VEGETABLES DIAGNOSTICS REPORT

DFID Market Development (MADE) in Northern Ghana Programme

Submitted to

Department for International Development, Ghana

Submitted by

DAI in association with Nathan Associates London Ltd.
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February 2014

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SECTION 1. INTRODUCTION

This market diagnostic examines the opportunities and systemic constraints for vegetable market systems other than onion and chilli which have dedicated market diagnostics. It focuses on tomatoes, garden eggs, okra and watermelon.

Some 600,000 households in the North cultivate vegetables[1]. They constitute an important source of incomes and food consumption for all types of households from the poor to the rich. Women of poorer households grow vegetables in their market gardens as a source of ingredients for soup, selling whatever excess they have left over for cash. Better off farmers, based around the major irrigation schemes (e.g. Tono, Vea, Bontanga etc.), grow vegetables as a cash crop in the dry season to augment incomes from the main rainy season crop.

Of the crops grown by a substantial proportion of Northern farmers, vegetables produce the highest income per hectare. However, growing vegetables profitably requires fertile land, a substantial outlay on inputs and large amounts of labour for establishing nurseries, transplanting and harvesting, so the average plot devoted to the commercial production of vegetables is very small, under a hectare for all but the most commercial farmer. The incomes from these small plots though can play a vital role in livelihood strategies with dry season vegetables providing the cash to pay for additional staples, invest in the main rainy season crop and paying for basic household essentials (e.g. school fees, medical expenses, expenditure on housing).

Vegetables need large quantities of labour. Whilst the poorer farmer is likely to rely on family labour and labour sharing pools, the commercial farmer hires in labour and that provides a major opportunity for the poor to supplement their incomes. Women and youth play a vital role in vegetable production and marketing from providing labour through to serving as the key market intermediaries (the market Queens and lead boys).

Demand for vegetables is growing rapidly in the South and Ghana is a small but significant exporter to Europe, especially the UK. The South, with its bimodal rains, has a longer growing season and can grow vegetables on un-irrigated land. However, in practice, the North has a comparative advantage in the growing of vegetables. It contains the majority of Ghana's irrigated land which enables year round cultivation, its dry conditions and diurnal temperature variations are ideally suited to growing vegetables. Labour is cheaper in the North and more productive[2]. The growing of vegetables is therefore potentially pro-poor and based on serving growing, attractive markets.

This diagnostic is organised as follows. To begin with, each of the four market systems is considered individually (sections 2-5), with a brief introduction followed by a table setting out the summary of the analysis of the market system, mapping of the poor and other actors, analysis of market segmentation and growth and finally an analysis of the value chain. Given the similarities in support functions and policies and institutions and systemic constraints, these are assessed together for all four vegetables. The diagnostic concludes with summaries of the opportunities presented by the four vegetables and the types of interventions that could address systemic constraints.

SECTION 2. TOMATO

2.1 INTRODUCTION

In Ghana, tomato is both a cash and food crop. It is the second most important vegetable consumed (estimated 38% of household budget on vegetables[3]) locally after chillies. It is consumed on its own and used in soup, sauces and salads.

1 Ghana Living Standards Survey 5.

2 Interviews with the president and members of the Executive of VEPEAG.

3 Ghana Statistical Services GLSS 3/4

There is a fairly robust market growth that suggests that tomato production is sustainable in the near future, and will continue to deliver good value to the smallholder and poor households engaged in its production for some time. However, local production has not kept pace with the growth of the market, allowing an influx of fresh tomato imports from neighbouring countries (mainly Burkina Faso) and processed tomato paste from Italy, China, etc. to dominate the market.

Tomato production in Ghana is highly seasonal depending on the geography of production, access to water and rainfall patterns. Within the calendar year, the northern and southern parts of the country produce tomato at different times of the year (see Figure 2 and 4). From late December through April/May, Ghana's Upper East and Northern Regions and Burkina Faso supply almost all the fresh tomato in the country under irrigation. Rain-fed production in the south is from March to June, while Brong Ahafo and Ashanti Regions (reflecting bi-modal rainfall patterns) have longer seasons. Irrigated tomato production is also done in the south namely some part of the Greater Accra, Brong Ahafo and Ashanti Regions. The tomato supply gaps created between December – May is due to Ghana's inability to produce mainly in the rain fed producing area in Brong Ahafo, Ashanti and Greater Accra Regions.

Figure 1. Tomato Supply Calendar

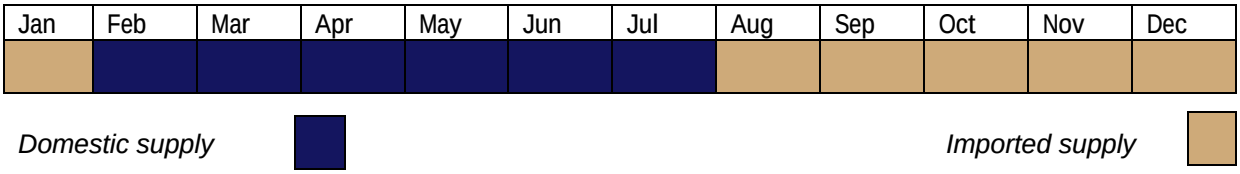


Figure 2. Production Calendar – North under Irrigation

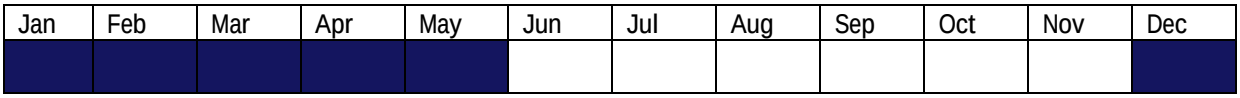
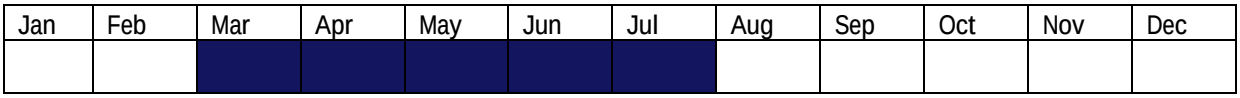


Figure 3. Production Calendar – South under Rain fed



Northern Ghana can increase its market share with improved agronomic practices, use of improved varieties, access to better markets, finance and processing facilities. This should lead to improved productivity and increased incomes for the smallholder and poor households engaged in tomato cultivation. The table below summarizes the tomato value chain in line with the key thematic areas within the M4P framework.

Table 1. Tomato Market System Analysis

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
General • 2nd most valuable vegetable crop in Northern Ghana with more than 90,000 households involved in its production. • Good comparative advantage for North, especially under irrigation • North can develop strong competitive position against imports. The Poor • For the 49% of poor households, tomato serves as a food crop and source of extra income to purchase staples, inputs for main season cropping; and pay for essentials. • Tomatoes are a labour intensive crop, which uses family labour, 'group help concept' and hired labour. • Youth and women are a dominant source of labour.	• Two main segments: fresh and processed products. Both are growing rapidly, especially processed. • Processed tomato currently growing at annual growth of 25%, driven by an increase in fast food joints, restaurants, chop bars and population growth. • Domestic supply is insufficient to meet the demand in Ghana. • Imported fresh tomato fetches a premium over domestic tomatoes and holds about 30% market share. • Locally produced varieties of tomatoes are considered to be watery, with thin skins, full of seeds and lack flavour. • Tomato prices have recorded fastest growth of all major commodities in Ghana. • Strong inter-seasonal variation in prices.	General • North is domestically competitive, but losing market share to imports of fresh tomatoes from Burkina Faso because of lower productivity and poor selection of varieties. Productivity • Low adoption of improved varieties and agronomic practices are often suboptimal, resulting in current low productivity (7.5MT/ha yield in north versus. 25MTt/ha in Burkina Faso). • There is a high input cost for the Ghanaian tomato farmer. Access to markets • Producers forced to sell at harvest due to high perishability of tomatoes and the lack of cold storage facilities, resulting in reduced income levels of poor farmers. • Farm gate prices in North not keeping pace with	Research • Poor and weak relationship between research and smallholder farmers. Research findings are not disseminated to smallholders and in cases not practical enough taken into account constraints faced by farmers. Knowledge, Extension • Weak knowledge and extension delivery. • Varietal trials – MoFA and NGOs, other donor funded projects piloting interventions in Upper East • High incidence of diseases and pests • Inadequate public extension services • Poor public-private partnership in commercialising good agronomic practices and new varieties. • Lack of investment in	• General acknowledgement of vegetables but no specific policy interventions or investment • Fertiliser subsidy policy needs better targeting to increase availability of fertilizer for dry season farming • Failure of institutions responsible for research to disseminate research findings. • Failure to commercialise innovation in partnership with the private sector • Poor governance and funding of public extension. • Private input suppliers are SMEs incapable of investing in market development activities at scale • Irrigation schemes not working optimally with problems of governance and funding.	• Inadequate supply of public goods (research, knowledge, irrigation) • Failure of public and private institutions to establish public-private partnership to commercialise new varieties of vegetables. • Ineffective delivery of extension services by public institutions and insufficient investment by private input suppliers who are SMEs. • Limited access to finance for producers, traders and importers. • Investment climate provides insufficient incentives to exporters and big traders to invest in supply chains in the North. • Coordination failures across the whole chain caused by lack of large scale players.

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
Other Actors • Service providers (input dealers, seed companies, research institutions, transporters) • Three big cities serve as market centres (Accra, Techiman and Kumasi) served by Ghana National Tomato Traders and Transporters Association (GNTTA). • There are three local tomato processing companies situated at Techiman, Wenchi and Pwalugu, but they are currently not processing • Importers of fresh tomatoes and tomato paste		prices in the South due to competition from imports. • High margins from North to South due to heavy losses during transport • Market power lies with intermediaries. Market channels controlled by GNTTA. Establishment of better supply chains with fewer intermediaries would improve farmers' incomes in the North. • Opportunity exists for the processing of tomatoes into canned products and paste. But current high cost does not make it attractive. Needs cultivation of new, high yielding varieties.	postharvest management and storage facilities by private sectors. Finance • Inadequate access to credit for farmers, traders, and other value chain actors.		

2.2 MAPPING THE POOR AND OTHER ACTORS

2.2.1 THE POOR

Tomatoes are produced mainly by smallholders. Cultivation in Northern Ghana is mainly along the White Volta and irrigation schemes such as Tono and Vea. It is estimated that over 90,000 farmers, 5,000 traders and 300,000 individuals are engaged in the tomato value chain[4] in Ghana. Cultivation is mostly done in the dry season due to food security concerns making farmers grow cereals and roots and tubers during the main rainy season. The majority of smallholder farmers working along the irrigation schemes cultivate staple food crops such as maize, millet, sorghum, cowpea etc. to feed their families during the lean seasons. Significantly, dry season tomato production also provides smallholder vegetable farmers with income to procure farm inputs for major season staple crops production, buy other staple food to supplement the main stock, family upkeep, pay school fees, health expenses and build and/or maintain their homes.

The activities in the tomato market create economic opportunities for women and the youth. Women are the nexus between production and market places, with the youth providing trucking services for movement of products at the market and aggregation centres. According to Robinson and Kolavalli, 2010, “market queens” and “lead boys” at the centre of the value chain, are perceived to be powerful – determining whose are collected and taken to the market, and thereby influencing prices at the farm gate and urban markets. These market queens are much organised and effectively control the trade in Ghana.

In addition, tomato production provides employment and source of income for the rural poor particularly in the dry season when cultivation of the crop is undertaken. Usually, labour is contracted for land preparation, establishment of nurseries, transplanting, weeding, harvesting, sorting and grading on the farms, thereby providing a livelihood for rural communities. This offers an opportunity for them to also earn some income by hiring out their labour. At the community/village level, in addition to farm operations, women also earn some income from selling tomatoes. This serves as a major source of income for most poor women who use the income earned for the upkeep of their families.

The youth also earn income from the tomato market as hired labour. An estimated 25 people are involved in getting one tomato from plot to plot, including day labourers working on the farms, haulage truckers, the men who load and unload the tomato crates onto and off the trucks, porters, restaurant and chop bar owners who are important consumers of tomato (Trader Report to IFPRI, 2009).

The northern parts of Ghana have a comparative advantage over southern Ghana in that there are various irrigable sites for production of tomato. The availability of water for all year round production provides an opportunity for tomato to be extensively cultivated as a cash crop among households. Tomato production in the northern parts of Ghana and Brong Ahafo Region do have the highest yields per hectare and as such have the lowest cost per metric ton compared to the Greater Accra Region.

2.2.2 OTHER ACTORS

Other actors along the tomato value chain include input dealers, transporters, farm workers, transporters, supermarkets, processors, etc. The largest urban wholesale markets for tomatoes are in Kumasi and Accra (Agbogbloshie and Makola). Other markets, such as Techiman, Tamale and Navrongo, are located in key growing areas and serve as centres for consolidation and for wholesale purchases by traders. Tomato traders and transporters in Accra and Kumasi have been organised into an Association known as the Ghana National Tomato Traders and Transporters Association (GNTTA), which has a strong influence on supply and sales at the urban centres.

This influence includes restricting persons and volumes of tomatoes delivered to these centres, with a strong control over the larger markets located near the key consumption areas, restricting who can bring tomatoes to the market and number of trucks bringing tomatoes to the markets on any one day.

4 Tomato Value Chain Report by IFPRI 2009

In addition, GNTTA is also importing fresh tomatoes from Burkina Faso due to its cultivation of very good varieties with a good shelf life between January and May.

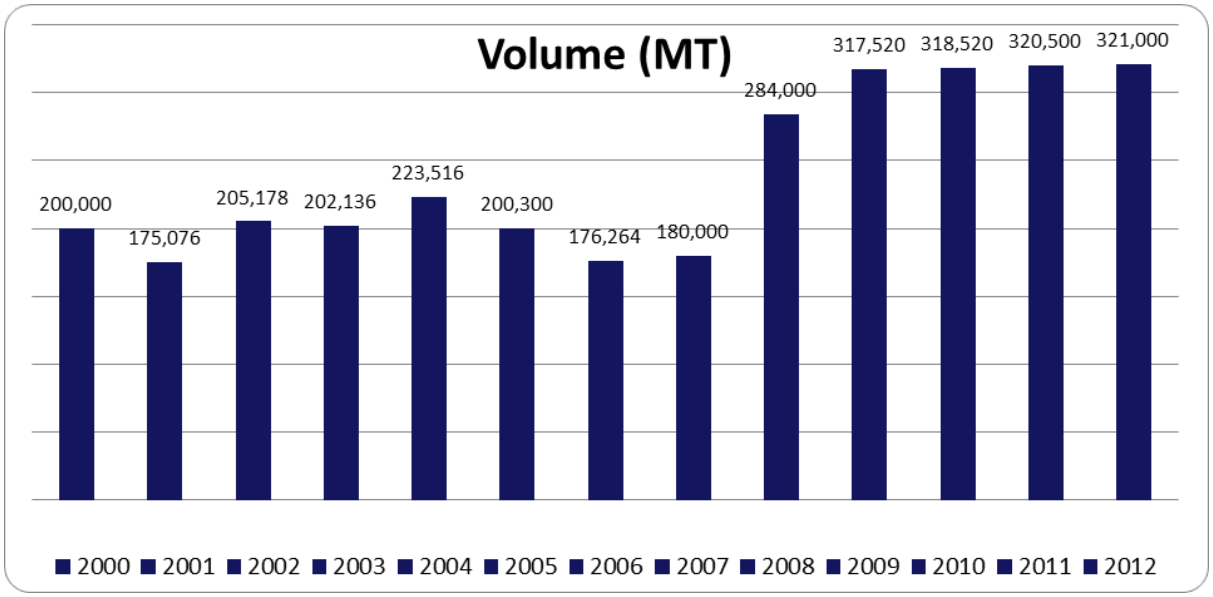
Ghana currently imports processed tomatoes though there are three factories located at Wenchi, Pwalugu and Techiman. The first two were established in the 1960s while the facility at Wenchi was divested in the late 1990s to Afrique Link Ltd. The owners are currently restructuring the company and have commenced production trials of new varieties for processing and fresh sales.

The facility at Pwalugu, though put on the divestiture list, could not attract private sector interest. The Government of Ghana in 2007, through the Ministry of Trade and Industry (MOTI) under its Presidential Special Initiative, refurbished the facility at Pwalugu and renamed it Northern Star Ltd. MOTI has engaged consultants to conduct valuation of the new company to divest to private sector by January 2014.

2.3 MARKET GROWTH AND SEGMENTATION ANALYSIS

Tomato is an important ingredient in most foods consumed widely in every household in Ghana. Major tomato production areas are in the three northern regions[5], Ashanti, Brong Ahafo and Greater Accra Regions where soils are sandy loamy with pH 6 - 6.5 and a suitable temperature of 20-27°C. Figure 4 shows production data from 2000 to 2012 revealing that tomato production fell gradually between the year 2000 and 2007. In 2012, domestic tomato production constituted about 70% of fresh tomato consumption (200,000 MT) in Ghana revealing a shortfall of about 100,000 Mt imported from Burkina Faso from December to May every year. However, production has been increasing steadily since 2008 reaching 321,000 MT in 2012.

Figure 4. Tomato Production in Ghana (MT) – 2000 - 2012[6]



This data is from the Food and Agriculture Organization of the United Nations who obtain their data from the Ministry of Food and Agriculture (MoFA). In our view, it is unreliable and when compared to other studies conducted by the Horticultural Development Unit (HDU) of MoFA in 2009/10 overstates production. Based on previous surveys conducted in production areas, estimated production of tomato in Ghana is presently around 200,000 Mt with imports from Burkina Faso accounting for a

5 Northern, Upper East and West Regions

6 FAO Data

further 100,000 MT per annum. This finding is reinforced by studies carried out by IFPRI (Robinson and Kolavalli)[7].

Like many other vegetable crops, tomato production remains a smallholder activity with very few commercial farms[8]. This has made Ghana a net importer of both fresh and processed tomatoes, with Burkina Faso accounting for about 30% of fresh tomato consumption. Tomatoes from Burkina fetch a premium over local varieties. They are grown using varieties that are not only more productive but are better tasting, less watery, with firmer skins and less seeds.

According to MoFA data, the price of tomatoes has, in constant price terms, increased faster than all commodities with the exception of groundnuts. Wholesale prices have more than trebled in real terms between 2003 and 2012. This reflects strong demand coupled with a failure of domestic production to keep pace.

Ghana also imports large amounts of processed tomato mostly from Italy (36%) and China (18%), retailing currently at Gh₵ 9.41 per kilo in markets and supermarkets. In response to high volumes of imported processed tomato paste/concentrate to Ghana at Cumulative Annual Growth Rate (CAGR) of 38% from 2002 to 2012, a foreign investor Trusty Foods Ltd imported bulk tomato paste and repackaged in smaller units under the brand name “La Bianca. Currently Olam International has purchased the facility from Trusty Foods and is promoting its brand “Tasty Tom” using the same facility and systems located in Tema. Some Ghanaian importers have in collaboration with companies in Italy and China developed brands such as “Obaapa” tomato paste which are solely produced and processed in the countries for sale in Ghana.

2.4 MARGIN ANALYSIS

Ghana’s tomato sector can be described as a low productivity-high price sector. Agronomic practices, yields and costs vary across the country with domestic supply of fresh and processed tomato insufficient to meet the demand in Ghana. Varieties grown locally are not preferred by the Ghanaian market due to their high water content and a short shelf life.

The key drivers of cost are crop protection, inputs and fertilisers, labour and irrigation. Analysis of cost indicates that inputs contribute the most to production cost for production under irrigation conditions. That notwithstanding, tomato farmers in the north receive the least price compared to farmers in the Brong Ahafo and Greater Accra Regions. Those from Brong Ahafo who mainly produce under rain fed conditions have the lowest cost but the highest price similar to that offered in Burkina Faso. The reason is that the North is close to Burkina Faso where quality of fresh tomato is high and cost of procurement is not marginally different at a transport margin of 33% compared to transportation margins between the three northern regions and Brong Ahafo at 87%. Greater Accra has the highest production and also commands the highest prices per metric ton. This can be explained by the low cost of transportation for tomatoes grown in the Greater Accra coupled with the perceived freshness and limited damage to the produce by consumers.

Tomato cultivation under irrigation is predominant in the Upper East, West and Northern Regions, and accounts for about 35% of the total tomato production in Ghana. According to the GLSS (2008), over 20,000 households in Savannah belt cultivate tomatoes with an estimated annual value of harvest and sale of Gh₵0.41million and Gh₵0.2million respectively. Farm productivity remains low and this has often led to high cost of inputs and reduced profit margins. Ghana has the potential to produce 15MT/ha with improved varieties, but productivity is generally low (7.5MT/ha) as compared to Burkina Faso (25MT/ha) due partly to very low adoption of improved varieties, as well as good agronomic and farm management practices, thus creating a supply gap in the sector.

Prices of tomatoes between December and May vary with production, thereby affecting incomes of farmers. The bumper harvest in the Upper East is around December and prices are low. It increases around March when tomato is scarce, but farmers are faced with competition from imports from Burkina Faso. Due to the seasonal and perishable nature of tomatoes, coupled with the lack of

7 The Case of Tomato in Ghana: Productivity, Elizabeth J.Z. Robinson and Shashi L. Kolavalli – IFPRI (GSSP Working Paper # 19)

8 FAO 2005

storage facilities, farmers are left with no option but to sell at relatively low prices to traders. The price differential between the Upper East and the national capital (Accra) is a clear indication: prices in the capital are 10 times higher. Refusal to sell at such low prices will only leave farmers with rotten tomatoes since they have no storage facilities. Exacerbating this challenge is the lack of processing companies to buy and process fresh tomatoes.

There is no well-established and reliable tomato supply chain in the northern part of Ghana: southern importers continue to import from neighbouring countries to the neglect of the industry in Ghana. Productivity will improve if these value chain actors (processors, importers and other major buyers) establish supply chain in the Savannah Belt using contract farming or other mechanisms to support varietal and productivity improvement. Investment by these actors coupled with better access to technologies and production resources are critical to upgrade and sustain the tomato industry in the North, and enhance the crop's role as a major source of income for smallholder tomato producing households.

However, getting these major buyers to switch from imports to local production will not be easy. Ghanaian tomatoes not only provide lower incomes for farmers but produce lower returns for wholesalers and retailers during the main and lean season, as set out in tables 2-5. They will need to be convinced of the potential for improved margins before they are likely to invest and that may require conducting trials.

Table 2. Gross Margin of Tomatoes Produced in Ghana and Burkina Faso[9]

	Ghana	Burkina Faso
Total Cost of Production (Gh₵)	2,808.3	5,204.0
Yield (MT/Ha)	7.6	23
Estimated Gross Revenue	3,800.00	9,857.1
Net Profit (Gh₵)	991.70	4,653.14
Gross margin	26%	47%

Table 3. Gross Margin of Tomatoes Purchased by Wholesalers in Ghana and Burkina Faso (Lean Season)

	Ghana	Burkina Faso
No. of crates	76.0	164.3
Farm gate price/bag (Gh₵)	200.0	270.0
Total cost (Gh₵)	15,200.0	44,357.1
Transport cost/crate + loading/crate + Customs[10] and Police	608.00	1,818.3
Selling price (Gh₵)	250.00	380.00
Estimated Gross Revenue	19,000.0	62,428.6
Net Profit (Gh₵)	3,550.0	17,691.4
Gross margin	19%	28%

Table 4. Gross Margin of Tomatoes Purchased by Retailers in Ghana and Burkina Faso (Peak Season)

	Ghana	Burkina Faso
No. of crates	76.0	164.3
Price/bag (Gh₵)	60.0	60.0

[9] Data computed through interviews with the Secretary and some members (wholesalers/retailers) of Ghana National Tomato Traders & Transporters Association (GNTTTA)

10 Custom duties applicable to tomatoes imported from Burkina Faso

Total cost (Gh₵)	4,560.0	9,857.1
Transport cost/crate + loading/crate + Customs and Police	0.0	0.0
Selling price (Gh₵)	70.0	80.0
Estimated Gross Revenue (Gh₵)	5,320.0	13,142.9
Net Profit (Gh₵)	690.0	3,205.7
Gross margin	13%	24%

Table 5. Gross Margin of Tomatoes Purchased by Retailers in Ghana and Burkina Faso (Lean Season)

	Ghana	Burkina Faso
No. of crates	76.0	164.3
Price/bag (Gh₵)	250.0	370.0
Total cost (Gh₵)	19,000.0	60,785.7
Transport cost/crate + loading/crate + Customs and Police	0.0	0.0
Selling price (Gh₵)	300.0	500.0
Estimated Gross Revenue (Gh₵)	22,800.0	82,142.9
Net Profit (Gh₵)	3,800.0	21,357.1
Gross margin	17%	26%

SECTION 3. GARDEN EGGS

3.1 INTRODUCTION

Together with tomato and pepper (chilli), garden egg is among the three most consumed vegetables in Ghana. Both garden eggs and tomato are used daily as complements rather than substitutes in Ghanaian dishes, for example in soups and stews. The activities of the garden egg market create economic opportunities for the poor, particularly women and the youth.

In Ghana, although garden eggs production is concentrated mainly in the South, the potential exists in the three Northern regions for smallholders to go into production of the crop. Northern Ghana has various irrigable sites for production of garden eggs and the availability of water for all year round production provides an opportunity for the crop to be extensively cultivated as a cash crop among poor households to feed the South. Significantly, this will provide smallholder farmers with income to procure farm inputs for major season staple crops production, buy other staple food to supplement the main stock, provide family upkeep, pay school fees, pay health expenses and build and/or maintain their homes.

Production of garden eggs is highly seasonal depending on geography of production, access to water and rainfall patterns. Within the calendar year, garden eggs are mainly produced in the Central, Greater Accra, Brong Ahafo, Eastern and the Volta Regions under rain-fed conditions. Irrigated garden eggs production is also done in some parts of the Greater Accra and Volta Regions (see Figure 5, Figure 6). From late December through April/May, some parts of the Greater Accra and Volta Regions produce garden eggs under irrigation. Rain fed production is from March to September in the five regions.

Figure 5. Production Calendar – Greater Accra and Volta Regions under Irrigation (Dry season)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Figure 6. Production Calendar – Central, Greater Accra, Brong Ahafo, Eastern and the Volta Regions (Rain-fed)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Northern Ghana can increase its market share with access to better markets, finance and storage facilities, which should lead to improved productivity and increased incomes for the smallholder and poor households, engaged in garden eggs cultivation. The table below summarizes the garden egg value chain in line with the key thematic areas within the M4P framework.

Table 6. Garden Egg Market System Analysis

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
General • Third most valuable vegetable crop in southern. • Potential exists for Garden eggs production in the irrigated sites in Northern Ghana. • North can develop strong competitive position against farmers in the South for garden egg production for exports. The Poor • Garden eggs production is a profitable business for farmers in the production areas – serves as alternative source of income for inputs and family upkeep. It is an important supplementary source of income for the vulnerable. • Highly labour intensive production. Uses family labour and hired labour • Youth and women dominant source of labour, • Other Actors • 2 large markets - Accra and Kumasi. District markets and village	General • Two main segments: Local market and export market • Domestic supply is insufficient to meet its demand in Ghana • Local varieties cultivated, - low yields/ha. • Varieties grown - 'aworoworo', 'obolo', 'white beauty', 'antropo'8, or 'yorgbe':	General • Domestic production low because of low productivity and poor selection of varieties. Productivity • Low adoption of improved varieties and better agronomic and farm husbandry land husbandry practices are often suboptimal, resulting in current low productivity (8.0 MT/ha yield versus achievable 18MT/ha.) • Domestic production is concentrated on local varieties • High input cost for Ghanaian garden eggs farmer. Storage and Technology • Opportunity exists for increasing exports to the region, EU and middle eastern markets provided improved varieties are grown and yields make the productive more competitive	General • Poor partnership between MoFA and Crop Research Institute, Universities and other relevant organizations results in low commercialization of new varieties and technologies. • Research not driven by market imperatives such as improving shelf life • Weak knowledge and extension transfer to smallholders • High incidence of diseases and pests need coordinated response from extension service and input dealers • Poor public-private partnership in commercialising good agronomic practices and new varieties • Poor postharvest management support from public institutions and lack of investment	General • Acknowledgement of vegetables but no specific policy interventions or investment • Fertiliser subsidy policy needs better targeting to increase availability of fertilizer for dry season farming • Failure of institutions responsible for research to disseminate research findings. • Failure to commercialise innovation in partnership with the private sector • Poor governance and funding of public extension. • Private input suppliers are SMEs incapable of investing in market development activities at scale • Irrigation schemes not working optimally with problems of governance and funding.	• Inadequate supply of public goods (research, knowledge, irrigation) • Failure of public and private institutions to establish public-private partnership to commercialise new varieties of vegetables. • Ineffective delivery of extension services by public institutions and insufficient investment by private input suppliers who are SMEs. • Limited access to finance for producers, traders and importers the sector. • Investment climate provides insufficient incentives to exporters and big traders to invest in supply chains in the North. • Coordination failures across the whole chain caused by lack of large scale players.

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
markets in the production areas. • Exporter associations (GAVEX and VEPEAG) of garden eggs to the EU market. • Service providers (input dealers, seed companies, research institutions, transporters, storage and pre-cooling facilities) • Varietal trials – Limited research on garden eggs varieties for commercialization.		• Producers forced to sell at harvest due to high perishability of crop and poor storage facilities resulting in reduced income levels of poor farmers • Establishment of supply chains and better contract growing in the north by, exporters and other major buyers could spur growth of better varieties • Access finance to boost use of better varieties, productivity and value addition	by private firms • Inadequate access to credit for farmers, traders and exporters		

3.2 MAPPING THE POOR AND OTHER ACTORS

3.2.1 THE POOR

As is the case with most vegetables, garden egg farmers cultivate plots of less than 1 ha. Garden egg production is an income-generating activity for smallholder farmers. Farmers usually grow a range of vegetables such as garden egg, leafy vegetables, tomato, okra, pepper and onion.

Garden eggs production is highly labour intensive, for instance, harvesting is done twice per week and it provides employment and source of income for the rural poor particularly women and the youth. Usually, labour is contracted for land preparation, establishment of nurseries, transplanting, weeding, harvesting, sorting and grading on the farms, thereby providing a livelihood for rural communities. This offers an opportunity for them to also earn some income by hiring out their labour.

At the community/district level, the farmer-traders, who are mainly women, also earn some income from selling garden eggs from their own production in addition to that of their colleagues to wholesalers. This serves as a major source of income for most poor women who use the income earned for the upkeep of their families. The youth also earn income from it as hired labour or providing trucking services for movement of products at the market and consolidation centres.

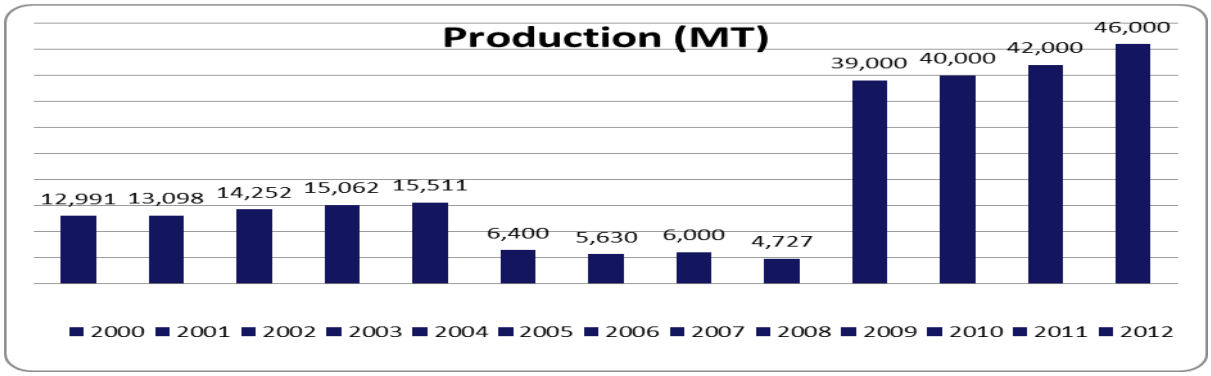
3.2.2 OTHER ACTORS

Other actors along the garden egg value chain include input dealers, transporters, farm workers, transporters, exporters, supermarkets, processors, etc. The largest urban wholesale markets for garden eggs are in Kumasi and Accra (Agbogbloshie and Makola). Other markets are the district capitals and other markets in key growing areas which serve as centres for consolidation and for wholesale purchases by traders.

3.3 MARKET GROWTH AND SEGMENTATION ANALYSIS

Major garden eggs production areas are in the Greater Accra, Central, Volta and Eastern Regions. These regions have soils that are sandy loam soil with pH 6 - 6.5 and a suitable temperature of 20-27°C. Figure 7 shows production data from 2000 to 2012 revealing that garden eggs production fell gradually between 2000 and 2008. However, production has been increasing steadily since 2008 reaching 46,000MT in 2012. Preferred varieties grown include ‘aworoworo’, ‘obolo’, ‘white beauty’, ‘antropo’8, or ‘yorgbe’ and depending on the variety, the garden egg fruit is either round or elongated. Farmers use a large diversity of names, that is more descriptive names, such as ‘long white’, ‘round white’, ‘white local’, ‘black local’, or else it adopts the names of the places where it is produced more abundantly, like: ‘kashie’, ‘kpando’, ‘techiman’ and ‘agogo’.

Figure 7. Garden Eggs Production in Ghana (MT) – 2000 - 2012[11]



11 FAO Data

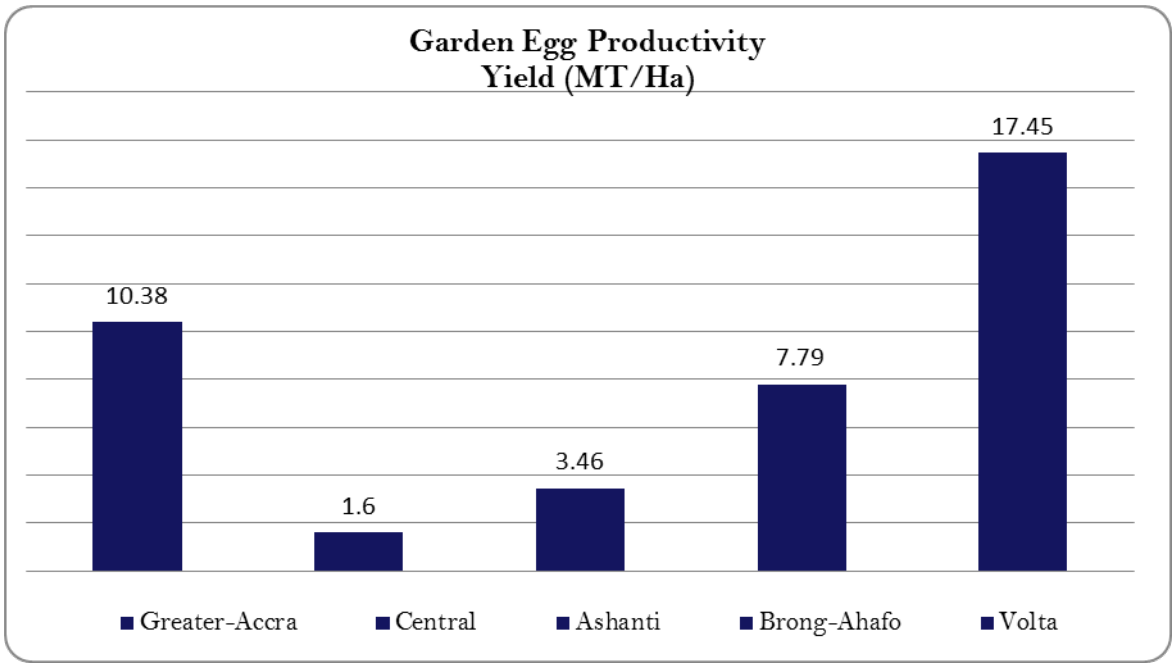
Garden eggs are exported on a limited scale in the cross-border trade in the West African sub-region and only a very small share of the total production in Ghana is exported to Europe (about 3%)[12]. The main market is the European Union, largely the United Kingdom. Unfortunately, there are no available statistics on volumes traded exclusively for garden egg. Usually this crop is either recorded under the broad vegetable category or lumped together with eggplants, another Ghanaian vegetable export. Exporters refer to the garden egg and pink ravaya6 as 'baby aubergines'. In terms of processing, not much has been done and the crop is mainly marketed fresh on both the domestic and export markets.

Figure 8. Garden Egg Supply Calendar

3.4 MARGIN ANALYSIS

Garden eggs production is mainly rain fed in Ghana in the main producing areas. However, some parts of Greater Accra and Volta Regions cultivate under irrigation in the dry season. Figure 3 indicates productivity levels for Greater Accra, Central, Ashanti, Brong-Ahafo and Volta regions respectively. Productivity levels are high in the Greater Accra and Volta regions, whilst the Central Region recorded the least yield/ha. This is attributed to the high input and labour cost without which yields are low.

Figure 9. Garden Egg Productivity (Yield/HA)



The table below presents the benefit-cost ratio for garden eggs production in Greater Accra, Central, Ashanti, Brong-Ahafo and Volta Regions. Garden egg is a labour-intensive crop, and labour costs are

12 Marketing Underutilized Crops: The Case of The African Garden Egg (Solanum Aethiopicum) in Ghana, Daniela Horna1, Samuel Timpo and Guillaume Gruère, Global Facilitation Unit for Underutilized Species (GFU), Via dei Tre Denari, 472/a, 00057 Maccarese, Rome, Italy, 2007

more than half of the total costs**.** Garden egg is a very profitable activity in the Greater Accra Region and Volta Region, where yields and prices are both comparatively higher, despite the fact that prices fluctuate a great deal during the year. It is only in the Central Region that producers make almost no profit by engaging in this activity. The main reason is the high labour cost.

Table 7. The Cost-Benefit Ratio for Garden Eggs Production per Region

	Greater Accra	Central	Ashanti	Brong-Ahafo	Volta
Total Cost of Production ($)	1012.9	1197.7	944.8	781.3 1	1225.5
Yield (MT/Ha)	10.38	1.60	3.46	7.79	17.45
Estimated Gross Revenue	4,150.2	947.7	1,726.0	2,093.0	2,910.8
Net Profit	3,137.3	(304.8)	774.8	1,309.5	1,685.2
Benefit Cost Ratio	1.32	(3.11)	2.23	1.60	1.73

Under irrigation, the productivity levels of the Greater Accra and Volta Regions are high. The smallholder farmers are able to expand production and crop twice in a year as result of availability of water. This potential can be harnessed in the North for smallholders to go into irrigated production of the crop. Northern Ghana has various irrigable sites for production of garden eggs and the availability of water for all year round production provides an opportunity for the crop to be extensively cultivated as a cash crop among households to feed the South.

Water management in the main irrigation schemes must be looked at to address to ensure that water is not poorly managed (causing serious siltation). Beside the irrigation facilities, cultivation along river boundaries and in valleys using hand-dug-wells, using diesel pumps, is also possible.

There is no well-established garden egg supply chain in the North as southern exporters and other major buyers continue to buy produce from smallholders farmers in the South. Productivity will improve if these entrepreneurs (processors, exporters and major buyers) establish garden egg supply chain in Savannah belt using some form of contract farming to encourage the growing of new varieties and the use of certified seeds and other modern inputs. Investment of these entrepreneurs, coupled with better access to technologies and production resources are critical to upgrade and sustain the garden egg industry in the North, and enhance the sector's role as a major source of income for smallholder garden egg production.

The main bottleneck will be the high cost of transporting garden eggs to the large markets in Kumasi and Accra, thus affecting profit margins of producers. This can be addressed through the adoption of agronomic practices and use of improved varieties to increase productivity from the current 8MT/ha to estimated national achievable yield of 18MT/ha to offset the high transport cost.

Table 8. Gross Margin of Garden Eggs Produced per Region

	Greater Accra	Central	Ashanti	Brong-Ahafo	Eastern	Volta
Total Cost of Production (Gh₵)	3,141.9	1,416.8	2,364.7	2,978.3	2,922.0	6,036.0
Yield (MT/Ha)	10.4	1.6	5.5	7.3	7.5	17.5
Estimated Gross Revenue (Gh₵)	6,920.0	1,066.7	3,666.7	4,860.0	5,000.0	11,633.3
Net Profit (Gh₵)	3,778.1	-350.1	1,302.0	1,881.7	2,078.0	5,597.3
Gross Margins	55%	-33%	36%	39%	42%	48%

Table 9. Gross Margin of Garden Eggs Sold by Farmer-trader to Exporter per Region

	Greater Accra	Central	Ashanti	Brong-Ahafo	Eastern	Volta

No. of boxes (delivered to exporter) - (Gh₵)	1,384.0	213.3	733.3	972.0	1,000.0	2,326.7
Price/bag (Gh₵)	5.0	5.0	5.0	5.0	5.0	5.0
Total cost (Gh₵)	6,920.0	1,066.7	3,666.7	4,860.0	5,000.0	11,633.3
Selling price (Gh₵)	12.3	12.3	12.3	12.3	12.3	12.3
Freight cost, cartons and shipping documents	6,585.6	1,142.0	3,560.0	4,669.8	4,800.0	10,969.0
Estimated Gross Revenue (Gh₵)	10,368.4	1,471.3	5,423.3	7,237.2	7,450.0	17,532.7
Net Profit (Gh₵)	3,782.8	329.3	1,863.3	2,567.4	2,650.0	6,563.7
Gross margin	36%	22%	34%	35%	36%	37%

SECTION 4. OKRA

4.1 INTRODUCTION

In Ghana, okra are consumed as vegetables, cooked or fried together with pepper, onions, tomatoes and garden eggs in stews, soups and usually served with “banku” and “akple” in most Ghanaian homes. Okra is also dried and processed into powder or dehydrated okra which is used in thickening soups, as emulsifier for salad dressing and as flavouring in preparing food products (Nonneck, 1989) [13]. Okra has strong export potential and it accounts for a sizable share (about 80%) of fresh vegetables exported to the EU market.

The crop thrives well in most parts of Ghana where soils are sandy loam with pH 7 - 7.5 and a suitable temperature of 20-27°C. Major production areas are in the Central, Eastern, Greater Accra, Ashanti, Brong Ahafo, Greater Accra and Volta. Results of okra trials conducted under irrigation in Northern Ghana by the USAID-funded Trade and Investment Project for a Competitive Export Economy (TIPCEE) revealed that the okra production is profitable.

Currently, production of okra is mainly rain fed and concentrated in the South where rainfall is bi-modal. Rain-fed production is from March to September in the South. However, in some parts of the Central, Greater Accra and Volta regions, smallholder farmers in some parts of these regions cultivate okra under irrigation from late November through April/May (see diagrams).

Figure 10. Okra Production Calendar – Rain-fed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Figure 11. Okra Production Calendar – Greater Accra and Volta Regions under Irrigation (Dry Season)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

While Okra production is concentrated mainly in the South, potential exists in the three Northern regions for smallholders to go into production of the crop. The irrigable sites in Northern Ghana ensure the availability of water for all year round okra production, and provide an opportunity for the crop to be extensively cultivated as a cash crop among smallholder households. Significantly, this

13 Nonneck I. L. (1989) Vegetable production pub. Nan No. 1 Sotram Reinhold Company N.Y. 608-112.

can provide smallholder farmers with income to procure farm inputs for major season staple crops production, buy other staple food to supplement the main stock, family upkeep, pay school fees, health expenses and build and/or maintain their homes.

The main bottleneck here is the lack of storage/pre-cooling facilities and the high cost of transporting okra to the port or airport for shipments to the EU market and local markets in Accra for selling rejects, thus affecting profit margins of producers. This can be addressed through ensuring access to storage facilities, greater investment in refrigerated transport, more channels to market and access to finance, which should lead also to improved productivity and increased incomes for the smallholder and poor households engaged in okra cultivation. The table below summarizes the Okra value chain in line with the key thematic areas within the M4P framework.

Table 10. Okra Market System Analysis

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
General • Potential exists for okra production in the irrigations sites in Northern Ghana starting with the main irrigation schemes. The Poor • Cultivation of Garden Eggs in the north is on a very limited scale in the Upper West Region but mainly grown in the southern part of the country where demand is established. • Okra cultivation is a profitable business for farmers in Southern production areas – serves as alternative source of income for inputs and family upkeep. It is a major source of income for the poor who supply labour. • Okra requires labour intensive production, using family labour	• Market reviving after sharp fall in production due to disease, poor weather conditions and global downturn • Two main product segments: Fresh okra and Dried/ dehydrated okra • Varieties not slimy as the local okra are preferred by Ghanaian consumers • Exports are controlled by importers in end markets who specify varieties, packaging and prices. • Ghanaian exports able to meet challenging EuroGAP standards. • Exporters supply inputs, knowledge of GAP and buy back production • Exporters sort, grade and pack and arrange for pre-cooling and shipment in refrigerated containers • Exporters struggling to meet demand because of fall in domestic production	General • Domestic production is reviving slowly as cultivation is capital intensive and without modern inputs, yields remain low • Agronomically, Okra will do well in the northern part of the country due to low relatively low humidity reducing incidence of fungal attacks. Productivity • There is inadequate access to high yielding okra hybrid seeds on the Ghanaian market. • Agronomic practices and land husbandry practices are often suboptimal, resulting in current low productivity (8.0 MT/ha yield versus achievable 18 MT/ha). • Domestic production is mainly rain fed. • High input cost for Ghanaian farmer	Research • The current poor partnerships between MoFA and Crop Research Institute, Universities and other relevant organisations result in low commercialisation of new varieties and technologies. Public extension services • Weak knowledge and extension delivery • Poor public-private partnership in commercialising good agronomic practices and new varieties. • Poor post-harvest management services from public institutions and private institutions. Finance • There is currently inadequate access to credit for farmers, exporters, traders, processors and other value chain actors.	General • Acknowledgement of vegetables but no specific policy interventions or investment • Fertiliser subsidy policy needs better targeting to increase availability of fertilizer for dry season farming • Failure of institutions responsible for research to disseminate research findings. • Failure to commercialise innovation in partnership with the private sector • Poor governance and funding of public extension. • Private input suppliers are SMEs incapable of investing in market development activities at scale • Irrigation schemes not working optimally with problems of governance and funding.	• Inadequate supply of public goods (research, knowledge, irrigation) • Failure of public and private institutions to establish public-private partnership to commercialise new varieties of vegetables. • Ineffective delivery of extension services by public institutions and insufficient investment by private input suppliers who are SMEs. • Limited access to finance for producers, traders and exporters • Investment climate provides insufficient incentives to exporters and big traders to invest in supply chains in the North. • Coordination failures across the whole chain caused by lack of large scale players.

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
and hired labour. • Youth and women are dominant source of hired labour. Other Actors • Two export associations are main buyers; they also supply domestic traders, supermarkets. • Exporter associations (GAVEX and VEPEAG) – export okra to the EU market. • Weak presence of service providers in the north (input dealers, seed companies, transporters, storage and pre-cooling facilities)		means that exporters have to be prepared to provide inputs to grow appropriate varieties, achieve competitive yields Storage and Technology • Producers are forced to sell at harvest due to high perishability of crop and lack of cold storage facilities, resulting in reduced income levels of poor farmers.			

4.2 MAPPING THE POOR AND OTHER ACTORS

4.2.1 THE POOR

Vegetable production is an income-generating activity for smallholder farmers. Households from coastal forest and savannah ecological zones in Ghana are actively involved in the production of vegetable crops such as garden egg, okra, leafy vegetables, tomato, pepper and onion. Okra is mainly grown as a cash crop in the South. The North could be a major producer of okra as a cash crop, especially on irrigated schemes and along the banks of rivers, where it would be possible to grow the crop year round.

Most of the Southern okra farmers cultivate plots of less than 1ha. Usually, varieties grown are hybrid which are more expensive to the smallholder farmer and include varieties such as Indiana, Essoumten, Lady Finger, Crimson spine, OH152, etc. Very little research has however been done in Ghana on okra varieties.

In addition, okra production is highly labour intensive, for instance harvesting is done thrice a week and it provides employment and source of income for the rural poor particularly women and the youth. Usually, labour is contracted for land preparation, establishment of nurseries, transplanting, weeding, harvesting, sorting and grading on the farms, thereby providing a livelihood for rural communities. Women also play key roles in the sorting, grading and packing of okra at the pack houses of the exporters and also the main sellers of the rejected okra around the 37 Military area and other fresh vegetables stands and in the large markets. This offers an opportunity for them to also earn some income by hiring out their labour. This serves as a major source of income for most poor women who use the income earned for the upkeep of their families. The youth also earn income from it as hired labour.

Like all other fresh vegetables, okra has a problem of short shelf life. At the production level, little is done about fresh storage of produce. Storage of fresh fruits and vegetables prolongs their usefulness, checks, market gluts and provides wider selection of fruits and vegetables throughout the year. This helps orderly marketing and may increase the financial gain to the producer. However, farmers do not have access to adequate storage facilities to reduce losses. There is also the lack of capital so that farmers are unable to acquire and use cold storage facilities even when available. Many growers depend on almost daily sales for their incomes and hence may not store their produce in anticipation of higher prices.

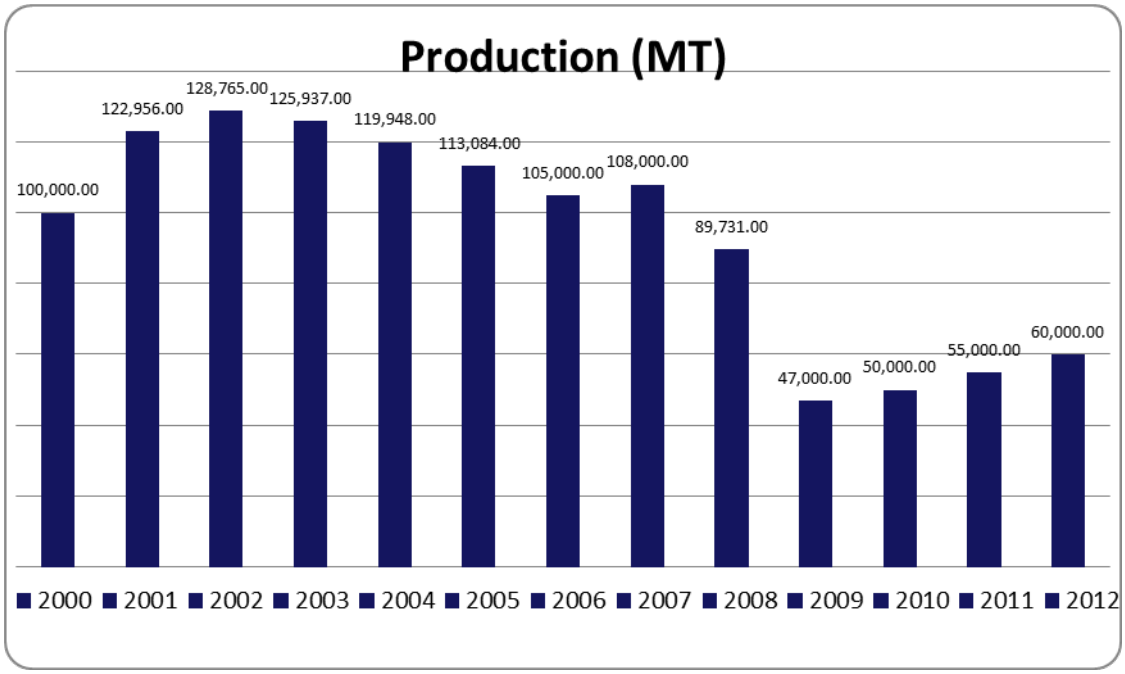
4.2.2 OTHER ACTORS

Other actors along the okra value chain include input dealers, transporters, farm workers, exporters, supermarkets, processors, etc. There are two main types of actors involved in okra export, i.e. export companies and export associations. There are basically two main identifiable export associations, GAVEX (Ghana Association of Vegetable Exporters) and VEPEAG (Vegetables Producers and Exporters Association). Exporters are in charge of the processes from supplying inputs through to harvest or post-harvest to final delivery in the foreign market. They contract smallholder farmers. Post-harvest handling, packaging and selection of okra according to export quality demand are key activities. Other markets are the market associations in the main consuming centres of Accra, Kumasi and Takoradi and traders operating fresh vegetables stands, hawkers, food processors and supermarkets.

4.3 MARKET GROWTH AND SEGMENTATION ANALYSIS

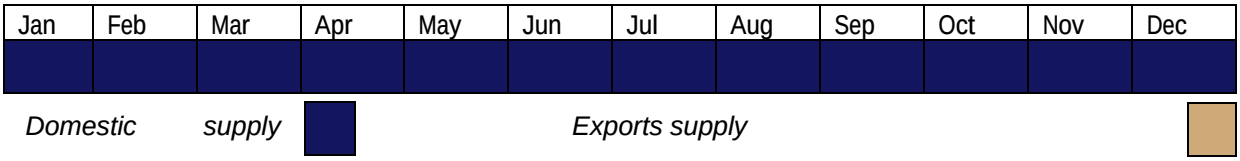
Figure 12 shows production data from 2000 to 2012 revealing that okra production increased from 2000 to 2003. It declined steadily from 2004 to a dip in 2009; production however, is increasing slowly to 60,000MT in 2012. The sharp dip was caused by a combination of disease, poor weather conditions and a fall in export demand caused by the global downturn. As mentioned, production is concentrated in the south of the country.

Figure 12. Okra Production in Ghana (MT) – 2000 - 2012[14]



There are two market segments for okra, namely fresh okra and dried/dehydrated okra. Unfortunately, there are no available statistics on volumes traded exclusively for okra. Usually this crop is either recorded under the broad vegetable category or lumped together with other Asian/ethnic vegetables. It is estimated that okra makes up about 80% of Ghana's exports fresh vegetables products. Exports are mainly to the EU market (excluding chilli), largely to the United Kingdom. Consumers are of Asian and African origin with Indian and African restaurants and food manufacturers adding to consumer demand. Demand is high throughout the year provided the quality is good.

Figure 13. Okra Supply Calendar



Okra is also dried and processed into powder, which is used in thickening soups, as emulsifier for salad dressing and as flavouring in preparing food products. In terms of processing, not much has been done and the crop is mainly marketed fresh on both the domestic and export markets.

4.4 MARGIN ANALYSIS

Okra production is mainly rain-fed in Ghana in the main producing areas. However, some parts of Greater Accra and Volta regions cultivate under irrigation in the dry season. Farm productivity remains low and this has often led to high cost of inputs and reduced profit margins. Ghana has the potential to produce 10MT/ha with improved varieties, but productivity is generally low (6.0MT/ha) due partly to quality and price of hybrid seeds sold on the Ghanaian market, high input cost which reduces their use and poor agronomic and farm management practices. Productivity levels are however high in areas where okra production is irrigated or when exporters provide inputs and knowledge of good agricultural practice (GAP) to meet EuroGAP standards.

14 FAO Data

The table below presents the benefit cost ratio for okra production under rain fed and furrow irrigation. As depicted in the table, yields are high under furrow irrigation and farmers stand to make more profit than relying on rain fed production.

Table 11. The Cost-benefit Ratio for Okra Production

	Rain fed	Furrow Irrigation
Total Cost of Production ($)	816.2	816.2
Yield (MT/Ha)	2.8	4
Estimated Gross Revenue	985.50	1457.5
Net Profit	169.3	641.3
Benefit Cost Ratio	0.83	1.79

The smallholder farmers are able to expand production and crop twice in a year as result of availability of water. This potential in the North can be harnessed for smallholders to go into production of the crop. Northern Ghana has various irrigable sites for production of okra and the availability of water for all year round production provides an opportunity for the crop to be extensively cultivated as a cash crop among poor households. There is no well-established okra supply chain in the North as southern exporters and other major buyers continue to buy produce from smallholders farmers in the South to the neglect of the North. Productivity will improve if these entrepreneurs (processors, exporters and major buyers) establish okra supply chain in Savannah belt using some form of contract farming akin to what exporters use in the South. Investment of these entrepreneurs, coupled with better access to improve hybrid seeds, technologies and production resources are critical to promote and sustain the okra production in the North, and enhance fulfil the crop's potential as a major source of income for smallholder vegetable producing households.

Table 12. Gross margin of Okra Produced per Region

	Greater Accra	Central	Volta
Total Cost of Production (Gh₵)	1,806.1	1,250.0	1,558.7
Yield (MT/Ha)	2.5	2.0	2.1
Estimated Gross Revenue (Gh₵)	2,500.0	2,000.0	2,100.0
Net Profit (Gh₵)	693.9	750.0	541.3
Gross Margins	28%	38%	26%

Table 13. Gross margin of Okra exported per Region

	Greater Accra	Central	Volta
No, of boxes (delivered to exporter) - (Gh₵)	416.7	333.3	350.0
Farm gate price/box (Gh₵)	6.0	6.0	6.0
Total cost (Gh₵)	2,500.0	2,000.0	2,100.0
Selling price (Gh₵)	17.5	17.5	17.5
Freight cost, cartons and shipping documents (Gh₵)	2,495.8	2,116.7	2,192.5
Estimated Gross Revenue (Gh₵)	4,795.8	3,716.7	3,932.5
Net Profit (Gh₵)	2,300.0	1,600.0	1,740.0
Gross margin	48%	43%	44%

Table 14. Gross margin of Okra sold by Retailer on the Local Market in the Peak Season per Region

	Greater Accra	Central	Volta
No, of bags sold (delivered at market) (Gh₵)	52.1	41.7	43.8
Price/bag (Gh₵)	18.0	18.0	18.0
Total cost (Gh₵)	1,237.5	1,200.0	787.5
Selling price (Gh₵)	30.0	35.0	30.0
Estimated Gross Revenue (Gh₵)	1,562.5	1,458.3	1,312.5
Net Profit (Gh₵)	325.0	258.3	525.0
Gross margin	21%	18%	40%

Table 15. Gross Margin of Okra Sold By Retailer on the Local Market in the Lean Season per Region

	Greater Accra	Central	Volta
No. of bags sold (delivered at market) (Gh₵)	52.1	41.7	43.8
Price/bag (Gh₵)	30.0	35.0	30.0
Total cost (Gh₵)	1,862.5	1,700.0	1,312.5
Selling price (Gh₵)	60.0	60.0	60.0
Estimated Gross Revenue (Gh₵)	3,125.0	2,500.0	2,625.0
Net Profit (Gh₵)	1,262.5	800.0	1,312.5
Gross margin	40%	32%	50%

SECTION 5. WATERMELON

5.1 INTRODUCTION

Watermelon is a sweet watery fruit with water content of 92% and the remaining 8% being sugar. The sweet juicy pulp of the ripe fruit is eaten fresh. Watermelon is rich in vitamins, especially vitamin C and has a high water content which qualifies it as a close substitute for water in quenching thirst. In Ghana, the cultivation of watermelon is concentrated along the southern sector of the country, i.e. Greater Accra, Ashanti, Volta, Western, Central and Eastern regions with much emphasis on the coastal savannah plain of the southern sector of the country. Some parts of Brong-Ahafo and the three Northern regions (particularly in the irrigated sites) are also under cultivation.

As with most crops, watermelon production is an income-generating activity for smallholder farmers, with women playing a key role in marketing the produce. A significant percentage of the rural households from coastal forest and savannah ecological zones in Ghana are actively involved in the production of the crop.

Production of watermelon is highly seasonal depending on geography of production, access to water and rainfall patterns. However, production levels of watermelon are not well documented.

Figure 14. Watermelon production calendar – Greater Accra and Volta Regions under Irrigation (Dry season)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Figure 15. Watermelon Production Calendar (Rain-fed)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

In Ghana, cultivation of watermelon is distributed from the north to the south. The potential exists to draw synergies between the two zones and promote watermelon production and marketing round the year for the domestic and export markets. A key requirement here is the provision of adequate storage facilities (pack houses and pre-cooling facilities), better market access, finance, adoption of improved agronomic practices and use of improved varieties to increase productivity and incomes of the farmers.

The table below summarizes the watermelon chain in line with the key thematic areas within the M4P framework.

Table 16. Watermelon Market System Analysis

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
General • Potential exists for watermelon production in the North. Currently, limited cultivation in the irrigation sites in Upper-East region (Tono and Vea irrigation schemes) • North can develop strong competitive position against farmers in the South for dry season watermelon & melon farming production for exports and local market. • Most households in the production areas are rural poor households in the forest and savannah ecological zones involved in production. • Serves as a profitable business for smallholder farmers with women playing a key role in marketing - in the production areas – serves as a major source of income for the vulnerable. • High labour cost - youth	General • Two main segments: Local market and Export market. • Sold mainly as fresh whole, fresh pre-cuts by local vendors and processed as ready-to-drink juice and/or as blend with other fruits. • Varieties grown – mainly FI hybrids seeds e.g. sugar baby, crimson sweet. • New varieties such as Cantaloupes and Galea Melons have a potential for exports in the United Kingdom. Market size of 24,000 MT has been estimated annually between September and April.	General • Domestic production low because of low productivity and poor selection of varieties. Productivity • Low adoption of improved varieties, poor agronomic and land husbandry practices resulting in current low productivity (20.0 MT/ha yield versus achievable 60MT/ha • Domestic production is concentrated on imported F1 hybrid seeds e.g. sugar baby, crimson sweet and expensive. • High input cost for Ghanaian watermelon farmer means skimp on inputs. Storage and Marketing • Lack of storage facilities - producers forced to sell at harvest due to high perishability of crop resulting in	Research & Extension • Poor public-private partnership in commercialising good agronomic practices and new varieties • Weak knowledge and extension delivery to smallholders. • Inadequate access to credit for farmers, traders and other value chain actors. • Significant problem for storage resulting in sales immediately after harvest. Cold Chain • Poor postharvest management services provided by public institutions & private firms with few cold stores and lack of refrigerated transport	General • Acknowledgement of vegetables but no specific policy interventions or investment • Fertiliser subsidy policy needs better targeting to increase availability of fertilizer for dry season farming • Failure of institutions responsible for research to disseminate research findings. • Failure to commercialise innovation in partnership with the private sector • Poor governance and funding of public extension. • Private input suppliers are SMEs incapable of investing in market development activities at scale • Irrigation schemes not working optimally with problems of governance and funding.	• Inadequate supply of public goods (research, knowledge, irrigation) • Failure of public and private institutions to establish public-private partnership to commercialise new varieties of vegetables. • Ineffective delivery of extension services by public institutions and insufficient investment by private input suppliers who are SMEs. • Limited access to finance for producers, traders and importers the sector. • Investment climate provides insufficient incentives to exporters and big traders to invest in supply chains in the North. • Coordination failures across the whole chain caused by lack of large scale players.

Mapping the poor and other actors	Market Growth and Segmentation Analysis	Value Chain Analysis	Analysis of support functions	Analysis of policies and institutions	Identification of Systemic Constraints
and women dominant source of labour. Other Actors • Three large markets - Accra Kumasi and Tamale. Major market in Accra – Agbogbloshie to feed the other regional capitals in the south. • Weak presence of service providers (input dealers, seed companies, research institutions, transporters, storage and pre-cooling facilities)		reduced income levels of poor farmers • Establishment of supply chains and better contract growing in the north by traders, processors and other major buyers would help to increase productivity and reduce high transport losses • Access finance to boost use of better technologies and improve transport and marketing would add huge value • Opportunity exists for preparing cut fruits and juice processing.			

5.2 MAPPING THE POOR AND OTHER ACTORS

5.2.1 THE POOR

Watermelon is grown throughout the country by smallholder farmers. Production is highly labour intensive and it serves as a major employment and source of income for the rural poor particularly women and the youth. Women play an important role in marketing of fresh watermelon at the wholesale and retail levels at the major urban centres where the goods are delivered. The fruit is either sold as fresh whole and/or pre-cuts by these female vendors in the major market centres and this serves as a major source of income for most poor women who use the income earned for the upkeep of their families. The youth also earn income from it as hired labour working on the farms for the cultivation of watermelons for the domestic market and cantaloupe for exports.

Usually, labour is contracted for land preparation, planting, weeding, harvesting, sorting and grading on the farms, thereby providing a livelihood for rural communities. This offers an opportunity for the poor to also earn some income by hiring out their labour.

5.2.2 OTHER ACTORS

Other actors along the watermelon value chain include input dealers, transporters, traders (wholesalers), retailers, supermarkets, fresh fruit processors, etc. The largest urban wholesale markets for watermelon are in Accra (Agbogbloshie), Kumasi, Tamale and other regional capitals. Other markets are the district capitals and other markets in key growing areas which serve as centres for consolidation and for wholesale purchases by traders, caterers and processors.

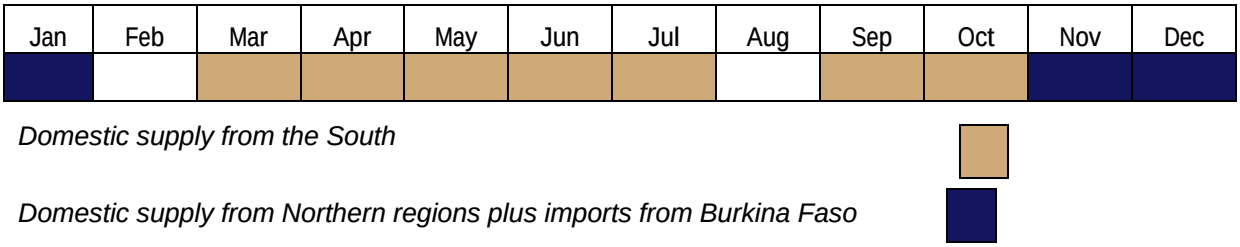
5.3 MARKET GROWTH AND SEGMENTATION ANALYSIS

Watermelon is mainly consumed fresh by most consumers as pre-cuts or fruits in a blend with other fruits. In terms of processing, not much has been done and the crop is mainly marketed fresh on the domestic market.

Although watermelon is widely grown in Ghana, production data has not been well documented as is the case for other fruits such as pineapple, mango, orange, etc. Common varieties grown are sugar baby and crimson sweet.

Watermelon is imported from Burkina Faso in the dry season to Northern Ghana. Unfortunately, there are no available statistics on volumes traded exclusively for watermelon as a result of aggregation of vegetables by the Ghana Export Promotion Authority. Usually this crop is either recorded under the broad vegetable category or lumped together with other vegetables.

Figure 16. Watermelon supply calendar



5.4 MARGIN ANALYSIS

Apart from the North, watermelon production is mainly rain fed in Ghana in the main producing areas. Farm productivity remains low and this has often led to high cost of inputs and reduced profit margins. Ghana has the potential to increase production through the adoption of improved varieties, agronomic and farm management practices to offset the supply gap in the sector.

There have been limited piloting of cantaloupe commercial trials by some commercial farmers in farms that historically are focused on pineapple production and export. Initial margins indicated high profitability and a gestation of 70 days from seeding to exports. Currently, the UK imports Cantaloupes during its winter season from September to April with an economic value of 105 Million Euros which accounts for 16% of the total EU.

Due to proximity, adequate sunshine and a history of knowledge of the production and export of horticultural products, Ghana has the potential to export 24,000 MT of melons to the UK alone at an economic value of 11 Million USD within the next two years thus capturing a sizeable share of the market. The crop requires dry weather with abundant sunshine for quality fruit production. Growing melons requires ample space, sunshine, water and nutrients. Melons grow best in sandy loam soils, which are well drained and slightly acidic and also with PH between 6.0 and 7.0.The crop thrives in almost all the agro ecological zones in Ghana but the North is especially suited to it. Melon production needs irrigation and the North has the largest area under irrigation in Ghana. Water for irrigation should be of good quality.

Table 17. Margin Analysis for Irrigated Cantaloupes for Exports from Ghana

Indicators	Melon
Yield/Ha Mt	40
Price per Kilo GBP/Kilo	0.55
Duration from Planting to Harvest/Days	70
Net Margin	
GHS	16,000
Pound Sterling	4,000

SECTION 6. ANALYSIS OF SUPPORT FUNCTIONS

6.1 RESEARCH

Previous research efforts on tomatoes appear to have had little impact. The Natural Research Institute (NRI), UK conducted a research in the Brong Ahafo Region on pure line selection of vegetables landraces, including tomato, aiming to produce a source of pure strains of particularly good open pollinated varieties. Qualities that were valued among the varieties included fruit quality, taste and shelf life. Although the research appears to be a well-documented action research project, it has not been fully implemented due to the lack of breeding programmes and no systematic seed multiplication in the country.

Since the NRI-led study, no new varieties have been introduced to farmers through seed companies, processing companies, NGOs and donor-funded projects which will encourage farmers to grow varieties for processing. Currently, the Wenchi Tomato Factory (Afrique Link) is carrying out field trials under wind tunnels and in the open fields to test and select varieties with less water content, strong skin and longer shelf life.

For the other selected vegetables, research in the north has been non-existent since these varieties are not historically grown there. Even in the south, not much research has conducted in the production of watermelons in Ghana with the exceptions of some initial trials conducted in cantaloupes in the Akwapim South district. There will be a need to engage research stations and institutions such as SARI to initiate commercial and research trials in these selected vegetables for both the local and export markets.

SARI has conducted a lot of tomatoes varietal trials vis-à-vis good crop agronomic practices/new technologies but the findings of these trials/innovations are yet to be felt on the field. Even though tomato is purely a cash crop and a good source of income for farmers, MoFA has given little attention to it, thus technologies required to enhance production and productivity are not made available and accessible to producers. In the Upper East Region, TRIAS Ghana (an NGO) has started pilot

initiatives aimed at enhancing tomato production, productivity and marketing in the region. Besides TRIAS Ghana, there are no other NGOs identified to facilitate any significant value chain arrangements in the vegetable sector in northern Ghana. TRIAS Ghana is however constrained by resources to upscale their intervention into other vegetable production districts in Northern Ghana thus limiting their intervention in only two districts.

SARI, MoFA and other private organizations (the private sector) have failed to respond with appropriate initiatives to the emerging market opportunities in the sector market to boost supply locally.

Under TIPCEE and later on using their own resource, exporters have tried growing okra in the North with promising results. The key constraint was the lack of refrigerated transport. The exporter ended up using buses which resulted in huge losses.

6.2 KNOWLEDGE AND EXTENSION

MoFA is the institution mandated by the government to create an environment of sustainable growth and development of the agricultural sector. The government, through MoFA and its Extension Services Directorate, has established a structure of frontline staff, Agricultural Extension Agents, (AEAs) as a conduit that carries extension information to the grassroots to facilitate farmer education. An important objective of agricultural extension is to increase farmers' knowledge about crops and cropping practices to enable them to improve their crop husbandry practices and increase productivity. The extension service delivery by MoFA personnel at the district level encompasses the use of a wide range of communication and learning activities to reach out to rural farmers. The AEAs receive regular training from the District Development Officers to enable them to send messages in all disciplines of agriculture to the farmer. The AEAs adopt a number of participatory and creative approaches in reaching out to the farmers at the community level with technical messages.

These may include:

- Field and home visits
- Group meetings
- Community campaigns
- Farmer field schools
- On-farm trials and demonstrations

Ideally, extension agent-farmer ratio is 1:500 nationwide, but in Northern Ghana, the ratio is between the range of 1:1500 to 1:3000[15]. This is woefully inadequate for farmers in Northern Ghana to access extension services. Productivity continues to decline as result of inadequate public extension services support, coupled with poor public – private partnership in commercialising good crop agronomic practices and new technologies, including new improved varieties, post-harvest and water resource management.

Besides the government's efforts, the private sector, NGOs and donor agencies also play a key role in the delivery of extension information. They are engaged in farmer education through the use of highly qualified technical staff to provide inputs, credits and capacity building interventions to ensure there is comprehensive delivery of extension services in efforts to develop the value chain. Various programmes have at various periods been undertaken by both the government and the private sector to help in the promotion of extension delivery and the development of commodity sectors, such as maize, rice and soya. In the irrigation schemes and projects designed and funded by donors to support value chains in the North, the extension ratios are lower, at 1:1,200, as a result of private sector intervening with its outgrowers with support from donor projects such as the USAID ADVANCE project.

[15]MoFA Regional MIS Officer, Northern Region

For example, farmers linked to these nucleus farmers are provided with seeds and technical support. Unfortunately for the vegetable sector in the Northern part of Ghana, the focal crops selected by the ADVANCE programme and other related projects are maize, rice and soya bean. There is also some intervention in the sorghum sector by Guinness Ghana Breweries Ltd, which also results in lower extension-farmer ratio in that crop.

Ensuring technical adoption by farmers will require the development of models where relationships between market players are strengthened and extension-farmer ratio is reduced to 1:100. This has been seen in successful models in the rice sector in the Volta Region of Ghana, for example the Copa Connect model instituted by Global Agri-Development Ltd[16] (GADCO).

This approach provides small farmers with an array of agricultural services to which they otherwise would have no access. This type of arrangement is becoming increasingly relevant as public service delivery to the agricultural sector declines as a result of funding constraints and the involvement of the private sector in providing agricultural services increases. For it to be sustained there should be an improved two-way communication between management and extension staff and farmers. This is crucial for making the commercial relationship successful and beneficial to all in the long run.

The current public sector delivery of extension services faces the following challenges:

- Inadequate extension personnel to effectively reach reasonable number of farmers.
- Limited budgets for supporting public extension service delivery.
- Inadequate staff training and incentives.
- Inadequate logistical support.
- Ineffective supervision of field workers to ensure effective delivery of extension services.
- Absence of organised feedback about farmer problems from field workers to researchers.
- Staff performing other tasks than dissemination of information such as data collection.

Some of the ways to improve public extension services are:

- Human resource development.
- Use of innovative ICT based approaches to provide advice to farmers through the use of mobile phones.
- Use of radio as a medium to educate the public.

Improving the supply of knowledge and extension from the private sector requires a partnership between the input suppliers and major buyers (e.g. exporters). They should be willing to carry out demonstrations and work with the public sector to disseminate extension advice using new media platforms.

6.3 FINANCE

Agricultural financing by financial service providers to the vegetable and fruit sector industry has been limited for some time now. Very few farmers and traders have access to business upgrading finance from rural banks, with majority relying on other sources of informal credit where credit arrangements are based on agreements to provide inputs for a share to the creditor of the produce at harvest. Producers in the North have less access to microfinance than other growers in the rest of the country and this is due in part to the lack of large commercial and institutional buyers who can serve as credible markets and guarantors to mitigate the lack of collateral demanded by the finance institutions. Resulting from the lack of access to finance, farmers are forced to mostly sell produce at harvest and accept lower prices. Lack of access to cold storage and refrigerated transport is also due to exporters failing to source sufficient finance from the commercial banks.

16 GADCO based in Sogakope is currently the largest producer of aromatic rice in Ghana

A good partnership of traders and exporters with financial service providers will increase access to finance to provide more credit to producers, thus increasing production through strengthening of domestic supply chain. Finance could support new business models, including contract farming. This has been already proven for farmers engaged in export commodities, with a structured market and price determined prior to harvest serving to boost yields and incomes.

SECTION 7. ANALYSIS OF POLICIES AND INSTITUTIONS

Ghana's current Agricultural Policy Framework and National Development Plan emphasise the importance of graduating from a subsistence-based, smallholder system to one characterised by a stronger market-based orientation, based on a combination of productive smallholders alongside larger commercial enterprises engaged in agricultural production, agro-processing and other activities along the value chain. This plan envisions the adoption of a value chain approach to agricultural development with value addition and market access given more attention. At the same time efforts will be intensified to increase productivity along the value chain while building the capacity to meet international quality standards. While overall imports will not be controlled by quotas and tariffs, the use of standards to control imports of poor quality produce will be pursued with attention given to improving standards in local markets and for food safety. In the short to medium term, selected commodities will be targeted as food security and for income diversification, based on comparative and competitive advantage, and sustainable land management and environmental practices.

This policy direction is rooted in FASDEP I, prepared in 2002 and revised in 2007 as FASDEP II. FASDEP II is a more comprehensive policy as it captures the concerns of all relevant agricultural stakeholders in a decentralized and consultative manner. It incorporates all the institutional issues within and outside Ghana such as the Comprehensive African Agricultural Development Programme (CAADP) and the New Partnership for African Development (NEPAD). It also contains key objectives of the Economic Community of West African States (ECOWAS) agricultural policy and Millennium Development Goals (MDG) that are related to agriculture and rural development. FASDEP II emphasizes the sustainable use of resources toward commercialisation of agriculture by highlighting market-driven growth and targets:

- Food security and emergency preparedness.
- Increased incomes for actors engaged in agricultural activities.
- Increased competitiveness and enhanced integration into domestic and international markets.
- Sustainable management of land and environment.
- Science and technology applied to food and agriculture development.
- Improved institutional coordination.

The crops and livestock sub-sectors are expected to lead the growth of the entire agricultural sector at an annual rate of 6% or more. To achieve this growth target, crops such as mango, cashew, oil palm, rubber, plantain and citrus, as well as small ruminants (sheep and goats) and poultry and vegetables will be promoted on the basis of comparative and competitive advantage of agro-ecological zones and availability of markets. Indigenous staple crops and livestock species produced by the poor can be commercialised through linkages to industry. To operationalize FASDEP II, MoFA in collaboration with its key stakeholders developed a Medium Term Agriculture Sector Investment Plan (METASIP) to serve as the implementation plan. The METASIP (2011-2015) was developed to achieve a target of agricultural Gross Domestic Product (GDP) growth of at least 6% annually, halving poverty by 2015 in consonance with the Millennium Development Goal 1, based on government expenditure allocation of at least 10% within the plan period (2011–2015). The main objectives of METASIP are to:

- Achieve 6% annual agriculture growth of total GDP and 10% government national expenditure allocation;
- Increase yields by an average of at least 50% by 2015;
- Increase productivity of all operations along the value chain and enhance access to markets; and

- Promote value chain development of selected commodities for food security and growth in incomes.

Six strategic programmes have been developed under the METASIP to help achieve its objectives in line with the FASDEP II policy framework.

(i) Enhancing food security and emergency preparedness aimed at reducing vulnerability increasing productivity, and enhancing nutrition, targeting five staple crops: maize, rice, yam, cassava and cowpea;

(ii) Supporting poverty reduction, wealth creation and also reinforcing food security through financial access to food diversification into cash commodities with value addition;

(iii) Supporting increased market output;

(iv) Supporting the maintenance of natural resources and ecosystem integrity;

(v) Supporting sustainable modernisation of the food and agriculture system; and

(vi) Supporting effective partnerships of institutions and stakeholders in the agriculture sector.

METASIP requires over US $1 billion for implementation of its programmes in Ghana to cover the period 2011-2015.The development partners in Ghana acknowledge that meeting Ghana's agriculture vision requires increases in the volume, quality and effectiveness of development assistance. Therefore they have committed collectively to harmonise and align their assistance to the sector, in line with the programmes and priorities identified in the FASDEP II and Sector Plan (2009-2015) agenda.

On the whole, farmers in Ghana have over the past years benefitted from the government fertiliser subsidy initiative only during the rainy season farming. The fertiliser subsidy is available from the start of the major farming season and is usually exhausted by the dry season, creating an increase in cost of growing crops in the dry season because farmers have to pay for the full cost of fertiliser. Better targeting of the subsidy, by insisting on proof of residence would help to reduce smuggling of fertiliser and keep more stock for the dry season. The seed subsidy does not apply to vegetables.

The few dams and dugouts in the Savannah belt are neither properly developed nor routinely maintained to provide the water needed for dry-season irrigated agriculture. The Ghana Irrigation Development Authority does not routinely maintain these water bodies due partly to little or no strong government support in the sector. Siltation has affected most of these water bodies reducing the available water to support expansion of dry season farms. Two key irrigation sites, Golinga and Botanga, were rehabilitated by the Millennium Development Authority under the MCA Compact I programme which ended in February 2012. The model was to introduce an anchor tenant who will provide technical service, facilitate inputs and access to markets for the smallholders. The model failed to attract competent anchor tenants and was abandoned.

The development partners are committed to working towards the scaling up of assistance in the medium to long term, in order to help meet investment costs of the programmes defined under the METASIP agenda. In the same spirit they will, in consultation with the government, provide indications of future aid to the sector on a multi-year basis in order to improve predictability and allow better planning, budgeting, and implementation. They are committed, in the maximum extent possible, to provide such financial/non- financial aid and related technical assistance in line with appropriate principles.

In practice, the Northern Rural Growth Programme is the only major donor funded intervention addressing vegetable production in the North. That programme is yet to start its intervention in the vegetable sector. So, it has been left to smaller NGOs, such as TRIAS, to develop vegetables and they are hugely under resourced for the task.

SECTION 8. IDENTIFICATION OF SYSTEMIC CONSTRAINTS

Overall, the market systems for the vegetables and fruit discussed above are failing to respond adequately to the market opportunity that the North has to supply markets in the south and develop a sizable volume of vegetable exports to Europe. The systemic constraints that underlie these symptoms are.

- Under investment in research and its dissemination and commercialisation: The Government of Ghana and the private sector have failed to support research and dissemination and the commercialisation of findings, including new varieties, innovations in good agricultural practices to target smallholder farmers, who are supposed to be served by these state institutions/organisations (MoFA, SARI etc.).
- Inadequate and ineffective extension. MoFA extension services are underfunded with a high ratio of farmers to extension agents. But the extension service has yet to develop a working relationship with private sector input suppliers to make better use of its resources.
- Inadequate governance and funding of irrigation facilities. GIDA is underfunded and yet to come up with a good model for the sustainable development of irrigation in the North.
- Limited access to finance for producers, traders and exporters. With high capital requirements, farmers need access to finance to grow vegetables but the rural banks and MFIs have yet to develop a good business model for lending profitably.
- Investment climate constraints provide insufficient incentives to exporters and big traders to invest in supply chains in the North. The high ambient temperature and distance to market calls for major investment in a cold chain. The lack of power and access to finance pose investment climate constraints that reduce the incentive for exporters and large buyers to invest in developing a supply chain.
- The lack of large firms in the chain prevents effective coordination. Failures in coordinating the supply of better seed varieties, agro-chemicals to control pests and diseases, storage facilities for the crop are the most obvious examples of poor coordination. Facilitating the development of supply chains could be accompanied by helping to build platforms that could improve coordination, including linking onion traders to farmer based organisations and sources of seeds and other inputs.
- Coordination failures: The lack of large firms in the chain prevents effective coordination. Failures in coordinating the supply of better seed varieties, agro-chemicals to control pests and diseases, storage facilities for the crop are the most obvious examples of poor coordination. Facilitating the development of supply chains could be accompanied by helping to build platforms that could improve coordination, including linking exporters to farmer based organisations and sources of seeds and other inputs.

SECTION 9. CONCLUSION

It is clear that increased vegetable production in the North could have a major impact on poverty reduction. Enabling smallholder farmers to increase the production of high value vegetables of the type discussed above would help to boost farmer's incomes dramatically. The poor, who do not have access to irrigated land, would benefit from the increased opportunity to sell their labour.

The North has the potential comparative advantages to be competitive against the South and in export markets. The combination of a dry climate, variations in diurnal temperatures, sandy loamy soils and irrigation provide ideal conditions for growing vegetables. Labour is cheaper and more productive than the South and is plentiful in the dry season.

However, this potential is yet to be developed to any meaningful extent. Neither government nor its development partners have targeted vegetables effectively. The policy stance is therefore not very helpful, though it has to be said it is also not negative.

Bringing about a market system that is able to respond to the market opportunity that vegetables represent requires addressing the systemic constraints that are the root cause of the system currently under performing. The types of interventions that are needed are:

1. Seeds, input package: Developing an effective partnership to commercialise certified seeds at an affordable cost. Domestic seeds are unavailable and, the market price for imported certified seeds is exorbitant (about 400% higher than local varieties), well out of reach of the average smallholder vegetable farmer. In the short term, exporters and major buyers could be incentivised to supply low cost imported seeds that they use to supply farmers they contract to grow vegetables as part of package of inputs including agro-chemicals and fertiliser to develop a market for new varieties. In the longer run, MADE could facilitate partnerships between SARI and seed companies to commercialise its new varieties using seed growers in the North.
2. Partnerships for extension advice: A partnership between input suppliers, extension services and exporters could help to disseminate extension advice and undertake demonstrations. One of the several ICT platforms that exist in Ghana could be incentivised to kick start the provision of advice and information for growing and marketing vegetables with the aim of developing a commercially viable service in the medium term.
3. Pilot improved governance and management of irrigation facilities. The aim would be to pilot new arrangements for investing in and maintaining irrigation facilities working with progressive water associations or helping GIDA to develop the anchor tenant model working with vegetable exporters/exporters associations.
4. Finance for crops, cold storage facilities and warehouse receipts and refrigerated transport: Working with progressive rural banks and MFIs, help to scale up successful pilots to provide crop finance, finance for building cold storage facilities with warehouse receipts facilities and to acquire refrigerated transport. The investment in storage and transport would be directed at exporters looking to build supply chains in the North.
5. Crowd in exporters into building supply chains in the North: Facilitate investment by progressive exporters/exporters associations in building supply chains from the North with the aim of developing business models that provide inputs, transfer knowledge and help with storage and access to finance through warehouse receipts. Such business models would probably work best if backed by the commercial banks.

ANNEX A: GENDER ANALYSIS

MADE Gender Market Screening Form		
Market name	**OTHER VEGETABLES**	**Assessment Colour Code**
1. Description	Northern Ghana has suitable weather conditions for vegetable production. Over 600,000 households are engaged in fruits and other vegetables production under rain-fed and irrigation during the dry season. Production is done by mainly smallholder farmers (men, women and youth). It requires substantial amount of labour using both family and hired labour, thus a source of income for the poor. Vegetables are an integral part of the Ghanaian diet. Demand is greater than supply especially during the dry season causing prices to increase substantially. It is highly perishable so much is lost at the post-harvest level. There are three tomato-processing plants in Ghana with one located in the north with no reliable chain of supply between producers and processing plants. The market is dominated by fresh vegetables and the major markets are all in the south. SARI has developed improved technologies but due to poor partnership with stakeholders, it resulted in a failure	
2. Gender sensitivity[17] (How gender sensitive is this market?)	The majority of the poor smallholder farmers involved in this market is women and youth. Women tend to dominate in the processing and trading of vegetables. It is a good source of income for both producers and traders.	
3. Contribution to negative gender effects.	Women vegetable farmers do not have access to improved seed varieties. They lack knowledge of good agronomic practices due to lack of extension services for vegetable production. There is also high level of post harvest lose due to the highly perishable nature of vegetables when there is no immediate market. Women processors do not have access to improved processing and drying equipment due to lack of credit. The quality of processed vegetables is low with no standardisation.	
4. Opportunities to adapt to or mitigate	Increasing women producers' access to improved seeds and extension services could lead to women producing	

[17] You need to make a decision, looking at the main risks and sensitivity, what colour (red, amber or green) to put here.

these negative effects	better varieties of vegetables using good agronomic practices, thus better yields and increased income. Improving women SMEs access to credit facilities could help them acquire improved processing and drying equipment leading to high quality processed vegetables to meet set standards. With improved processing equipment the SME could increase their production thus ensuring constant market for raw material from women traders. Linking women traders to small processing units could also ensure constant market for vegetables.	
5. Gender promoting measures	The gender promoting measures to employ are as follows: • Increase awareness and access among women SMEs about better facilities and improved technologies for processing vegetables • Facilitate training in BDS as well as packaging, standardisation and distribution • Create awareness among women producers of existing improved seed varieties, good agronomic practices • Facilitate access to NGOs and GoG support systems for women in agricultural processing • Facilitate MFIs and other financial institutions to develop suitable agricultural financial products for women	
6. Obligatory gender mitigating measures	MADE's interventions in the sector should ensure the following: • Introduction of women producers to improved seed varieties and good agronomic practices to increase their vegetable yields and income. • Enhancement of women processors access to finance for the acquisition of facilities and improved processing technologies. • Improvement of women SMEs skills in processing, packaging standardisation and distribution.	
7. How will gender promotion measures be monitored?	There will be a yearly assessment by the Gender Specialists with inputs from the Market Development Specialist.	
Risk colour coding	Low	Medium / High

ANNEX B: ENVIRONMENT AND CLIMATE CHANGE ANALYSIS

MADE Environment/CC Screening Form			
Intervention/ component name		**Other Vegetables (Tomatoes, Garden Eggs, Okra, Watermelon)**	
1. Description		This Component will focus on providing linkages between farmers and private input dealers (improved seed varieties), research institutions (for new improved technology), credit facilities, post-harvest management service providers and market opportunities to promote vegetable production. Dry season irrigated crops, also grown rain-fed in wet season.	**Risk**
Risk from Climate Change	**2. Sensitivity of the intervention to risks from CC**	Relatively climate resilient cropping pattern but: Offseason farming (60%) – can be affected by insufficient water and excessive heat; Rainy season farming (40%) - can be affected by flood, poor rains and late start of rains. These crops can provide increased resilience through diversification.	Without adapt.
	3. Opportunities to adapt to these CC risks	Planting early maturing varieties, use of drought resistant varieties, coaching farmers on efficient use of water and water management practices. Research into improved technology, early maturing and drought resistant varieties – there may be some new market opportunities in seeds, agrochemical inputs and machinery for agro processing.	With Adapt.
CO_2/GHG emissions	**4. Contribution of the intervention to CO_2/GHG risks**	Relatively small. Some limited adverse effects from clearing riverbank land – loss of vegetation and soil carbon.	Without Mit.
	5. Opportunities to mitigate the CO2/GHG risks	Linked to good riverbank management.	With Mit.
Environment risks	**6. Risks to the environment from intervention**	Clearing of riverbank land for cultivation can create severe risks – with a range of biodiversity, erosion, flooding and siltation outcomes. Extraction of water for irrigation can reduce availability for other users. In larger irrigation schemes poor management and inadequate drainage can lead to salinization. Small risks from increased agrochemical use.	Without Mit.

	7. Opportunities to mitigate the environment risks	Researching and promoting sustainable riverbank cultivation techniques. LEISA (i.e. Low External Input and Sustainable Agriculture). Facilitating farmers' access to pumps can increase distance of cultivation from riverbank, facilitating sustainable management. Promoting efficient use of water.	With Mit.
8. Summary		Relatively climate change resilient crops – but with dependence on access to dry season water. The environmental risks from riverbank cultivation can be managed by improved practice.	
9. Obligatory mitigation or adaptation measures		Any market intervention on these crops which seems likely to lead to an increased area of cultivation will be accompanied by promotion of sustainable cultivation and irrigation techniques.	
10. Overall Risk assessment after mitigation		Low from climate change, medium from environmental impact of riverbank cultivation – but this should be able to be mitigated by improved practice.	
11. How will the mitigation/ adaptation be monitored?		A random sample of producers will be visited on an annual basis and the sustainability of their practice will be monitored in respect to: 1. Maintaining anti-erosion vegetation barrier on the riverbank. 2. Prevention of soil erosion. 3. Safe use of agrochemicals. 4. Over-extraction of irrigation water to detriment of other users. 5. Continued availability of irrigation water.	
Risk		Low / Medium / High	

ANNEX C: POLITICAL ECONOMY ANALYSIS

MADE Political Economy Market Assessment	
MARKET	**Primarily tomatoes**
Stakeholder mapping	
1. Who are the "most influential" stakeholders or stakeholder groups in the market?	Production mostly done by poor smallholder farmers. Women dominate the marketing/trading segment. The major markets exist in the south, but the supply chains linking the markets to the producing centres in the North are not well developed. **Processors**. Currently there are three plants, two of which are refurbished old plants and the other is a new investment. The Ministry of Food and Agriculture (MoFA) is planning to set up another plant in Brong Ahafo. Trusty Foods Ltd (renamed Expom) a private company established in 2003 in Tema, was set up to supply the west African market, including Nigeria, with tomato paste. Although it sources some tomatoes from the Upper East region and more from nearby farms, it has predominantly been importing and repackaging bulk tomato paste. Currently fresh tomato from Ghana comprises 7% of its tomato inputs, the rest coming from bulk paste imports. The Northern Star Company in the Upper East was formerly the Pwalugu tomato company that was closed in the 1980s. It is located in a tomato growing area with a short season of three months (January through March). In 2006, the factory was refurbished by the Ministry of Trade and Investment (MoTI), as part of the District Industrialization Policy which aims to have a factory in each district, and taken over by the local Northern Star Tomato Company Limited, in collaboration with Trusty Foods Company Limited. Northern Star was configured to produce and package in bulk for supply to Trusty Foods in Tema for further processing and retail packaging. Because Northern Star is government owned and there is only one buyer for its products, the price at which it sells to Trusty Foods is to be determined through negotiations between MoTI and Trusty Foods. The processor re-opened in 2007 but closed down again after just one season. With a new agreement between growers and the processor, it reopened in 2010, part way through the 2009-10 season by which time many farmers had already harvested their crop. After being shut down again, the Minister of Trade and Industry recently announced its reopening. Afrique Link Ltd processor, originally called the GIHOC Tomato Cannery (TOMACAN), is located in Wenchi, Brong Ahafo, at the centre of the production areas of Akomadan and Tuobodam, and currently is configured to produce natural tomato pulp and chopped tomatoes, thereby supplying a niche market rather than trying to compete with imported paste. The processor was re-opened through a private-public partnership in the mid-2000s but was not able to source sufficient high quality tomatoes from Ghana at a competitive price and so after a pilot season, Wenchi again ceased processing.
2. Is there a presence of legitimate and credible	A National Vegetable Growers Association appears to have influence with policymakers. The association was influential in

stakeholders?	working for the re-start of the Pwalugu processing plant.
3. Is there a national politician or other influential political actor (e.g., national or regional "best farmer") who has a notable interest in or 'champions' the interests of any of the participants in this market?	The parliamentary sub-committee for agriculture was involved in setting up a committee of three actors, ICOUR, MoFA and Northern Star, to examine and recommend a strategy to reopen the Pwalugu-based tomato processing plant. It appears that keeping the agro-processing plant operational has strong political backing, primarily because of its youth wage employment effects.
4. Are there vested interests that can block, derail or sabotage policy and institutional change?	There are no organised vested interests adverse to MADE.
5. Are farmers in the market organized collectively? Is there a representative farmer based organisation?	There is a wide range of vegetable grower FBOs at the local level, as well as national associations ostensibly representing vegetable growers.
Institutional assessment	
6. Are there any policies/regulations/norms in the market that could limit or facilitate MADE's interventions?	Ghana's direct public sector efforts to support and improve the tomato sector have focused primarily on large-scale processing. Over the years, successive governments have started, closed, and re-started one state-owned tomato processor or the other. In its drive to develop a linkage between agriculture and industry, and to improve on export earnings, the government has put in place certain incentive schemes to attract investors to go into agro-processing. These include a tax holiday for certain industries in the agriculture and agro-processing business, and lower taxes based on the location of the industry; with lower tax for factories in the other regions and rural areas compared to Accra-Tema area. Although a common policy justification for these projects is to provide a ready and steady market for tomato growers by "buying up the glut," often the political motivation to provide wage (factory) employment for local youth has tended to drive policy. Smallholder-farmer interests have not been the predominant political drivers behind these agro-processing initiatives. Moreover, public investment in tomato processing has not worked. Often, traders have managed to offer significantly higher prices for farmers' produce than the processing plants. Processors have thus not been able to obtain sufficient supplies at competitive prices to make them operate to capacity or produce and sell their products at prices competitive with imported paste.
7. Which are the key public sector institutions, agencies and offices (national, regional, or local) relevant to the market?	MOFA, Ministry of Trade and Industry.
8. What platforms or forums are available and accessible to farmers, FBOs and other market participants to engage with policymakers or the policymaking process?	The Parliamentary committee on agriculture appears accessible to tomato interests, though more processor-driven interests.
9. Do traditional authorities and other customary institutions play any role in the market?	Traditional authorities play no unique or exceptional role.
10.Are there capable private market participants in the market?	Private importers and processors.

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Summary	
Assessment	From a political economy perspective, the risk of engagement in this sector is low, as there is significant political interest in both the production and marketing/processing ends of the value chain yet little clarity in how to effectively link the various parts of the chain for positive sum outcomes for all participants. Large value of imports, in light of the depreciation of the cedi, also makes import-substituting market interventions politically favoured.

ANNEX D: LIST OF RECENT AND ONGOING RELATED PROGRAMMES

Full name of project	Market	Organisation	Geographical areas of intervention	Start and end year	General Description
Akumadan Tomato Irrigation Project	Tomato	Ministry of Food and Agriculture (MoFA)	Ashanti	2011-2013	
Trade and Investment Program for competitive Export Economy (TIPCEE)	Fruits & Other Vegetables (includes Okra, garden eggs, Butternut Squash etc.)	Chemonics Consortium	Northern, Upper East and Brong Ahafo regions	2005 - 2009	Linking of actors in the value chain, conducted demonstration of best practices, introduction varieties, export varieties promotion, capacity building etc. http://pdf.usaid.gov/pdf_docs/PDACP167.pdf