



Vegetable Business Opportunities in Ghana: 2016



Vegetable Business Opportunities in Ghana: 2016

*Authors: Yeray Saavedra Gonzalez, Youri Dijkxhoorn,
Irene Koomen, Edwin van der Maden, Sjoerd Herms,
Frank Joosten, and Samuel Asante Mensah*



The GhanaVeg Program

GhanaVeg believes in healthy and quality vegetables from Ghana through new ways of doing business. GhanaVeg supports frontrunner companies in the vegetables sector with business information, contacts and can provide hands-on assistance in setting up or expanding your company.



Wageningen UR

Wageningen UR is a university and research centre in the Netherlands that focusses specifically on the theme 'healthy food and living environment'. Wageningen UR has a staff of 6,500 and 10,000 students from over 100 countries work everywhere around the world for governments and the business community-at-large.



Private Extension Services For Commercial Vegetable Sector Development – Consultancy Report, 07 July 2015

This consultancy report was prepared by Advance Consulting BV under assignment by the GhanaVeg Program in Accra, Ghana. The two consultants, Frank Joosten and Samuel Asante Mensah, interviewed a large number of growers and other stakeholders in the Ghanaian vegetable sector in the period March and April 2015. The consultants wish to thank their colleagues at GhanaVeg and all others who participated during the process.

The views and opinions expressed in this report are those of the consultants and do not necessarily reflect those of the GhanaVeg program or any other stakeholder involved in the commercial vegetable sector in Ghana.

For information on the GhanaVeg program, refer to: www.ghanaveg.org.

ADVANCECONSULTING
Advancing your international business

Advance Consulting is a business consulting firm with a focus on private sector investment in developing countries. Advance Consulting identifies commercial opportunities; advises on strategic cooperation between businesses and between public and private partners; develops bankable business plans; writes project proposals and investment propositions; acquires financing; and provides technical assistance and project management services.

For more information on Advance Consulting, refer to: www.advanceconsulting.nl.

To contact the main author of this report, please send an e-mail to: frank@advanceconsulting.nl.

© 2016 Wageningen UR, Droevendaalsesteeg 4, 6708 PB Wageningen, The Netherlands.

T +31 (0) 317 480100, www.WageningenUR.nl



Wageningen UR uses a Creative Commons Attribution 3.0 (Netherlands) licence for its publications.

The user may copy, distribute and transmit the work and create derivative works. Third-party material that has been used in the work and to which intellectual property rights apply may not be used without prior permission of the third party concerned. The user must specify the name as stated by the author or licence holder of the work, but not in such a way as to give the impression that the work of the user or the way in which the work has been used are being endorsed. The user may not use this work for commercial purposes.

Wageningen UR accepts no liability for any damage arising from the use of the results of this research or the application of the recommendations.

Table of Contents

Foreword	1
Acknowledgements	2
Abbreviations & Acronyms	3
1. Introduction	5
2. Opportunities for the Domestic Vegetable Sector	9
<i>Authors: Yeray Saavedra Gonzalez, Youri Dijkxhoorn</i>	
3. Private Extension Services for Commercial Vegetable Sector Development	22
<i>Authors: Sjoerd Herms, Frank Joosten, Samuel Asante Mensah</i>	
4. Update on Food Safety and Plant Health	38
<i>Authors: Irene Koomen, Edwin van der Maden</i>	
5. Business Case – Export	43
<i>Authors: Yeray Saavedra Gonzalez, Youri Dijkxhoorn</i>	
References	51
Annex 1. About GhanaVeg	52
Annex 2. GhanaVeg Projects	54
Annex 3. Business Directory	73

Foreword

Emerging dynamics within Ghana's vegetable landscape paint a picture of a robust sector that can generate urban and peri-urban growth, and contribute significantly towards the economic development of the country. Domestically, the emergence of supermarket chains and high-end restaurants and hotels creates an enormous opportunity for increased vegetable production to feed an ever-increasing middle class with the quest for healthy-eating. On the international scene, Ghana's geographic location favours the country, comparatively, in developing thriving trade relationships with destination countries in the EU.

Recent developments however command that swift action is taken to address what could potentially erode years of investments in the export sector. The ban on Ghanaian exports to the European Union, though limited to a selection of vegetables, is bad news for the sector. Serious efforts are needed to address this in the short to medium term. Also at the domestic front, a general lapse in the national vigilance systems to ensure safe vegetable production and consumption need urgent attention.

In this regard, GhanaVeg's institutional engagements with the relevant national authorities through the Plant Protection and Regulatory Services Directorate (PPRSD), the Ministry of Food and Agricultural (MoFA), Vegetable Producers and Exporters and allied state authorities is an added value. Such efforts are necessary in creating the conducive framework for the sector to thrive. Additionally, the Program's direct interventions in the science of vegetable production through the facilitation of Wageningen UR-backed training of a cross-section of stakeholders will deliver the required numbers of agronomists to the Ghanaian vegetable sector. A critical mass of such skilled agronomists and extensionists are a sure way to galvanize the rapid surge in private extension delivery in the country.

The cadre of trained agronomists is crucial for the next phase of the sector's development, particularly as

commercial producers take on the emerging domestic and international opportunities. Already, GhanaVeg's grant program is supporting the expansion of chain activities within the sector. Increasing production and marketing activities should therefore meet with available knowledge systems, in country, for mutual commercial interests.

It is this confluence of sector dynamics that constitutes the running theme of the current business opportunities report. Like the one that preceded it, the current report lists a number of opportunities for Ghana's private sector to explore and exploit. For example, there are opportunities for private entities that want, through agronomic advisory services, to support the upstream production of healthy and high quality vegetables for both domestic and international markets. A robust domestic market development needs to emerge, which, in turn, can feed into growing the export sector subsequently.

Having known the GhanaVeg Program since its inception, I cannot but conclude that Ghana has been in dire need of such a program. The Program's unique approach of painstakingly studying the business environment, documenting the outcomes and generously sharing them with the private sector in volumes such as this, is highly commendable. Equally commendable is the sheer hard work that has gone into documenting this report, which leaves me with no doubt that its readers – particularly those who will latch onto some of the business opportunities presented therein – will remain the ultimate beneficiaries.

- Alhaji Limuna Mohammed-Muniru,
Hon Minister of Food and Agriculture, MoFA

Acknowledgements

This is a result of the dedicated efforts of a team of Wageningen UR and Ghanaian researchers who worked industriously on the GhanaVeg commissioned studies to publish this report. The authors are grateful to the numerous institutions, organizations, companies and individuals whose enthusiastic contributions and collaborations made this work possible.

The Ministry of Food and Agriculture (MoFA) was particularly helpful in providing key information on the policy direction of the Government of Ghana, with respect to the vegetable subsector. Other MoFA Directorates, especially the Plant Protection and Regulatory Services Directorate (PPRSD), the Crops Services Directorate (CSD) and the Extension Services Directorate (ESD) were very helpful in sharing knowledge and experiences with the team.

Institutions and Authorities like the Water and Food Research Institutes (WRI & FRI), Food and Drugs Authority (FDA), Ghana Standards Authority (GSA), Ghana Exports Promotion Authority (GEPA), Environmental Protection Agency (EPA), Ghana Airport Cargo Centre (GACC) and the Ghana Irrigation Development Authority (GIDA) provided useful

platforms for technical consultations and inputs during the studies; they deserve our sincere gratitude.

In addition, a number of research, knowledge institutes and universities have been extremely helpful in providing us with the in-depth insights on technical and economic developments in the country. In particular we would like to thank: University of Ghana (Forest and Horticultural Crops Research Centre in Kade), Kwame Nkrumah University of Science and Technology (KNUST), Crops Research Institute (CRI) and Savannah Agricultural Research Institute (SARI). We are also grateful to the Ghana Association of Vegetable Exporters (GAVEX), the Vegetable Producers and Exporters Association of Ghana (VEPEAG), Federation of Associations of Ghanaian Exporters (FAGE) and the Ghana Agro Input Dealers Association (GAIDA) whose members provided useful inputs during field visits and the stakeholder workshops to validate findings.

Finally, the coordination role of the GhanaVeg team in continuously providing feedback, arranging appointments with key informants, and organizing the workshops were an invaluable support we received before, during and after our studies in Ghana.

Abbreviations & Acronyms

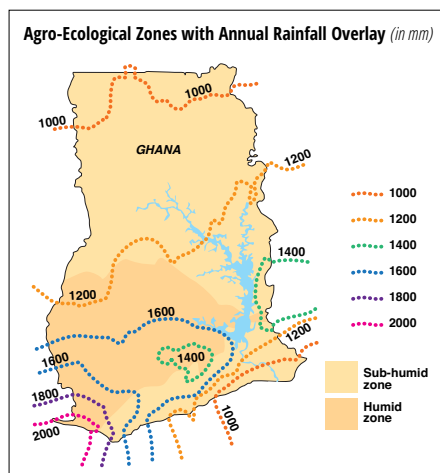
ADM	Archer Daniels Midland
ADRA	Adventist Relief Agency
BRC	British Retail Consortium
CSD	Crop Services Directorate
EPA	Environmental Protection Agency
EU	European Union
ESD	Extension Services Directorate
FAGE	Federation of Associations of Ghanaian Exporters
FBO	farmer-based organisation
FDA	Food and Drugs Authority
FFS	Farmer Field School
FRI	Food Research Institute
GACC	Ghana Airport Cargo Centre
GAIDA	Ghana Agro Input Dealers Association
GAP	Good Agricultural Practices
GAVEX	Ghana Association of Vegetable Exporters
GEPA	Ghana Exports Promotion Authority
GIDA	Ghana Irrigation Development Authority
GIZ	<i>Gesellschaft für Internationale Zusammenarbeit</i> (German International Development Organisation)
GREL	Ghana Rubber Estates Limited
GSA	Ghana Standards Authority
ha	hectare
IFDC	International Fertilizer Development Center
IPM	Integrated Pest Management
kg	kilogram
KNUST	Kwame Nkrumah University of Science and Technology
METASIP	Medium Term Agricultural Sector Improvement Programme
MoFA	Ministry of Food and Agriculture
MRL	Maximum Residue Limit
NGO	Non-Government Organisation
PPRSD	Plant Protection and Regulatory Services Directorate
SARI	Savannah Agricultural Research Institute
t	tons
TOPP	Twifo Oil Palm Plantation
UK	United Kingdom
USAID	U.S. Agency for International Development
VEPEAG	Vegetable Producers and Exporters Association of Ghana
WUR	Wageningen University and Research Centre
WRI	Water Research Institute

1. Introduction

1.1 Country Profile

Ghana lies on the shore of the Gulf of Guinea in West Africa and occupies a total area of about 24 million hectares (ha). To the North, it borders Burkina Faso, Togo to the East and Ivory Coast to the West. The country is divided into ten administrative regions and six ecological zones, dominated by semi-deciduous forest and Guinea savannah. Rainfall ranges from 600 mm/year in the coastal zone to 2,200 mm/year in the southwestern rainforests. In most parts of the country there is one distinct rainy season and one dry season lasting longer in the northern parts of Ghana than in the South. Ghana's population stands at about 27 million and its distribution is varied across the 10 administrative regions and eco-zones of the country with 68 percent and 32 percent living in the rural and urban areas, respectively.

Ghana's economy has been strengthened by a quarter century of relatively sound government management, a competitive business environment, and sustained reductions in poverty levels. Ghana is well-endowed with natural resources and agriculture accounts for roughly 22 percent of GDP and employs more than half of the workforce, mainly small landholders. About 52 percent of the labour force is engaged in agriculture, 29 percent in services and 19 percent in industry.



1.2 Ghana's Vegetable Sector

Overall vegetable consumption in Ghana is still relatively small, also in comparison with other African countries like Kenya, but is expanding rapidly. Apart from local vegetables the most important vegetables are tomatoes, peppers (both sweet and hot chillies), onions and okra. Especially the market for tomatoes and peppers has boomed recently, which is visualized in Table 1.

Table 1. Production of key vegetables in Ghana, 1986-2011

Production (tons)	1986	1991	1996	2001	2006	2011
Chillies & peppers, dry	23,000	24,684	44,539	45,000	78,000	88,000
Chillies & peppers, green	137,000	140,000	265,000	191,049	277,000	270,000
Eggplants (aubergines)	7,500	6,900	11,160	13,098	5,630	4,800
Okra	146,000	135,000	208,376	122,956	105,000	80,000
Onions, dry	28,000	20,189	29,500	44,322	42,500	48,000
Tomatoes	38,900	91,700	182,000	175,076	176,264	340,000

Source: FAOStat, 2013

Tomato production in particular has increased significantly in the last five years, almost doubling from 176,000 tons (t) in 2006 to 340,000 t in 2011. In the overall production of crop and livestock products, vegetables represent a value of around US \$675 million out of a total US \$6.4 billion. Four vegetables rank in the “Top 20” of crop and livestock products: dried chillies, green chillies, tomatoes and okra (Table 2). In addition, both fresh and dry onion imports from Togo and Burkina Faso are high and anecdotal evidence indicates these amount to more than US \$120 million for the Accra and Kumasi markets alone.¹

Traditionally vegetables are mostly eaten processed or cooked both as a spicy tomato paste (shito) as well as ‘soups’ with banku or fufu. More recently, the urban population is turning to fresh salads. This is mainly a result of Ghana’s sustained economic growth that has led to the emergence of a middle class of consumers demanding higher quality fresh products. Production of fresh vegetables takes place all around the country and is strongly related to the specific weather conditions and market windows. In addition, irrigated agriculture is on the increase leading to new production areas around the Volta and Volta Lake as well as specific irrigation areas in and around Accra. The up-and-coming higher middle-class is demanding better quality products, including more emphasis on food safety. In turn this will lead to greater market segmentation between specialized retail markets, the wholesale bulk markets and local production-consumption systems.

In terms of exports, Ghana’s vegetables show increased potential. While traditionally fruits like pineapple, bananas and mangoes were the main horticultural export crops, recently especially chillies (capsicum) and Asian vegetables (different types of gourds and okra), have become popular. In addition, baby corn and butternut squash production are picking up significantly since the arrival of the multinational VegPro. In general, exports of peppers are believed to have a comparative advantage over competitors like Kenya, given Ghana’s climatologic conditions and relatively short distance to the EU market (WB, 2011) – e.g., air freight costs to

Table 2. Value and production of Ghana crop and livestock products

Value & production of Ghana crop & livestock products	Value (US\$1000)	Production (t)
1 Yams	1,605,617	6,295,450
2 Cassava	1,487,647	14,240,900
3 Plantains	747,343	3,619,830
4 Cocoa beans	726,942	700,000
5 Taro (cocoyam)	275,639	1,299,650
6 Maize	220,046	1,683,980
7 Groundnuts, with shell	196,951	465,103
8 Game meat	161,667	74,300
9 Chillies & green peppers	127,105	270,000
10 Rice, paddy	126,265	463,975
11 Tomatoes	125,652	340,000
12 Oranges	102,427	530,000
13 Chillies & peppers, dry	96,398	88,000
14 Indigenous chicken meat	77,469	54,387
15 Indigenous cattle meat	75,126	27,810
16 Meat	59,470	45,000
17 Palm oil	52,207	120,000
18 Okra	51,159	80,000
19 Sorghum	43,778	287,069
20 Indigenous goat meat	38,231	15,955

Source: FAOStat, 2011

Northwestern Europe from Nairobi are US \$1.75 per kilogram (kg) while for Accra they are US \$1.05. Exports between 2001 and 2007 rose from 418 t to 2,947 t while EU total imports rose from 25,000 t to 36,000 t at the same time. The 2011 WB report indicates that further growth to 5,000 t should be attainable, reflecting an export value of around US \$10 million. More recently, however, horticultural exports have declined sharply, which is directly related to failure to meet phytosanitary requirements by the EU.

¹ <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=254969>

1.3 Main Issues in the Vegetable Sector

Moving from business as usual to more commercial vegetable production requires serious efforts. Currently, the vegetable chains are characterized by: (1) low availability and knowledge of improved inputs; (2) limited agronomic skills and practices; (3) poor food safety and phytosanitary practices for both the domestic and export markets; (4) high level of post-harvest losses; and (5) loose chain linkages between producers and buyers.

(1) Input supply

One of the major bottlenecks for the take-off of Ghana's vegetables sector is the availability of well adapted seeds and seedlings; specialized horticultural fertilizers and pesticides; irrigation equipment and greenhouse equipment. E.g. for the seed sector, there is currently an overdependence on a few number of relatively older varieties (for e.g. tomato, peppers and onions) while few new domestic and international varieties enter the market. Some promising signs are also seen in protected horticulture where a number of farmers are adopting greenhouse (tunnel) technology for vegetable production. Some issues in the enabling environment more systemically hamper the development of a more effective input supply system. In this context reference is made to the large amounts of low quality or even fake fertilizers or pesticides in the markets.

(2) Agronomic practices and production

Knowledge and skills of vegetable production (both greenhouse and open field) are still relatively rudimentary in Ghana. This is also demonstrated by the low yields per hectare (ha); e.g. in tomato, yields have remained steady for the last decade at 6 t/ha, while Kenyan farmers produce 22 t/ha and neighboring Burkina farmers 9 t/ha (FAOStat, 2013). Partly this has to do with the inputs available, partly with the agronomic practices. Observations include the limited use of: adequate irrigation of right water quality; specialized fertilizers (K, Ca/Mg, micronutrients); proper plant protection (chemicals) and crop rotation.

Boosting agricultural productivity will require a more professional input supply system with better and more tailor-made information for farmers on the use, adaptability and effectiveness of seeds, fertilizers and pesticides. The public extension system increasingly faces challenges and agro-dealers so far have not taken up the challenge to also provide quality information and services. Possible solutions most probably lie in a more privatized extension system. Chapter 3 in this report is dedicated to opportunities for Private Extension Services for the vegetable sector.

(3) Safety and Phytosanitary Issues

There is little government capacity for pesticide registration, testing and enforcement of regulations. Out of six aspects of unsafe use of pesticides by farmers two directly relate to the government's performance: the use of banned chemicals, e.g. DDT and the presence of dangerous chemical pesticides on the approved pesticide list, e.g. atrazine. Substantial traces of these chemicals were found on consumer vegetables as well. In addition, the judicious use of chemicals (both in type and quantity) is at a low level. A number of reports mention poor practices of spraying and storing of chemicals, resulting in serious health problems of farmers. At the same time, consumers have little awareness of the potential health problems associated with banned and excess pesticides. Recently the Ghana Green Label (GGL) certification system has been put in place. This scheme certifies farmers and their produce on the basis of good agricultural practices (GAP) and can become a good instrument for ensuring quality vegetables reach the consumer (from farm to fork).

In 2015 Ghana was struck by an export ban on vegetables (chillies, gourds and eggplants) due to the detection of high incidences of harmful organisms upon arrival of vegetable export shipments in the EU. The main organisms found were false codling moth, thrips and white fly. To combat these pests a comprehensive action plan has recently been devised by MoFA and its Export Taskforce. Chapter 4 of this report is devoted to these SPS issues with specific recommendations for actions that would lead to lifting of the ban.

(4) Postharvest management, trade and logistics

Much of the vegetable production is lost after harvest, either along the road, during transport or at the market. Especially the lack of cold storage and the sheer size of the packaging material (big 60 kg wooden crates or large sacks for cabbages) contributes to high post-harvest losses, estimated by some at 50 percent. Some innovations are being presented in this report on improving the shelf life and reducing postharvest losses of vegetables (see Chapter 2 on the domestic sector).

(5) Value chain development

In the horticulture sector roughly four vegetable value-chains exist:

- The export market of especially peppers, Asian vegetables and butternut and baby corn. Both specialized larger farms with outgrower schemes as well as small-scale individual farmers, are targeting this market, focussing on top quality and adhering to GAPs (GLOBALG.A.P., BRC). The current size is around 3,000 t, mainly capsicum.
- The supermarket, hotel and restaurant, and dedicated corner shop chains: an emerging retail and high-level hospitality industry is developing, demanding high-quality vegetables. Currently, the demand cannot be met; both in quality and quantity, and imported vegetables fill the gap. The production systems require higher levels of agronomic knowledge and skills, as well as postharvest management.
- The main market for vegetables, at least, for the coming years, will still be dominated by open markets and smaller, street shops. The production systems will compete on price and less on quality. These markets include the large Agbobloshie, Makola and Tudu markets where specific commodity associations manage the market system. Price fluctuations are high following the different production periods.
- The processed vegetable chain: especially tomato paste and canned vegetables like eggplant. Though often seen as a last resort market (with low market prices) the chain still requires specific varieties and quality standards. Currently, most

factories are idle due to the fact that imported products are cheaper and domestic supply of raw materials is expensive (market prices for fresh products are higher). It is estimated that (open field) yields of 100 t/ha are necessary to develop a competitive tomato paste industry. The overall competitiveness of this sector is debatable, though for specific mix products like shito a market exists.

While Chapter 2 in this report is dedicated to the domestic sector, Chapter 5 presents the business case developed for an integrated export vegetable chain.

1.4 GhanaVeg

The GhanaVeg mission is to establish “a sustainable and internationally competitive vegetable sector that contributes to inclusive economic growth and has the capacity to continuously innovate in terms of products and services”. The initiative is driven by a strong belief in healthy and quality vegetables from Ghana through new ways of doing business and targets the high-end domestic and international markets (high-end supermarkets, hotels, restaurants and exports). The objectives include improving productivity; facilitating more efficient markets; improving the business climate and further professionalizing the value chain for vegetable production and consumption. The program seeks to develop the sector by attracting and/or supporting frontrunner companies (both for domestic and export markets) in all elements of the chain: input supply, production, processing, retail and logistics.

An important aspect of this initiative is to stimulate production for both the domestic and export markets, through the provision of support (technical) for innovations by the private sector, reducing cost price, improving environmental sustainability and increasing productivity. GhanaVeg is also assisting the sector with evidence-based information and facilitating greater collaboration “to tackle the bigger issues”, and hence improving the business climate. It hopes to improve coordination between public, private sector and knowledge institutes to enhance sector growth.

To this effect, the Program has the following strategies:

- Quarterly Business Platform to bring together main public/private vegetable sector stakeholders.
- Business Opportunities Fund to support front-runner companies with co-financing to innovate or expand their business.
- R&D Innovation Fund to facilitate collaboration between companies and research to do applied research.
- Consultancy Fund for strategic studies on key sector challenges like: postharvest losses, SPS, greenhouse cultivation and private extension.
- Agronomic Training series for senior agronomists and extensionists, involved in outgrower or input supply schemes.

In this report specific attention is paid to the domestic sector and reducing postharvest losses; new business models for private extension; an update on the state of the art with respect to the phytosanitary situation in the country, and lastly, a business case for a medium-sized export vegetables farm. Other studies that were carried out by GhanaVeg include one on Vegetable Exports and Greenhouses. These reports and other information in the business platform and funds can be found on the GhanaVeg website: www.ghanaveg.org. Studies can also be obtained at the GhanaVeg Secretariat (please contact: Sheila Assibey-Yeboah, sassibeyeboah@ifdc.org). ■

2. Opportunities for the Domestic Vegetable Sector

2.1 Introduction

“The vegetable sector in Ghana can be vastly improved provided that challenges along the value chain are overcome.” This affirmation represents the feelings of most people talked to when asked about the prospects of the sector. Vegetables in Ghana are sought-after in many markets, especially in the local market centres.

According to a study by Agri-Impact (2013),² The authors sincerely thank Agri-Impact Consult and the EMQAP (AfDB) program for accepting parts of their report to be reproduced in this publication one in two Ghanaians buys fresh vegetables from a limited number of local markets in Ghana. They are mostly operated by so-called market queens who serve as a

point of sale for most buyers who run corner shops, hotels and restaurants. The vegetable traders in Ghana are organized under these “queens”. The queen settles disputes between traders, and represents them in negotiations. For each crop there is a specific market queen. The market queen is selected by all traders, and is later introduced to the local traditional community leaders and the district assembly. Market queens are never removed. When they retire or die, they are replaced by their deputies (Peppelenbos et al, 2008). For tomatoes, onions and exotic vegetables (hot peppers, okra etc.) there are different market queens.

Local market centres are placed at the heart of the value chain and its performance make an impact both up and down the chain. Figure 1 shows the value chain map and the linkages among actors.

² The authors sincerely thank Agri-Impact Consult and the EMQAP (AfDB) program for accepting parts of their report to be reproduced in this publication.

2.2 The Need for Innovation in the Vegetable Sector

The rise of a middle class in Ghana is fuelling the emergence of high-end retail markets, and consequently causing a surge in food imports (Kingombe, 2014). These developments, coupled with increased competitiveness of Africa's fresh exports to Europe, are driving the need for a more competitive and commercial-oriented domestic vegetable sector in Ghana.

Today, the local market comprises about 70 percent of the fresh fruits and vegetables' market in Ghana. The main wholesale markets serve as a point of sale for most buyers who run corner shops, hotels and restaurants. These central market centres are supplied with fruits and vegetables from domestic bulk suppliers, itinerant traders, regional bulk suppliers and specialized (contract) suppliers and imports from Europe. Furthermore, local market centres are encountered with high post-harvest losses, food safety problems and a low product shelf life.

Experts, local stakeholders and international organizations understand the need for change. A different question however is how to bring about long-lasting and effective change in the sector. A driver for change can be innovation that aims at transforming and making value-chains more efficient, profitable and more sustainable.

The objective of this report is to provide examples of innovations that have contributed to the development of the sector in other developing countries. We do this by firstly analysing thoroughly the sector, its actors and main activities and secondly identifying the focus points for innovation.

To meet the objective of the report we have conducted an in-depth literature review and interviewed more than 20 stakeholders and experts in Ghana.

2.3 Value Chain Map

Figure 1 depicts the general value chain for vegetables serving the domestic market, and helps to understand the dynamics in the value chain. It starts with production at the bottom, and follows the produce all the way to consumers on the domestic market on top.

The traditional open market constitutes approximately 70 percent of the fresh fruits and vegetables' market in Ghana. These are Makola, Techiman, Agbobloshie and Abinkyi markets and, as stated before, they are mostly operated by market queens. These open markets serve as a point of sale for most buyers who run corner shops, or supply hotels and restaurants. They are supplied with fruits and vegetables from domestic bulk suppliers, itinerant traders, regional bulk suppliers and specialized (contract) suppliers and include some imports, from Europe for example. Among them, domestic bulk suppliers provide almost 80 percent of the produce sold. Bulk suppliers are individuals that buy and sell in bulk a wide range of products.

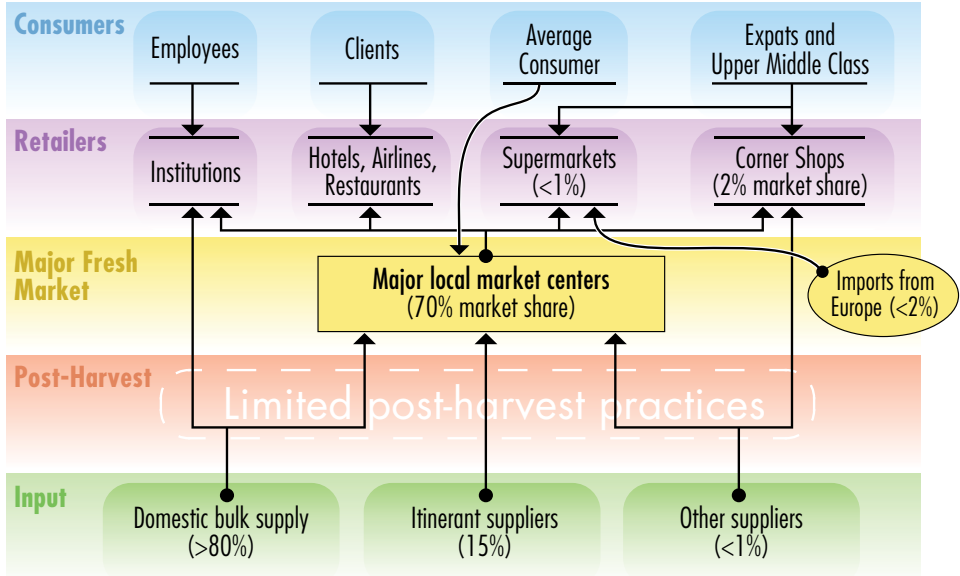
2.4 Key Value Chain Activities

Production and inputs

Farming takes place predominantly on a smallholder basis in Ghana. About 90 percent of farm holdings are less than 2 hectares in size. However, overall farmers dedicate only a fraction of land to vegetable production. In this regard, farmers are hardly organized in vegetable or horticulture groups and neither are they trained specifically on vegetable production. This holds true for farmers supplying to domestic and itinerant suppliers. The latter group operates similarly to bulk suppliers but deal with limited volumes. Only in a few instances farmers work together to supply specialized suppliers and have more specialized knowledge on vegetable cultivation. Interestingly, some farmers interviewed indicated that they miss the knowledge where and on what soil to grow vegetables more efficiently.

Farmers supply the fresh produce mainly to three type of suppliers, who in turn supply the major local market centres or other higher-end retailers directly:

- **Domestic bulk suppliers:** They supply over 80 percent of the produce sold in the local market centres. Most of the bulk suppliers have supply contracts with the market queens; their supplies are regular and volumes are large. Some bulk suppliers can also supply directly to institutions or even hotels.

Figure 1. Simplified value chain map for the vegetable sector in Ghana.

Source: Adapted from Agri-Impact, 2013.

- Itinerant suppliers:** This group supply around 15 percent of the produce sold at local market centres. They operate similarly to the domestic bulk suppliers but their volumes are small and do not have contracts or supply arrangements with the buyers/market queens.
- Other suppliers (<1 percent):** A few local operators sell quality produce to high-end-markets such as the supermarkets, hotels, restaurants and corner-shops. They sell by contracts and according to specifications, pre-agreed price, delivery schedules, varieties and quality control protocols. Other companies such as Eden Tree target the middle and upper class by making available its well-packaged vegetables in some chain stores. A third type of company targets also the middle-upper class in Ghana: Freshmark. It is ShopRite's fruit and vegetable procurement division and supplies fresh produce to all local and international stores in Africa.

Furthermore, it was agreed among farmers and other stakeholders interviewed in the sector that many crops

are underperforming due to poor starting material. Producing the right variety in the right way can contribute significantly to the reduction of the post-harvest losses and also lead also better marketability. Having access to good quality seed isn't easy for vegetable farmers in Ghana. Much of the seed used in vegetable production is farm-saved. Interviewed traders mentioned the lack of good quality seed as a main challenge.

Other obstacles in the production arena are the water source and usage, incidence of pest and diseases, use of chemicals or soil fertility management.

Major vegetables consumed in the domestic market

According to MoFA's Statistics, Research and Information Directorate (SRID), tomato, onion, okra, eggplant, green pepper and beans are the main vegetables produced and consumed in Ghana. Of these, tomato and onion are the two most-consumed vegetables.

The production of tomato as well the area harvested and reported yields seem to have remained steady in recent years in Ghana. On the other hand, onion,

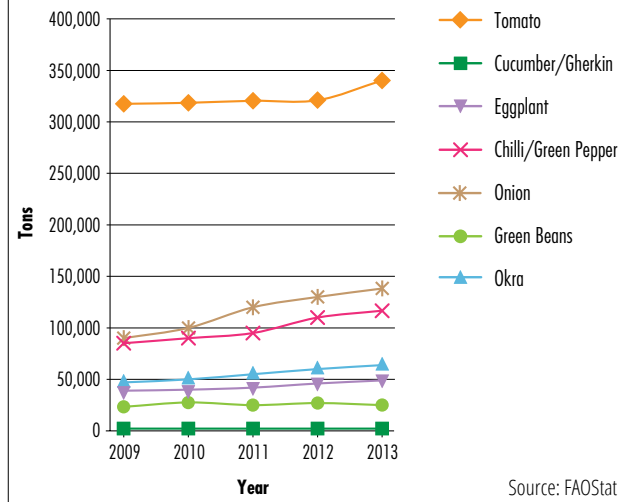
chillies, okra and eggplant have experienced an upward trend over the last five years (Figure 2).

According to FAOStat figures, Ghana cultivates about 46,000 ha of tomato per year, which is between 5 and 10 percent of the acreage dedicated to food crops such as maize or cassava. As of 2013, production was estimated at about 340,000 t (FAOStat). The average yields oscillate around 7-7.5 t/ha, which is only 50 percent of what is deemed as achievable by MoFA (2013).

Tomato production is characterized as highly seasonal, geographically-specific and with a strong demand all year-round from southern Ghana. From December through April-May, Ghana's Upper East region and Burkina Faso supply most of the vegetables in the country. Later on, the Brong Ahafo, Ashanti and Greater Accra regions supply the market at different times. Toward the end of the year, irrigated tomato from Greater Accra dominates the market. According to COMTRADE figures, Ghana imports on average 6,000 t of fresh tomatoes per annum from Burkina Faso.

Another favourite ingredient in local cuisine are onions. FAO figures report a production of 138,000 t over an area of 8,200 ha and a yield of 16.7 t/ha in 2013. For the period 2009-2013, the area harvested and yields have increased by 5 percent per annum. Production for the same period has increased by almost 12 percent per annum. In addition, Ghana imports on average 60,000 t annually from Niger and Burkina Faso (UNComtrade). The value of these imports exceeds US \$13 million. Ghana produces the Bawku red variety (desirable for traditional cuisines) whiles Niger and Burkina Faso supplies Ghana with the Galmi variety which is preferable in the hospitality industry as it is less pungent.

Figure 2. Production of main vegetable crops over 2009-2013 in Ghana.



The third crop in importance by production is chillies and green peppers. Ghana produced 117,000 t over 14,000 ha in 2013. FAO statistics account for an increase on yields of 7 percent annually and 9 percent on production for the period 2009-2013 while acreage has remained stable. Yields have then gone up from 6.5 t/ha in 2009 to 8.3 t/ha in 2013, although they only represent 25 percent of what is achievable according to the Ministry of food and Agriculture.

Post-harvest

Post-harvest losses typically occur due to a host of factors, including human activities such as transportation and faulty or lacking storage and cold facilities, among other factors. In Ghana, about 20 to 50 percent of vegetables are lost before produce reaches the market.³

Selling fresh produce in bulk contributes greatly to post-harvest losses. The photos at top right show examples of bulk handling for cabbages. Overall, farmers are oblivious to the activities of sorting and grading since local market centres fail to provide incentives for good

³ <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/Ghana-s-post-harvest-losses-hit-GH-700-000-annually-185268>



Seasonal workers unloading cabbages.



A bag before the cap is put on.

Post-harvest practices that contribute to loss

Sun exposure and cooling – A highly critical but neglected topic in Ghana is sun exposure and lack of cooling facilities. Whether it is on the farm, en route or in the market place, produce is often left uncovered and exposed to sunlight for long periods of time.

Physical damage during transport: Farmers seek to stack as much produce as possible in one crate/sac. In turn, bulk suppliers aim at transporting as many crates and sacs as possible. Through this market practice, substantial food losses in Ghana are inevitable.

Cold chain: Little awareness was found among stakeholders of the importance of cooling, and in general cooling is missing throughout the entire value chain. Only in the higher-end market segment (traders supplying supermarkets) can cooling facilities be found (e.g. reefer containers at the trader's premises and cooled shelves in the supermarket). Also in the onions value chains some people have introduced cooling facilities to store the onions during

peak supply and to release them when prices are more favourable.

Surprisingly, some local corner shops, traders and marketers remain doubtful about the convenience of vegetable cooling. Nevertheless, it is expected that Ghana will make significant strides towards the acceptance, use and spread of cooling technology in the near future.

Packing: Along the value chain different types of packing materials are used. Often large sacks or wooden crates that can carry huge amounts of produce are preferred. The boxes are not weighed, but are used to determine the price. The interviewed traders argue that these wooden crates are more economical to load on a truck. More boxes or bags per truck is better for their business as opposed to small crates since their business model is based on dealing with large volumes.

Due to the size and importance of post-harvest losses in Ghana's vegetable sector, Chapter 3 gives an extensive review of loss-reduction approaches successfully applied in other developing countries.

quality produce. As a result, farmers decide to sell in bulk, which consequently causes product loss on several fronts, such as when filling bags or boxes.

In addition, farmers can hardly afford to store vegetables for a longer period of time, nor do they have the financial muscle needed to afford such investments.

Market channels

Local fresh market centres

Most of the trade that takes place in Ghana. Onions, tomatoes, carrots and cabbages are the most widely sold vegetables followed by okra and garden eggs. The first two, onions and tomatoes, are used in almost every Ghanaian dish and altogether account for 43 percent of the total vegetable consumption in the country. Carrots and cabbages have also become an integral part of modern Ghanaian diets especially food prepared in hotels and restaurants. Garden eggs and okra account for 16 percent of vegetable usage in most urban areas but their use could be higher than that of cabbage and carrots in rural and peri-urban areas.

The markets lack sufficient produce receiving and handling sheds and storage rooms. In some instances, vegetables get sold on the bare floor or on tarpaulins.

Corner shops

The second market segment in terms of size is the corner shop. More than 26 percent of consumers interviewed in the Agri-impact study say they buy their fresh produce from corner shops located in East and West Legon, Cantonments, Airport Residential Area, Spintex Road, or Osu in Accra. The photos at right show front views of two corner vegetable shops in Haatso and Cantonments.

Corner shops offer proximity, higher (physical) quality produce and a wider selection of (exotic) vegetables. Customers of corner shops are said to have higher disposable income and are willing to pay 30–50 percent higher prices than on the local wholesale markets.

Upon closing, vegetables are kept and stored in the open air or inside the building under no cooling conditions. Owners doubt whether cold storage can bring significant economic returns. Furthermore, some interviewed owners believe that cold storage can reduce



Local corner shop in Haatso.



Local corner shop in Cantonments.

the freshness of vegetables and can thus undermine, rather than reinforce, product quality. As a consequence of poor stocking conditions, some corner shops face hygiene challenges. By placing fresh produce in clean and sanitary storage facilities food safety risks are minimized. Unfortunately, the situation in Ghana is far from perfect and thus the risks exist for the spread of pathogens to the produce.

Supermarkets

Even though prices are higher than in the other market segments, the supermarkets provide the convenience, variety and quality of fresh produce that affluent customers want. About 20 percent of the consumers interviewed in the 2,000 people survey buy some of their products at supermarkets. In this market segment, customers have access to higher-quality, and often imported, products. Shops such as ShopRite, Koala and MaxMart and other community level supermarkets like gas station grocery shops within the urban cities have long opening hours (12-14hrs/day) and sell other groceries in addition to fruits and vegetables (Agri-Impact, 2013).

Hotels and restaurants

The hospitality industry has seen an enormous surge in recent years. Movenpick, Holiday Inn, Best Western, Alisa Hotel, Africa Regency hotels, among others, have added to the existing 4-5 star hotels including La Palm, La Beach, Golden Tulip, Fiesta Royale and Novotel in Accra. With restaurants the trend is similar. The Agri-Impact study shows that most hotels and restaurants have increased their purchases of fruits and vegetables by at least 30 percent within the last two years. The use of carrots, cucumber, cabbage and sweet pepper in this sector has increased by over 40 percent.

Institutions

If the emergence of new hotels and restaurants has been booming, so has been the rise of offices and institutions around Accra. This has increased the demand for quality vegetables and sometimes ready-cooked products. The demand for vegetables delivered to offices is expected to increase in the next years.

Consumers

Figure 1 (page 11) depicts the consumers for each of the five market segments. The average consumer, or in other words the everyday Ghanaian, buys his or her vegetables in one of the local market centres. As we move up the price and quality ladder, expats, hotel clients, employees and upper-middle-class Ghanaians purchase vegetables at specialized retailers with higher quality standards and a larger product portfolio.

Consumer preferences

Although fruit consumption seems to be on the rise, the consumption of vegetables has always remained higher than that of fruits. In the study conducted by Agri-Impact, results showed that almost 60 percent of consumers interviewed eat vegetables every day against 40 percent for fruits. Consumption of vegetables mainly occurs at lunch and supper while Ghanaians consume fruits mostly at breakfast and as a snack between meals.

According to Agri-Impact findings, cabbages, onions and sweet potatoes have shown a consumption growth rate of 29-50 percent in the last 4 years. In the case of products such as tomatoes and peppers, Ghanaians are consuming more as reflected in the production figures given in Figure 2. When looking to the future, about 61 percent of consumers interviewed predicted their consumption of vegetables would continue on the basis of their price insensitivity, and to a lesser extent (30 percent), on characteristic taste.

The same study, which surveyed over 2,000 consumers, revealed that 90 percent of respondents perceive locally produced fruits and vegetables as “very good” so far as freshness and taste are concerned. This is despite the negative perception (30 percent) on the hygiene of point of sales locations and product shelf life.

Domestic sector challenges

Stakeholders and experts agree that the domestic sector has not yet realized its full potential. And the upcoming market trends (rise of middle class and increased demand for healthy and quality vegetables) adds to the need for a more competitive and quality oriented domestic sector.

Challenges are numerous and can be found at different steps along the value chain. In this report, we distinguished the sector’s challenges in three categories:

1. Farmer practices
2. Post-harvest practices
3. Market issues

These categories will be examined in the next section.

2.5 Value Chain Innovations

There are a number of current post-harvest and marketing innovations that can contribute to an increased shelf life for vegetables and fruits. The current shelf life of most vegetables is limited. For example the shelf life of tomatoes in Ghana is estimated at around 3-4 days. Value-chain innovations can relate to: i) improved inputs and farmer practices in order to increase final quality of the produce; ii) post-harvest innovations to prevent losses in the vegetable value chain and hence increase the food availability for consumers in Ghana; and iii) innovations in marketing.

Various low cost initiatives have been tested in developing countries, mainly in sub-Saharan Africa and Asia. An important source for post-harvest innovations in sub-Saharan Africa is the Horticulture Innovation Lab⁴ which is a collaborative research project implemented by UC Davis and funded by the Feed the Future program⁵ of the U.S. Agency for International Development (USAID) (WFLO, 2010). The Horticulture Innovation Lab promotes smallholder participation in markets and post-harvest innovation in 35 projects.

Farmer practices

Farmers can have a significant influence on the shelf life of their produce by producing good quality varieties. As such they are able to reduce losses throughout the entire value-chain. Farmers are mainly able to improve in the following areas in order to increase the storage life:

1. Starting material
2. GAP related to:
 - Farming
 - Harvesting

Starting material

Planting improved seed varieties can reduce post-harvest losses and can also lead to a better marketability of the product due to a higher quality. To reach the full potential of improved varieties, farm practices need to be upgraded, which have an effect on losses throughout the chain.

There are two types of seeds available in the Ghanaian seed market: open-pollinated and hybrid varieties. Because they breed true, the seeds of open-pollinated plants are often saved by smallscale farmers. Hybrid seeds produced by breeders are likely to have improved characteristics but are not widely available.

In addition, adaptation of hybrid varieties to local conditions is critical. Key issues that breeders keep in mind when adapting improved varieties are:

- a) Climate requirements
- b) Soil requirements
- c) Resistance to damage by diseases, insects and other pests

Currently in most African countries hybrid seeds are still being imported. However, an increasing number of breeders is breeding in and for Africa. An example is the partnership between the vegetable breeders of Rijk Zwaan and East West. They have developed a project called Afrisem in Tanzania. At Afrisem, the two companies are aiming to provide the local African horticulture sector with hybrid varieties suitable for the local growing circumstances. This should enable growers to realise a better yield, increased resistant to pests and diseases and meet the demands of the local market.

Strong seedlings are also important. Seeding in the open field (on field beds) can increase the incidence of pest attacks and soil borne diseases. Therefore, farmers can improve the start of the growing season by producing seedlings in controlled conditions (e.g. a protected screen house with raised tables and sterilized soil). Therefore, growing vegetables like tomato or cucumber in screen houses on sterilized soil could be a solution, but the majority of smallholder farmers has no access to these production methods. Simpler structures can be built by farmers at a relatively low cost. An effective solution to control soil borne diseases is successfully applied in many countries is grafting tomato cultivars on a resistant rootstock.

Good Agricultural Practices

Good Agricultural Practices (GAP) and Integrated Pest Management (IPM) have become essential components of sustainable agriculture. Adoption of GAP by farmers can improve farm management since it focuses

⁴ <http://horticulture.ucdavis.edu/>

⁵ <http://www.feedthefuture.gov/>

on various themes ranging from seed bed preparations and planting to pesticide use. All these aspects result in improved production and can eventually result in positive outcomes for farmer income, product quality, the environment and farmer health.

IPM is an approach designed to manage pests and diseases with as little damage as possible to people, the environment and beneficial macro- and micro-organisms. Increased environmental awareness has led to the need for sustainable agricultural production systems. Well-considered strategies in which all components to prevent pests and diseases fit together are the cornerstone of IPM. Different techniques and products are used within IPM, including scouting, monitoring, crop sanitation, cultural and mechanical control, and the introduction of beneficial insects and mites. Corrective chemical control measures are used as a last resort. Currently IPM is being introduced in Ghana by CABI in a new project focusing on reducing phytosanitary and food safety incidences.

Since 2014 Wageningen UR is training vegetable farmers on GAP in Indonesia via the vegIMPACT project.⁶ Wageningen UR is training with Indo-Dutch seed company Ewindo more than 10,000 farmers. They are trained on effective spraying techniques, pesticide use, application of PPE and occupational health issues. Impact of the training are not known, but positive effects of the training on farmer's income, product quality, and the environment are expected. GhanaVeg has taken up a similar approach for training Ghanaian agronomists or 'super trainers'.

Timing of harvest

Maturity at harvest is an important determinant of storage-life and final quality (FAO, 2004). Usually, immature products are highly susceptible to shriveling and mechanical damage, and are of inferior flavour quality when ripe. However, many vegetables, in particular leafy vegetables and fruits and vegetables such as cucumbers, sweet corn, green beans, peas, and okra, attain optimum eating-quality prior to reaching full maturity. Lack of understanding of this aspect

often results in delayed harvest, and consequently in produce of lower quality.

Harvesting produce at the wrong time of the day and under the wrong conditions can lead to a high temperature in the pulp of the product immediately after harvesting. Harvesting early in the morning when temperatures are often still moderate can help, but what can also help is minimizing the effect of direct sunlight by putting the produce after harvest under a basic cover. This can be done by developing shading through covers during handling activities like grading, sorting and transport. Shades can be inexpensive when using local materials, and greatly improve shelf life.

The Horticulture Collaborative Research Support Program (CRSP)⁷ supports vegetable farmers in Zambia to develop a more consistent supply to local markets, hotels and the tourist industry by focusing on the produce handling. This project focused on strengthening the value chain to scale up production of horticultural crops, including chillies, using public-private partnerships for economic development and introducing new postharvest technologies to improve the quality of produce and to substitute imports. Farmers were trained in agricultural management practices, post-harvest and storage systems, and technologies including low-cost coolers and appropriate cold storage systems were introduced at farm level. The combination of improved skills and introduction of innovative cold storage facilities has so far proven successful to reduce losses and strengthen overall performance of the value chain.

In southern Zambia the project worked with Agribusiness in Sustainable Natural African Plant Products (ASNAPP)⁸ and Sun International Hotel Group from South Africa to develop quality produce for sale to local supermarkets. When the project started there were no post-harvest technologies in use by these groups; farmers would harvest full ripe and immediately deliver the produce to the hotels and supermarkets. During the duration of the project farmers were trained to use good starting material. However, they also recognized that crops produced at the right time, and offered

⁶ <http://www.vegimpact.com/>

⁷ http://horticulture.ucdavis.edu/main/36_postharvest_Zambia.html

⁸ <http://www.asnapp.org.za/>

at the correct growth stage help gain market share. Therefore, more attention was given to the “ideal” time to harvest.

2.6 Post-Harvest Innovations

Cooling

The loss of quality of the product at harvest often relates to high temperatures. High temperatures are known to result in increased rates of respiration, deterioration and water loss in fresh produce. Therefore there is a strong need to decrease the temperature after harvesting and during the entire process of handling, storing and transporting of fresh vegetables.

Temperature in Ghana can go up to 35°C or more during the late morning and afternoon. A decrease in product temperature of 20°C to 15°C can extend the shelf life by 4 times (Table 3). For example, tomatoes handled at a temperature of 35°C will have a shelf life of only 3 days. The recommended temperature for a tomato to best be conserved is 15°C, which gives an increased shelf life up to 14 days.

Various options for low tech cooling solutions have been introduced in the Feed the Future Innovation Lab funded by USAID. The study by Kitinoja and Thompson (2010) gives an extensive overview of the different cooling options available for small scale producers.



The CoolBot micro-controller

The CoolBot was developed by Store It Cold⁹ as an affordable way for smallholders to cool products on their farms. The CoolBot¹⁰ uses a programmed micro-controller wired to a regular air-conditioner and operates in such a way that low temperatures can be maintained without freezing up the fins of the air conditioner and is suited to work during the heat of summer and even when people are opening and closing the door all day long. According to Kitinoja and Thompson (2010) a room air conditioner with a Coolbot control system costs about 90 percent less than an equivalent commercial refrigeration system. The technology requires an air conditioner and insulated room to work. Over 22,000 units have been sold worldwide

⁹ <http://storeitcold.com/>

¹⁰ CoolBot can be bought online and shipped within days. Also, the unit is packed with international power supplies so they run on all voltages with no transformer needed. The CoolBot also works with “Split” and “Mini-Split” air conditioners.

Table 3. Effect of temperature on vegetable storage life

Crop	Recommended temperature for handling (°C)	Storage life at recommended temperature	Post-harvest storage life at...			Increased marketing time available at 15°C
			35°C	25°C	15°C	
Cabbage	0	6 months	2 weeks	4 weeks	8 weeks	4x
Carrot	0	6 months	2 weeks	4 weeks	8 weeks	4x
Tomato	15	14 days	3 days	6 days	14 days	5x
Pepper	12	20 days	3 days	7 days	15 days	5x
Potato	5-7	5-10 months	2 weeks	4 weeks	8-10 weeks	4x
Spinach	9	14 days	1 day	2 days	5 days	5x
Sweet potato	15	4-6 days	1 month	2 months	4-6 months	4x

Source: Barrett et al (2014)



Source: www.storeitcold.com

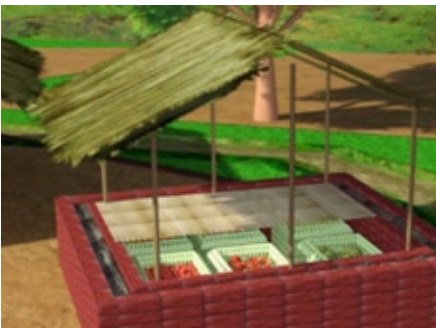
An air conditioner with a CoolBot unit connected to its controls.

since 2006 at a cost of US \$299 (excluding the cost of air conditioner and insulated room).

Zero Energy Cold Chambers

Passive cooling chambers are based on the principle of direct evaporative cooling. They require no electricity and uses local materials to build the infrastructure needed. Such an evaporative cool chamber is also known as a Zero Energy Cold Chamber (ZECC) and decreases temperatures by 10-15 degrees. It is a double brick-wall structure in which the cavity is filled with sand and walls of the chamber are soaked in water. Cold chambers reduce the temperature and maintain an humidity of about 95 percent. The structure does not require any specialized skill or material.

Different pilots implemented by the Horticulture Innovation Lab indicate that about 100kg in 6 medium



The Zero Energy Cool Chamber, 3D model.

sized plastic crates can be stored (Barrett, et al 2014). This storage structure works especially well in arid and semi-arid regions, during the dry season in other regions, and in locations where night time temperatures are much lower than day time temperatures (mountain zones or at higher altitudes). This implicates that it will probably not be suitable for southern Ghana, but could be interesting for northern Ghana during the winter period, when differences between day and night temperatures

are relatively high.

The ZECC is widely used in India. It can decrease the temperature by 10-15 degrees and farmers are using it to store vegetables a few days in order to avoid the middlemen since vegetables cannot always be sold directly on the market. Also, sometimes it is advisable to employ a hold-up tactic to obtain a higher price days after produce has been harvested. However, high temperature and conditions in Ghana add pressure to the storage systems found in the country. Also, large-scale cooling solutions (such as cold stores) are too expensive for small-scale farmers. However, a number of pack houses with adequate facilities are present in Ghana – but they are hardly used. Making an inventory of these cold stores and developing new business plans for them could be explored.

The investment is estimated at around US \$250 and can be repaid in 83 weeks by preventing losses (if an average of 100 kg per week is harvested and handled). After those 83 weeks, an average of US \$3 can additionally be earned per week per 100 kg (Barrett, et al 2014). This is without the financial benefits that might come from fetching a better price on the market. The biggest advantage of ZECC technology is that it can be constructed with local materials. The University of California (UC Davis), provides simple manual for its construction.¹¹

Application of shading to store the produce: Using roofing or cloth tents to prevent contact with direct

¹¹ <http://ucce.ucdavis.edu/files/datastore/234-2143.pdf>

The Zero Energy Cool Chamber in use.

Source: www.e-krishaksahyogi.org/

sunlight and reducing the surface temperatures. UC Davis has tested several shade nets for storing the harvest and results indicate that the temperature can be reduced with 20 degrees by using these basic covers.

Packaging

Packaging that properly protects (fresh) food products can extend their shelf life. The length of shelf life involves a complex process that is influenced by environmental factors such as temperature and light, as well as oxygen and carbon dioxide levels. Good packaging is essential to maintain quality throughout the chain. Currently the volume packed in one crate or sack is too high and the material for the packaging has a high contamination risk.

In Ghana most vegetables are packed in traditional sacks or wooden crates. For tomatoes, the common way of packaging for transport seems to be a large wooden crate of about 20 kg. Cabbages are packed in sacks that contain more than 65 cabbages each. Frequently, it even serves as a unit for transactions: one sack is often sold for GHS 40 during the wet season when there is plenty of supply. During the low season prices can go up to GHS 100.

A study in Tanzania (Barrett et al, 2014) shows that the wooden crates are generally rough and large (up to 50 kg) so several examples of improved locally made crates were developed, including half sized crates, smooth

wooden crates (sanded inside) and liners for crates. Studies have shown that simply by decreasing the size of large packaging material (crates, sacks or baskets) damage to produce can be reduced by 50 percent or more. Field trials in Tanzania have shown that tomatoes suffer 50 percent of their total post-harvest damage when shipped in rough wooden crates – and this can be reduced to less than 5 percent by using crate liners, smaller crates or plastic crates.

Introducing plastic crates is a possible solution to reduce contamination risks since plastic crates (even though more expensive in purchase) can be cleaned more easily, last longer and minimize the losses due to damage, as indicated in the studies in Tanzania and Cape Verde. Currently the wooden boxes are emptied at the open market and the products are then sold in smaller batches. Not only can plastic crates prevent losses, an efficient use of the crates in the value chain can also minimize the number of times the goods are repacked. It is estimated that plastic crates can be bought in Kenya for an average prices of US \$6 per crate.¹² Local production in Ghana could also be explored.

For further improvement of better packaging during transport it is advised to use materials that protect the produce from sunlight, thus keeping cooled products cool longer. It is also important to evacuate any moisture accumulation inside packaging, which can cause spoilage. Small ventilation openings on top can prevent this.

2.7 Marketing Innovations

Marketing innovation in small-scale farming

Besides improved agronomic practices and technical innovations, there are also ways to bridge the gap between farmer and trader in such a way that post-

¹² The Kenyan company Kenpoly offers suitable crates.

harvest losses can be reduced, the time from farm to market can be reduced and value can be added. Produce quality increases with a shorter time from farm to market.

Some examples:

- **Home or office delivery:** Energy Africa Ltd., a local company operating in Kenya, decided in 2006 to expand their services by introducing home delivery of organic and fresh fruits and vegetables. They operate a nucleus farm and work with outgrowers from whom they source more than 15 different vegetables and fruits.¹³
- **Prepackaged selections:** In South Africa, local company 'Wild Organic Foods'¹⁴ offers a choice of three bags, the standard bag, the mini-bag and the made-to-order bag. Both the standard and mini-bag include a seasonal selection of products. In the made-to-order bag the consumer chooses the products from the catalogue. Importantly, bags are delivered to a collection point from which consumers can collect at any preferred time.
- **Farm to consumer:** In South Africa, a non-profit development organization developed a marketing project through which micro-farmers would sell their excess of organically-grown vegetables, packed in boxes, to consumers. The project, called Harvest of Hope,¹⁵ ensures that farmers are paid at the moment of delivery. Members of Harvest of Hope sign up for a box and pay for their weekly delivery of vegetables in advance.

Processing

In Sub-Saharan Africa there are many examples of local companies that invest in processing fresh vegetables in order to store them for longer periods. Tomatoes are a favourite produce used for processing purposes. In Rwanda, a company called Sorwatom restarted processing tomatoes in 2003-4, but closed operations in early 2013 due to problems with supply of fresh

quality tomatoes. Sorwatom could only rely on sufficient fresh tomatoes during one out of three annual harvests, so they temporarily switched to importing semi-processed tomato paste from China as a stop-gap solution (Gathani and Stoelinga, 2013).

According to various sources, about 1 litre of concentrate requires 7 kg of fresh tomatoes. In addition large volumes of water and sugar are needed for processing tomatoes, adding serious costs. To establish tomatoes processing facilities, the expected total investments costs are high and since (over-) supply is seasonal in most African countries the facilities are only running during a small period of the year, making it an inefficient business. In addition most African countries face large imports of cheap tomato paste and ketchup from other countries (i.e. Italy, China, USA). The imported products use specific types of open field tomatoes with high yields (up to 100 t/ha) that are machine-harvested, leading to a competitive cost advantage.

2.8 Opportunities for Investment

Here we combine findings from the preceding chapters and identify opportunities for development of the sector. Each business opportunity meets three criteria:

- Demand-driven
- Economic viability
- Immediate impact on the sector

The fulfilment of the above criteria has led to the following opportunities (in order of priority):

- (1) *Serving fresh, healthy vegetables for the growing middle class in Ghana. This includes supporting short food chains between farmers, retailers and consumers.*

The vegetable sector in Ghana is polarized at the retail level. At one end of the spectrum, we find the traditional local wet markets supplying the bulk of the production and at the other end modern supermarket retailers which offer imported and quality domestic products at high prices. The middle segment is only exploited by local corner shops and specialized farmer markets, and is growing faster than the low-end and high-end segments. Thanks to the growing awareness of these new opportunities, new entrepreneurs are

¹³ <http://www.wildorganics.co.za/>

¹⁴ <http://www.wildorganics.co.za/>

¹⁵ <http://harvestofhope.co.za/about-us/our-story/>

reportedly experimenting with new business models for procuring and marketing of vegetables. The new business models have to deliver on the quality, volume, choice, convenience and price level that the population is demanding.

The current opportunity focuses then on innovative business models whereby fresh and healthy vegetables are sold at (new) and convenient stores or specialized markets, and can also be delivered to homes or offices.

(2) *Reducing post-harvest losses at farm and retail level by introducing improved post-harvest practices and technologies in every step of the value chain.*

Post-harvest losses in Ghana exceed 20 percent of the total value of the produce. We found that these losses can be greatly reduced and hence profits can be increased. This opportunity can be seized by operators of storage facilities and pack houses and targets farmers, traders and retailers at the local market centres. The opportunity envisages the introduction of basic storage facilities and post-harvest technologies along the value chain, as well as improved packaging materials to increase the quality of the fresh produce (e.g. smaller sizes, reusable boxes – see Chapter 3.1 for specific examples). ■

3. Private Extension Services for Commercial Vegetable Sector Development

3.1 Executive Summary

The commercial vegetable sector in Ghana is growing. However, the growth falls behind when compared to the demand for quality vegetables in the high-end markets, both domestically and abroad. A quick scan was implemented to explore the different private sector driven technical support services in the Ghanaian vegetable sector.

There appears to be a clear void in the delivery of technical support services for the commercial vegetable sector which is slowing down the further development of the sector. There are a lot of knowledge-based issues that could and should be addressed. Below the main technical support needs are listed for the different supply chain actors identified:

- Commercial growers
 - Production and investment planning (assessing qualitative and quantitative demands; financial planning and funding; dealing with uncertainties)
- Cultivation (irrigation, pest and disease management, soil fertility)
- Product handling (preservation, sorting, grading, handling, packing)
- Quality assurance & traceability
- Emerging commercial grower
 - Cultivation (choosing the right cultivars, soil fertility management, irrigation, crop protection and safe use of chemicals, harvesting)
 - Product handling (preservation, grading)
- Input suppliers (wholesale/large scale)
 - Trends and opportunities in the sector
- Input suppliers (rural shops)
 - Cultivation (choosing cultivar, soil fertility management, crop protection, etc.)
- Handling agents & logistical service providers
 - Quality management systems and traceability
 - Handling of vegetables (sorting, grading, processing and packing fresh vegetables)

The required know-how and skills are largely available already in the country. There are several local consultancy companies and a number of technical specialists working for public sector knowledge institutes who have the combined know how and expertise required in the commercial vegetable sector. Furthermore, the input supply sector is well-connected internationally and has access to modern technologies and inputs used in the international commercial horticultural sector. The uptake of the available knowledge and expertise by the sector is, however, limited. There is a general unwillingness and inability to invest in knowledge-intensive improvements.

Recommendations

Supporting the development of the commercial vegetable sector in Ghana requires the establishment of new extension and technical support services. Based on the assessment of technical support needs, available know-how and expertise and operational and financial possibilities, we recommend that GhanaVeg supports the establishment of three different types of private extension services:

- Local GAP advisors for smallholder vegetable growers who (wish to) supply high-end markets.
- Vegetable study groups for (emerging) commercial growers in same (category of) vegetable crops.
- Vegetable business development coaches for the large-scale commercial growers and wholesale traders/exporters.

3.2 Introduction

The commercial vegetable sector in Ghana is growing. However, the growth falls behind when compared to the demand for quality vegetables in the high-end markets, both domestically and abroad. Large quantities of vegetables in the emerging supermarket sector are still imported, rather than supplied by Ghanaian growers. Export consignments get rejected too often due to quarantine problems or inadequate quality. Furthermore, vegetable exporters cannot always meet the volumes required by their clients in Europe. To meet the requirements of the high-end markets it is important that growers and other stakeholders

in the emerging commercial vegetable sector have the required know-how and skills related to the efficient and safe production and handling of quality fresh produce.

Improving the knowledge and skills of vegetable growers and other stakeholders is a critical component of the support services for the emerging commercial vegetable sector. Traditionally the public agricultural research and extension services have had an important role to play in providing farmers with up-to-date knowledge and information on technical innovations, product standards, etc. However, due to a variety of reasons, the role of public extension services as an importance source of information for commercial vegetable growers is very limited. This includes limited public funding for extension services, lack of incentives for field extension workers and unfamiliarity among extension field staff with quality requirements in the commercial vegetable sector.

Given the importance of knowledge and innovation support for emerging commercial vegetable growers, GhanaVeg commissioned a study to investigate whether there would be scope for (an expansion of) a private extension system. This private extension system could operate as a complementary or alternative service to the public extension services. The private extension services could be operated by different partners and will have to meet several important criteria, including:

- a) **Relevant** for emerging commercial vegetable growers by meeting their specific questions and needs related to optimisation of cultivation practices, quality management, certification, harvesting and post-harvest-handling, etc.
- b) **Technically sound** by being well connected with relevant knowledge centres and other references.
- c) **Efficient and timely** in the delivery of information services by choosing the most appropriate communication channels.
- d) **Financially viable** in terms of a direct or indirect cost-recovery mechanism through which the services can be sustained and expanded without continuous external support.



The initial findings and recommendations were discussed with different stakeholders in the sector during a one-day workshop on 22 April 2015 in Accra.

The ultimate goal of the private horticultural extension services will be to contribute to the overall GhanaVeg objectives, which are: (i) improving productivity in the vegetable sector; (ii) facilitating more efficient markets, including linking vegetable producers and other value chain operators with the Dutch private sector; (iii) improving the business climate; and (iv) further professionalizing the value chain for vegetable production and consumption in Ghana.

Overview of options

A quick scan was implemented to explore the different private sector driven technical support service models which could be led by different actors, including:

- Specialised commercial extension service executed by a national or international agronomic consultancy service or horticultural research organisation.
- Embedded extension service executed by input suppliers, produce buyer, exporter or other supply chain partner of the vegetable growers.
- Specialised extension service developed and executed by a growers' association.
- Contracting of horticultural specialists from the MoFA and/or knowledge institutes (e.g. research institutes, agriculture faculties at universities).

In terms of funding of these technical support services for commercial vegetable growers and their supply chain partners, different options are considered:

- Commercial sponsorship by supply chain partners, including, for example:
 - Input suppliers
 - Crop buyers/exporters
 - Equipment suppliers
- Membership fee-based payments
- Fully private: technical consultants working for individual companies/small groups
- Public sponsorships, for example through:
 - Vouchers (grant-based)
 - Public credit vouchers
- Combinations of the options listed above.

Scope and Objectives

This report summarises the findings from a quick scan implemented by two independent consultants contracted by GhanaVeg. During this quick scan the different potential technical service providers were

identified and evaluated and the different options for either improving an existing or establishing a new commercially and operationally viable extension service were assessed.

The quick scan comprised the following main activities:

1. Assess different actors in the vegetable sector and profile the nature of current or potential extension service delivery initiatives in vegetable sector.
2. Assess the quality and range of current technical support services.
3. Assess viability and feasibility of the different initiatives and preconditions or assumptions for service development and commercial success.
4. Assess if/where Dutch technical service providers can play a supporting role.
5. Identify market linkage opportunities and their role for commercial success.
6. Identify economic and cost-recovery approaches.
7. Produce shortlist of commercial extension service options and recommend the most viable and promising options.
8. Review regulatory framework for involvement of private sector in extension services.

The central objective of the quick scan was to recommend around 2–3 of the most appropriate private sector technical service developments which could be developed into a fundable business proposition. The recommended options were discussed during a stakeholder workshop organised by GhanaVeg in order to check specific detailed aspects of the suggested developments and create ownership for the recommended technical service options.

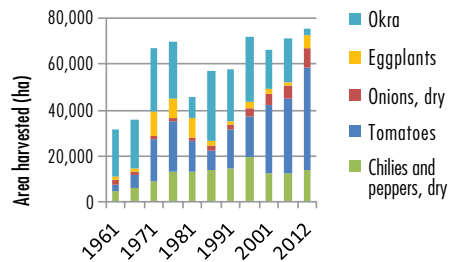
3.3 Assessment of the Current Situation

The Ghanaian Vegetable Sector

Around 78,000 ha are used for vegetable production in Ghana. Main products are tomatoes, green chillies and onions. The production of vegetables increased in the mid-1990s and dropped after 2003, but recently increased again (Figure 3). Commercially

Figure 3. Area (ha) of vegetable production in Ghana.

Source: FAOStat.



Asian vegetables and chillies (green and dried) are also important. Among the most important Asian vegetables produced in Ghana are hot chillies, okra, ravya, bitter gourd and garden egg. These products are consumed by the ethnic-Asians in Ghana, but are mostly exported to Europe, the UK in particular. In 2012 the total production of chillies was 110,000 t. In addition 60,000 t of okra and 46,000 t of eggplant were produced.¹⁶

The main economic driver behind the development of the commercial vegetable sector are Ghana's growing middle class with a heightened health awareness of consuming vegetables, coupled with the rise of the supermarket industry. This results in an increasing domestic market demand for a broadening variety of quality vegetables. The main supermarket chains in Ghana are MaxMart, ShopRite and Game. Also the demand for Asian vegetables and chillies drives the commercial development of the vegetable sector in Ghana. The closer proximity to the EU market and increasing irrigation opportunities make it possible for Ghanaian growers to export their produce to the EU market.

Production of fresh vegetables takes place all around the country and is strongly related to the specific weather conditions and market windows. In addition, irrigated agriculture is on the increase leading to new production areas around the Volta River and Lake Volta, as well as specific irrigated areas in and around Accra (see Table 4).

¹⁶ Source: *Vegetables Business Opportunities in Ghana (2014)* by Y. Saavedra et al; *GhanaVeg Sector Reports 1*

Table 4. Main vegetable production communities and seasons by region

Major Production Communities	Production Calendar/Remarks	
Pepper (Capsicum)		
<i>Eastern Region</i>		
Begoro, Dedeso, Nsawam, Teacher Mante, Koforidua area, Nkurakan, Boti Falls, Juapong, Akrade	Transplant in March/April and July. Harvest from May til Sep/Oct.	
Kwahu South and North districts: Kwahu Praso, Adawso, Kotoso, Amartey Kwame Dwamena, etc.	Largely rain-fed. Few areas under irrigation	
<i>Greater Accra Region</i>		
Ningo, Prampram, Dawa, Ada	Largely rain-fed	
<i>Volta Region</i>		
Denu, Aflao, Keta	Well irrigated	
<i>Central Region</i>		
Gomoa, Awutu Breku, Okyereko	Rain-fed, some irrig.	
<i>Northern Region</i>		
Tolon, Kumbungu, Tamale Metro, Kukubila-Nasia	Rain-fed. Irrig. at 3 dam sites: Libga, Golinga, Bontanga	
<i>Ashanti Region</i>		
Woraso, Abotansi, Besro, Beposo, Kwaman	Rain-fed April to October	
Tomato		
<i>Greater Accra Region</i>		
Ada	Rain-fed	
<i>Ashanti Region</i>		
Akomadan, Offinso, Woraso, Abotanso, Besro, Kumawu environs	Rain-fed transplanting: Feb-March. Harvesting: May-July. Minor season: transplanting July-Aug, harvesting Oct-Nov.	
<i>Brong Ahafo Region</i>		
Tuobodom, Techiman	As above	
Asian vegetables (<i>Green chillies, Turia, Ravaya, Marrow, Bitter gourd, Tinda, etc.</i>)		
<i>Eastern Region</i>		
Nsawam, Teacher Mante, Akuse	May-Sep rain-fed, Dec-May under irrigation	
<i>Volta Region</i>		
Gbenorkope (South Tongu), Akatsi		
Garden Eggs/Okro		
<i>Ashanti Region</i>		
Woraso, Abotanso, Besro, Beposo, Ejisu, Konongo, Juaso, Offinso, Abofour Kwaman, Nsuta, Mampong, Ejura		Rain-fed and dry-season irrigation Mar-Aug, Dec-Mar/Apr.
<i>Eastern Region</i>		
Anyinam, Akwasiho, Kwahu Praso, Kotoso, Nkurakan, Huhunya,		As above
<i>Brong Ahafo Region</i>		
Peri-urban Sunyani, Nsoatre, Abesewa etc.		
<i>Volta Region</i>		
Vakpo, Kpandu		
<i>Central Region</i>		
Mfantseman district, Gomoa, Bawjiase		
Cabbage/Lettuce/Carrots		
<i>Greater Accra Region</i>		
Accra metro and peri-urban Accra		Rain-fed and irrigation, major and minor rainy season and dry seasons
<i>Central Region</i>		
Gomoa, Awutu , Mfantseman, Cape Coast metro, Kasoa, Bawjiase, Okyereko, etc.		Rain-fed and irrigation where there is access to water
<i>Eastern Region</i>		
Begoro, Anyinam, Koforidua peri urban, Nsawam, Teacher Mante, Akuapim Ridge,		Rain-fed and dry season small-scale irrigation
<i>Ashanti Region</i>		
Mampong/Nsuta, Beposo, Kwaman, Kumasi metro and peri-urban		Rain-fed and small-scale irrigation
<i>Volta Region</i>		
Denu		
Onions/Shallots		
<i>Volta Region</i>		
Keta		
<i>Eastern Region</i>		
Kwahu South district: Kwahu Amanfrom, Amartey, Adawso		Irrigated
<i>Northern Region</i>		
Libga, Bontanga and Golinga dam sites		Irrigated
<i>Upper East Region</i>		
Bawku and environs		Irrigated

Moving from “business as usual” to more commercial vegetable production requires serious efforts. Currently, the vegetable chains are characterized by: 1) low availability and knowledge of improved inputs; 2) limited agronomic skills and practices; 3) poor food safety and quality standards for both the domestic and export market; 4) poor phytosanitary standards leading to a relatively high number of interceptions of export consignments by EU inspectors; 5) limited post-harvest management systems; and (6) inadequate linkages between input suppliers producers and buyers.¹⁷

3.4 Knowledge and Information Needs

Commercial Growers

The knowledge and information needs of the commercial vegetable growers are numerous and cover a broad range of issues. Many of the commercial growers are experienced business people who have seen an opportunity and are responding to the growing demand for quality vegetables. Whilst experienced in setting up and managing a business, some of them do not have much inside knowledge and hands-on experience yet in the cultivation, handling and marketing of vegetables. It is not uncommon for the commercial growers to source also from smallholder growers to supplement their own product supplies in times when market demand is high. The arrangements between smallholder growers and the commercial growers and exporters are informal.

In terms of production planning and organisation of the vegetable business operations the commercial growers face a range of challenges, including assessing the demand, organising operations with outgrowers, choosing production equipment, organising financing, etc. To some extent these challenges are knowledge and experience related. However, also the lack of a conducive environment for production and investment planning is a constraining factor for commercial growers. There is no effective supply chain governance mechanism in the commercial vegetable sector that



Maintaining quality after harvest is a challenge.

creates stability and a pattern of organized production and planning. Furthermore, the general economic climate in Ghana makes investment planning difficult.

In relation to the cultivation issues the commercial growers experience most challenges with crop protection and plant health issues. Preventing the outbreak of pests and diseases, timely recognition of symptoms and taking adequate control measures are all aspects of this. The lack of knowledge and expertise in this field leads to too many rejections of export consignments for phytosanitary reasons. Irrigation is another aspect of vegetable cultivation which poses important challenges for commercial growers. How and what to irrigate, the use of the more drought tolerant varieties and managing the cost of irrigation are some related issues.

Related to the post-harvest handling and management of the fresh produce supplies the commercial growers greatest challenge is the management of quality and safety systems, including grading, sorting and managing a traceability system. This is partly related also to the fact that own produce is often mixed with produce bought from other (smallholder) farmers. In terms of monitoring the source of supplies for choice of vegetable varieties, spraying regimes, phytosanitary issues, pesticide residue levels and record keeping there are no effective systems in place that govern these procurement and supply arrangements.

¹⁷ These issues are described in more detail in the above-mentioned GhanaVeg Sector Report 1.

Emerging Commercial Growers in the Smallholder Sector

In the smallholder sector there is a growing group of emerging commercial growers who produce vegetables for the market. They cultivate a few acres of land and some have access to irrigation also for dry season cultivation. Their knowledge and information needs are somewhat similar to the larger-scale commercial growers. However, due to the fact that they are not directly involved in the (export) marketing of the produce, the smallholder growers have even less insight in the qualitative and quantitative demands for vegetables in the high-end domestic and export markets.

This poses many challenges for the emerging commercial growers in relation to, among others:

- Choosing the most appropriate varieties required by the high-end domestic and export markets.
- Assessing options for out-of-season cultivation of certain vegetable crops.
- Appropriate use of irrigation and choice of irrigation equipment.
- Maintaining soil fertility and soil health management, including organic matter content and pH levels of soils.
- Avoiding pests and diseases in the vegetable crop by using resistant cultivars, crop rotation, etc.
- Effective and safe use of plant protection chemicals, including the choice of correct chemicals, correct application, adhering to waiting periods, etc.
- Time of harvesting and post-harvest handling of produce, including grading.

Other Supply Chain Actors

Input and horticultural equipment supply companies get their supplies mostly from abroad. In quite a few of the cases these companies are foreign-owned and managed. As such the wholesale input supply companies are well connected with the international supply industry and are up to date with the latest technologies and supplies in their industry.

The local input dealers who run their business with seeds, small equipment and agro-chemicals in the



Vegetable seeds and agro-chemicals for sale.

production areas are less informed and knowledgeable on efficient and safe vegetable production practices. In some cases the local input suppliers have an agricultural background and are reasonably knowledgeable on commercial vegetable production practices and the appropriate use of modern inputs. The majority of the input suppliers, however, have the same knowledge and information needs as their clients, the smallholder vegetable growers.

There are few logistical service providers and handling agents in Ghana who are specialised in dealing with vegetables for the export or high-end domestic markets. Some have experience with handling fresh produce (fruits such as pineapple and mango), but the specific know-how on and experience with sorting, grading, processing and packing fresh vegetables in Ghana is of a much lower standard than in other vegetable producing countries in Africa such as Kenya, Egypt and South Africa.

3.5 Existing Initiatives and Sources of Technical Information

General Overview of Agricultural Extension Services in Ghana

During the British colonial period extension services were only provided for the export commodities such as cocoa, palm oil and rubber. The Bunso Agricultural Training School (now the Bunso Cocoa College) was established in 1950 to train frontline field assistants and technical officers to train farmers and provide extension services on cocoa. Later other agricultural colleges were set up at Kwadaso, Ohawu, Nyankpala for the vocational training of extension officers who were posted all over the country to provide extension services to farmers on the production of both export commodity and food crops. After Independence public extension services extended the focus more towards the production of food crops and promoting general rural development. Currently MoFA focuses its support activities on general farm production and income, farmer household livelihoods, and the nutrition of the rural population. Under the decentralization policy public sector extension staff have been transferred from the national and regional offices to the district offices. The purpose of the decentralization has been to develop more demand driven extension systems, with the ultimate goal of increasing farmers' productivity and income. Public extension staff resort under the District Assemblies in line with the identified needs of the farmers in the district. The regional and national level administration of extension focuses now on policy planning, coordination, technical support, monitoring and evaluation.

The regulatory framework for agricultural extension services in Ghana is determined by the Extension Services Directorate (ESD) under MoFA. The official position of the Directorate is that a pluralistic agricultural extension is to be promoted. MoFA encourages the participation of stakeholders such as private companies, research institutes, NGOs and development partners in providing support to extension and to farmers. The Ghana Medium Term Agricultural Sector

Improvement Programme (METASIP) document also admits that government cannot provide all the needed extension support to all farmers¹⁸ due to the serious budgetary constraints, logistical constraints for field staff and the limited number of extension staff.

The Ministry acknowledges that there is a need to include other stakeholders in the planning and delivery of extension services. Across the different agricultural sectors there are numerous examples of other governmental and non-governmental initiatives in extension support for Ghanaian farmers:

- **Public extension system** operated by MoFA providing extension on staple food crops and vegetables.
- **Quasi-Public Commodity extension systems** for specific crops such as cocoa and coffee operated by the Ghana Cocoa Board.
- **Private Companies Commodity extension system** operated by agricultural commodity and input supply companies such as:
 - Ghana Rubber Estates Ltd (GREL) for rubber
 - OLAM for cotton
 - WIENCO for maize, sorghum and cotton
 - NORPALM, TOPP and KWAE for oil palm
 - Ecom, Cargill, ADM and others: cocoa
- **Non-Governmental Organizations (NGOs):**
 - ADRA Ghana: mango, cashew, citrus, maize, soybean, cowpea, roots and tubers, vegetables
 - Care International : general crops
 - Solidaridad: cocoa, palm oil
 - IFDC: maize, rice, soybean, general crops, input supplies
 - ACIDI/VOCA: mango; maize, rice and soybean value chains
 - World Vision: cereals and legumes

¹⁸ See also: *Extension Services Directorate, Ministry of Food and Agriculture (2012): Agricultural Extension Approaches being implemented in Ghana. MoFA, Accra*

■ Research Institutes:

- Crops Research Institute and Savanna Agriculture Research Institute (SARI): cereals and legumes, roots and tubers, vegetables, fiber crops, plantains
- Cocoa Research Institute: cocoa, coffee, shea nut, cashew
- Oil Palm Research Institute: oil palm and coconut

Some of the extension approaches and models used in the Ghanaian agricultural commodity sectors by private companies and NGOs can be modified and applied also in the vegetable sector. This includes, for example, farmer field school (FFS) approaches, farmer group formations and training and GAP certification through either farmer groups or intermediate traders.

Public Sector Extension Services for Vegetable Growers

Generally the vegetable sector is poorly served by public extension services. Public extension staff focus more on staples such as cereals, tubers and legumes. Until recently vegetables were not viewed as important crops from an economic or food security perspective. At the vocational and academic agricultural education institutes the production and handling of horticultural crops is given little priority and the modern high-value

vegetable production systems are not (yet) covered at all. As a result most extension agents have little or no knowledge and skills on cultivation and handling of Asian vegetables or other high value vegetable cropping systems.

There are however a number of specialists in the public sector (particular in agricultural research and at universities) with relevant know-how and expertise that could be used by the emerging Ghanaian commercial vegetable sector. Several of them have been identified and are listed in Table 5 (Note: this is not an exhaustive list of specialists). We have not found any examples of commercial growers or emerging small scale growers using the expertise of these specialists. The public extension services are failing in this respect and there are no alternative linkages in place between the Ghanaian knowledge institutes and the commercial vegetable sector.

Existing Private Sector Initiatives in the Ghanaian Vegetable Sector

Some knowledge and expertise is disseminated through outgrower or contract farming schemes. These schemes are built on the premise that the vegetable growers will be guaranteed of a market for their produce if they cultivate the vegetables in

Table 5. *Some of the horticultural specialists working for public sector institutes*

Name of Specialist	Institute	Relevant Field of Expertise for Commercial Vegetable Sector
K. Offei Bonsu	Crops Research Institute	Plant breeding, pepper/tomato specialist
Dr K.O. Fening	Crops Research Institute	Entomologist
Dr Haruna Braimah	Crops Research Institute	Entomologist: Biological pest control
Dr Kingsley Osei	Crops Research Institute	Nematologist
Prof Charles Quansah	KNUST – Dept. of Crop and Soil Sciences	Soil scientist/soil chemistry, fertility and conservation
Dr Ben Banful	KNUST – Dept. of Horticulture	Vegetable crops agronomy
Dr Francis Appiah	KNUST – Dept. of Horticulture	Vegetable crop agronomy and post-harvest specialist
Patrick Kumah	KNUST – Dept. of Horticulture	Post-harvest handling and storage specialist
Prof. Oduro Nkansah	Univ. Ghana Agric. Research Center	Vegetable breeding/agronomy
Dr Susan Akrofi	Plant Genetics Resources Institute	Vegetable crop diseases

accordance with the planning and specifications of the buyer. The buyer could be a commercial grower or an aggregator/exporter who in addition to a guaranteed offtake also often provides technical assistance and/or seeds and other inputs on a credit. Contract farming and outgrower scheme operations can in principle be an effective mechanism for extending technical advice and skills on modern vegetable cultivation. Both parties, growers and buyer, have a direct interest that the cultivation is done according to the specifications of the market. However, most of the outgrower schemes in the Ghanaian vegetable sector are loosely organized and set up. Side-selling of produce by smallholder growers has been a frequent occurrence and is mentioned by many traders and exporters as the main reason for investing in input supplies and knowledge services to smallholder vegetable growers.

Currently, most private-sector-driven technical support services are found in the input supply sector. Major importers and wholesale suppliers of equipment and seasonal inputs have their own technical support division through which advice, installation support and after sales services are provided to commercial growers. They also provide training to their clientele amongst the local input dealers and small-scale commercial growers. At the moment the two main companies involved in these services are Agrimat and Dizengoff. Wienco has similar technical support services for small-scale vegetable growers on a small scale, but for the time being focuses more on other sectors such as cocoa and maize. The technical support services by the main equipment and input suppliers are provided without charges. Costs are recovered through the sales of inputs and equipment. All indicated that they could scale up the technical services if these could be linked up with outgrower schemes whereby a buying partner could provide a guaranteed off-take of the produce and the payment for the inputs supplied.

Several seed companies are also active in the field of farmer training and extension services. This includes for example East West Seeds, which provides samples of new cultivars and implements demonstrations and farmer field days in the main vegetable production areas. Through these extension activities several interrelated objectives are pursued: (a) introduction

Finlays in Kenya

Example of extension services for contracted growers by a large international trader

Finlays Horticulture Kenya limited (formerly known as "Homegrown") is one of the largest vegetable exporters in East Africa and is owned by Finlays Fresh produce UK, one of the largest horticulture importers in the UK. In rural areas of Kenya there are over 1,000 smallholders who grow vegetables for Finlays Horticulture Kenya Limited. The small-scale growers are grouped into two categories: the medium size individual farmers considered as farm(s) and smallholders of between 10 to 20 small farms that join together to make up a group, which is equal in scale of production to one medium-sized farm. These farms and groups are closely managed by a Technical Assistant from Finlays Horticulture K Limited who gives them the technical support and training needed to grow vegetables to the high standards demanded by the customers in Europe. The focus on medium scale vegetable growers and groups of smallholders is required to minimise transaction costs for training purposes and quality certification.

of seed-based cultivation innovations aimed at higher yields, out-of-season production, reduction of crop failure due to drought and/or diseases and pests); (b) ensuring higher incomes for vegetable growers; and (c) building up buying power and loyalty among growers to use their seed products. The growers do not have to pay for these extension services; the costs are partly recovered through the increasing sales of quality seeds and partly through agricultural development programs. East West Seeds and its Ghanaian distribution and sales agent Tikola work for this purpose with the Ghana Veg Business Opportunity Fund and the IFDC-managed 2SCALE program. Other input supply companies also obtained a grant from the Business Opportunity Fund of the GhanaVeg program.

The local input supply agents in the rural areas are also important sources of technical information and advice for vegetable growers. Growers visit their nearby input



Asian vegetables such as ridged gourd cultivated for the export market.

dealer with questions on choice of variety and pest and disease problems. We have found some excellent examples where the local input supplier was reasonably well-informed and could be an effective advisor. These technical services were not charged for, but were seen as part of the general service. However, it seems that the majority of rural input dealers are less knowledgeable on modern vegetable cultivation and recommend practices that involves the products they happen to have in stock regardless whether these are effective and appropriate for the grower concerned.

There are several agricultural consultancy companies active in Ghana and some of these have also a track record in the commercial vegetable sector. Few of them are fully specialised in commercial vegetable production and marketing. A list of some of the existing agricultural consultancy service providers is included in Table 6 (Note: this is not an exhaustive overview). The market for commercial consultancy services in the Ghanaian vegetable sector is limited. The willingness and ability to pay for these services is not very high given the insecure market environment and the high

East West Seeds

Combining breeding, seed marketing and farmer training in Asia

East West began in 1982 in Asia with the breeding, production and marketing of hybrid and OP vegetable seeds for the smallholder market in Asia (Philippines, Indonesia, Thailand, etc.). Part of the business success in Asia has been East West's approach to market development and assisting smallholder vegetable farmers with training and demonstration on cultivation improvements.

risk associated with commercial vegetable production and marketing. Commercial growers and traders in Ghana therefore often use other (cheaper) sources of information, such as the Internet and consultations with each other (e.g., through meetings of their associations VEPEAG and GAVEX).

GAVEX has recently employed a consultant to assist the export growers with solving the recurrent phytosanitary

Table 6. *Some agricultural consultancy services for commercial vegetable sector in Ghana*

Name	Contact Person	Relevant Field of Expertise
Smart-Cert Ltd	Dr Bernard Nisah	Training and certification for BRC and GLOBALG.A.P.
Agri-Commercial Services Ltd	Kwabena Adu-Gyamfi	Commercial production of tomatoes and other crops
Shakespeare	Shakespeare Dzokoto	Phytosanitary issues & supply chain management
Agri-Impact Consult	Daniel Acquaye	Training and advice on market assessment and agri-business management
LD Consult	Cephas Ametefe (0244971439)	Training in production, pest and disease management, post-harvest quality management
Global Farmrice Consult	Joshua Glover-Tay (0244875331)	Post-harvest management training, Food Safety, GLOBALG.A.P. Certification, Organic/Fair Trade certification
3As Agri Solutions	Benjamin Atidjah (0244649810)	Training in Farm Management: Production and financial records, Post-harvest quality management, Marketing, Business Plan Development
GAPS Consulting Ltd	Emmanuel Oduro Owusu and Victor K. Avah (0244507530 / 0244695429)	Training farmers in GAP in vegetables and fruits. Preparation and coaching farmers for GLOBALG.A.P. certification

problems (mainly thrips, false coddling moth and white fly). The number of rejected export consignments to EU (around 30-40 per month in the first half of 2014) resulted in high losses for the individual exporters and reputational damage for the Ghanaian vegetable export sector as a whole.

3.6 Conclusions

There is a clear void in the delivery of technical support services for the commercial vegetable growers and companies which is slowing down the further development of the sector. There are a lot of knowledge-based issues that could and should be addressed. These are further explained in the previous chapter and are summarised in Table 7.

The required know-how and skills is to some extent available already in the country, but the uptake and accessibility of these is limited. There are several local consultancy companies and a number of technical specialists working for public sector knowledge institutes who have relevant know how and expertise for the commercial vegetable sector. Furthermore, the input supply sector is well-connected internationally and has access to modern technologies and inputs

Fresh Studio

Example of a private extension and consultancy service in Vietnam

Established in 2006 and now active mainly in horticultural and fisheries sector. Services include:

- *Agricultural training for farmers*
- *Farm performance monitoring and consultancy*
- *Introduction of private and public GAP standards in supply chains*
- *Production supervision and quality assurance control*
- *Production planning management amongst groups of producers*
- *Post-harvest training and consultancy.*

Important success factors include continuous investments in its own HR development, a research and development farm for testing and demonstrations, a broad national and international client base including both for-profit and not-for-profit clients, and a focus on the whole supply chain.

Table 7. Summary of technical support needs of different actors in the vegetable sector

User Group	Information and Knowledge Needs
Commercial growers	<ul style="list-style-type: none"> • Production and investment planning (assessing qualitative and quantitative demands; financial planning and funding; dealing with uncertainties) • Cultivation (irrigation, pest and disease management, soil fertility) • Product handling (preservation, sorting, grading, handling, packing) • Quality assurance and traceability
Emerging commercial grower	<ul style="list-style-type: none"> • Cultivation (choosing the right cultivars, soil fertility management, irrigation, crop protection and safe use of chemicals, harvesting) • Product handling (preservation, grading)
Input suppliers (wholesale/ large scale)	<ul style="list-style-type: none"> • Trends and opportunities in the sector
Input suppliers (rural shops)	<ul style="list-style-type: none"> • Cultivation (choosing cultivars, soil fertility management, crop protection and safe use of chemicals)
Handling agents and logistics service providers	<ul style="list-style-type: none"> • Quality management systems and traceability • Handling of vegetables (sorting, grading, processing and packing fresh vegetables)

used in the international commercial horticultural sector. There is a general unwillingness and inability to invest in knowledge-intensive improvements, which is one of the reasons behind the poor uptake of the available technical services. Another important reason is that the available know how is not (yet) packaged and promoted in a targeted and specific manner.

Overall the vegetable supply chains aimed at the high-end domestic and export markets are weakly governed. The emerging supermarket sector in Ghana

does not play a dominant role in organising supplies and commercial aggregators and exporters have too little means and experience to take a leading role in ensuring adequate levels of supply chain governance. Combined with the slowdown in the economic growth of Ghana, the lack of supply chain governance does not provide a conducive environment for knowledge-intensive improvements and investments in technical support services. Instead, it promotes opportunistic production and marketing practices. There is a general unwillingness to pay for technical support services simply because the direct returns are not guaranteed in the short term.

Nevertheless a few examples of private-sector driven technical support services have been found that could provide a basis for further development:

- Technical advice, training and after sales services for vegetable growers and local input dealers by large-scale input/equipment supply companies.
- Employment of a technical advisor to address phytosanitary problems in the export supply chain by GAVEX.
- Large scale aggregators/exporters providing some technical support to small scale vegetable growers who supply them vegetables for onward sales to the high-end domestic retail or export market.



Tomatoes transported to market in Accra.

3.7 Recommended Options for Private Extension Services

Supporting the development of the commercial vegetable sector in Ghana requires the establishment of new extension and technical support services. Based on the assessment of technical support needs, the available know-how and expertise and the operational and financial possibilities, we recommend that the GhanaVeg program supports the establishment of three different types of private extension services:

- Local GAP advisors for smallholder vegetable growers who (wish to) supply high-end markets
- Vegetable study groups for (emerging) commercial growers in same (category of) vegetable crops
- Vegetable business development coaches for large-scale commercial growers and wholesale traders/exporters.

For each of type of extension/technical support services the main features are described in the sections following. The summary description is based on the five interrelated elements of an extension support service (see Figure 4).

Local GAP Advisors for Smallholder Growers

Objectives:

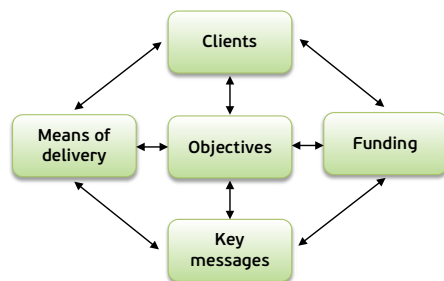
- Intensify smallholder vegetable production in a sustainable and viable manner
- Raise quality and food safety standards in the smallholder vegetable sector
- Increase growers' yields and income

Clients: Smallholder vegetable growers (male and female) who see vegetable cultivation as their major income-generating farming activity.

Key subjects to be covered: GAP, including:

- Choice of improved varieties
- Sowing, nursery and transplanting techniques
- Soil fertility management
- Identification and prevention of most common pests and diseases
- Effective and safe control measures for pest and disease outbreaks

Figure 4. Five main elements of an extension service



- Harvesting and post-harvest handling
- Optional: irrigation techniques, out-of-season cultivation

Means of delivery:

- Selected local input dealers trained in providing production advice ("training-of-trainers")
- Series of CDs with films on GAP for main vegetable crops

Funding: Large scale input supply companies or contract farming scheme operators with co-funding from GhanaVeg for the development and start-up of these training of trainers programs and the production of the audio-visual materials.

Key success factors/preconditions:

- Adoption of GAP by growers will lead to higher income and more use of appropriate inputs and equipment.
- Focus the program on the major vegetable crop for the main production regions only.
- Develop a training-of-trainers program with inputs from international vegetable crop specialists and align the GAP with international standards on vegetable production and product quality.
- Select only local input suppliers with a basic agricultural background and interest for the training-of-trainers program.
- Link-up with the main vegetable buyers in the selected regions.
- Check whether different wholesale suppliers of inputs and equipment can jointly work together on the training of trainers and development of films.

Vegetable Study Clubs

Objectives:

- Achieving higher and more stable vegetable yields
- Meeting (export) market standards and certification (food safety, quality, phytosanitary)
- Value addition and quality improvements
- Reduction of the relative cost price of cultivation

Clients: Commercial vegetable growers/aggregators.

Key subjects to be covered:

- Cultivar selection
- Irrigation efficiency
- Integrated pest management (IPM)/effective plant health management
- Quality control/certification (GLOBALG.A.P., BRC, etc.)
- Soil fertility improvement
- Harvesting and post-harvest handling

Means of delivery: Small groups of like-minded vegetable growers share knowledge and experience supported by an international expert and a local consultant/expert.

Funding: Membership fees and GhanaVeg support for international expertise.

Key success factors/preconditions:

- Form groups around common interests, opportunities and challenges
- Limit the range of issues to be discussed/learnt about (e.g., one specific vegetable, soil fertility management, etc.)
- Realise that you can gain more from sharing than you lose
- Combine discussion sessions with site visits to each other's farms
- Define what you expect to learn from external consultants/experts (local and international)
- Get GAVEX or VEPEAG involved to facilitate the program and collect fees from members

Vegetable Business Development Coaches

Objectives:

- Reliable supplies of fresh produce with consistent high quality

- Efficient logistics and supply arrangements with supply chain partners
- Increased turnover and profits
- Improved (international) market access

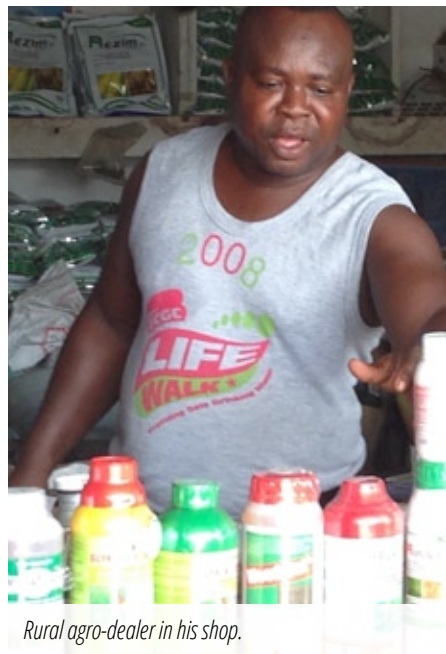
Clients: Commercial (export) growers and aggregators, logistics companies and handling agents.

Key subjects to be covered:

- Production planning
- Cost awareness and management information services
- Supply chain efficiency
- Outgrower scheme development
- Equipment selection and investment planning
- Quality control in the supply chain, traceability and certification
- Human resource development

Means of delivery: One-on-one consultancy support.

Funding: Own contribution with co-funding from GhanaVeg.



Rural agro-dealer in his shop.

Key success factors/preconditions:

- Experienced (international) advisor (e.g., DLV Plant, GreenQ) chosen by the client
- Returns on investment for the client
- Clear insight in risks and strategies to mitigate the risks
- Combination of clear short term gains and longer term impact
- Willingness to pay for consultancy services.

3.8 Concluding Remarks

Upgrading the knowledge and skills of growers and other supply chain partners is a precondition for the improved performance of the commercial vegetable sector. The public sector extension services in Ghana are not in a position to provide the required support services. This report summarises the main knowledge and information needs of different groups of stakeholders in the sector. It also provides an overview of some of the available resources and existing private-sector driven initiatives taking place already in the

sector to alleviate the need for up to date know how and information on vegetable cultivation issues and post-harvest improvements.

GhanaVeg could play an important role in promoting the further development of these private sector-driven extension services. The most promising developments are summarised in the previous chapter. Through its Business Opportunities Fund the GhanaVeg Program can support different initiatives that will help to build up relevant and sustainable extension services for the commercial stakeholders in the vegetable sector. GhanaVeg can provide interested private sector service providers with co-funding support and assistance with structuring their plans and proposals. ■



Agro-input dealer visiting his clients in the field.

4. Update on Food Safety and Plant Health

Sanitary and Phytosanitary Status of the Vegetable Sector

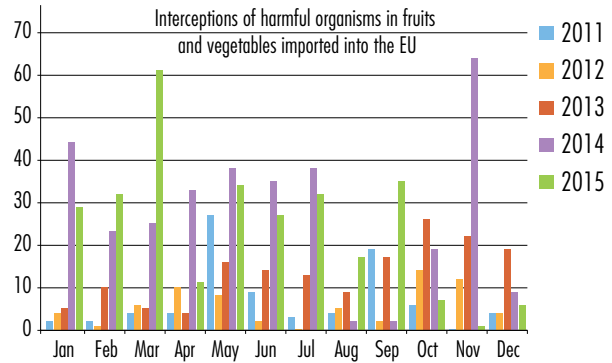
4.1 Introduction

This update on the sanitary and phytosanitary status of the vegetable sector in Ghana follows an initial analysis in 2014 (Maden et al., 2014), and reflects on the current developments around food safety and plant health.

With regard to plant health issues Ghana continues to struggle with rejections of vegetables by the EU due to the presence of organisms that occur on the EU list of harmful organisms (Figure 5). This situation finally led to an export ban imposed by the EU on a number of vegetables, on which Ghana needs to act promptly with serious and well-organized measures to be able to regain access to the European market. On the

food safety side, Ghana is taking steps towards reducing food safety risks and creating confidence amongst Ghanaian vegetable consumers through the launch of the GGL certification. However, at the moment, broad

Figure 5. Overview of interceptions 2011-2015



Imported vegetable seeds of different fruits and vegetables.

Table 8. *Interceptions in 2014 by crop and organism.*

Vegetable	Interceptions	Organism	Interceptions
Ridged gourd	103	Thrips	160
Chili pepper	60	False codling moth	70
Eggplant	58	Silverleaf Whitefly	41
Luffa sp.	28	Fruit fly	32
Capsicum sp. (pepper)	18	Others	27
Sweet potato	14		
Jute mallow	7		
Corchorus sp. (mallow)	7		
Other	35		
Total	330	Total	330

Table 9. *Interceptions in 2015 by crop and organism.*

Vegetable	Interceptions	Organism	Interceptions
Capsicum sp. (pepper)	72	Thrips	113
Eggplant	62	False codling moth	66
Ridged gourd	43	Fruit fly	52
Momordica sp. (gourd)	18	Silverleaf Whitefly	44
Lagenaria sp. (gourd)	17	Others	17
Bottle gourd	12		116
Corchorus sp. (mallow)	8		
Sweet potato	7		
Luffa sp.	7		
Others	46		
Total	292	Total	292

Source: EUROPHYT, 2016

support from the sector and acceptance of the label by the market and consumers are limited.

4.2 Plant Health

Interceptions and the export ban

The Ghanaian export vegetable sector has been struggling for a number of years with the presence of harmful organisms banned by the EU in their export consignments. This has led to a high number of interceptions, and currently Ghana is at the top of the European Commission's Alert List of developing countries with poor interception records.

In the second half of 2014, MoFA imposed a voluntary 3 months' ban on vegetable exports to the EU, in response to the EU's official notification on numerous interceptions of horticultural products from Ghana at EU borders due to the presence of harmful organisms (Table 8).

MoFA's intention for the voluntary ban was to avoid potential EU sanctions and to address, improve and ensure Ghana's compliance to SPS standards. The ban was lifted in October 2014, but no justification for lifting the temporary ban was provided. During the voluntary ban, very little changed structurally – and shortly after the ban was lifted, the number of interceptions again increased rapidly. November 2014 was a particular high point with 51 consignments of pepper species intercepted due to detection of false codling moth. Overall the most important interceptions in 2014 were thrips in ridged gourd (83) and eggplant (56), and false codling moth in pepper species (53).

After numerous interceptions in 2015 (Table 9), and following an audit by the European Commission's

Food and Veterinary Office (FVO), in September 2015 the EU Plant Health Standing Committee decided to suspend imports of Capsicum (peppers), Lagenaria (gourds), Luffa, Momordica (gourds) and Solanum (mainly eggplant) species from Ghana. The main pests detected are similar to those in 2014 and include thrips, false codling moth, whitefly and fruit fly (Tables 8 and 9), with especially a high number in March 2015 of 61 interceptions, mainly thrips detected in Luffa and Solanum species (30) and fruit fly in Lagenaria and Momordica species (12). Overall the most important interceptions in 2015 give the same picture as for 2014 with false codling moth in pepper species (65), thrips in eggplant (60) and thrips in ridged gourd (35).

The current suspension is provisionally due to last until 31 December 2016, but can be reviewed in light of new developments. In addition, the Plant Protection and Regulatory Directorate (PPRSD) of MoFA decided to extend the ban of export for selected vegetables with a ban for exporters of fresh vegetables not belonging to registered associations or recognized by the directorate, or sourcing from unregistered farms.

4.3 Plant Health Initiatives

An audit carried out by the EU's FVO was undertaken in April 2015 in response to continued interceptions in the EU of consignments of fruits and vegetables originated in Ghana. The objective of the audit was to evaluate the system of official controls and the certification of plants and plant products exported to the EU (regulated by Council Directive 2000/29/EC). The FVO concluded that the Ghanaian authorities had made very little progress since the last audit (April 2012) and the situation around interceptions of vegetables remained unchanged. The report (FVO, 2015) specifically mentions the airport facilities, the inspection and export procedures, and training of PPRS staff being of insufficient quality:

1. Facilities and equipment in the airport remain insufficient for performing official pre-export inspections.
2. No sufficient action has been taken to review the effectiveness of the export procedures and the certification system for export purposes.
3. There are no reliable Standard Operating Procedures, guidelines and work instructions for carrying out pre-export inspections and the system in place does not allow full traceability of consignments for export and their parts.
4. Samples for visual examination are not representative or big enough and plant health inspectors are unsure of the requirements of the EU legislation and the implications when quarantine pests are found on consignments.
5. Information provided during training events is very basic and insufficient to cover the issues of concern.
6. Some corrective actions were agreed upon with exporters, however these actions are not consistent.

The number of weaknesses found during the audit compromise significantly the effectiveness of any controls carried out, which therefore do not provide sufficient assurance with regard to the pest status of certified consignments.

The FVO mission formulated 15 recommendation points which form the basis of the MoFA action plan to improve the current situation. The actions include training activities (both PPRS staff and exporters), improvement of inspection and export procedures, enhanced inspection facilities, and a registration procedure for exporters and their suppliers together with a traceability system. For the detailed findings, conclusions and recommendations resulting from the FVO audit, reference is made to the audit report (FVO, 2015).

Two technical and training missions (Dutch NPPO, June 2015; ALC on behalf of COLEACP, June 2015) assessed follow-up and progress on the FVO audit recommendation points and provided technical advice and training. For the moment it appears that these are very ad-hoc activities. Ideally these activities should be coordinated by the Task Force (see below) and serve the implementation of the action plan. From both mission reports (Meggelen, 2015; Agri Livestock Consultants, 2015) it became apparent that again very limited progress was made since the last FVO audit and there are still many outstanding issues that need to be addressed.

A Dutch-funded project to be implemented by CABI together with several stakeholders in the sector has the aim to 1) improving the phytosanitary system through capacity building of public and private stakeholders, 2) develop with them improved procedures and protocols, and 3) work with them towards compliance with international standards.¹⁹ The project will run for 4 years until May 2019.

¹⁹ <http://www.cabi.org/projects/project/45477>

4.4 Task Force

Following the FVO audit in April 2015, MoFA has created a Vegetable Task Force to address the issues raised by the FVO audit, to guide the PPRSD in their response to the EU, and to overcome the challenges the sector is facing with regards to quarantine organisms and interceptions by the EU. During a press conference on the 2015 ban, The Minister for Food & Agriculture, Mr Fifi Kwetey MP, reinforced the responsibilities of the Task Force as following:

"I am today charging the task force which is representative of key agencies to be solely responsible for getting the vegetable sector back on track, by engaging all stakeholders and working closely with PPRSD and officials of the European Commission's Food & Veterinary Office to allow Ghanaian exporters to export these selected varieties in a very short time."

The Task Force assembled representatives of MoFA PPRSD, a technical Advisor to MoFA (Chairman), Ghana Exports Promotion Authority (GEPA), the German International Development Organisation (GIZ), CABl, GAVEX and GhanaVeg (Secretary). Three sub-committees have been formed to implement the actions that the Task Force has formulated: 1) Field & Production, 2) Inspection & Certification and 3) Logistics & Facilities. Since their assembly the Taskforce has had regular meetings. Some activities and results so far include:

- Several ad-hoc training activities to train farmers, agricultural extension agent, exporters and phytosanitary inspectors, based on the recommendation by the EU.
- Registration of exporters and their out growers, ensuring they belong to recognized associations and assigning them with unique codes to allow traceability.
- Several first improvements in inspection and certification procedures.
- Development of a computerized export record keeping system.
- Validation and finalization of the Standard Operating Procedures (SOP) Manual and Plant Quarantine Manual (supported by GhanaVeg and CABl respectively) and development of a Pest List (supported by GIZ).

- The new inspection room built by AVIANCE for PPRSD at the airport is 90 percent complete and Air Ghana Perishable Cargo (AGPC) is receiving a port cabin donated by USAID to be situated at their premises to be used by PPRSD, Customs and NACOB for inspections;
- The Export Development and Agricultural Investment Fund (EDAIF) has agreed and approved the financing of a permanent inspection facility for PPRSD at the airport.

These activities are a first response to the FVO 2015 audit and ban. The Task Force will continue to improve the phytosanitary system until compliance with EU phytosanitary regulations is reached.

4.5 Food safety

Pesticide residues

In general, there is little information available on pesticide residues as no effective national monitoring plan and food safety standards are in place. The little information that is available comes from data collected on a project by project basis or from tests done on exported products.

In 2015 no notifications were reported of Maximum Residue Limit (MRL) exceedance on vegetables exported from Ghana into the EU (RASFF portal).²⁰ The quarterly market survey carried out in Great Britain by the Expert Committee on Pesticide Residues in Food found in the first half of 2015 4 samples exceeding MRLs (in total 5 active ingredients) in curry leaves from Ghana and a too high MRL for chlorpyrifos on one sample of yard long beans. A 2013-2014 survey carried out by the GSA on fruit and vegetables collected in 5 regions indicated that on 23 percent of samples no residues were detected, 63 percent had pesticide residues but these were below the MRL and 14 percent had pesticide residues above the MRL.²¹

²⁰ <https://webgate.ec.europa.eu/rasff-window/portal/>

²¹ <http://www.newsghana.com.gh/pesticide-levels-in-food-are-safe-gsa/>



Attendees of a GhanaVeg-sponsored “round table” meeting on food safety.

4.6 Introduction of the Ghana Green Label

The Ghana Green Label (GGL)²² introduction is an initiative from MoFA and is supported by GIZ. The Ghana Standard Authority (GSA) contributed to the development of the standards. The objective of introducing GGL is to reduce food and safety risks and increase consumer confidence in Ghanaian fruits and vegetables, by ensuring producers undertake their activities in a safe and environmentally sustainable manner. The initiative focuses on the national market, but provides a stepping stone to graduate towards organic and GlobalG.A.P. certification. Farmers who are already organic and/or GlobalG.A.P.-certified can easily obtain the GGL certificate. If farmers do follow the standard it is also a stepping stone to controlling quarantine organisms in the field.

Currently MoFA is rolling out the GGL activities. A GGL Farmer Manual is being finalized and training programs are being implemented to train farmers on how to obtain the GGL certification. Currently the GGL certification is obtained by 4 farmer groups (consisting of farmers ranging in number from 15 to 50) and 3

larger farms. Furthermore, MoFA is looking into ways for marketing the GGL concept and to establish farmer market linkages. GhanaVeg is supporting MoFA to raise awareness and gain the interest of the private sector for the GGL through “round table” meetings/fora for the front-runner retail and hospitality industry players as well as for smaller corner shops and the open market.

It is being recognized by MoFA that a market pull is essential for successful introducing the GGL and is preferred over a market push strategy. The demand for qualitative and safe products should eventually come from the consumer as well as retailers, justifying the need for a safety certification. However, currently the consumer has no regular source of information available to verify if the food they buy and consume is safe and therefore cannot make informed decisions on their choice of food. When an increased demand arises for safe food, combined with a fair price for the product, the demand for certified products in domestic markets will increase, which in turn will lead to an increased supply of products on the domestic market by certified producers. GhanaVeg is involved in promoting the GGL to supermarkets chains, hotels and restaurants, who source vegetables locally.

²² <http://www.ghanagreenlabel.org/>

4.7 Conclusions

The continued limitations in the sanitary and phytosanitary compliance system for Ghanaian vegetables could hamper the growth of the sector in the years to come. This relates in the first place to the struggle of Ghana with the presence of harmful organisms banned by the EU in their export consignments. This has already had a major impact on the Ghanaian exporters that rely on exports of vegetables to the EU, as they depend on placing their produce on the European market for their revenues. Farms producing for export markets have been forced to put their products on the local market at lower prices and are even (temporarily) moving away from producing export crops as the demand for these locally is limited. If the ban continues to be imposed for too long, exporters may lose their market shares and acquired trade links risking the future development of Ghana's horticultural sector.

Therefore, the Ghanaian Government is advised to make every effort to address this problem as soon as possible and focus less on making plans and more on taken actions based on the recommendation points provided by Food and Veterinary Office based on the audits undertaken. On the other hand the private sector should work with the Government to address the current problems and do their best to meet all the necessary conditions and procedures and regain their market share.

Introduction of the GGL certification could potentially increase the trust of domestic consumers in the food safety of the vegetables, however in that case the demand for quality and safe produce should come from the consumer as well as retailers, justifying the need for safety. ■

5. Business Case – Export

The European market continues to demand Asian vegetables and in particular hot peppers produced according to international standards. A strong business case can be made on how Ghanaian entrepreneurs can benefit from this market development by starting a farm to provide a continuous supply of high quality export vegetables.

5.1 Background

EU ban slows down export growth

A handful of companies dominate the vegetable export sector in Ghana. These are medium-sized local enterprises that hold a track record in exporting Asian vegetables, also referred to as Asian vegetables, with small but frequent shipments of hot pepper, gourds, eggplants of 1-5 t once or more times per week. The

close geographic proximity of Ghana to the EU market and competitive air freight rates have contributed to the development of the sector.

Vegetable export to the EU was worth US \$15 million per year before 2008, but in 2014 it only reached US \$8.5 million (COMTRADE). The UK traditionally received the largest volume of vegetables (90 percent in 2014; with 2,800 t). The main products are Asian vegetables, hot peppers and various types of aubergine including eggplants. Competing countries that supply the UK market with Asian vegetables are India, Uganda and Kenya.

However, Ghanaian exporters are faced with the challenge of not owning sufficient production fields, and sourcing from smallholder farmers who lack knowledge on export regulations and are difficult to

control. As a result, exporters in Ghana faced various bans on trading hot peppers and bitter gourds to the EU. Some of these bans were temporarily imposed by the Food and Vegetable Office (FVO) of the European Commission (EC), and another was self-imposed by MoFA to give support to farmers so that the minimum requirements are met.

Unfortunately, in September 2015 the FVO introduced a ban on the export of hot peppers, eggplants and gourds from Ghana onto the EU market due to problems with harmful organisms and incomplete documentation with shipments from Ghana entering the EU.²³ The suspension is in force until 31 December 2016. Actors in the export sector remain confident to overcome these challenges and return to the path of growth as quickly as possible by improving agricultural practices and becoming compliant with the EU import norms.

Ghana's Asian vegetables mainly for UK low-end market segment

Consumers can purchase ethnic products in two main markets channels: low-end and high-end segments. For the low-end segment, consumers purchase their goods in ethnic-specialised fruit and vegetables shops. Shop owners buy the produce at wholesale markets. Throughout the years, Asian vegetables produced in Ghana have gained an important presence in the Western International Market, located near Heathrow Airport. This wholesale market has been the traditional trade hub for exporters for two main reasons:

- **Location:** Thanks to its location near Heathrow International Airport and short air distance to Accra, Western International is a preferred option for exporters.
- **Market segment:** Whereas supermarkets require size, quality and presentation, Western International's business model builds on exclusiveness, quality, variety, freshness and volume of the product and not on certification.

Box 1. GLOBALG.A.P.'s role in the high-end market

GLOBALG.A.P. is the private sector standard used by European retailers. Although attaining this standard is not a legal requirement nowadays, it is regarded as the minimum standard for exporters to be able to supply. In addition to GLOBALG.A.P., many supermarkets demand compliance to specific certification schemes. For example, in the UK, this includes Tesco's 'Nature's Choice' and Marks & Spencer's 'Field to Fork' standard. Nevertheless, if an exporter can achieve GLOBALG.A.P. certification, supermarket-specific standards are often within reach. A key facet of private sector standards is the ability to track the history of a product throughout the supply chain from the field to the consumer, and trace the product's origin from the retailer back to the field. This essentially requires a comprehensive system of record keeping and labeling.

As for the high-end segment, ethnic products can be found in conventional retail supermarkets. The major differences between segments is the product hygiene, packaging and presentation, higher quality standards, certification and to some extent premium pricing

- The low-end segment is governed by informal buying agreements in which voluntary certification is neither a requirement nor a demand from customers. Dozens of small- and medium-sized, specialised importers focus on this segment. They supply ethnic produce to wholesale traders and specialised fruit and vegetables shops. The main UK wholesale markets, with various traders dedicated to supplying the ethnic market, are located in Southall (Western International Market), Stratford (Spitalfield Market) and Birmingham (Birmingham Wholesale Market).
- The high-end segment demands high-quality and 'safe sourcing'. Supermarket customers

²³ http://brussels.cta.int/index.php?option=com_k2&view=item&id=10810:ghana-loses-out-with-eu-import-ban

expect transparent information about the sourcing and a high quality product. To meet their customers' expectations, supermarkets require that suppliers meet stringent global standards that include adoption and certification of social and environmental standards and/or GLOBALG.A.P. (see Box 1).

5.2 Opportunities

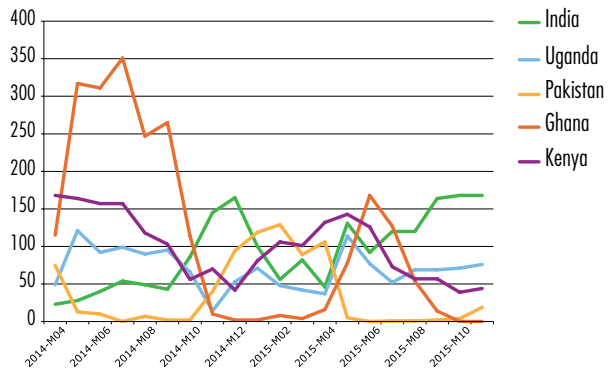
Strong market demand for Ghana's superior quality and taste

The UK market continues to look for Asian vegetables. Whether it is a shortage of fresh produce or problems with shipments at the port of departure/entry, importers are always in need of (new) suppliers who can provide volumes promptly. In 2014, the UK imported 17,000 t of chillies and hot peppers (excluding sweet peppers) of which 2,000 t were imported from Ghana.²⁴ Almost 85 percent of hot pepper exports from Ghana take place during Ghana's main rainy season. During Ghana's dry season, India, Kenya and Uganda surpass Ghana in export figures (Figure 6). This provides an opportunity to gain market share since the quality and taste of Ghanaian hot peppers are seen as superior by the interviewed importers. Also other European markets offer opportunities to meet the increasing demand for Asian vegetables. However, up to now, hot peppers from Ghana can only be found in the specialised fruit and vegetable shops and not in the main conventional supermarkets such as Tesco.

Supermarkets are responding to consumer demand for ethnic vegetables

Supermarket chains offer a wide range of ethnic vegetables at competitive prices. Their portfolio extends

Figure 6. Monthly hot pepper import to the UK from selected countries (tons)



not only to fresh, but also to processed forms. A few years ago, supermarkets considered hot chilli or hot chilli pepper as a niche market with little prospect for growth. Today, hot peppers are rapidly becoming popular throughout the UK, and not only in the low-end channels. This is exemplified by the fact that the hottest peppers, such as bird's eye, scotch bonnet and habaneros, are now sold at a rate of 45 million t per year in the UK.²⁵ Supermarkets handle almost 70 percent of these sales.

Ghanaian exporters are yet to tap into this market. Lack of compliance to GLOBALG.A.P. coupled with inconsistency in the quality and phytosanitary status seem to be the major bottlenecks for penetrating the market.

5.3 Challenges

Exports of vegetables from Ghana have declined over the past years. Challenges are national and persistent. However, despite the volatile performance of the sector in recent years, the market in the UK continues to offer great prospects for re-building a sound export sector in Ghana. To achieve the objective, stakeholders must realise, and give response to, three top challenges.

24 Eurostat Comext via www.trademap.org; product code 07096099

25 <http://www.dailymail.co.uk/femail/article-2211711/Bedfordshire-Super-Naga-Tesco-stocks-hottest-chilli-pepper-UK.html>

Lack of phytosanitary measures and good postharvest management practices

Lack of pest scouting, pest early warning systems and good post-harvest practices (sorting, grading, washing or packing) hamper the export of vegetables from Ghana. As a consequence, DEFRA at the UK border rejects shipments because of trips, whiteflies or false codling moth infestations. Better crop management in the growing areas can reduce the amount of pest incidence. In addition, farms can improve on the sorting, grading and packing to guarantee compliance with EU's market requirements regarding minimum quality and size. The attainment of GLOBALG.A.P. would serve as a point of entry to the high-end EU market.

Lack of good seeds

With regard to inputs, the everyday vegetable farmer normally uses farm-saved seeds while they have limited accessibility to improved hybrid seeds. The situation changes as far as outgrowers are concerned. Some of the exporters seem to provide certified hot pepper seeds to farmers regularly. This also applies to less-planted crops such as okra and bitter gourd.

Lack of facilities (cargo, cold chain)

Once the produce has been harvested early in the morning, sorted, graded and packed (if available), open, non-cooled trucks carry the fresh produce to the Kotoka International Airport in Accra. At this point, food losses are significant. Increasingly, exporters realise the potential value of vegetable cooling in reducing food losses and increasing product quality. With every degree of temperature reduced from the outside the storage life increases. A decrease in product temperature of 20°C to 15°C can extend the shelf life of products such as tomatoes, peppers or cabbages by 4 to 5 times (Barrett et al., 2014). Therefore any form of cooling is beneficial for the quality of the produce, especially in Ghana's warm and humid climate.

5.4 Starting a farm that fits market demand

Market-driven export schemes can be more profitable and have a greater chance of adapting to the reigning

business environment in Ghana and the EU than the current 'business as usual', supply-driven schemes. Adaptive, market-driven export schemes can better identify, and adapt to, market changes by reducing the risks involved or by tapping into new or existing market opportunities.

In this business case, we propose the establishment of a farm dedicated to Asian vegetable production for the export market. The receiving markets are both wholesale markets (low end) and the conventional supermarkets (high end) in the UK. To serve the conventional market segment obtaining GLOBALG.A.P. certification is essential. The plan draws on four core elements: year-round supply of vegetables, minimum quality decline after harvest (cold chain), plant protection, and GLOBALG.A.P. certification.

- Year-round supply of vegetables:** Ghanaian hot peppers are grown in rotation with okra and bitter gourd. The Asian vegetables are grown in a 20 ha farm. The size is believed to provide optimal results in volume and yet requires low to medium investment and management skills/coordination. The model can also be operationalised with outgrowers, although this increases the risk due to farmers' unreliable farm management skills.



Shade netting for herbs and lettuce production.

- **Plant protection:** Better crop management in the growing areas can reduce pest incidence. An IPM programme can solve pest problems while minimising risks to people and the environment.
- **Cold chain:** Right after harvest, fresh produce is cooled in dedicated cold stores.
- **GLOBALG.A.P. certification:** The business case assumes that the company works and is

certified according to GLOBALG.A.P. standards for fresh vegetable production. To start this up, investments need to be done to comply with the norms. In addition, annual independent auditing is required to renew the certificate.

Table 10. Yields per hectare of preferred crop varieties for the export market

Crop	Area (ha)	Yield (t/ha)	Production (t) per 20 ha	Preferred variety
Hot pepper	6.7	14	93	L18
Okra	6.7	9	60	–
Bitter gourd	6.7	13	87	–
Total	20	–	240	–

Box 2. Implementation plan specifics

Steps to establishing a successful export-oriented vegetable farm

1. Contact potential clients in the UK to establish or to strengthen relationships with buyers. Visit the CBI market intelligence website (www.cbi.eu) for information on the UK market.
2. Select and buy varieties of vegetables to grow that best suit the market needs. Table 10 provides an overview of suitable varieties for the export market. In addition, seed companies such as Rijk Zwaan, Enza or the like can provide up-to-date information on high quality seeds and their agronomic performance in Ghana.
3. Consult possible clients in the UK in the process, and select, if needed, suitable outgrowers for a partnership and agree on a required Quality Management System (QMS) to maintain a minimum quality and to comply with international standards.
4. Select a location, test the soil and acquire/ lease land and buildings.
5. Become GLOBALG.A.P. certified. For more information, visit the website www.globalgap.org to become familiar with the GLOBALG.A.P. fresh fruit and vegetable standard. When ready, arrange an independent audit.
6. Prepare an adequate planting calendar for year-round supply as soon as varieties and desirable characteristics are selected and purchased. Develop a capacity-building plan to support outgrowers in growing the desired volumes (right size, fertilisation or harvesting techniques), pest and disease management and GLOBALG.A.P. practices.
7. Acquire equipment for preparation and soil improvement, as well as irrigation systems.
8. Purchase equipment for post-harvest practices.
9. Purchase cooled truck(s) and a cold room to store the fresh vegetables.
10. Hire and train staff.
11. Plant and start production.
12. Start supplying the export market.

5.5 Business strategy and numbers

Sales volume projections

The vegetable farm projected, with a size of 20 ha, can produce 240 t of various Asian vegetables. It is estimated to produce 93 t of hot peppers, 60 t of okra and 87 t of bitter gourd per season. All is sold in 4.5-5.5 kg carton boxes. See Table 10 for more details of the estimated yields per crops and the preferred varieties for the export market.

This crop rotation ensures limited pest and disease incidence. These projected production figures are compiled from interviews with relevant actors in the Ghanaian vegetable sector. Box 2 offers further specifics about the implementation plan.

Table 11. *Investment and finance, in GHS*

Investments	Amount	%	
A) Main investments			
Soil improvement and plant material	50,000	7	
Civil works	25,000	4	
Plant protection products	150,000	22	
Irrigation scheme	40,000	6	
Equipment, crates, other	150,000	22	
Cooled trucks and cold room	140,000	21	
Certification	100,000	15	
B) Others			
Unforeseen	20,000	3	
Total investment	675,000	100	
Finance	Amount	%	
D) Equity			
Owner	100%	202,500	30
Other Partners	0%	0	0
Grants	0%	0	0
Total equity		202,500	30
E) Debt			
Existing loans	0	0%	
New loans	472,500	70	
Total finance	675,000	100	

Investment and finance

Table 11 details the investments foreseen for setting up a medium-sized vegetable farm (20 ha). The projected amounts are estimates based on interviews and available secondary data. Please note that the actual investment amounts may vary, depending on several factors; inflation, costs of borrowing or validation of companies' quotations. Amounts are given in New Ghana Cedi (GHS). GHS 1 equals US \$0.25.

The current investment plan envisions a farm prepared with equipment of lasting and enduring quality. The list of investments includes main investments and an investment line in case of unexpected or unforeseen events (Box 3).

A vegetable farm in Ghana is profitable

A detailed financial analysis shows that an entrepreneur can expect a profit before tax of more than GHS 500,000 annually. Table 12 shows the profit calculation for the farm as a whole. The farm gate price for each product has been retrieved from the interviews with various stakeholders in Ghana and the UK. Transport and shipping from Ghana to the EU is paid by the exporter and costs around US \$1.15 and 1.50 per kg depending on the airline and destination.

Note that prices, although on the high side, might not differ much from the prices provided by the wholesale market where GLOBAL.G.A.P. is not a requirement. However, by tapping into more competitive markets the investor has more and better prospects of finding reliable partners with clear and more favourable buying conditions. The gross margin calculated for the vegetable farm is 58 percent – the difference between the price obtained at farm gate and variable costs.

In brief, revenues generated from the export of the Asian vegetables in the international market would be GHS 1,394,700 annually. On the other hand, variable costs (seeds, fertilisers etc.) on 20 ha would amount to GHS 699,700 and fixed costs would set at GHS 195,250 per year. Fixed costs include the loan disbursement at an interest rate of 25 percent over the total debt, depreciation on total assets, fixed labour and land rental.

Box 3. Main investments explained

A. Main investments

Soil improvement and plant material, includes:

- *Testing the soil: measuring the soil quality and nutrient levels is important to set up good fertiliser programmes and to assist with identifying nutrient deficiency and/or toxicity.*
- *Second, soil adjustment can be required to bring the soil pH and organic matter levels to desired levels. One sample per ha plus fertilisers to correct. The investment foreseen is GHS 28,000.*
- *Good starting material is essential. For the production of hot peppers local L18 seed will cost GHS 240 per ha. Seed for okra will cost about GHS700. Bitter gourd seed is more difficult to come by and will cost about GHS2,400 per ha. The investment required is GHS22,000 for soil seeds.*

Civil works include all the small infrastructures that need to be built in the nucleus farm. This includes the building where the pack house, office, and sanitary will be installed. Total: GHS25,000.

Plant protection products for better crop management in the growing areas can reduce pest incidence. An integrated pest management strategy (IPM) offers a sustainable, long-term strategy to reduce the use of pesticides while also minimising the impact on the environment. We envision an IPM investment programme with a value of GHS 150,000 with the following elements:

- *Protective gear in order to comply with GLOBALG.A.P. requirements.*
- *Modern plant protection products*
- *2 knapsack sprayers*
- *Sticky traps*
- *1 small storage facility for plant protection products in order to comply with GLOBALG.A.P. requirements.*

Irrigation scheme investment covers the purchase and installation of drip irrigation storages, various pumps per ha, mainlines and laterals.

Diverse equipment (for pack house) investments focus on acquiring the equipment needed to pack vegetables. This includes a washing machine, packing and labelling machine(s), crates and packaging material. Total: GHS 150,000.

Refrigerated truck and cooled room, includes:

- *1 vehicle is required to collect and to transport fresh produce from out growers to the pack house and to the airport. The estimated price for a second-hand mini truck is GHS 80,000.*
- *To maintain freshness 1 cold room with a capacity for 15 t is required. The estimated investment is GHS 60,000.*

GLOBALG.A.P. certification: This voluntary certification is seen as the minimum requirement by European retailers. Basic investments need to take place to align the company with the norms. The GLOBALG.A.P. fruits and vegetable standard covers: food safety, traceability, quality assurance, workers' occupational health and safety, site management, soil management, fertiliser application management, IPM, plant protection products management and responsible water use. More information on exact norms can be found on www.globalgap.org. Total budget for obtaining this is estimated at GHS 100,000.

B. Others

The budget line included in case of any eventuality is GHS 20,000.

C. Equity

The business case assumes a finance model whereby 30 percent investment comes from own capital and 70 percent comes through a loan at 25 percent interest. Various institutes provide loans for investments like Export Trade, Agricultural Development Fund (EDAIF) or AgDevCo. Also, there is a grace period of 2 years after loan disbursement in 2015.

Table 12. *Economic indicators for a 20 ha mixed cropping farm (in GHS)*

Ref.	Indicator	Total
A	Total produced volume	240 t
	-Hot pepper	93 t
	-Okra	60 t
	-Bitter gourd	87 t
B	Final farm gate price per ton	
	-Hot pepper	4,100 GHS/t
	-Okra	5,000 GHS/t
	-Bitter gourd	8,200 GHS/t
C	Total revenue per year (A x B)	GHS 1,394,700
D	Total variable costs per year (seeds, fertiliser, labour, packaging, certification, transport)	GHS 699,573
E	Total fixed costs per year	GHS 195,250
F	Total costs per year (D+E)	GHS 515,350
G	Profit before tax per year (F-C)	GHS 500,000

Financial performance indicators

Key indicators provide important information on the overall performance. Table 13 gives the main indicators for the reader's reference.

Return on equity

The calculated return on Equity (ROE) is 78 percent. This is based on a 10-year period (2016-2025). This number indicates how much profit the entrepreneur will earn for each GHS invested. For the proposed investment plan, the investor will earn GHS 0.78 for each cedi invested over the 10-year period.

Payback period

The payback period is 2 years. This means that it will take 2 years for the investor to break even on the initial capital investment.

Internal rate of return

The internal rate of return (IRR), for a 10-year period is calculated at 111 percent. The IRR should be

Table 13. *Financial performance indicators*

Indicator	Value
Return on Equity for the 2016-2025 period, in percent (ROE)	78%
Payback period (PBP)	2 years
Internal Rate of Return (IRR) for a 10-year period	111%
Net Present Value (NPV) for a 10-year period	GHS 1,044,223

Box 4. Co-financed support from Wageningen University Research

To make the outlined plan feasible, interested companies can receive support from Wageningen UR to develop a plan that best suits their needs. This could include support in feasibility and financial analyses, matchmaking, crop production schedule or search for market opportunities. In addition, GhanaVeg offers 50 percent co-financing opportunities through its Business Opportunity Fund on Chain Integration. Promising business plans can be submitted four times a year.

higher than the cost of borrowing (25 percent). In this case, the IRR calculated represents a very healthy investment indicator.

Net present value

The net present value (NPV) gives an account of the projected earnings generated by the investment which exceed the anticipated costs. Investments should only be done in projects with a positive NPV. The NPV of this project is GHS 1,044,223 for a 10-year period.

Do you need more information?

A full-fledged financial assessment for the vegetable farm in Ghana can be requested from the GhanaVeg team based in Accra (Box 4). It was prepared by Wageningen University and Research centre, the Netherlands. ■

References

Agri-Impact Consult (2013). *Potential and regional domestic markets for Ghanaian horticultural produce*, EMQAP/AfDB.

Agri Livestock Consultants (2015). *Support to the Phytosanitary Inspection Service of the Plant Protection and Regulatory Services Directorate of the Ministry of Agriculture, Ghana*. Mission report. EDES-130318-Lot9/CC/ALC/004/GHA.Ref#2978

Barrett, D., L. Kitinjo, J. Chen and N. Nenguwo (2014). *Pilot Project Final Report*. USAID Horticulture Innovation Lab Online via http://postharvest.org/Final%20report%20Hort%20CRSP%20PTSC%20pilot%20project_5.23.14.pdf

Eurostat Comext and Comtrade via www.trademap.org

Food and Veterinary Office (2015). *Final report of an audit carried out in Ghana from 21 April 2015 to 30 April 2015 in order to evaluate the system of official controls for the export of plants and plant products to the European Union*. DG (SANTE) 2015-7635-MR. European Commission, Directorate-General for Health and Food Safety.

Gathani, S. and D. Stoelinga (2013). *Understanding Rwanda's Agribusiness and Manufacturing Sectors*.

The International Growth Centre.

Kingombe, C. (2014). *Africa's Rising Middle Class and Extreme Poverty Amid Plenty*.

Kitinjo, L. and J.F. Thompson (2010). *Pre-cooling systems for small-scale producers*. Stewart Postharvest Review. Online via <http://ucce.ucdavis.edu/files/datastore/234-1594.pdf>

Maden, E. van der, J. Glover-Tay and I. Koomen (2014). *Food Safety and Plant Health in Ghana - Analysis of the Sanitary and Phytosanitary Status of the Vegetable Sector*. Centre for Development Innovation, Wageningen UR (University & Research Centre). Report CDI 14-035. Wageningen.

Megglen, J. van (2015). *Fact finding mission report Ghana*. Dutch Food and Consumer Product Safety Authority, NVWA.

Ministry of Food and Agriculture (2013). *Agriculture in Ghana – Facts and Figures*, available at: http://mofa.gov.gh/site/?page_id=6032

Peppelenbos, L. (2008). *Trading up; building cooperation between farmers and traders in Africa*. KITT and IIR.

Robinson, E.J.Z. and Kolavalli, S.L. (2010). *The case of tomato in Ghana: Marketing*. Ghana Strategy Support Program working paper No. 20. Development and Strategy Governance Division International Food Policy Research Institute, Ghana.

Websites

- <http://www.asnapp.org.za/>
- <http://www.cbi.eu/>
- <http://www.e-krishaksahyogi.org/>
- <http://www.energy-africa.com/#/home-delivery/cfcz>
- <http://www.fao.org/>
- <http://faostat3.fao.org/>
- <http://www.feedthefuture.gov/>
- <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/Ghana-s-post-harvest-losses-hit-GH-700-000-annually-185268>
- <http://www.globalgap.org/>
- <http://harvestofhope.co.za/about-us/our-story/>
- http://horticulture.ucdavis.edu/main/36_postharvest_Zambia.html
- <http://www.kenpoly.com/>
- <http://www.storeitcold.com/>
- <http://www.vegimpact.com/>
- <http://www.wildorganics.co.za/>

Annex 1. About GhanaVeg

GhanaVeg's mission is to establish a sustainable and internationally competitive vegetable sector that contributes to inclusive economic growth and has the capacity to continuously innovate in terms of products and services.

GhanaVeg is driven by a strong belief in healthy and quality vegetables from Ghana through new ways of doing business. The initiative targets the high-end domestic and international markets (high-end supermarkets, hotels, restaurants and exports) as well as value chain actors in the open markets and consumers.

Our objectives include improving productivity in the vegetable sector; facilitating more efficient markets, including: linking vegetable producers and other value chain operators with the Dutch private sector; improving the business climate and further professionalizing the value chain for vegetable production and consumption in Africa.

To this effect, GhanaVeg supports strong business-led initiatives through: a Vegetable Business Platform; Trade Missions, Business Opportunities Fund and an R&D Innovation Fund. In addition, training in agronomy modules are being conducted to address the very basics required for sustainable vegetable production resulting in minimal losses, pest and disease incidence. The public sector (Ministries, Departments and Agencies), knowledge and research institutions are engaged through our high-level public-private dialogue which has seen the establishment of the Round Table Forum on Domestic Food Safety and the Exports Taskforce.

Business Platform

The Business Platform consists of all the key service providers, producers, processors, traders and wholesale/retailers in the vegetable sector and representatives from public institutions such as MoFA and GEPA. Together the companies advise on the Agenda of the GhanaVeg program in terms of themes for the Calls for Proposals of the Business Opportunities Fund and R&D Co-Innovation Fund, as well as for issues that need further investigation through the Consultancy Fund. The Business Platform meeting is held every quarter within the year, usually with prior notification and invitation sent out to key stakeholders within Ghana's vegetable sector.

Local and International Trade Missions

These trade missions and fairs are aimed at facilitating market access and developing partnerships through networking, seminars and matchmaking sessions. All these contribute to our goal of doing business in a new way that results in healthy and quality vegetables from Ghana.

Funds

The GhanaVeg Initiative supports businesses financially through the Business Opportunities Fund and the R&D Innovation Fund. These funds are announced through



Bitter melon arriving at the UK market.

a Call for Proposals on a quarterly basis. Applications for the Calls are published at <http://ghanaveg.org/grants/>. Both funds require co-financing from the applicant (private sector) whilst the rest is provided as a grant by the GhanaVeg Program. In addition Wageningen University and Research Centre provides additional technical assistance with training modules and applied research.

Business Opportunities Fund

The Business Opportunities Fund is a 50 percent matching fund aimed at mobilizing innovations and investments in the vegetable sector. The fund can be used for different thematic areas that currently hamper the growth in the vegetable sector ranging from seed supply to certification, and from greenhouse technology to setting up out grower schemes. Grantees are expected to share their accomplishments during the Business Platform meetings to trigger further uptake and upscaling of their investments.

R&D Co-Innovation Fund

The R&D Co-Innovation Support Fund is a 67 percent–33 percent matching fund arrangement where the private sector teams up with a research or knowledge partner to provide 33 percent co-funding while GhanaVeg supports them with 67 percent to provide applied research for companies and businesses to address specific agronomic or technical bottlenecks in the vegetable sector. The private sector, again, is the lead in the partnership, with research or knowledge institutes as service providers to collaborate in the implementation of the proposal. Results from the implementation are shared during the Business Platform meetings.

- For more information you can visit our website at www.ghanaveg.org
- If you want to subscribe to our newsletter please send an email to info@ghanaveg.org



Export chillies in locally made carton boxes.

Annex 2. GhanaVeg Projects

3As Agri-Solutions

The goal of this project is to 'Enhance the Production and Marketing of Vegetables among Selected Farmers on Torgorme Irrigation Project (TIP) through Improved Production methods, Quality Assurance and Reduction in Post-harvest Losses'. The specific objectives of the project are to:

- Increase the knowledge and skills of farmers involved with the project in vegetable production
- Increase the volume of vegetables produced and marketed by the farmers.
- Contribute to volume of vegetables produced and marketed in the country.
- Improve the quality of vegetables produced by participating farmers.
- Train and certify selected farmers under the GGL scheme.
- Establish vegetable value chain for selected actors to sustain production and marketing of vegetables on Torgorme irrigation project.

The activities to be embarked on with the support of this project and the expected deliverables against which the output of the project is to be measured are outlined below:

Mobilization of actors and integration into a vegetable value chain

This will involve identifying and linking up the various actors that have roles to play in forming a formidable vegetable value chain. Among them will be the input suppliers, on-farm producers of the various kinds of vegetables of interest, marketers (off-takers, wholesalers, Supermarkets, exporters and retailers); and other indirect actors such as research institutions, transporters, NGOs interested in developing the vegetable value chain, financial service providers, training services providers, MoFA, and the Ghana Irrigation

Development Authority (GIDA). The project will begin with the nucleus production from the fields of 3AS Agri Solutions Limited. An out-grower arrangement has been concluded with three farmer-based organizations (FBO), with an average membership of 33 farmers (about 100 in all) whose produce will be fed into the marketing channels identified by 3As. This number may increase in the course of the project depending on the changing circumstances. 3As Agri-Solutions Limited will be directly in charge of establishing this value chain. Deliverables from this activity will include the list of all actors that form the chain and the Memorandum of Understanding (MoU) signed between them to outline the roles each actor is to play to sustain the growth and sustainability of the value chain.

Training and coaching programmes

Regular problem-solving meetings shall be organised to include farmer field days, and demonstrations with the farmers 3 times over the life of the project (once every six months). Farmer training in both technical and business aspects will form an important part of this project. These trainings will first of all explain the rationale of the whole project concept to the farmer organisations to make sure they fully understand how the whole system will operate. In addition to these the farmers' fields will be visited regularly to ensure that the technical trainings are hands-on. Business trainings will also form part of the training to improve the business knowledge, skills and attitudes of the farmers. Areas to be covered in the trainings will include; association development, vegetable productivity development, post-harvest handling and marketing as well as market standards and certification. The trainings will ultimately be geared towards certifying the farmer organizations with bodies such as the GGL for the local markets. Existing training materials from various reputable training institutions and organisations will be evaluated and approved by GhanaVeg as well as the trainers before they will be allowed to be used. Deliverables

to be generated from these activities will include; training manuals and hand-outs made available to the trainees, lists of participants and total number of people trained (segregated to their gender), training timetable/ programmes, training reports and list of trained members certified to produce for the market under GGL.

Input supply arrangements

3As nucleus farms will solely be responsible for procuring seeds and will set up a central nursery for the production of seedlings to be distributed to farmers working with the project. This is to ensure that farmers are supplied with seeds and seedlings from certified sources that are known to meet the requirements of the markets that the produce will be serving. Arrangements will be made with reputable seed companies such as Tikola, Agriseed, and Dizengoff Ghana Limited for the supply of desirable seeds. The central nursery to be established will be a modern nursery that will make use of facilities such as shade nets, nursery trays with high level of technology that will ensure a healthy atmosphere for the production of good seedlings. The cost of supplying the seedlings to farmers will form part of the cost of input supply to be deducted from their revenue during the time of sales of the produce. It is believed that quality and safety of vegetables to be produced from our fields will largely be determined by the hygiene and biosafety measures applied from the nursery. There will be an area of about 50m by 30m demarcated on the field solely for nursery. This area will be fenced by steel pillars and barbed wire and covered with shade net to prevent the entry of insects that are vectors of plant diseases. Seeds will be acquired from creditable seeds sources and nursed in seed trays that will be filled with prepared mediums of organic materials sold at the input stores. Water for watering will come from the Kpong dam located on the Volta River which is also the source of the irrigated water. The quality of water in the dam is regularly checked to ensure that they conform to acceptable standards. Access to the nursery will be limited to the nursery attendant and the supervisors who will be disinfected before getting access to the nursery. Protocols for the raising of the various seeds will be established

and followed in line with good nursery standards developed by Ghana Standard Authority (GSA). Delivery of seedlings to the farmers and the farms will be done by the project team also under controlled conditions. The team will make sure farmers' fields are ready and the seedlings supplied are transplanted the same day. In addition to this, the project will take advantage of the collaboration with other institutions including the Wageningen University for technical support for plant health, hygiene and biosafety issues.

The supply of other inputs such as fertilizers, pesticides, growth regulating hormones among others that will be needed by the project will be contracted to WAAF Agro Limited, one of the leading agri input distributors in the country, with a wholesale and distribution centre based in Tema. WAAF Agro will also be part of the value chain team to be established. Special arrangements will be made between the farmers and suppliers so that they are not burdened with full payment for inputs till their produce are harvested and marketed. Deliverables from this activity will include the list of farmers that benefits from the inputs showing their signature, supply contract signed with the supplier, and evidence of payment made to the supplier.

Field production

3As farms on its own will be involved in the production of the vegetables already mentioned above. The main target market is the local market where about 85 percent of the marketable vegetables will be sold with the rest 15 percent produce earmarked for the export market. The nucleus farmer-outgrower production model will be adopted for this project with the company producing as the nucleus farmer while the farmer organisations working with them will produce as the out growers.

Proceeds from the production will be ploughed back to expand production continuously. Production will be planned with the needed rotations such that it will be continuous both on the nucleus farm and from the fields of the out-growers. Production of vegetables from out-grower farms will start on small plots and will be maximized within a year as farmers get more experienced in handling such crops. Most of the new

technologies to be introduced will start from the fields of the nucleus farm.

Off-taker arrangements

E. Darkey and Associates Ltd will be the off-taker for the export produce while Whytebage Company Ltd, Eden Tree Ltd, and Agri-Impact Consult will be the channels through which produce going into the local market will be distributed. They will give pre-arranged time tables for their periodic requirements, and the produce will be harvested, packed and delivered to them. On the days of harvest, trucks will be dispatched to the fields for the collection of the produce after which sorting, grading, weighing and packing will be done in 3As packing shed. Production patterns will be staggered to ensure supply throughout the year. Any changes from this arrangement will be communicated to the producers as early as possible. Mr. Rowland Aggor who has an extensive experience as a fresh produce marketing expert in vegetables will lead this activity.

Price setting and payment arrangements

Prices for produce will be set based on weights and grades and to a lesser extent, the seasons may also be considered. The various grades will be set for each vegetable to be produced and farmers will be trained to know and be able to grade their own produce. Prices based on the various grades will be determined periodically with farmers' representatives that will be engaged in such price negotiations. With this, the market price of the commodities offered by the end market and all other marketing costs will be made known to the farmers' representatives. Based on this an agreed percentage of the prevailing price will be indexed. The rest of the income due the farmer will be paid through their accounts with the member financial institution of the value chain. There will be passbooks into which various activities and information from the farmer will be documented.

Post-harvest handling activities

3As will build a central vegetable packing shed where all vegetables produced from the fields will be assembled, sorted, cleaned, pre-packed and pre-cooled both for the domestic market and for export. It is also in our

long-term plans to install simple processing plants to produce consumer-packs for end users. In addition to the post-harvest handling activities on the field, the company will arrange through leasing the acquisition of suitable refrigerated trucks for transporting vegetables to our clients. This activity will be led by Mr. Rowland Aggor, who will link with the off-takers. Although processing is to be considered seriously in the future activities of the company, the current phase of processing of vegetables will be limited to such primary activities such as washing, cutting and packaging.

Demonstrations, technology transfer and field days

In order to evaluate new products and technologies to be introduced into the project, demonstration plots and other extension methods of transferring these technologies to farmers will form part of project activities. Mr. Emmanuel Annan the team member who is an expert in this field will be in charge of this activity. Deliverables to be generated from this activity will include the list of products and technologies demonstrated under the project and introduced to participants, list of participants at the various demonstrations, photographs taken from the various demonstrations and technology transfers, etc.

Monitoring and Evaluation

To make sure that project activities move according to plan, there will be a periodic monitoring and evaluation of ongoing activities under the leadership of the management team of 3As to ensure all activities are carried out as planned.

ACSL

1. By end of the project, release of 3 OPV tomato varieties with yields of 10-15mt/ha, 10-14 days shelf life, firm, hard, brix of 4.5-6 percent, intermediate tolerance of fungal diseases and suitability for fresh market and processing industry.
2. Release of 2 OPV chilli pepper varieties, 2 OPV garden egg varieties and 2 OPV okra varieties.

All the above varieties should be adapted to the Transitional and Forest Agro-Ecological zones of Ghana.

The project is targeted to start from January 5, 2015 and end in December 31, 2017.

Two on-farm sites for test production to confirm the characteristics and performance data of the on-station performance of varieties of tomato, garden-eggs, chilli pepper and okra developed by breeders at CSIR-CRI (Messrs Offei Bonsu and Michael Osei) and of UG-F&HCRC-Kade (Prof. George Nkansah). The project will involve the following activities:

- On-farm test production of 1 acre/trial of the varieties in the 2 different locations namely Wenchi (Transitional Zone), Akomadan (Forest Zone) will be done.
- Two cycles (rain-fed and irrigation) will be done in year 1 at all locations. During the period the collaborating farmers will be trained in good agronomic practices for vegetable production.
- Analysis (e.g. shelf life, acidity, brix levels, colour, hardness, organoleptic etc.) of the harvests will be done for evaluation by processors, (ALL, TEPCO, OLAM etc.) pack-houses, hotels, restaurants, consumers, and traders. The analysis will be done at the laboratories of CRI in Kumasi and the AOAC methods of analysis will be used.
- The application to the Varietal Release Committee will also be done in Year 1.
- In year 2 the same processes will be repeated for the evaluation of the Varietal Release Committee members in accordance with their procedures.
- In year 2, final presentations and documentation on the on-farm tests will be submitted for the final approval of the Varietal Release Committee of MoFA.

CSIR-CRI and UG-F&HCRC will design and provide all the production protocols of their varieties the activities listed above. They will also provide on-farm practical training of staff of ACSL and farmers on specific areas of production (e.g. seed selection, nursery management, land preparation, crop nutrition and water management, pest and disease management, harvesting) and post-harvest management.

Prior to the release the staff of ACSL will be trained on the specifics of vegetable seed production.

Daily implementation management will be done by the collaborating farmers and supervision will be done by CSIR-CRI and ACSL designated Monitoring and Evaluation staff.

All agricultural inputs will be purchased and stored per each year's requirement.

Bakker Brothers

Objectives

The overall goal of Bakker Brothers and its Ghanaian partners is to contribute to healthy and quality vegetable production in Ghana, taking into account sustainable environmental and food safety standards by supplying hybrid varieties of tomato, capsicum, onion (sweet and hot) and eggplant that have the most optimal combination of yield potential, pest and disease resistance and market qualities.

Activities and expected deliverables

To achieve the purpose as formulated above Bakker Brothers and its partner Whytebage International will implement the following main activities:

1. Development of an on-farm participatory variety selection plan for tomato, capsicum, onion and aubergine. Deliverables:
 - Detailed varietal selection schedule based on a randomized complete block design List of varieties of the four crops to be included in the varietal selection.
 - Guidelines for Whytebage farm manager, farm workers and 15 contract farmers.

The breeding and variety selection specialists of Bakker Brothers will develop a varietal selection plan that can be implemented at the farm of Whytebage International. In total around 0.5 ha will be planted. The trial design will be based on a randomized complete block design with three replications. The number of different hybrids

that will be compared against an OP variety currently cultivated by Ghanaian growers will be as follows:

- Tomato: 10 different hybrids (determinate for open field cultivation)
- Capsicum: 10 sweet peppers and 10 hot chillies hybrid varieties
- Onion: 10 different hybrids
- Aubergine: 10 different hybrids.

In addition demonstration plots will be established at 25 farmers of the Whytebage International outgrower scheme. At each of these smallholder farms 10 different hybrids of one of the vegetable crops will be planted next to a commonly used OP variety for comparison. The new hybrid varieties will be tested for yield and resistance (or tolerance). The resistance/tolerance levels will be tested for the following in particular:

- Tomato: bacterial wilt and Tomato Yellow Leaf Curl Virus (TYLCV)
- Pepper: Potato virus Y (PVY)
- Onion: downy mildew and bolting (day length sensitivity)
- Aubergine: Fusarium wilt

For the management of the variety demonstration plots at Whytebage and farmers' fields Bakker Brothers will develop cultivation guidelines together with the farm management and workers at the Whytebage farm. These guidelines will be in line with GLOBALG.A.P. to ensure compliance with the standards in the high-end domestic and export-markets. In addition a practical training will be given and guidelines will be developed for selected farm workers (crop scouts) on pests and disease recognition and scoring. Photographs and short descriptions of the main symptoms will be produced in advance of the trials.

2. Assessment of the different hybrid varieties against the common OP varieties in terms of yield and pest/disease resistance. Deliverables:
 - Statistical analysis of (a) yields of different crops and (b) pest/disease incidence of the different varieties for the four crops The plots will be planted in accordance with the randomised complete block design developed by Bakker Brothers. The work will be supervised by an

agronomic expert of Bakker who will visit Ghana a few times to oversee the cultivation and data collection activities. The cultivation practices (in line with the agreed GAP) of the different plots with tomato, onion, pepper and aubergine varieties will be the responsibility of the Whytebage farm manager and his workers. The trained farm workers (crop scouts) will regularly inspect the crops and will record any disease incidence. They will be asked also to take photographs of disease outbreaks and share these with the crop specialists at Bakker Brothers for verification.

During harvest time the produce will be weighed per variety before it is put in crates for marketing. In addition the harvesting dates will be recorded (to enable also to provide accurate data on crop duration under Ghanaian conditions). For tomato, pepper and aubergine this will imply that the weighing and data recording will have to take place during each picking. The harvest of each onion variety per plot can be weighed and recorded once (onion being a more uniform ripening product). One of the experts of Bakker Brothers will visit Ghana to assist and oversee during the beginning of the harvesting and data recording period. The recorded data on disease incidences and yields will be compiled by Bakker Brothers and averages will be calculated from the three plots (replications). In addition it will be statistically assessed whether the differences in yield and disease resistance between the different hybrids are significantly different (90 percent reliability or higher).

3. Evaluation by growers and vegetable buyers of the different hybrids in terms of product quality and agronomic aspects. Deliverables include:
 - Average scores of different hybrid varieties by vegetable traders/wholesalers
 - Average scores of different hybrid varieties by growers of the Whytebage outgrower schemes.

At the beginning of the harvest time of the different crops Bakker Brothers and Whytebage will organise an open day for supermarket buyers and a selected number of the contract growers in Whytebage's network. During the open day the buyers and growers will be given an opportunity to observe the

crops in the field. Furthermore the supply chain partners will be given an opportunity to taste the different products. Information and data will be made available on the cultivation practices followed, the crop duration, production costs and storing capacities of the different varieties demonstrated.

Each visitor will be given a score card (different score cards for growers and buyers) to select their most favourite crop on the basis of product quality, cultivation information and their observation on crop health. The score cards will be collected for further analyses and the most popular hybrid varieties will be listed.

At the 25 smallholder plots similar open days will be organised for neighbouring farmers. Here also the GLOBALG.A.P. approved cultivation practices will be explained; the pesticide reduction and yield impact of the different hybrids will be given special attention. Farmers present will be asked to score their favourite hybrid varieties and their scores will be analysed alongside the other data collected.

4. Joint production planning by supply chain partners of disease resistant hybrid varieties. Deliverables:
 - Report on the outcome of hybrid production and participatory selection of hybrid varieties.
 - Leaflets with GLOBALG.A.P. cultivation guidelines and key characteristics of selected hybrid varieties.
 - Outgrower scheme production plan for hybrid vegetable production for high-end markets.

The final data compilation on the farmer-managed trials and the scores by the traders and growers will be done by Bakker Brothers in the form of a variety report. For each of the four crops one or two hybrid varieties will be selected for commercial production by outgrowers in the Whytebage International production and supply programme. For these hybrid varieties crop leaflets will be produced with GLOBALG.A.P. guidelines for open field cultivation under semi-commercial and commercial farming conditions in Ghana.

A vegetable production plan will be drawn up by Whytebage International based on its market partners' demands and preference. The selected hybrid varieties will be introduced to the contracted smallholders for

commercial production on the basis of this production plan. Hybrid seeds and other essential inputs will be part of the integrated contract farming operation involving Bakker Brothers and its local agent, Whytebage International and its domestic and international buyers of fresh produce.

Dizengoff

Seed/variety trials

Farmers' seeds will be cropped alongside improved seeds (F1 hybrids). They will be subjected to the same regimes of nutrition and protection. Yields will be evaluated at the end of the cycle. Post-harvest quality of fruits and marketability will also be assessed. It is estimated that improved seeds will yield more than 200 percent in comparison to the farmers' varieties.

Gravity-fed Family Drip System trials (irrigated vs. rain-fed fields)

The gravity-fed Family Drip System (FDS) can irrigate a crop throughout its entire cycle over a land area of up to 10,000 m². This irrigated production system will be compared to purely rain-fed production system for vegetables. The vegetables cultivated under the two water systems will be given the same crop management practices. Yields will be evaluated at the end of the cycle. Postharvest quality of fruits and marketability will also be assessed. It is expected that the irrigated fields will produce over 300 percent more yields, than the rain-fed vegetables.

Open field vs. protected environment

Tomato, pepper, okra will be grown in open field and in greenhouse (protected environment). Open field plants will be treated as typical farmers' fields whilst greenhouse plants will be handled with the regime that the greenhouse technology requires. Yields will be evaluated at the end of the cycle. Post-harvest quality of fruits and marketability will also be assessed. Greenhouse vegetables are expected to produce over 300 percent more than vegetables produced in the open field.

Dissemination of findings through training of Farmers and agro-processors:

1. Training sessions will be organized for farmers to disseminate the findings from the studies and provide them with hands-on skills acquisition of the proven technologies. Dizengoff will train at least 1,000 farmers and agro-processors over the project period.
2. Production, postharvest handling and processing manuals will be developed for each of the vegetables. These will be distributed to the farmers free of charge during the training sessions.

Eden Tree

Project activities include, but are not limited to, providing extension services to 55 core ETL out-growers and their outlets in the Accra metropolis. This will involve farmer mobilization and training on Eden Tree's demonstration farm located in Nsawam, Greater Accra Region. The training will focus on agronomic practices, crop handling and post-harvest management. ETL will also seek to establish contractual agreements with the out-growers, ensuring them in formal terms a guaranteed market for their produce. This will be presented and arranged as an optional approach since some farmers already have contractual agreements with other companies. This will also limit monopoly in the system. Farmers will have the liberty to sell in the open market if they so wish.

Capital investment

ETL is in the process of procuring one brand new tractor (John Deere) and one power tiller from Agriculture Engineering Service Directorate to be used for land development for key out-growers. Over the years, the company has received complaints from its out-growers about problems related to ploughing during the farming season. As a result of the lack of machinery, most of the farmers delay in cultivating their fields and are thereby not able to produce to meet the high demand periods in order to reap the benefits associated with this season.

The company will provide agricultural inputs to all its selected out-growers and also provide irrigation pumps and accessories to its out-growers. The company will procure refrigerated vans that will be used to cart farm produce at the farm gate to the processing center. This is to reduce post-harvest losses associated with the handling of this perishable produce. Three refrigerated vans are critical to assist the company and the farmers.

Project organization and justification for grant funding

The Company will use its expertise and engage external expertise to provide agricultural equipment, provide extension services and storage facilities. Typically, agreements or contracts will be signed between the service provider and cooperatives; it is expected that the cooperative will then put specific agreements in place with members (individual smallholder farmers) who will be involved in producing raw materials for the company to be stored in the storage facility.

Eden Tree will implement a new multi-faceted program which is aimed at benefiting the out-growers and the company at large. This will involve:

- Expansion of supplier contracts to increase out-grower/Eden Tree alignment: position Eden Tree to out-growers as source of increased profitability.
- Deliver technical assistance to increase yields and lower production costs.
- Support farmers to obtain better quality inputs (seeds, fertilizers, and pesticides at good prices).
- Support its out-growers and other suppliers to the company to produce vegetables under labels that represent GAP (GLOBALG.A.P., GGL, etc.)

Green OK

Green OK's goal is to increase smallholder farmers' income by strengthening the capacity of tomato and pepper farmers to participate in the vegetable value chain in Ghana. Specific project objectives are:

- To independently and scientifically compare a number of different soil amendment treatments

including the Green OK organic fertilizer on tomatoes and pepper production

- To create awareness in the use of Green OK for vegetable production
- To enhance access to Green OK to vegetable farmers in Ghana
- To conduct trials of Green OK products on tomatoes and pepper

With the support from CSIR's Plant Genetic Resources Research Institute (PGRI), GREENOK will employ Randomized Control Block Design (RCBD) experimental design as the main research methodology with the following treatments:

- No treatment (control)
- Soil amended with compost type 1
- Soil amended with compost type 2
- Soil amended with Green OK humic substances
- Soil amended with available inorganic fertilizer (e.g. DAP+Urea)
- Soil amended with slow release fertilizer (NPK)
- Soil amended with compost type 1 + inorganic fertilizer
- Soil amended with compost type 2 + inorganic fertilizer,
- Soil amended with Green OK humic substances + inorganic fertilizer

We shall employ similar agricultural practices at trial locations. Soil samples will be taken prior to the trial so as to confirm the nutrients levels and on the basis of the test, we will fine-tune the application of the fertilizers (quantities).

Create awareness in the use of Green OK for vegetable production

Based on the outcome of the trial, Green OK will then undertake promotional activities such the establishment of demonstration farm to educate vegetable farmers on the use of the products. To this end, the following activities will be undertaken:

- Development of promotional materials
- Establishment of demonstration plots
- Develop simple-easy to follow protocols for different vegetables

- Organizing field days

Enhance access to Green OK by vegetable farmers in Ghana

- Training of input distributors and retailers
- Linking FBOs to agro-input dealers
- Embark on membership drive

Deliverables

- One publication in an international journal
- 500 copies promotional videos developed and distributed to 500 farmers
- 5 demo farms established
- Simple protocols for Green OK products developed and distributed to 1,200 farmers
- 20 field days attended by 5,000 farmers
- 15 distributors and their network of retailers trained
- 20 FBOs linked to distributors/retailers
- Report on achievements of the project

Joekopan

The primary objective of this project is for Joekopan to attain increased productivity and sales through building capacity of supply chain. Currently Joekopan exports 1,500 t of vegetables per annum, made up mainly of long chillies and Asian vegetables, to ethnic retail customers in the UK and Germany. It is anticipated that on completion of this project the total tonnage of vegetable exported per annum will increase by 80 percent to 2,700 t. Furthermore Joekopan will add two new high-value crops to its list of products currently exported. The following specific activities are planned:

Develop and formalize contractual relationships with FBOs

A key challenge that the industry has faced to date is building long term sustainable relationships between producers and exporters built on trust and loyalty.

Joekopan intends to provide full support and guidance initially for two FBO groups (consisting of about 50 farmers per group) in the surrounding area. The farm sizes of the farmers in the FBO groups range from

between 1 to 5 acres and the project would ensure that the right quality and quantity of specific Asian vegetables stated above are produced for Joekopan for export. It is our belief that our proposed model to build capacity of the enterprise's supply chain will go a significant way to address this issue. However as a form of reinforcement, Joekopan will enter into formal relationships with its FBO groups clearly stating the obligations of all parties under the arrangement. A key deliverable from this activity will be the presence of a signed contract between the FBOs and Joekopan by the end of January 2015 and evidence of actual farming collaboration on the field of the initial 25 acres of out-grower lands by first quarter 2015.

Based on current customer demand, Joekopan will use its nucleus farm to cultivate two high-value vegetables i.e. bullet chillies and scotch bonnets which will be new additions to its product lines. Out growers will cultivate long chillies, birds' eye chillies, tinda, turia, long marrow and ravaya under the arrangement. Joekopan will eventually have FBOs covering between 100 and 120 acres of land cultivating the above mentioned products. Table 14 shows the estimated yield and acreage per product.

Table 14. *Estimated yield and acreage per product*

Product	Acreage	Estimated Monthly Yield (kg)
Turia	20 – 25	3500
Tinda	10 – 15	1300
Ravaya	10 – 15	870
Long Marrow	10 – 15	1300
Chillies	50	35000

The cultivation of the entire 100 to 120 acres will be staggered over a reasonable period to ensure that the project is manageable and therefore more likely to succeed. The initial phase of the project will involve cultivating the initial 25 acres which will be gradually increased to the target of 100 to 120 acres by mid-2016 by which time the operational objectives of the project would have been realized. The plan will be to bring on

board a new set of FBOs approximately every 4 months of the duration of the project.

After the provision of full support to FBOs, Joekopan intends to purchase produce from FBOs at a price that will be 90 percent of the market price at all times. This will not only help Joekopan recuperate its share of the initial investment but will also be an incentive for the farmers to be a part of this project. Service level agreements between Joekopan and all its farmer groups will be created as part of the contracting process starting from first quarter 2015.

Capacity building

The success of this project in terms of building capacity is very dependent on the implementation of GAP both for the nucleus and the FBO farms. This project will take a proactive approach to ensure that the required technical skills are available and that good strategies are in place to deal with key risks such as pests.

Joekopan will collaborate with the University of Ghana (School of Agriculture) to provide farmers with the needed technical knowledge for the cultivation of the various crops. The training program will be practical and cover key topics such good agronomical practices, integrated pest and disease management, managing post-harvest losses, and effective record keeping. As part of the program, the University will develop demonstration fields as well as training material tailored specifically to the needs of the farmers. A robust pest control strategy will be put in place to mitigate the risk of infestation. As part of the planting process, plants will be drained with systemic pesticides due to high population levels of termites and crickets in the soil. The subsequent use of pesticides will be based on an IPM strategy after scouting. Pheromone traps will be set to monitor population thresholds of dangerous quarantine pest. GAP will be observed throughout the growing period. Food safety concerns will be addressed with a strict observation of pre harvest intervals associated with pesticide usage.

Additionally, Joekopan will provide support for all preliminary activities such as soil testing, ploughing, fertilization and other activities required for the preparation of the soil for planting. The company will provide

high quality seeds for the planting of Tinda, Turia, Long Marrow, Ravaya and Chillies, and also provide pumping machines and associated resources to ensure the availability of water all year round.

Increasing quality of production

Joekopan will organize and arrange for option 2 GLOBALG.A.P. certification for the farmer groups. Invariably, farmer participation in the GLOBAL-G.A.P. certification process leads to enhanced knowledge and appreciation of GAP. The deliverable from this activity will be GLOBALG.A.P. certification for farmer groups working exclusively for Joekopan at the end of this program. Joekopan intends to begin the GLOBALG.A.P. certification process for the nucleus by the first quarter of 2015 when the first phase of out growers will be adopted.

As well, all Joekopan FBOs engaged as at the first quarter 2015 would have been enrolled on the Joekopan-FBO training program with the aim of increasing the technical knowledge in crop production.

Investing in capital equipment

The proposed project requires activities such as ploughing and harrowing huge tracks of farm land. Joekopan considers owning its own tractor for this purpose financially justifiable and a clear cost saving exercise. Also taking direct ownership of ploughing etc. in that way will further cement the much needed supervisory authority for this project. Joekopan will by end of the first quarter of 2015, purchase a tractor to provide ploughing and harrowing services to both the nucleus and the out-grower farms. The company will purchase and install a fully functioning irrigation system for its own farm as well as the first 25 acres for outgrowers within the same timeframe.

Also important to the project is the need to harvest and package produce right on the farm premises prior to export, in order to shorten the supply chain and reduce losses and costs. Joekopan will build a packhouse that is GLOBALG.A.P. compliant by first quarter of 2016 by which time all FBOs would be fully assimilated into Joekopan's operations.

Marketing of produce in Europe

Joekopan Enterprise currently under-supplies to customers in the UK and Germany and therefore can with relative ease increase sales both to current customers and potential new customers that have approached the enterprise in the past but haven't been engaged due to lack of capacity.

In addition to the above Joekopan Enterprise will actively market itself especially after gaining GLOBALG.A.P. Certification. Tools such as a good website, effective networking and direct marketing through the participation in fruit and vegetable fairs such a Fruit Logistica will all help to maintain and further build on current demand. A key deliverable will be the creation of marketing material (containing farmer group case studies) and finding a suitable platform to exhibit and create the desired opportunities.

Increasing youth employment in the community

It is envisaged that succeeding with this project will create employment opportunities for the youth in the Togorme area. Joekopan will immediately employ up to four permanent workers to oversee activities on the nucleus farm, as well as one tractor operator. A conservative estimate is that when the capacity is finally built and output is increased, there will be the need to employ up to 15 more permanent employees to help with packaging. There will also be opportunities created for casual employment for activities such as planting, harvesting etc. Joekopan will be expected to have a minimum of 90 percent of all new permanent and casual employments being made up of locals.

Lubok Farms

Lubok Farms Ltd. has a vision of having its brand of vegetables on the shelves of high-end retail shops in southern Ghana and exporting its produce to Europe in 2020. Lubok Farms has set short-term and medium-term objectives to achieve the long-term vision above. These objectives will be attained by installing Dizengoff Farmers Kit (DFK) greenhouses on half an acre out of

the total 5 acres where chilli pepper is currently being cultivated. Specific activities include:

1. Produce 12 t of high-quality chilli peppers for high-end domestic markets by 1st Nov. 2016:
 - With the installation of greenhouses, vegetables produced will be free from pests, diseases and weeds that adversely affect vegetable growth, and thus quality and yield increase.
2. Produce 20 t of high quality tomatoes for high-end domestic markets by 1st Nov. 2016:
 - To avoid soil related diseases such as bacterial wilt and fusarium, a crop rotation system of tomatoes will be grown after each chilli pepper cycle.
 - In a year the proposed cycle will be “chilli pepper-tomatoes-chilli pepper”.
 - Tomatoes grown in greenhouses are known to have the highest yields as compared to other vegetables.
3. Educate and showcase to 15 other small scale farmers and students the benefits of protected horticulture by June 2016:
 - During the initial stages of the project, Lubok Farms will in collaboration with the University of Cape Coast and Dizengoff conduct training sessions with surrounding smallscale farmers and agriculture students on the benefits of protected horticulture. Students will use this project as a case study for research purposes. By facilitating this, Lubok Farms aims to benefit from university know-how and share experiences with other farmers. In addition, the activity contributes to Lubok’s CSR policy.
4. Expand greenhouse cultivation from 0.5 acre to 1 acre by December 2018:
 - In the medium–term, Lubok Farms expects to expand its supply of high quality vegetables from domestic markets to European markets such as the Netherlands and UK. To achieve this, Lubok farms aims to expand its protected vegetable farm from 0.5 acre to 1 acre by installing additional greenhouses.

Expected Deliverables

- Approximately 12 t of chilli peppers and 20 t of tomatoes produced annually.
- Seven DFK greenhouses installed.
- Operation & Maintenance Manual prepared.
- Training reports/evaluation reports, farmers gain knowledge on modern best farming practices that can increase yield and quality of produce.
- 15 selected participants from vegetable farms within Gomoa Ayensuadze will be invited to a workshop/demonstration at Lubok Farms. Training topics: benefits of using greenhouses vs. open field systems and proper usage and maintenance of greenhouses with information provided by Dizengoff. Training report to be submitted.
- Students from the Department of Agricultural Economics and Extension prepare a business case study on the benefits of protected horticulture as compared to open field farming.
- Connect 4 greenhouse tanks to dam, to enable water supply to drip irrigation system.

Srighan

Objectives

- Establish the efficacy of new products for control of False Codling Moth (FCM) in on-farm field trials
- Train farmers and multiplication agents in the use of new products and overall GAPs
- Apply for and receive registration of new products for use in Ghana with EPA
- Upscale the initial trial to a larger number of farmers to confirm the economic viability and train 1,400 outgrowers in GAPs using the new bio-pesticide products
- Re-establish export of chilli peppers from Srighan Farm and its outgrowers and avoid further losses of income

Activities

- Conduct field trials of new bioagents for control of FCM on 11 outgrower farms of Srighan Farm
- M&E, measuring yields and losses

- Development of training matrix and materials
- Conducting 5 training and supervisory workshops
- Document trials for EPA application with a registered scientist (Dr. Cornelius)
- File application to EPA for registration of new products
- Up-scale trial of successful bioagents on 1,400 farms
- Conducting 40 training and supervisory workshops
- Conduct trials of successful new bioagents the control of FCM on up-scale farms
- Monitor and evaluate economic performance and viability
- Preparing a scientific article on the trial results
- Disseminate information on the trial results and the availability of new products

Deliverables

- Trial evaluation on efficacy of the new bioagents (yield, percent of affected fruit) reported
- Yield and loss figures calculated and produced
- Training cards and CBT training matrix developed
- Farmers and multiplication agents trained
- New bioagent products registered for use in Ghana
- Farmers and multiplication agents trained
- One article published in a scientific journal
- Number of interceptions due to FCM are reduced

Sunripe

Objectives

- Improve the quality and consistency of supply of fruits and vegetables for processing.
- Increase the yield of production of vegetables and fruits for better pricing for company and additional income for farmers.
- Reduction of post-harvest losses of non-exportable grade of fruits in the country.
- Increase its product range to satisfy the high-value end of the market.
- Increase net earnings and foreign exchange earning the company, farmers and the nation.

- Contribute to national goals of wealth creation for smallscale farmers.
- Provide a healthier alternative to carbonated softdrinks with their attendant negative attributes on health.

Activities

Sunripe food processing company limited is seeking the grant amount for product development along the entire value chain from farm to table. The project will be implemented in four components:

Phase 1 will involve the upgrade of the factory to increase the volume of watermelons being processed from 10 t a week to 50 t a week with other variants like ginger, red and yellow sweet peppers and cucumbers. It will also involve the development of new products for the high end of the market such as fruit and vegetable blends of fruit juice and smoothies currently being imported This activity will take place in the first quarter of 2016. The first phase will be supervised by company's plant manager and engineer and implemented external engineering firms and food science consultants.

Phase 2 involves training of existing farmers. The major factor affecting the quality of fruits on the current market is the poor agronomic practices and general lack of standards in the industry. Phase 2 of the project, seeks to correct the situation by the selection and training of 12 existing farmers to cultivate 1 ha of existing varieties of watermelon such as Sugar Baby and Florida Giant, under supervision in second quarter of 2016. The objective is to improve the quality and yield of existing varieties through improved agronomic standards. Seeds and inputs will be supplied. The project will be managed by a consultant and a farm manager.

Phase 3: The variety of seeds planted, soil and agronomic practices determine the final quality of the crop (especially brix, colour and yield). In the third quarter activities of 2016 the company seeks to establish a 1 ha demonstration farm to introduce new varieties of fruit and vegetables into the industry, suitable for processing and export. The project will produce 6 varieties of watermelon including seedless ones, yellow fruits and normal ones with high brix and rich colour. Varieties include Treasure Chest, Yellow Doll, Tiger, Sayda and Adaman. Half an acre of cucumber

and sweet peppers will be cultivated for blending with watermelons. Selected variety of cucumber and sweet pepper include Nandini FV Hybrid and others. A compost site will also be attached to the demonstration site to provide fertilizer for the farmers and reduce solid waste management in the district. The project will be supervised by the consultants and a farm manager.

Phase 4: Fourth-quarter activities of 2016 involve the introduction, training and support of new varieties to 120 farmers for adoption and production under supervision of the farm manager and consultants to produce fruits and vegetables for processing, local market and export.

Deliverables

- Yield of 15-20 t/acre
- Sunripe equipment retooled/upgraded
- High brix (13) of seedless watermelon produced
- Increased processing capacity from 10 t per week to 50 t per week
- Additional melon-based products (jam, juice with ginger and pineapple) added to production line

Tacks Farms Limited

Objectives

- Increase the annual production of fresh kitchen herbs from around 2 t to 90 t in 2016, thereby making it possible to export fresh kitchen herbs from Ghana. Increased production will lead to increased revenues from higher domestic sales as well as exports of fresh kitchen herbs. Revenues can increase from 8,000 € to 370,000 € in 2016.
- Increase number of employees from 30 to about 50, and their conditions of service.
- Introduce uncommon (for Ghana) technology in the production and export of fresh kitchen herbs such as (i) green and adaptable houses (ii) foil and other post-harvest systems (iii) Product handling facilities (PHF) with cooling for storage and transportation.
- Introduce a new product to other farmers in Ghana once the first trials are successful for

increased capacities and growth of the market and establishing Ghana as one of the major suppliers of fresh kitchen herbs. On successfully exporting 90 t in year 2016, the project will be extended to 20 outgrowers mainly for the production of basil and chives to volumes around 200 t.

The project will allow the acquisition and transfer of high skills and know how to farmers in the use of high tech production with state of the art irrigation and production methods to include green houses and hydroponics. Tacks Farms Limited (TFL) will scout small-scale farmers in its vicinity before interviewing them to determine who meets the ideal characteristics required to produce fresh kitchen herbs.

Logistics will be an important factor in choosing an outgrower. For example, quick access to good road from farm site to airport and cooling. Selected small-scale farmers will be trained in several aspects of GAP. As a consequence of the stringent quality requirements of fresh kitchen herbs, it takes considerable care, commitment and training to prepare small-scale farmers to produce them.

Also, the produce is highly perishable and significantly loses quality without immediate cooling so it is vital that potential outgrowers have access to a cold truck or cooling facilities. Hence, in the first couple of years of the project, TFL will only reach out to a maximum of 20 outgrowers. If the initial partnerships are successful, then more outgrowers can be included after three to four years of the project. TFL will be supported by COLEACP and GIZ in the training of outgrowers.

- Increased revenue from export of herbs will affect and increase the overall cash flow and results of TFL. This will enable the company revamp its large mango plantation and improve the cultivation of other vegetables which will place the company as one of the major players in the fruit and vegetable trade in Ghana.

Expected Deliverables

- Functional well-equipped PHF built, which satisfies international standards
- Fully-operable cold truck procured
- Reliable consistent source of power secured for PHF operation
- Modern computers and accessories acquired
- Packaging material in use that satisfies regulatory and market requirements
- Soil fertility level attained that meets nutritional needs of crops
- Pest-free crops consistently produced for the market
- MRL, soil and water analyses conducted
- All staff trained in GAP, new skills and technical capability necessary for production of fresh kitchen herbs
- New employees hired to improve production capacity
- Employee benefits updated in line with present economic situation. Employee working conditions must comply with regulatory standards
- Farmers trained in GAP and technical aspects of producing herbs
- Production capacity increased to 200 t per annum by the end of the project in 2017

Tikola

In its first two years Tikola achieved the following milestones:

- Registration of the company with all related permits from MoFA
- Initial trials were carried out using free sample seeds
- In close cooperation with East West Seeds and IFDC, 9 test fields were initiated
- First commercial amounts of seeds were imported
- 25 sub-distributors were established in 10 regions of the country
- Stands organized at several expositions e.g. FAGRO and USAID/WUR; Feed the Future project launched in Tamale

Tikola is, after its initial introduction of the hybrid seeds, now running into its operational and financial limits to enforce a real 'take-off' in the use of hybrid seeds and complimentary growing techniques. To enable such a 'take-off', Tikola must invest in additional sales and extension personnel, related means of transport, a dedicated office enabling conditioned storage of seed, software for CRM and bookkeeping and in targeted promotion like radio spots and farmers' events and expositions.

For the short term (the next three years) Tikola wants to focus on an increased service level to the actual target groups respectively the small scale farmers and the professional growers. In addition, we want to tap into a third target group we distinguish namely the farmers that are affected through CSR-programs of (multi) national companies like the several mining companies, GREL, oil industry and the Licensed Buying Companies in the cocoa industry.

The following is to be achieved short term (1 year project duration):

- Increase number of dealers from 25 to 50
- Increase number of demonstration fields from 9 to 14 by organizing 5 test fields by ourselves
- Increase visits of demonstration fields by extension officer from once/2 months to once/2 weeks
- Increase frequency of dealer visits from once/3 months to once/month
- Increase number of professional clients from 6 to 18
- Increase visits of professional farmers from once/3 months to once/month
- Creation of interactive internet site
- Rent an office
- Organize back office services
- Presence in (local) media, e.g. radio spots and newspapers
- Introduction of the benefits of plastic mulch in combination with system for recycling
- Incorporation of irrigation hardware and advice in Tikola's product portfolio

As per 1st of January 2015 Tikola therefore intends to invest in:

- Recruitment of 1 FTE extension officer
- Recruitment of a test field coordinator/sales officer Western region
- Recruitment of a (part-time) project manager
- Opening of an office in Accra/Tema with an embedded conditioned store room
- Purchasing office equipment and furniture
- Purchasing one or two company cars

VegPro

The specific objectives VegPro Ghana seek to achieve in this project are:

- Design and construct greenhouses and nursery structures which are affordable and tailored to the Ghanaian environments.
- Produce seedlings of other varieties of vegetables for distribution to its outgrowers and other vegetable producers in the southern horticultural zone.
- Replicate the initial greenhouse for its use and share technology with interested not only for producers but also for outgrowers for ease of use for production of vegetables for both local and export markets.
- Improve the quality of agri-business in the country through greenhouse hydroponics, vegetable processing and marketing and GLOBALG.A.P.-approved exportation.

Activities

- Design and set up demonstration greenhouse units
 - This activity describes the specifications of what determines the exact technical characteristics of all the required components (constructions and equipment) of the demonstration scale unit and also the acquisition, installation, construction and testing of these components.
- Set up nurseries for vegetable seedlings production
 - This activity will involve propagation of seeds, conducting germination trials to determine best treatment and duration of treatment to achieve maximum germination, proper sanitary pruning of plants etc. to bring out the right fruition of the plants.
- Training of smallholder farmers under GLOBALG.A.P. protocols
 - This activity involves selecting, training, organizing, directing, controlling, and coordinating activities of smallholder farmers engaged in propagating, cultivating of horticultural specialties. In addition, smallholder farmers will be trained on the best agronomic practices under GLOBALG.A.P.
- Testing and rolling out technology for wider vegetable sector
 - This activity involves the roll out of the first phase of the project greenhouse units to the wider vegetable sector and also hold field show days and assist farmers/exporters in the vegetable sector to adopt this new technology.

Expected Deliverables

- Shift farmers from open field pollinated farming to greenhouse/net-house hybrid high yielding farming methods
- Increase the availability of fresh horticultural products all year round in the local markets
- Produce export suited horticultural products for the local market at competitive rates
- Produce high quality organic horticulture products grown under best practices for the local and export market
- Increase the incomes of the beneficiary farmers through the sale of innovative horticultural products at competitive rates
- Boost farmer confidence through the availability of a structured market in the export sector
- Enhanced beneficiaries' capacity to design, install and maintain a greenhouse/net house unit under the project in order to be replicated
- Increased awareness and knowledge on greenhouse unit among key stakeholders

- Increased number of successful commercial greenhouse/net houses unit

Wienco

Objectives

- **Seed production:** Produce 8 t of seed over the two year project life span for the selected crops (pepper and onion) to meet the seed requirements of smallholder farmers. 3 t of pepper seed and 5 t of onion seed are expected to be produced in year 1 and 2 respectively.
- **Seed import:** 4.6 t of preferred superior vegetable varieties will be imported from Holland Farming, Rijk Zwaan and Starke Ayres to supplement the national demand. All these organizations have been contacted and some of their varieties have been evaluated to ascertain suitability and demand. The varieties will include exportable Asian varieties including butternut squash (Table 15).
- **Seed distribution and awareness creation:** to develop a comprehensive seed distribution system that is capable of getting seeds to farmers in locations where seed dealer distribution system is unable to reach. WIENCO expects to sensitize and train about 7,200 smallholder farmers on the importance of using certified seeds and adopting improved production practices to increase yield and quality and finally make effort to connect them to markets. This is expected to be achieved in close collaboration with our key partners i.e. MoFA, CRI, SARI, ADVANCE and AgdevCo.

Production locations

- Two locations have been identified for seed production; Tainso, in the Wenchi Municipality and Yagaba in the West Mamprusi District. The two locations fall in different agro-ecological zones which allow Wienco to spread the risk production related risk e.g. erratic rainfall.
- Beside the good soil conditions, the Yagaba field lies close to Kulpawn River, a tributary to the White

Table 15. Breakdown of yearly seed imports by crop

Crop	Yearly Imports (t)		Total
	Year 1	Year 2	
Cabbage	0.20	0.30	0.50
Eggplant	0.20	0.25	0.45
Lettuce	0.20	0.30	0.50
Onion	0.20	0.30	0.50
Cucumber	0.30	0.35	0.65
Sweet pepper	0.35	0.50	0.85
Tomato	0.35	0.50	0.85
Melon	0.10	0.20	0.30
Total	1.90	2.70	4.60

Volta and that in Tainso lies along the Tain River which is also a tributary to the Black Volta. The locations are strategically selected so that Wienco can undertake supplementary irrigation during short dry spells.

Inspections and certification

- The company will liaise with the Ghana Seed Inspection Division (GSID) to ensure the fields are adequately inspected to ensure quality. Post-harvest processes including seed treatment, bagging branding and storage will be undertaken to ensure quality of seeds at all levels in the production chain.

Establishment of high-impact pilot demonstration plots

- 100 demonstration plots of ¼ acre each shall be established at selected locations across the country. 100 committed lead farmers shall be selected to undertake the demonstration productions. 60 of the lead farmers are expected to be rural women who are very experienced in producing any of the selected crops.
- The pilot sites shall demonstrate to farmers' three key technologies i.e. (a) use of improved seeds (b) use of fertilizers and (c) crop management. Selected lead farmers shall contribute land and labour for the establishment of the demonstration plots while WIENCO will provide seeds, fertilizers

and extension support through MoFA. A farmer field school each shall be organized around a demonstration plot to introduce seeds and good cultural practices to smallholder farmers. Farmer field schools shall be organized in close collaboration with MoFA.

All produce realized from the demonstration sites shall be given as compensation to the lead farmers. In addition, serious and interested lead farmers shall on a systematic basis be given the opportunity to partner Wienco as a local distributor.

Agri-Impact Consult

Poor production technologies have been identified as the key constraint to the productivity of vegetable production in Ghana. In an attempt to address the challenges, there has been introduction of some technologies including greenhouses to improve productivity. However, there is inadequate technical know-how in weak value added services to support the sector. More so, MoFA staff lack technical expertise in modern vegetable production technologies. Presently, agricultural vocation in the country is declining as most of the formal institutes providing vocational training in agriculture have been converted into tertiary institutes, leaving a gap in hands-on training for agricultural vocational training.

There are no established innovative and technology training centres available to support service providers, youth and entrepreneurs to upgrade their knowledge in emerging techniques in horticulture production. A recent “needs assessment” conducted by Agri-Impact Consult on the technical staff of MoFA in urban and peri-urban areas showed that less than 10 percent have knowledge in the protected production of high value horticulture crops. This creates gaps in the quality of information and extensive services provided to horticulture producers and other value chain actors.

Objectives

- Enhance knowledge and skills in greenhouse production technologies

- Increase production, productivity and profitability of vegetable producers and suppliers
- Enhance the vocational and entrepreneurial skills of young graduates in vegetables production through incubation

Activities

- Develop training materials
- Identify and select commercial producers for training
- Train commercial producers in greenhouse production including irrigation management
- Establish quality-control systems for commercial producers
- Mobilize and select AIC/Eden Tree outgrowers for training
- Train outgrowers, vegetable producers and marketers associations and aggregators in production technologies, quality systems and post-harvest management
- Establish market and financial linkages between value chain actors and service providers
- Incubate young graduates and mentor them in intensive production technologies
- Support young graduates/start-ups (the “incubatees”) to develop business plans
- Establish market and finance linkages for incubatees

Deliverables

- 1 commercial producers selected for training
- 5 technical officers and 20 greenhouse production assistants trained
- 1 commercial producer implementing a comprehensive production and packing protocols
- 40 AIC/Eden Tree outgrowers selected for training
- 40 AIC/Eden Tree outgrowers increase yields by 30 percent and profitability by at least 20 percent
- Value chain actors linked to 2 financial institutions and supermarkets/aggregators
- 5 incubatees/start-ups selected and mentored
- 2 vegetable business plans developed
- 3 incubatees linked to financial institutions and buyers

Meridian Seeds and Nurseries

The overall objectives of underlying project are to (a) improve agricultural, quality assurance and business knowledge, (b) support GLOBALG.A.P. certification, (c) facilitate access to credit and (d) increase productivity of commercial farms, greenhouse operators and smallholder farmers in the vegetable sector by introducing an integrated private sector extension service that combines farm advisory, training and certification preparation services.

Specifically, the following objectives will be achieved during the project's 2 year implementation period:

- 300 smallholder farmers and 7 commercial farmers have received continues on-farm advice on GAP and IPM

The project shall engage a full-time extension manager and 15 cluster advisors for provision of these services by means of a subscription service (see Table 16) to increase farm-level productivity. A cluster advisor is responsible for serving 15-25 subscribers in a geographical area. The selection of cluster advisors is based on academic qualifications and field experience, and cluster advisors will receive intensive agricultural, quality assurance and business before being deployed. The project also operates a toll-free Tigo line for real-time support to subscribers.

- 80 smallholder farmers, commercial farmers and input dealers trained in sound business management practices and operational skills.

MSN has adapted the COLEACP Pesticides Initiative Program training curriculum (<http://pip.coleacp.org/en>) to local circumstances for training of its clients throughout Africa. During the project MSN shall integrate the audio-visuals of the GhanaVeg training curriculum in its training curriculum to provide a series of non-residential trainings to address skill and management with budding firms in the vegetable sector. The trainings shall cover governance, strategic planning, operational management, production

planning, and marketing. The cost for the 2-day training is set at €141.

- Prepared GLOBALG.A.P. certification for 3 exporting commercial farmers with 45 smallholder farmers from their out-grower schemes.

The project offers the most cost effective option to access technical assistance to obtain GLOBALG.A.P. certification, as farmers don't have to employ expensive quality management staff for record keeping (training, farm operations), data analysis and report writing. The project will offer these services under subscription, whereby exporting commercial farmers and smallholder farmers will receive support under option 1 and 2 respectively, in line with set-up of GLOBALG.A.P. standards. The subscription fee is based on the size of the company. To ensure effective data management, the project will acquire specialized database management software. Reports from the software will serve multiple purposes, including fulfilling GLOBALG.A.P. reporting standards, MoFA requirements and access to credit and insurance (see objective 4). The companies Trosky Farms and Whytebage Limited have already expressed interest in off-taking the service.

- Pilot access to credit and insurance for 5 farms.

The project database will enable farmers to obtain insurance and/or credit, as the finance institutions can use the data in its credit ratings. During the project 3 farms will be introduced to (micro) finance institutions and 2 farms will be introduced to farm insurance schemes. The results will be shared during a GhanaVeg business platform meeting at the end of the project.

Table 16. *Types of subscriptions available*

Type	Rate	Description
Gold	€89	Pre-season training, 4 farm visits of 0.5 day, and phone advice; mostly for commercial farmers
Silver	€43	Pre-season training, 3 farm visits of 1-2 hours, and phone advice; mostly for smallholder farmers
Bronze	€29	Pre-season training, 2 farm visits of 1-2 hours, and phone advice; mostly for smallholder farmers

- Increase food safety and quality awareness of 60 smallholder farmers and 30 road-side vegetable traders.

The project will implement 2 group trainings as CSR component, because food safety and quality knowledge of these important actors in the value chain is low. The campaigns will also initiate dialogue and linkages between the traders and farmers to promote trade relationships that hinge on mutual awareness of quality requirements. To work as cost effective as possible, the project will facilitate the trainings during GhanaVeg business platform meetings.

- Management and M&E

The project will be managed and administered according to GhanaVeg requirements, and 8 quarterly reports will be generated. Mr. Aaron Attefa Ampofo will be responsible for M&E. The project database will monitor farmer performance. Subscribers will be asked for their permission to use company data for portfolio analysis and external portfolio reporting. At the end of the project, the analysis and lessons learned on the portfolio level will be presented at GhanaVeg business platform meeting.

Deliverables

- 1 pickup truck purchased
- 300 smallholders +7 large exporters/farms reached
- 15 sets of extension kits procured
- 15 Cluster Advisors engaged
- Extension manager hired
- 16 pre-season meetings held
- 1 toll-free mobile number secured
- Stationary purchased
- Staff connected to internet service
- 4 set of furniture purchased
- Announcements in 20 communities
- 8 courses; 80 participants
- Website developed
- QMS software installed
- 5 staff people trained
- Reports generated
- QMS trainer engaged
- 3 exporters + 45 smallholders certified
- Needs assessment report
- 3 farms connected to financial institutions
- 2 on farm insurance program implemented
- 30 lead farmers + 20 traders
- 8 quarterly reports

Annex 3. Business Directory

Organization	Contact	Email	Location	Website	Address
3As Agri Solutions Ltd	+233 (0) 243246818, 2446498210	3asagsol@gmail.com	Accra	-	P.O. Box CT 10262 Cantonments, Accra, Ghana
ARB Apex Bank	+233 (0) 302772129	-	ACCRA	www.arbapexbank.com	No.5 9th Road Gamel Avenue, South Ridge, Accra, Ghana
ATC Farms	+233 (0) 244971439	cametefe@yahoo.com	Sogakope	-	PO Box 167, Sogakope, Ghana
Bakker Brothers	+31 (0) 226331364	wouter@bakkerbrothers.nl	North Holland	-	PO Box 71723 ZG Noord Schanwoude, The Netherlands
Beausanis Farms	+233 (0) 208111814	beausanis@yahoo.co.uk	Accra	-	PO Box AN6769, Accra
Bothapraku Co. Ltd	+233 (0) 269386500, +233 (0) 246306505	bothapraku@yahoo.com	Esikuma Odoben-Brakwa, Central Region	-	PO Box AF 2257 Adenta, Accra, Ghana
Chilli Central	+233 (0) 246996905	tdannyma@gmail.com	Kwabenyia	-	PO Box WV2442, Kwabenyia, Accra, Ghana
Commonwealth Agricultural Bureau International (CABI)	+233 (0) 302797202	westafrica@cabi.org	No. 6 Agostino Neto Road, Airport Res. Area, Accra	www.cabi.org	PO Box CT 8630 Cantonments, Accra, Ghana
Crop Research Institute	+233 (0) 322060396, 322062522	Csir.cridirector@gmail.com	Fumesua -Kumasi	www.croperesearch.org	PO Box 3785, Fumesua - Kumasi, Ghana
Dizengoff Ghana Ltd	+233 (0) 302221831, 302227601	enquiries@dwagh.com, info@dwag.com	Circle	www.dizengoffgh.com	PO Box 3403, Accra, Ghana
Ebenlitz Farms	+233 (0) 244806263, 302660842	-	Tema	-	PO Box 11595 CE II, Tema, Ghana
E. Darkey and Associates	+233 (0) 302780924	edarkey@yahoo.com	Accra	-	PO Box 7155, Accra, Ghana
Eden Tree	+233 (0) 302812266, 302815625	edentreegh@gmail.com	Accra	www.edentreeltd.com	PO Box 165, Legon, Accra, Ghana
Eltrut Enterprise	233 (0) 542692079	info@eltrut.com	Aburi	-	PO Box CT 5084, Cantonments, Accra, Ghana
Export Trade Agricultural & Industrial Development Fund (EDAIF)	+233 (0) 243690520, 302234668/69	info@edaifgh.org, info@edifgh.org	3rd Floor GOC Building, Ridge, Accra	www.edaifgh.org	PO Box MB 439 Accra, Ghana

Organization	Contact	Email	Location	Website	Address
Food and Drugs Authority	+233 (0) 302233200, 235100	fdat@fdaghana.gov.gh	Accra	www.fdaghana.gov.gh	PO Box CT 2783, Cantonments, Accra, Ghana
F. Odoro Koranteng Ltd	+233 (0) 244639215	Francis_koranteng@yahoo.com	Accra	-	PO Box 10878, Accra-North, Ghana
Ghana Association of Vegetable Exporters	+233 (0) 303 965689, (0) 248 121512	gavexghana@gmail.com	2nd Floor, Old Revenue House, Mile 7 Achimota	-	2nd Floor, Old Revenue House, Mile 7 Achimota, Ghana
Ghana Statistical Services (GSS)	-	info@statghana.gov.gh	Accra	www.statghana.gov.gh	PO Box GP 1098, Accra, Ghana
Ghana Export Promotion Authority (GEPA)	+233 (0) 302673153, (0) 302675234	gepa@gepaghana.org	Opposite Cedi House Ambassadorial Enclave	www.gepaghana.org	PO Box M146 Accra, Ghana
Ghana Institute of Entrepreneurship Development (GIED)	206621106	kwawstephen@gmail.com	Adenta- Accra	-	PO Box 10849 Accra North, Ghana
Ghana Angel Investment Network (GAIN)	+233 (0) 303935097	info@gain.com.gh	Ministries Accra	www.gain.com.gh	12th Floor Premier Towers, Ministries, Accra, Ghana
Green Gold Organic Farm	+233 (0) 242684426	sirhatsun@yahoo.com	Koforidua	-	PO Box KF 2439, Koforidua, Ghana
Jodek Farms	+233 (0) 244316355	joekpeng@gmail.com	Accra	-	PO Box AN19083, Accra, Ghana
Joekopan Enterprise	+233 (0) 302407407	info@joekopangh.com	Accra	www.joekopangh.com	PO Box 01063 Osu, Accra, Ghana
Joro Farms Agriculture Processing Ltd	+233 (0) 302221947, 24438227	josephonto@yahoo.com	Accra	-	PO Box NK 306, North Keneshie, Accra, Ghana
Kukobila Nsia Farms Ltd	+233 (0) 264988197, 208114488	seiduhisham@gmail.com	Tamale	-	PO Box CT 4031 Cantonments, Accra

Organization	Contact	Email	Location	Website	Address
Directorate of Crop Services, Ministry of Food and Agriculture (MoFA)	+233 (0) 302665066	-	Accra	www.mofa.gov.gh	P.O. Box MBA 37, Accra, Ghana
Param Farms	+233 (0) 244513076	paramproduce@yahoo.com	Accra	-	P.O. Box KIA 18118, Accra, Ghana
Quin Organics	+233 (0) 302500999 287010438	info@quinorganics.com	Accra	www.quinorganic.com	P.O. Box TF313, Trade Fair, Accra, Ghana
Quist Farms	+233 (0) 244379173	marjorieabdin@gmail.com	Accra	-	P.O. Box CT 8566 Cantonments, Accra, Ghana
Sowgreen Farms	+233 (0) 241234234	kobinahudson@gmail.com, kobi@sowgreenfarms.com	Ayim	-	P.O. Box AH 217, Ayim, Ghana
Srighan Farms (GH) Ltd	+233 (0) 302412685	ponsaatheesh@hotmail.com	Adoagyir Nsawam	-	P.O. Box GY 117 Adoagyir Nsawam, Ghana
Syngenta	+312 28366114	Petervander.toorn@syngenta.com	North Holland (The Netherlands)	-	NL-1601 BK Enkhuizen, Westeinde 62
Terra Agric Group Ltd	-	info@terraagric.com	-	-	Terra Agric Group Ltd
Tikola Ghana Ltd	-	info@tikolaltd.com	Accra	-	P.O. Box AX222 Takoradi, Ghana
Vegpro Ghana Ltd	+233 (0) 269547415	jagdish@vegpro-group.com	Accra	www.vegpro-group.com	P.O. Box PMB MD 210 Madina, Accra, Ghana
VEPEAG	+233(0) 244382277	josephoton@yahoo.com	Accra, Ghana	-	P.O. Box SD 239 Accra, Ghana
Volta Veg	+233 (0) 244114474	info@voltaveg.com	Accra	www.voltaveg.com	P.O. Box KA 16404, Airport, Accra, Ghana
Welgrace Research Farm	+233 (0) 303306697	jake_fenning@welgrace.com	Tema	-	P.O. Box DT 604 Tema, Ghana
Wienco Ghana Ltd	+233 (0) 302772251 30773458/9	Roland.quaye@wienco.com, Ken.addy@wienco.com	Accra	www.wienco.com	P.O. Box AN7593, Airport-Accra, Ghana
Whytebage Int. Ltd	+233 (0) 248121512 26812152	whytebage@yahoo.com	Achimota	-	P.O. Box AH 1374, Achimota, Accra, Ghana

GhanaVeg Secretariat

No. 113A Mbabane Avenue, East Legon Residential Area

PMB CT 284 Cantonments, Accra – Ghana

Tel +233 (0) 560 027 917/18

Email info@ghanaveg.org

Web ghanaveg.org

© 2016 Wageningen UR. 



Kingdom of the Netherlands

