cost	
Planting	140
Weeding	250
Fertilizer application	140
Havsting	340
Washing, sorting and grading	700
Conveying to packing centre	800
<i>Sub-total</i>	<i>2370</i>
Fixed cost	
Management and permanent labour	1,200
Equipment and tools	500
Miscellaneous (10%)	788
<i>Sub-total</i>	<i>2,488</i>
Total Production cost	8,668
Logistics cost to Tema Port	
Packing	4,000
Transportation	2,000
Port handling charges	2,600
Others	430
<i>Sub-total</i>	<i>9,030</i>
Total Expenditure	17,698
Returns	
Price/kg Export (exportable grades sold at GH₵ 3.00)	24,000
Price/kg local (local sales, sold at GH₵ 3.00)	1,000
Total income	25,000
Net returns	7,302
Yield per ha (kg)	23,000
Total cost of production per ha	23,000

Source: Field Survey, 2019.

Appendix 1 Structured questionnaires for field survey.



**van hall
larenstein**
university of applied sciences

Topic: *Upgrading butternut squash (BNS) value chain to enhance market access for upscaling and inclusion of smallholder farmers. A case of smallholder farmers in Savelugu municipal of the Northern Region, Ghana.*

Now, do you want to ask anything about the survey? Yes [] No []

Do you [NAME.....] agree to participate in the study? Yes [] No []

If No, reasons for refusal:

.....
.....

Signature/Thumbprint of Interviewee _____

Date: _____

Survey questionnaires

Date of interview (dd/mm/yr) ____/____/____

Respondent's Name: _____

Respondent's age _____

Respondent's gender 1= Male [2= Female []

Educational background 1= Illiterate [] 2= Informal Education []

3= Elementary Education [] 4= Secondary education []

5= tertiary education []

What is the size of your household? _____

Production practices

1. How long have you been producing butternut squash? _____ years.

2. What motivated you into BNS production? 1=Employment [] following [trend]
3=Others _____

3. How many acres do you cultivate BNS on? _____ Ha.

4. How did you acquire the land? 1= Own [2= Family land

3= Rented land [4= Others (Specify) _____

5. What is your BNS average yield per hectare? _____ Kg Y1____ Y2____ Y_____

6. How do you prepare your land? 1= Zero tillage [2= Minimum tillage []

3= Tractor ploughing [] 4= Bullock Ploughing []

5=Spraying with chemicals [] 5=Others (Specify)_____

7. What variety of BNS do you cultivate? _____

8. Where do you get your seed from? 1=Input dealer 2=Nucleus farmer []

3= Own seed [] Others (Specify) _____

9. What is your farming system? 1= Conventional [] 2=Organic []

10. Which of the following cropping systems do you practice on the BNS field? 1= Mono cropping 2= Mixed cropping 3= Crop rotation

11. Do you use fertilizer? Yes [] No []

12. If yes, what type of fertilizer do you apply to your BNS field? 1=Chemical fertilizer 2= Compost 3= Animal manure 4=ISFM []

13. Where is the source of the fertilizer for BNS? 1= Own 2=Nucleus farmer []

3=Input dealer 4= VSLA 5=Friends 6=Family []

7= Others _____

14. How do you control weeds? 1= Manual weeding []

3=Spraying with chemical [] 4= Cover cropping [] 5=Mulching []

6=Others (Specify)_____

15. Do you have a problem with pests and diseases on BNS? 1= Yes 2= No [] []

16. Where is the source of water for your BNS field? 1= White Volta river basin []

2= Dugouts [] 2= Borehole [] 3= Others (Specify)_____

17. If yes, how do you control pests and diseases? 1= Use chemicals []

2= Use Neem extracts 3= IPM 4=Nothing [] []

5=Others (Specify)_____

18. What type of irrigation scheme do you use? 1=Flood/farrow irrigation

2=Drip irrigation [] 3=Spring irrigation [] 4= Sprinkler []

5= Manual 6=Others (Specify)_____

19. How do you draw water from the river? 1= Manual watering

2= Small diesel water pumping 2= Big mechanised pumping machine

20. Do you have plans for increasing production? 1= Yes 2= No

21. What will you say is the top three problem of your business? Multiple choice

1= Access to the land

2=high cost of labour 3= high cost of seed

4=High incidence of Pests and disease 5=Inadequate technical support

6=Lack of storage facility 7= Limited access to market

8= lack of irrigation facility 9= Others (Specify)_____

22. Do women currently produce BNS? 1= Yes 2= No

23. If no, what can be done to include women in BNS production?

why? _____

24. If yes, what can be done to increase women participation in BNS production?

1=Facilitate access to land 2=Facilitate access to credit

3= Facilitate access to training and capacity building

4= Facilitate access to irrigation facilities Others (Specify)_____

Extension support (Analysing extension-farmer relationship & effectiveness)

1. Did you receive any training on how to cultivate BNS? 1=Yes 2=No

2. If yes, who trained you? 1= Nucleus farmer 2=MoFA 3=NGO 4=Others

3. Did you get training on fertilizer application, pests management and weeds control?

1=Yes 2=No

4. If yes, who trained you? 1= Nucleus farmer 2=MoFA 3=NGO 4=Others

5. Did you receive training on ISFM? 1=Yes 2=No

6. If yes, who trained you? 1= Nucleus farmer 2=MoFA 3=NGO 4=Others

7. Did you receive training on organic pests management? 1=Yes 2=No

8. If yes, who trained you? 1=Nucleus farmer 2=MoFA (3=NGO (4=Others ()
9. Did you receive technical support from MoFA on BNS production? 1=Yes (2=No ()
10. If yes, what type of support did you receive? 1= Class training (2=Technical advice ()
3=Field demonstration 4=FFS (5=Others_____
11. Do you get monitoring visits from any extension service provider? 1=Yes (2=No ()
12. If yes, which extension service provider? 1=Private service provider (2=NGO (3=MoFA
4=Others _____
13. How frequently does the AEA visit? 1=Twice a week () 2=Weekly ()
3=Once a month () 4=Once a year ()
14. How will you rate the support from MoFA? 1=Very low ★ (2=Low ★★ ()
3=Satisfactory ★★★ (4=Good ★★★★ (5=Very Good ★★★★★ ()
15. Do you think the frequency of visit enough? 1=Yes (2=No ()
16. If No, how frequent? 1=Twice a week (2=Once a week () 3=Once
every two weeks 4=Once a month ()

Quality requirement

1. Do you know about the market requirement for BNS? 1=Yes (2=No ()
2. Who gives you information on market requirements? 1= Nucleus farmer () 2=Group
3=NGO (4=MoFA (5=Others_____
3. Do you know about the quality specification for BNS? 1=Yes (2=No ()
4. Did you receive training on how to comply with quality specification? 1=Yes (2=No ()
5. If yes, who trained you? 1=MoFA (2=Private service provider (3=NGO ()
4=Nucleus () 5=Others_____
6. How was the training done? 1= Classroom training (2=Field demonstration ()
3=FFS (4=Others
7. Are you able to meet the required specifications? 1= Yes (2=No ()
8. How will you rate your capacity to produce to specification? 1=Very low ★ ()
2=Low ★★ (3=Satisfactory ★★★ (4=Good ★★★★ ()
5=Very Good ★★★★★ ()

9. Who inspects your produce after harvest and gives approval? 1=Nucleus farmer ()
 2=MoFA () 3=PPRS () 4=GSA () 5=Others ()
10. Do you know of certification requirements? 1=Yes () 2=No ()
11. Do have any certification? 1= Yes () 2=No ()
12. If yes, which certification? 1= Global GAP () 2=Fair Trade () 3=Organic ()
 4=Others _____
13. Are you certified as an individual or as a group? 1= Individual () 2=Group ()
14. Has your field been mapped? 1=Yes () 2=No ()
15. If yes, who mapped your field? 1=MoFA () 2=Private service provider () 3=NGO ()
 4=Nucleus ()
16. Which of the following post-harvest activities do you undertake? 1=Curing ()
 2=Sorting () 3=Grading () 4=Packaging () 5=Processing ()
17. Which grades do buyers require? 1=Grade I () 2=Grade II () 3=Grade III ()
 4=Others ()
18. Where do you carry out these activities? 1=On-farm () 2=My house ()
 3=Nucleus farmer () 4=Pack house () Others ()
19. Do you store your produce after harvest? 1=Yes () 2=No ()
20. If yes, where do you store your produce? 1=On-farm () 2=My House ()
 3=Nucleus farmer () 4=Pack house () 5=Others ()
21. How long can you store BNS? 1=Less than Three months () 2=Three months ()
 3=More than three months ()

Marketing

1. Do you belong to a cooperative? 1=Yes () 2=No ()
2. Is your cooperative involved in price negotiation? 1=Yes () 2=No ()
3. Do you obtain information on prices before selling? 1=Yes () 2=No ()
4. If yes, where do you get the information from? 1= Nucleus farmer () 2=Wholesaler ()
 3=Retailer ()
5. Who do you sell your produce to? 1=Nucleus farmer () 2=Wholesaler ()
 3=Retailer ()
6. Do you sign contract with buyer before production? 1=Yes () 2=No ()
7. If yes, who do you sign contract with? 1=Nucleus farmer () 2=Wholesaler ()

3=Retailer []

8. Who determines the price? 1= Nucleus farmer [] 2=Wholesaler []
3=Retailer [] 4=Farmer [] 5=Group [] 6=Others []

9. How much did you sell 1kg of BNS last year? GHC _____

10. Is the profit margin sufficient to cover your cost of production? Yes [] No []

11. How will you rate the level of satisfaction in term of price? 1= Very satisfactory []

2=satisfactory [] 3=Not satisfactory []

12. Do you know where the produce is sold? 1= Yes [] 2=No []

13. If yes, where is the produce sold? 1=Ghana [] 2=Outside Ghana []

14. Do you know of any other market apart from Ghana? 1=Yes [] 2= No []

15. If yes, where? 1=Asia [] 2=US [] 3=The Netherland [] 4=UK [] 5=Others []

16. Are you able to sell all your produce? 1= Yes [] 2= No []

17. If no, how do you handle the surplus? 1=Sell [] 2= For home consumption []

3=Give to friends [] 4=livestock Feeding [] 5=Composting [] 6=Others []

Climate Smart Agricultural practices

1. Do you practice bunding? 1=Yes [] 2=No []

2. Do you produce compost and use on BNS field? 1=Yes [] 2= No []

3. How do you power your pumping machine? 1=Fuel [] 2=Solar [] 3=Others []

4. Using the River basin, do you know of buffer zone protection?

1=Yes [] 2= No []

5. If yes, how many metres from the river? 1= Less than 100m [] 2=100m []

3=More than 100m []

6. What have you planted to protect the river from siltation? 1=Grasses [] 2=Hedges []

2=Trees [] 2=Bamboo [] 3=Others _____

7. If no, how willing are you to protect the buffer zone? 1=Not at all [] 2=Less willing []

3= willing [] 3=Very willing []

8. Do you practice crop rotation? 1=Yes () 2=No ()
9. If yes, which crop do you rotate BNS with? 1=Legumes () Cereals ()
2=Fruits & Vegetables () 3=Root & Tuber () 4=Others ()
10. How do you dispose of the crop residues after harvesting? 1=Gather & burn ()
2=leave on the farm () 3=Animal feeding () 4=plough back into the soil ()
5=Use for composting () 6=others
11. How possible is it for you to adopt CSA practices? 1=Not possible () 2=Possible () 3=Very possible ()

Access to credit facility

1. Do you have access to credit? 1= Yes () 2=No ()
2. If yes, what type of credit? 1=Input credit () 2=Loan () Others _____
3. Where do you get the credit from? 1=Bank loan () 2=Buyer () Nucleus farmer ()
3=Micro financial institution () 4=VSLA () 5=Others ()
4. Do you pay interest on loan? 1=Yes () 2= No ()
5. If yes, what is the interest rate? 1= Less than 30% () 2=30% ()
3=More than 30% ()
6. What is the duration of the credit? 1= Less than 6 months () 2=6 months ()
3=More than 6 Months ()

Appendix 2 Interview checklist for Women opinion leaders

1. Do you know of BNS production?
2. Access and control to fertile land (what is the land tenure system and does it limit women participation to BNS cultivation? What should be done to facilitate women access to fertile land?)
3. Access to resources (Can women access seed and fertilizer? What are the limitations? How do you think women can improve their capacity to access seed and fertilizer?)
4. Access to irrigation facility (Can women access irrigation facility to participate in BNS production? What are the limitation? What should be done to increase women access to irrigation facility?)
5. Access to credit Facility (Can women have access to financial and input credit? What is the possible source of financial support? Are women involved in VSLA? What are the limitations to women accessing credit? Any suggestions to increase women access to credit facility?)
6. Access to labour (Can women engage labourers to work on the BNS field? What challenges do women encounter in relation to labour?)
7. Access to technical support (what knowledge and skill Do women require to participate in BNS production? Do women have access to skill training and capacity building to participate in BNS production? What is the limitation of accessing technical support? What do you suggest should be done to improve that?)
8. Opportunities and obstacles to women inclusion.

Appendix 3 Guideline for stakeholder meeting

1. Current /futuristic value chain
2. Value share (Cost-benefit analysis, value addition and prices at each level of the chain)
3. Current/futuristic business model (Is there a business model? What business model is appropriate to facilitate access to the UK market)
4. Conduct a SWOT analysis of the Chain
5. Marketing strategy (What marketing strategy should be stakeholders proposing to access the UK market? What is the market demand and how should BNS be presented as well as branding? Which niche market can the BNS chain compete with? Is CSA possible?)
6. Opportunities and limitations for inclusion of women?
7. What are the possible upgrading strategies?

Appendix 4 Interview check list for Plant Protection and Regulatory Services.

Quality Requirement.

1. Do you know of BNS production in the Savelugu municipality of Ghana?
2. What quality specifications must producers meet to access the UK market?
3. Are there a phytosanitary requirement for compliance to access the domestic market?
4. What phytosanitary requirement should producer comply with in order to access the UK market?
5. Who is responsible for ensuring that producers comply with required quality standards?
6. How do farmers get information on the required specification?
7. What is the minimum certification required for smallholder farmers to access the UK market?
8. What programmes are designed to enhance farmers' capacity to meet quality specification/standard?
9. Is there any policy guideline to facilitate access to the UK market?
10. What are the opportunities and limitation to meeting the quality specification?

Appendix 5 Interview checklist for District Agricultural Extension Officer.

1. Do you know of BNS production in the Savelugu municipality?
2. Technical support (Is there an officer in charge of BNS VC? How many times does he/she visit in a quarter? Has the officer received training on BNS production? What GAP activities has your outfit taken producers through? What services do you offer the BNS producers? What is your role in the BNS value chain? What system of production are they engaged in?)
3. Quality requirements (What do you know about BNS quality specification? What quality specifications must producers meet as to access? Are there a phytosanitary requirement for compliance to access the domestic market? What phytosanitary requirement should producer comply with in order to access the UK market? Who is responsible for ensuring that producers comply with required quality standards?)
4. Extension support (What programme is in place to support BNS production? What capacity building programmes are designed to train producer to produce to meet the required standards? What opportunities are available to facilitate producers access to technical services and advise?)
5. Compliance to qualify for GloabalGAP certification (what do you know about GlobalGAP certification? Or are you conversant with GlobalGAP certification? What are your outfits plans on GAP to improve smallholders' capacity to produce to meet quality specification, access the UK market and increase smallholder inclusion in BNS production?)
6. Climate Smart Agriculture practices (What CSA practices are the BNS smallholder farmers engaged in? What SCA training did the BNS producers receive? Who carried out the training? What are the possibilities of adopting CSA practices by BNS producer?).
7. What are the opportunities and limitations for the inclusion of women in BNS production?

Appendix 6 Interview checklist for NGOs and GhanaVeg association.

1. Quality requirement and market access (what is the involvement of your outfit in the BNS VC in the Savelugu municipality? What are the opportunities and limitation to accessing the UK BNS market? What are the possible marketing strategies to facilitate access to the UK market? What is the minimum certification required to enter the UK BNS market? What is the possibility of targeting a niche market to increase competitiveness?).
2. Extension support (What programme is in place to support BNS production? What capacity building programmes are designed to train producer to produce to meet the required standards? What opportunities are available to facilitate producers access to technical services and advise?)
3. What are the opportunities and obstacles for the inclusion of women in the BNS VC?

Appendix 7 Interview checklist for Retailers (Supermarket)

1. Who supplies your BNS?
2. Do you have a specific quality requirement that must be met by producers?
3. What are the quality requirements for BNS that must be met by producers?
4. Does your supplier meet the required quality?
5. What grade of BNS do you accept from suppliers?
6. How do you test for confirming quality compliance?
7. What quantity of BNS do you require in a year?
8. Do you get the required quantity at the right time and all year round?
9. Do you sign a contractual agreement with your supplier?
10. Are you able to trace the source of the BNS you receive?
11. How do trace the source of BNS?

12. Do you sell organically produced or conventionally produced BNS?
13. Are consumers concerned with BNS production practices?
14. How will consumers react to organically produced BNS?
15. Are you willing to pay more for organically produced BNS?
16. What do you think about the BNS VC targeting the UK market?
17. What suggestions will make for service improvement?
18. Do your company pre-finance BNS production?

Appendix 8 Interview checklist for nucleus farmer

1. How long have you been producing BNS? Years
2. What is the size of your farm? Ha
3. What variety of BNS do you cultivate?
4. What is your yield per hectare?
5. Do you produce organic or conventional?
6. How many out grower do source your produce from?
7. What type of support do you offer out-growers?
8. What is the Quality and market requirement for BNS?
9. What are the programmes in place to ensure that out-growers meet quality specification?
10. What is the minimum certification required for marketing BNS?
11. Are you able to meet the quality standards?
12. Which regulatory institutions are involved in BNS VC?
13. What grade of BNS does the market require?
14. Who are your buyers?
15. What are your strategies for improving access to the UK BNS market?
16. Do you have plans of exploring the niche market in the UK?
17. Do you know about buffer zone protection?
18. What conservational practices do you employ in BNS cultivation?
19. What is the opposability of adopting CSA?
20. Do you sign a contractual agreement with out-growers before production?
21. Who determines the price of BNS?
22. How much did you buy 1kg of BNS this year?
23. How much did you sell 1kg of BNS this year?
24. Do you do sorting, grading and packaging?
25. Where do you carry out these activities?
26. Do you store BNS before selling?
27. What are the opportunities and limitations for women inclusion in BNS production?

Appendix 9 below is the list of participants who attended the stakeholder meeting during the filed data collection period.

Appendix 9 Butternut squash stakeholder meeting – Attendance list.

Butternut squash stakeholder meeting- Participants list				
Name	Sex	Organization	Location	Contact number
ALHAJI SEIDU HISHAM	Male	Nucleus farmer, CEO of Kokobila Nasia Farm	Tamale	
Alhassan Abdul Rasheed	Male	ADVANCE Project	Tamale	
Mathew Sulemana	Male	District Director of Agriculture	Talensi	
Benjamin Issifu Adam	Male	BNS		
Atta Yusif	Male	BNS farmer	Kokobila	
Adam Fatayiya	Female	Retailer	Tamale	
Yakubu Zaid	Male	PPRS		
Christopher K	Male	Savelugu Municipal Agriculture Extension Officer	Savelugu	
Musah Adam Bawa	Male	BNS Producer	Gushei	
alhasan Wasila	Female	Opinion Leader Gushei	Gushei	
Mohammed Saani	Female			
Alhaji Zibrim Mukaila	Male	Input dealer	Tamale	

Source: Author own sketch, 2019.

Appendix 10 below gives the details of the various Key informants interviewed during the In-Depth Interviews with Experts and women opinion leaders.

Appendix 10 Details of Key informants.

Details of Key informants interviewed						
Name	Sex	Organization	Location	Interview date	Contact number	Code
ALHAJI SEIDU HISHAM	Male	Nucleus farmer, CEO of Kokobila Nasia Farm	Tamale	15/07/2019	+233208114488	Key Informant 1
Hon. Yussif Sulemana	Male	MP for Bole-Bamboi Constituency & Expert on BNS chains and export	Accra	17/07/2019	+233244886833	Key Informant 2
Mr. Abdul-Wahab Rufai	Male	Plant Protection Regulatory Services	Accra	18/07/2019	+23326227845	Key Informant 3
Mr. Redeema Kumah	Male	Shoprite-Fresh Mark Ghana	Accra	19/07/2019	+233246327072	Key Informant 4
Madam Sheila Assibey Yeboa	Female	Horti-Fresh(GhanaVeg) project manager	Accra	20/07/2019	+233263794715	Key Informant 5
Mahama Alhassan Seidu	Male	Savannah Agribusiness and Services Ltd (Expert on BNS chains and export)	Savelugu	16/07/2019	+233208256721	Key Informant 6
Alhaji Ahmed Mohammed Adam	Male	Savelugu Municipal Director of Agriculture	Savelugu	15/07/2019	+233	Key Informant 7
Christopher K	Male	Savelugu Municipal Agriculture Extension Officer	Savelugu	16/07/2019	+233246917061	Key Informant 8
Issah Asana	Female	Opinion Learder Kokobila	kokobila	23/07/2019	N/A	Key Informant 9
alhasan Wasila	Female	Opinion Learder Gushei	Gushei	23/07/2019	N/A	Key Informant 10
Zibila Aliya	Female	Opinion Learder Nabogo	Nabogo	24/07/2019	N/A	Key Informant 11

Source: Author own sketch, 2019.

Appendixes

Appendix 11 below gives an overview of detailed activities with timelines for the execution of the research

Appendix 11 Research Time table.

Activity	Output	Week	1	2	4	5	6	7	8	9	10	11	12	12	13	14	15	16	17	18
		Month	May	May	June	June	June	June	July	July	July	July	July	Aug	Aug	Aug	Aug	Sept	Sept	Sept
		Date	20	27	3	10	17	24	1	8	15	22	29	3	12	19	26	2	9	16
Desk research Prepare background information & concept note	Introduction & background information on study area & butternut squash production & related problem on producers		X	X	X															
Conduct literature review	Explain concepts & studies related to upgrading		X	X	X															
Prepare research context & methodology	Explain data collection process & discuss tools and method of data gathering		X	X	X															
prepare research questionnaires & check list	Generate questionnaires & check list on survey for target farmers & identified key informant		X	X	X															

Compile & finalise thesis proposal	Final thesis proposal finalised submitted & defended	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depart to Ghana for field work	Arrive in Ghana to begin data collection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Finalise discussions with MoFA- Savelugu & kokobila Farm on scope of research & book apointment with key informants	Delivery of letter for consent to conduct research; select & train staff to join team on research; interview date scheduled and confirmed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pre-test suvey questionnaires in different district	Assess pre-test survey and adjust questionnaires where necessary, finalise & multiply questionnaires for main data collection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conduct survey with farmers	Data collected on survey in study area, processed & stored; debrief with team for improvement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conduct key informant interviews with Accra & Savelugu	Conducted interviews with key informants transcription	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>						

	using grounded theory																		
Organise stakeholder meeting in Savelugu	generate information on chain actors including current VC, business model, futuristic VC, business model, alternative marketing strategy for chain upgrading											X							
Data encoding, processing & analysing	Coding & encoding data in SPSS version 25 entered, processed & analysed							X	X	X	X	X	X	X					
Travel back VHL	Returned to VHL													X					
Discuss results with further literature review	Report writing and literature reviewed to support findings, triangulation for validity & reliability														X	X	X		
Discuss conclusion & make recommendation	Conclusion & recommendation based on research findings															X	X		

Edit the thesis	Editing report based on feedback and comments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>												
Finalise the thesis	Further editing and finalising report for submission	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													
Submit thesis	Thesis submitted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													
Defend thesis	Thesis defended	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>													

Source: Author own sketch, 2019.

Appendix 12 below shows the total amount needed to execute the research including the funding source. A total amount of Five Thousand Eight Hundred and Fifty Ghana cedis (Ghc 5,850.00) equivalent to Nine Hundred and Seventy-Five Euros (€975.00) is required to accomplish this research.

Appendix 12 Detailed budget for research

Activity	Number	Frequency	Unit cost Ghc	Total cost Ghc	Source of funding
Planning research	1	0	0	0	N/A
Drafting research methodology and tools	1	0	0	0	
Literature review	1	0	0	0	
Selecting and training of enumerators.	4	1	50	200.00	Employer
Pilot study in one community	1	1	200	200.00	Research
Field data collection: Survey in three communities	4	3	100	1,200.00	Commissioner
Conducting IDI in Accra	2	1	1,500	3,000.00	Researcher
One stakeholder meeting	12	1	100	1,200.00	Nucleus farmer
Data Analysis	1	1	0	0	N/A
Thesis writing	1	1	0	0	
Commenting and editing	2	1	0	0	
Design and printing	1	1	50	50.00	Researcher
Presentations (Thesis defence)	1	0	0	0	N/A
Grand Total				5,850.00	

Source: Author own sketch, 2019.

Appendix 13 Pictures of field Data collection.



