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Upgrading the Productivity and Competitiveness of the Cassava Industry

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GHANA

Prepared for the United Nations Industrial Development Organization

By

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List of Abbreviations

RTIP	Root and Tubers Improvement Programme
IFAD	International Fund for Agriculture Development
MOFA	Ministry of Food and Agriculture
FRI	Food Research Institute
FORIG	Forest Research Institute of Ghana
GoG	Government of Ghana
IDRC	International Development Research Centre
IITA	International Institute of Tropical Agriculture
UNIDO	United Nations Industrial Development Organization
GDP	Gross Domestic Product
Ha	Hectare
Kg	Kilogram
EU	European Union
DfID	Department for International Development
US$	United States Dollar
Cds	Ghanaian Cedis
HACCP	Hazard Analysis Critical Control Points
ASRP	Agricultural Services Rehabilitation Project
MTADS	Medium Term Agricultural Development Strategy
ERP	Economic Recovery Programme
ARCT	Africa Regional Centre for Technology
NRI	Natural Resources Institute
ITA	Institut de Technologie Alimentaire, Senegal
NIOMR	Nigerian Institute for Oceanography and Marine Research
DANA	Direction de l'Alimentation et de la Nutrition Appl,ique, Benin
PRA	Participatory Rural Appraisal
SMEs	Small and Micro Enterprises
VIP	Village Infrastructure Project
REP	Rural Enterprise Project
AMIS	Agricultural Machinery Industrial System
REDS	Rural Enterprise Development Support
KUST	Kwame Nkruma University of Science and Technology
PSI	Presidential Special initiative
COSCA	Collaborative Study for Cassava in Africa
ASCo	Ayensu Starch Factory
EDIF	Export Development and Investment Fund
GCB	Ghana Commercial Bank
ADB	Africa Development Bank
NIB	National Investment Bank
CIF	Cost Insurance and Freight
FoB	Free on Board
USA	United States of America
UK	United Kingdom

List of Tables

List of Figures

EXECUTIVE SUMMARY

Main Findings

The survey on cassava productivity and competitiveness in Ghana was carried out between Oct 29 and November 21st 2003. The actual work involved review of available literature, stakeholder consultations, interviews with processors, government ministries, research and development agencies, private processors, current and potential cassava users, and farmers groups.

Cassava is the most cultivated food crop in Ghana, where an estimated 90% of all rural households are involved in cassava production. The crop is grown in all regions of the country except Upper East and Upper West where production is extremely limited. The current production is estimated at about 10 million MT per annum, with an average yield of over 12MT/ha. The yields are comparable to major cassava producing countries in the world. In areas where RTIP has carried out intensive extension campaign, yields of up to 28MT/ha have been realized. Ghana is sixth largest cassava producer in the world and second in Africa.

Cultivation is largely based on household needs and for local markets, and not to supply large industrial users who would require a more programmed cultivation, harvesting and probably homogeneous varieties.

Cassava production costs are estimated at between Cds940,000/acre and 1.1million/acre (approximately US$104).

The national average price for fresh tubers is about Cds780 per kilogram, while factory gate prices in Brazil are in the range of Cds142 per kilogram. Ayensu starch factory is offering Cds225 per kilogram factory gate, while Amasa Agro offers Cds300 per kilogram farm gate. Prices decrease further into the interior from the coastal regions, but again increase towards the North where production is limited. Raw material cost for Ayensu starch factory is 76% of the starch processing cost.

Improved processing technologies for gari, flour and starch have been introduced to farmers groups and cooperatives by various organizations to improve efficiency of processing. Group trainings have been carried out but no follow-ups to measure impact. Most of the activities have therefore not taken off. Groups have also been trained on cassava flour utilization in baking. Again little follow-up or effective linkages have been established.

There is a major push for commercialization of cassava sub-sector. Efforts include PSI, RTIP, DfID, EU, UNIDO etc. Processing is being encouraged for starch, high quality flour, gari, kokonte and fufu.

Efforts to link high quality flour and glucose manufacturers with markets by one of the projects are bearing fruit. However, although potential exists for use of cassava flour in the plywood and paper board manufacturing, only lukewarm effort has been made to promote the use. There is danger of missing this opportunity.

Some companies are using cassava flour in manufacture of plywood, textile and paper packaging respectively. Surprising the flour being used was kokonte and the companies were satisfied with results. The industries were buying the flour at an average factory gate price of Cds2,500 per kilogram at a time when wheat flour was wholesaling at Cds 3,500 per kilogram. Attempts to increase the price of cassava flour above Cds2,500 would result into a reversal to 100% wheat flour use by these industries.

The potential annual use of cassava in various industrial application is as follows; plywood 1000MT of flour, textiles 480MT of flour/starch, pharmaceutical 480MT of starch, paper/packaging 840MT of starch/flour, food (confectionery/bakery) 120MT, animal feeds 5,000MT of pellets/chips.

Previously a Ghanaian company was exporting cassava chips to Europe but the business collapsed as a result of high prices of local chips and poor infrastructure (roads, lack of bulk handling facilities at the Port of Tema).

There was evidence of emerging regional and international market for gari, kokonte and high quality cassava flour, based on export figures and orders from local processing companies.

Ghana's competitiveness in export of cassava products is affected by high cost of raw materials and inefficiencies in collection and delivery of raw roots to processing factories, which increases costs of production. For example, Ghana's starch is priced at US$200/mt (fob Tema), while the international price is between US$160-170/mt.

While individual uses of various cassava products may be small in terms of potential quantities of raw cassava that would be required, the sum total would make a significant impact in positioning cassava to grow as an industrial crop in the country and in the region.

Industrial use of cassava is unlikely to threaten food security of the producing communities as the Ministry of Food and Agriculture estimates a current surplus production of 3.8 million MT per annum.

Recommendations

Productions systems need to be reorganized to better serve commercial processing enterprises. This can be done through organization of group farming, extensive extension services, credit provision and contract farming. The groups should be encouraged to produce specific varieties for the industry. Links with the VIP project to support

necessary infrastructure development for ease of transportation of raw roots is also recommended.

Introduction of appropriate and more efficient harvesting technologies is also recommended. The current harvesting technologies cannot service a major industrial user of roots.

Vertical integration of farmers into processing activities is not recommended as this leaves farmers with little time to ensure efficiency of their farming operations and to engage in other farming and non-farm activities. However, where farmers have a cooperative society value adding is recommended as long as it is delinked from their farming activities. This can be done by hiring independent management of the cooperative society activities. The farmers then become suppliers to the cooperative.

Investment in new starch processing enterprises is not recommended until the Ayensu Starch factory is fully operational and has established a strong market base. Ayensu should also be supported to achieve internationally competitive costs of production. The current level of domestic demand for starch does not warrant investment in new starch processing enterprises.

A strong focus should be directed at nurturing the domestic and regional market for cassava flour that is emerging in Barkina Faso, Togo, Rwanda and Burundi. There is also potential for export of quality flour, gari, and high quality kokonte to North America and Europe. This demand needs to be natured.

Promotion of flour for local food industry should only be directed at biscuits and pastries and not bread as field survey indicated that consumers have not appreciated bread with cassava composite, but are supportive of pastries made with composite flour.

In order to penetrate the export market quality control is of utmost importance and must be introduced and enforced. Ghana should establish grades and standards for the main cassava products, especially those produced for export and industrial markets.

Once production costs are brought down, investment could be directed at processing of pellets for domestic and export market. Farmers groups could be encouraged to produce high quality dried cassava chips, which can then be sold to pelleting companies. Intensive training would be required to achieve acceptable qualities and quantities.

The small-scale processing companies should be supported to expand their scales of operations, increase efficiency by upgrading their processing equipment and introduction of quality control mechanisms in their operations. Waste and effluent disposal is wanting in most of the small establishments and this needs to be addressed as a matter of urgency.

A baseline survey should be undertaken to establish convenient locations for establishing processing plants for various cassava products based on cost of raw material, accessibility and target markets for the processed products.

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Table of Contents

INTRODUCTION

Global cassava production has been on the increase since 1999. Nigeria is currently the world's number one cassava producer followed by Brazil and Thailand in that order. Ghana was ranked 6th in 2001. The world cassava production in 2001 was estimated at 178,868,310MT of which Ghana produced 8,512,000MT (4.8% of world production). Africa produced 92.7million MT of cassava in 2000, while Asia produced 50.5 million MT in the same year and in Latin America 32.1 million MT were produced in the same year[1]. Current cassava production in Ghana is estimated at 9,731,000MT (2002 figures), with a national average yield of 12MT/ha.

Cassava is the most important food crop in Ghana. It is prepared and consumed in a variety of ways, with most important products being gari, fufu and banku. Fufu and banku are widely served in commercial outlets (food kiosks and middle class hotels). The par capita intake of cassava is currently estimated at 151.4kgs/annum (MOFA, Facts and Figures 2003).

The government and its development partners have embarked on ambitious programmes to develop cassava into an industrial crop as a way of fighting rural poverty by giving cassava farmers opportunities to earn incomes.

The potential local markets for cassava include, textiles, paper and packaging industries, plywood industry and animal feeds industry. The pharmaceutical industry is also a potential target for cassava starch but require stringent manufacturing processes. The level of demand for starch in the country is limited and may not be a viable entry point for cassava promotion.

Government Policies for Agriculture and Cassava Sub-sector

I) **Economic Recovery Programme:** This was initiated by the government in 1983 to help reverse declining trends in major contributions to economy such as agriculture. The bold steps taken under the programme resulted in reversal of downward trend of production of major crops such as cassava. Under ERP an **Agricultural Services Rehabilitation Project** (ASRP) was launched in 1987 to strengthen capacity of the public sector to support research, extension services, irrigation, policy planning, monitoring and co-ordination and to make the required investments for expanded agricultural production.

II) In 1991 a 10 year **Medium Term Agricultural Development Strategy** (MTADS) was launched to consolidate and sustain gains in the agriculture sector reforms. The emphasis was on efficient resource allocation, attainment of food security and abundant food supply for the people at affordable prices.

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[1] This represented a 10% growth in output compared to previous year.

III) The government through a Presidential Special Initiative (PSI) has decided to support cassava sub-sector in order;
To transform cassava industry into a major growth pole by end of 2006
To establish 10 cassava starch processing companies by end of 2006
To generate annual export revenue of US$40 million be end of 2006
To bring 100,000 peasant farmers into mainstream economic activity by end of 2006 and
To obtain 50 per cent women farmers participation in the PSI programme.

So far one factory with an annual capacity of 22,000MT of cassava starch has been established at Bawjiase some 65kilometers West of Accra. It has so far produced 800MT of starch. A second factory is to be build in Kpondi district in the Volta region by end of 2004, with a capacity to process 5,000MT of starch per year.

Because of its wide potential industrial application (Balagopalan, C. 1998), cassava is central to government's agro-industrial development. Due to the fact that cassava is available through out the year and can grow even under extreme conditions (poor soils and limited rainfall) cassava plays an important role as a food security crop in the country.

The importance of cassava in the country is also exemplified by the many projects targeting the sub-sector.

Past Efforts To Promote Cassava

Most of the past efforts have focused on improving productivity through introduction of better yielding and disease resistant varieties, improvement on traditional processing of cassava and market linkages between producers and potential markets. Some of the projects include; ARCT/IDRC-Agro-foods enterprises project; DfID/NRI/FRI Crop Post-Harvest Programme Project – Improved Cassava Chip Processing to Access Urban Markets[2].

I) **Agro-foods Enterprises Project:** The project was funded by African Regional Centre for Technology (ARCT)/IDRC. Its aim was to promote environmentally benign small and medium scale agro-processing enterprises, particularly those dealing with cassava and fish, in selected Africa countries with a view to enhancing their techno-economic development on a sustainable basis, valorizing their natural resources and generating employment.

[2] The project has been renewed for one more year as SMEs with funding from EU.

Specific objectives of the project were;

- To identify technologies for agro-food enterprises using appropriate feasibility studies.
- To establish and promote the viable operation of small/medium scale agro-food enterprises for cassava and fish, using the experience gained by the ARCT in previous projects.
- To strengthen the capacities of entrepreneurs, policy makers, researchers, technical personnel and institutions in the promotion of sustainable small and medium scale agro-processing food enterprises.
- To disseminate relevant information so as to promote the utilization of research results pertinent to the agro-food industry.

In Ghana a survey carried out under the project found cassava processing was carried out on commercial scale in all regions of the country and the main products in order of magnitude were; gari, agbelima, tapioca, starch and starch biscuit. The survey found that raw materials and supply of unskilled labour was abundant, but there was acute shortage of skilled labour to man improved technologies and manage viable business enterprises. The project was implemented in four ARCT member countries; Benin, Ghana, Nigeria and Senegal and executed by four institutions;

- Direction de l'Alimentation et de la Nutrition Applique (DANA) in Benin, dealing with cassava processing in the frame work of the project.
- Food Research Institute (FRI), Ghana on cassava processing.
- Nigerian Institute for Oceanography and Marine Research (NIOMR) on fish processing and
- Institut de Technologie Alimentaire (ITA) in Senegal on Fish processing.

In Ghana the project strengthened capacities of four cassava producing communities in cassava processing and trained selected staff at FRI on PRA techniques. Management systems were established for each of the processing units.

II) DfID/NRI/FRI Crop Post-Harvest Programme Project – Improved Cassava Chip Processing to Access Urban Markets[3].

The project aimed at investigating the processing of high quality cassava products based on traditional ones, to meet identified markets in urban areas. Specific attention has been given to rural-urban linkages and quality assurance. The project has build upon the village level cassava chipping technology developed under a previous cassava processing project and examines the linkages between rural producers and urban consumers.

Aim of the project: to improve the quality and convenience of traditional cassava based foods in order to access the growing urban market.

[3] The project has been renewed for one more year as SMEs with funding from EU.

Specifically the project aims at examining the processing and marketing of instant fufu and kokonte flours in order to develop recommendations on;

- Reducing cost of production
- Improving product quality
- Increasing shelf life and stability
- Promotion strategies to expand market demand

The project had two main components;

Component one: dwelt with supply of raw materials and its processing into intermediary products such as cassava flour, starch, and cassava grits. Farmers were to be organized to supply a centralized cassava factory with raw material that would process the intermediary product. Due to capital limitations within the project the factory could not be established although a potential entrepreneur was identified. Little progress was made on component one.

Component two: dwelt with processing of improved cassava products for urban markets. This was carried out in collaboration with existing cassava processing enterprises. Laboratory work was carried out to develop improved cassava products, which were then to be adopted by manufacturers on a large scale. Development of quality assurance systems with manufacturers was also to be undertaken but this was not achieved.

The project focused on improving the quality of local processed cassava products, fufu, Agbelima, Gari and Kokonte into high quality products acceptable to urban middle income group. Price, hygienic manufacture and packaging were considered key determinants of acceptability of the products by middle income groups.

The project developed a range of instant fufu products with good sensory properties and high consumer acceptability. The project has encouraged linkages between processors who are able to produce high quality cassava flour and supply it on a regular basis to end manufacturers. However, actual linkages have however not been established.

Current Projects/ Programmes In Cassava Sub-sector

The government with its partner institutions is also focusing on improving the efficiency of harvesting (provision of improved harvesting equipment) and processing (improved processing techniques).

I) Root and Tuber Improvement Programme (RTIP)**: Largely production and distribution of improved planting material, also includes a post-production activity**

RTIP is the most ambitious programme focusing on the cassava sector. It has an overall funding of some US$10million and covering the period 1999-2004. It is implemented by the Ministry of Food and Agriculture (MOFA) and is funded by International Fund for Agriculture Development.

The overall objective of the programme is to enhance food security and increase the incomes of resource poor farmers on a sustainable basis by facilitating access to new but proven locally-adapted technologies of root and tuber crops (cassava, yam, coco yam, sweet potato and Frafra potato).

Focus has been on increasing availability of planting materials of improved varieties of cassava, sweet potato and cocoyam.

The programme has six components;

- Multiplication and distribution of improved planting material
- Integrated pest management
- Adaptive research
- Community support and mobilization
- Post-production and marketing
- Institutional set-up and linkages

The Ministry's Objectives under the programme are;

- To address food security concerns
- Raw materials for industry (**flour, starch, etc**) exploring the potential use of cassava flour in baking and plywood industries. The cassava starch is largely targeted at the export market.
- Expand export commodities base
- Input supply and distribution (planting material multiplication and distribution)
- Output processing and marketing (support to groups and individuals processing cassava into various products with processing technologies, technical advice and backup and market linkages).
- Effective implementation of policies & programmes

The specific strategies to achieve the stated objectives are;

- Enhanced HRD and institutional capacity
- Access to financial services
- Appropriate technology
- Improved infrastructure
- Improved access to markets

On the post-production and marketing, training modules on five cassava food products have been developed. The main focus has been on utilization of cassava flour in the baking industry.

II) CASSAVA-SMEs project funded by EU: The project is an extension of the DfID/NRI/FRI Crop Post-Harvest Programme Project – "Improved Cassava Chip Processing to Access Urban Markets". It is focusing on SMEs for processing of fufu, kokonte and cassava grits (to make cassava flour) in Ghana and fufu and Tapioca (local starch) in Nigeria. It started in January 2003 and will bring together and validate and expand to a broader range of products. It will look at optimizing product quality and assist manufacturers to develop integrated quality assurance systems, further reducing

costs, promoting the products and developing a linkage between rural producers and urban manufacturers. A private company is participating in the project with express intention of setting up such a linkage (Gallat S. et al, March 2003).

UNIDO: UNIDO has two projects in Ghana at the moment; Agricultural Machinery Industrial System (AMIS) and Rural Enterprise Development Support (REDS).

III) **Rural Enterprise Development Support (REDS) Project funded by UNIDO**: The project is working in Volta, Eastern and Western Regions. Products of interest for REDS include; gari, palm oil, fish, rice, palm kernel oil and honey.

IV) **Agricultural Machinery Industrial System (AMIS) Project funded by UNIDO**: This project aims at developing appropriate and more efficient technologies for the agriculture sector. It has already developed prototype cassava harvesters, which are being tested by ASCo.

V) **Village Infrastructure Project (VIP): The project is funded by IFAD.** The project has helped with installation of cassava processing units in collaboration with RTIP programme.

The relevant activities for the Post-Harvest Infrastructure Project of VIP project to cassava development are to (i) Finance post-harvest treatment of crop and animal products, (ii) Finance storage and other simple processing techniques, (iii) Support the development of on-farm and village-level drying facilities to reduce post-harvest losses, (iv) Provide on-farm and village-level market infrastructure for more efficient marketing of produce, and (v) Add value and enhance the shelf-life of cassava and yams. The latter was to be achieved by providing (a) Village-level drying and processing facilities, (b) Funds for the procurement of eligible processing equipment and facilities, (c) On-farm and village storage facilities, and (d) Technical assistance through organisation and the training of users.

VI) Rural Enterprise Project (REP): The project is funded by IFAD.

The project has helped with training of micro-entrepreneurs in business management. The objective of the project is to alleviate rural poverty through skills provision and technology transfer. Funded by IFAD, Africa Development Bank, GOG and other small financiers. Target is rural entrepreneurial poor with bias to women, have already gotten into new six districts.

Areas of Activity:-Agro – processing, training in business management and other off farm activities. Project does not support direct farming activities. For the cassava sub-sector the project is supporting cassava processing , business development service, Technology transfer component (rural technology facility).

VII) Sustainable Uptake of Cassava as an Industrial Crop: funded by DfID and implemented by NRI and FRI. Other collaborating institutions include, Forest Research Institute of Ghana (FORIG), University of Science and Technology (KUST), MOFA, University of Ghana, private companies and National Board for Small-scale Industries. The project is funded for two years (January 2003 – December 2004).

Impact of Past and Current Interventions

- Improved processing technologies for gari, kokonte, agblemana and flour have been developed and are in use in various regions in the country.
- One small-scale company has started processing glucose from cassava for a biscuit company
- High quality flour has been produced and tested in baking of bread and pastries
- A modern starch factory with state of art equipment has been build and started operations in Sept. 2003 and so far has produced 800MT of starch (annual domestic requirements based on imports are 600MT/year).
- High yielding varieties have been distributed to farmers in all major cassava growing regions in the country (459,773 farmers have received material as follows (PSI-5,126; RTIP direct- 101,343; Farmer to farmer-353,304). Yields of up to 28MT/ha have been observed in some areas where adoption of improved technologies has taken place (RTIP, Evaluation Report).

However, despite these interventions a number of teething problems still exist that limit full commercialization of cassava in the country. These are;

- Lack of effective extension –
- Uncoordinated linkages between farmers-processors- and industrial users
- A cassava production system not geared to supplying a modern industrial sector
- No clear policy support for use of cassava products in the industrial sector
- Lack of grades and standards for cassava products
- Inefficient chips drying, gari roasting and glucose processing technologies
- Poor and inefficient transport infrastructure between cassava fields and collection centers
- Lack of bulk haulage facilities at Tema Port
- Poor and inefficient harvesting technologies
- Lack of cohesiveness in some of the cassava development activities
- Limited capacity for small-scale processors to handle large orders
- Potential cassava users not sure they can get consisted supplies of good quality and at competitive prices.
- Lack of waste and effluent management technologies especially among small-scale processors
- High cost of processed products

PRODUCTION PROFILE

Cassava was introduced in Ghana (then Gold Coast) from Brazil in 16 and 17th Century. By the second half of 18th Century it had become the most widely grown and used crop of the coastal plains (Adams, 1957). Ghana is the sixth largest cassava producer in the world[4] and the third largest in Africa.

The area under cassava in Ghana increased from 387,000ha in 1986 to 794,000ha in 2002 (MOFA, 2003) an increase of 105%. In the same period, cassava production increased from 2.9million MT to 9.731m MT an increase of 236%. The increase in production has therefore come both from increase in the area under cultivation as well as gains in yields. Current yields are now estimated at 12MT/ha[5] although in areas where RTIP has conducted intensive extension work yields of upto 28MT/ ha have been realized. Cassava is the most important agriculture commodity in Ghana contributing 22% to Agriculture GDP compared to 5% for maize, 2% for rice, sorghum and millet, 14% for cocoa, 11% for forestry, 7% for fisheries and 5% for livestock (Al-Hassan, 1989, Dapaah, 1996 – update with new data).

Efforts by the government to promote cassava production and commercialization through various programmes have seen area under cultivation and production increase by 2.90% and 3.48% between 1997 and 2002 respectively (MOFA, Facts and Figures, Sept. 2003. pp8&10).

Table 1. Cassava Production, Area under Cultivation and Yields (MT/HA)

Year	CassavaP	CassavaH	Yield
1990	2717.0	322.8	8.42
1991	5701.5	534.7	10.66
1992	5662.0	551.9	10.26
1993	5972.6	531.8	11.23
1994	6025.0	520.4	11.58
1995	6611.4	551.3	11.99
1996	7111.2	590.7	12.04
1997	6999.5	589.3	11.88
1998	7171.5	629.7	11.39
1999	7845.4	640.3	12.25
2000	8106.8	660.1	12.28
2001	8965.8	726.4	12.34
2002	9731.0	794.4	12.25

Source: Statistics, Research and Information Directorate, MOFA

[4] The country produced 4% of the world cassava production in 2001.

[5] The average yields for Thailand, the leading cassava exporter are estimated at 16MT/ha (Food market Exchange website, 2003).

Production Capacity at Optimal Conditions

Ghana has one of the highest yields of cassava is Africa and almost comparable to elsewhere in the world. Through the RTIP programme improved yields have been achieved using four varieties of cassava in different region in the country. These are high yielding varieties but each with different qualities. Afisiafii is the most preferred by farmers. The optimal yield levels, dry mater content and the maturity period for each of the varieties is presented below. From RTIP's experience, farmers acceptance of varieties is based on their immediate needs (e.g. poundable for farmers in Brong Ahofo region and gari processing in Volta region) and ability to dispose surplus within the local markets (RTIP Review and Planning Workshop report, Nov. 2000. pp6).

Table 2. High Yielding and Disease Resistant Varieties Being Promoted by RTIP

Variety	Yield Levels	Dry matter Content	Maturity Period
Afisiafi	27-30MT/ha	30%	120 -130days
Gblemo Duade	33-38MT/ha	27%	120-130days
Abasafitaa	26-31MT/ha	30%	100-120days
Tekbankye	26-31MT/ha	40%	120-130days

Source: RTIP

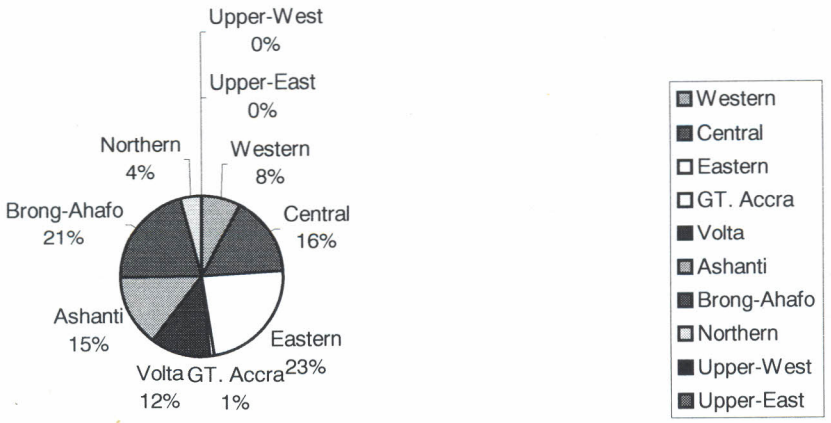
The country has the capacity to achieve higher levels of cassava production given that only a proportion of arable land is currently cultivated[6]. Production levels can also be increased through improved yields by adoption of high yielding varieties and recommended agronomic practices. Yield levels of up to 28MT/ha have been achieved in areas where intensive extension service has been undertaken. Production can therefore be doubled through improved yields. However, according to ministry statistics the country is already producing a surplus, which means incentives to increase yields are limited.

Major Cassava Producing Regions

Cassava in Ghana is produced in all the regions except Upper West and Upper East where production is extremely limited. Eastern, Brong Aholf, Central and Ashanti Regions are the leading cassava producers in that order (see figure 1 below).

[6] According to Ministry of Food and Agriculture less than 50% of the available agriculture land is currently cultivated.

Figure 1. Ghana- Share of Cassava Production by Region (2001)



Production Systems

Agriculture is predominantly on a smallholder basis in Ghana. About 90% of farm holdings are less than 2 ha in size, although there are some large farms and plantations, particularly for rubber, oil palm and coconut and to a lesser extent, rice, maize and pineapples. Farmers use traditional production methods. The hoe and cutlass are the main farming tools. Although there is little mechanized farming in the country, bullock farming is practiced in some areas especially in the north. Most food crops are intercropped. Mono-cropping is mostly associated with large-scale commercial farms.

Cassava is produced under small-scale production system with average cassava fields ranging between 0.5 and 2 acres per household (.....). Mean area under cassava for COSCA studies was 0.7ha/household (Nweke, 1999, COSCA wp21). Cassava is either grown as a mono-crop or intercropped with maize, yams, and plantains. Farmers do not use any soil fertility enhancing inputs for cassava fields, but fallow system is practiced in some areas as means of regaining soil fertility. Cassava is mainly grown under continuous cultivation (Nweke F. I. et al, COSCA wp21, pp22). Farmers grow cassava in multiple fields.

All cassava is grown under rainfed conditions. Soil fertility and rainfall patterns therefore have an important influence on cassava yields.

There is potential to increase production through: increase in area under cultivation, or increase in yields. Of the available land for cultivation only 46.5% is currently cultivated.

Most farmers only harvest their cassava depending on household or market needs, otherwise the mature roots are left in the ground until there is need for harvesting.

Costs of Production

The mission received four sets of costs of production, two from the Ministry of Food and Agriculture, one by Amasa-Agro and one by Ayensu Starch Co. The estimates differ in terms of yields estimates, costs of inputs including labour and land and also frequency of some of the activities such as weeding.

The cost estimates are reproduced in the table below, and they are used as a guide in arriving at farm gate price for raw tubers. Ayensu starch company has the lowest production cost and also the highest yields per acre. The production costs from Amasa and the Ministry do not differ significantly but the yields are significantly different. Each of the agencies uses a different farm gate price to arrive at the gross profit for the farmer. If we take the lowest price paid by Ayensu and apply it to the other two agency calculations, the farmer still makes a positive return although extremely low (cds4,623/acre) under the Ministry of Agriculture calculations. However, if the farmers use all the inputs and management activities costed in the profitability calculations they should be able to get better yields than indicated by either the Ministry or Amasa.

Table 3. Cost of Cassava Production Based on Estimates of Various Agencies

ACTIVITY	**Ayensu Starch Factory**	**Amasa Agro-Processing**	**Ministry of Food and Agriculture***
Land (hire proxy)	200,000	50,000	50,000
Land clearing (new land)			50,000
Preparation	90,000	120,000	21,000
Planting material	Free	5,000 (27 bundles)	300,000
Transportation		50,000	Bought farm-gate
Coppicing of planting material		10,000	
Planting	90,000	180,000	35,000
Refilling	20,000	----	---
Weeding	360,000 (4X)	540,000 (3X)	63,000 (X2)
Tools and Equipment			33,600
Harvesting	180,000	135,000	70,000
Bagging			14,000
Sub-Total (MOFA column)			**636,600**
Contingency (10%)			63,660
Total (MOFA column)			**700,260**
Interest bank rate (45%)			315,117
Total cost/acre	**940,000**	**1,100,000**	**1,015,377**
Cassava Yield/acre	12MT	8MT	6MT
Farm-gate price	170,000/mt	300,000/mt	350,000
Revenue	**2,040,000**	**2,400,000**	**2,100,000**
Net Return/Acre	**1,100,000**	**1,300,000**	**1,084,623**

**Calculation are for Coastal regions, Forest areas have different costing and yields*

Ghana has one of the highest recorded cassava yields in Africa, and among the highest in the world. Therefore it terms of yields, one can argue that the country's productivity at the farm level is recommendable. Where RTIP programme has made intensive campaigns yields of up to 28MT/ha have been realized. Cost of production however, remain high due to labour costs for land preparation, weeding and harvesting.

Mechanizing land preparation, and introducing appropriate harvesting equipment can reduce the production costs. A reduction in cost of production will enhance competitiveness.

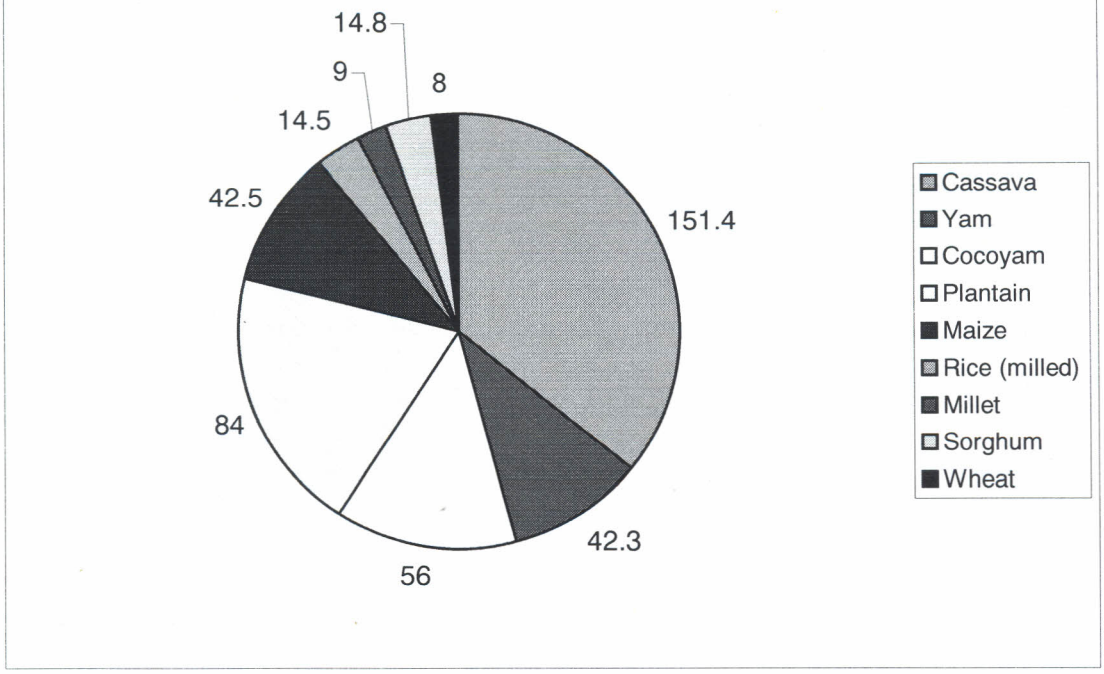
Level of Cassava Utilization

Most of the cassava produced in Ghana is consumed locally in various forms. COSCA studies estimated that 50% of the cassava is processed into various products while the rest is either eaten raw or cooked and eaten at home in various forms (Nweke et al, COSCA wp21).

Cassava is the most important food crop in Ghana, with an average par capita intake of 151.4kgs compared to plantain at 84kgs and cocoyam at 56kgs (figure..). COSCA studies estimated that 50% of the cassava is processed into various products and eaten at home, while the rest is either sold fresh or processed into other products and sold.

Only a small percentage of cassava production is processed and used in non-food applications. Although there is no documentation on the amount of cassava going into non-food sectors, there are a number of plywood and paper converting companies that are using cassava flour or starch in processing their products. The amounts being used are small compared to national production, but there is scope of expansion for industrial usage.

Figure 2. Par Capita Utilization of Major Foods in Ghana (kgs/head/year) for year 2000



Source: MOFA, Facts and Figures, September 2003.

According to Ministry of Food and Agriculture out of the 9,730,000MT of cassava produced in 2002, 6,810,000 were available for human consumption of which the estimated national demand was 2,940,000MT leaving a surplus of 3,870,000MT (MOFA Facts and Figures, Sept. 2003). Increased usage of cassava in the industrial sector, is therefore not likely to threaten food security of the producing households, but rather enhance their income levels.

Table 4. Ghana: Cassava Supply and Demand Situation in 2002 ('000MT)

	'000mt	Percentage
Production	9730	100
Avail. For Human Cons.	6810	69.98972
Est. Nat. Cons.	2940	30.21583
Surplus	3870	39.7739
Per capita Cons.	151.4	

Source: MOFA, Facts and Figures, September 2003.

Gari and Kokonte are important cassava products in sub-humid zones than in the humid zones. It is attractive to urban working-class urban consumers because it is easily converted into food or it can be eaten directly without further preparation.

PROCESSING

Traditional cassava processing technologies have been developed over the years to overcome the problem of poor storability of cassava. Processing adds the shelf life of cassava and presents cassava in more convenient form for preparation, while at the same time increasing the variety of ways in which it is consumed. The main cassava processed products in Ghana include; Gari, Kokonte (fermented flour), Aglemana, Akyeke (steamed cassava) and starch. Gari is the most widely processed product across the country (Nweke, et al COSCA wp21, pp83) and is also the most traded cassava product.

In Ghana both traditional and modern cassava processing technologies are being practised. Traditional processing technologies are being replaced with more efficient technologies developed by International Institute of Tropical Agriculture (IITA). The improved technologies include graters, screw press, gari roasting stoves and dryers.

A modern starch processing plant has been build in Ghana with a capacity of 22,000MT of starch per annum. This will enhance usage of cassava in the industrial sector considerably.

Processing Steps for Some of The Main Products

Small-Scale Processing

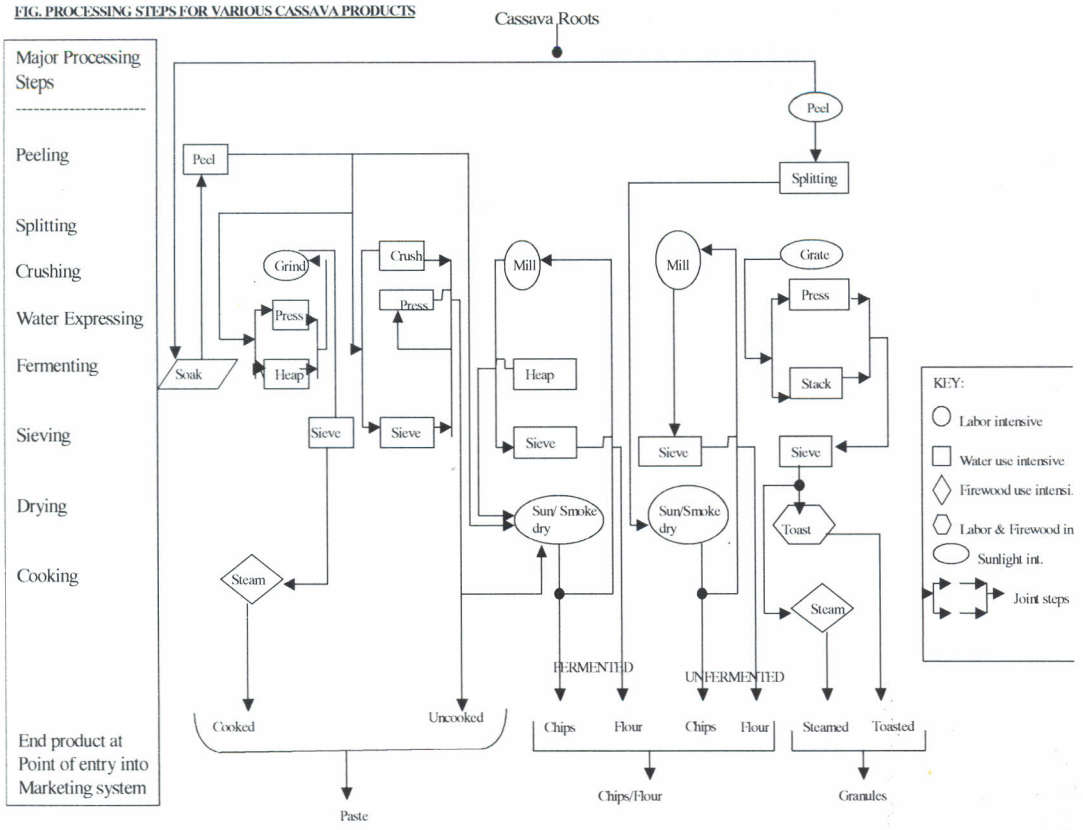
Kokonte: cassava roots are peeled and chopped into chips which are sun dried or smoke dried. During the drying process the chips attain some level of fermentation. The dried chips are then milled into flour using hammer mill. Depending on the fermentation process some chips become mould, this lowers their attractiveness to consumers and hence attract a lower price. In Techiman Market, Kokonte chips that were whiter than others were attracting twice (C5000/2.2kg) the price of the mould chips (C2500/2.2kg). The baking quality flour that is being promoted for baking purposes can not be substituted for kokonte because it lacks the fermentation flavour properties available in kokonte.

Toasted granules of Gari: This is the most popular form in which cassava is processed in Ghana. It serves well as a method of preserving cassava by increasing its shelf life by up to 6 months. Gari is also a ready to eat product, which requires minimal further preparation before consuming. Fresh roots are peeled and grated, the grated pulp is put in sacks, and the sacks are placed under heavy objects (press) for 1 – 4 days to drain excess liquid from the pulp while it is fermenting. The dewatered and fermented lumps of pulp are sieved, and resulting fine pulp is toasted in a pan. Palm oil is normally added during toasting, to stop the pulp from burning.

Glucose: A small-scale processing company has been working with a the DfID funded project within FRI to process glucose from cassava flour. The company is linked to a

biscuit manufacturer. They started processing only two months ago and have been producing 50kgs of syrup per week. The syrup is brownish in colour.

FIG. PROCESSING STEPS FOR VARIOUS CASSAVA PRODUCTS



Large/Medium Scale Processing

Cassava starch is the only product currently being processed on a large scale in Ghana. As stated elsewhere, 10 starch processing companies are to be setup under PSI. So far one company has been established and started processing.

This factory has the state of the art technology imported from Denmark's International Starch Company. It has a processing capacity of 22,000MT of starch per year. The plant is made up of a peeler, washer, raspers, centrifuges, hydro-cyclones, vacuum filters, a boiler for steam generation and dryers and packing machine.

The process involves peeling, washing, chopping and rasping to expose starch grains. Copious volumes of water are added to the mass and the starch is concentrated, refined, de-watered, dried, cooled and bagged. All the operations are automated.

The total investment for the factory was US$7 million. Funding sources included long term loans from a syndicate of local banks: Agricultural Development Bank (ADB), National Investment Bank (NIB), and Ghana Commercial Bank Ltd. (GCB), Oikocredit (a Dutch Non-governmental organization) and Export Development & Investment Fund (EDIF).

The Company is owned by farmers and two banks, ADB and NIB, which have agreed to convert US$1.7million of their long term loans into equity. In the next five years the banks are to transfer their shares to farmers.

Challenges Facing the Ayensu Factory

Harvesting and Haulage of roots is the immediate serious challenge. Since the factory has yet to establish a large nucleus farm, it relies on small-scale cassava farmers for supplies. The farmers do not have efficient harvesting technology and therefore shortages of processing material has been a teething problem.

Logistical problems of organizing the harvesting and delivery have also affected the company. Some deliveries are made on Saturdays which means the processing will have to wait until the following week on Monday. This lowers the quality of the roots and has effect on quality of the starch. The company is intensifying extension service and organizing farmers into producing blocks. The Factory has been operating for only two days a week since it started operations due to lack of roots.

There has been negative press publicity largely due to the pricing being offered by the factory. Currently the factory is offering C150,000/MT farm gate and C225,000/MT factory gate. The press has called this "slave price". However, given that the target market for the starch is export, the factory has to receive raw roots at internationally competitive prices for it to process and compete in the international market. Brazil is currently paying an equivalent of C132,000/mt factory gate.

Credit for the farmers to increase production through adoption of better agronomic practices is another limitation facing the factory.

Frequent power outages have also been a problem to the operations of the factory. The management is considering purchase of a backup generator.

Processing Capacities

Starch:
ASCo plant has a capacity of 22,000MT of starch per annum. However, the plant is only operating two days a week due to lack of raw materials. Since it started processing in September 2003, the factory had processed only 800MT of starch by first week of November 2003.

Gari, Kokonte, Agbelima and High quality cassava flour:
These are processed using traditional and small-scale technologies. Processors use graters with capacities ranging between a few kilograms (traditional manual graters) to 5MT (IITA graters) per day. Milling is done using hammer mills with varying capacities.

Some of the graters have been installed by FRI in the following locations; Brofo Yeduru, Beposo, Mantse and Doblo Gono (RTIP, Midterm Programme Report, Dec. 2001. pp7). Other graters, and screw presses have been installed with support from VIP project.

Technologies in Use

Starch: Starch is processed using three types of technologies in Ghana, a modern technology, small-scale technology and traditional technology. The modern technology has been introduced by Ayensu Starch Co. The company has state of the art technology imported from Denmark's International Starch Institute. The plant is made up of a peeler, washer, raspers, centrifuges, hydro-cyclones, vacuum filters, a boiler for steam generation and dryers and packing machine. Small-scale technology involves hand peeling with knives, graters, screw press, decanting bays and dryers. Traditional technology users manual graters which have very low output and are labour intensive.

Technologies for Processing Flour, Gari, Kokonte (Chips)

The technologies in use include peeling knives (this leads to losses according to industry players), washing bays (some with running water others without). The bays are made of bricks and ceramic tiles lining while other use half cut drums. Graters (these are either motorized or manual, slicers (mainly for flour making), screw press (for dewatering), sieve mats, drying slabs or solar sheds, milling machines (hammer mills) and dryers. All the technologies can be fabricated locally by a number of engineering firms (annex V & VI).

Gari Roasting Stoves: FRI has developed improved Gari roasting stoves with a chimney to reduce excessive heat and smoke associated with traditional Gari roasting stoves. These stoves have been distributed to various regions in the country under the RTIP programme (Annex III). The traditional stoves have been blamed for several health problems including reddening of eyes, headaches, breathing problems and even miscarriages (RTIP, Midterm Programme. Report, Dec. 2001, pp7).

Processing Productivity and Competitiveness

Some of the small-scale and medium scale processing enterprises are using newly installed equipment, but according to RTIP evaluation report and our own field findings, the capacities of the different technologies along the processing chain are not synchronized and this leads to inefficiencies in use of certain stages along the processing chain. Manual peeling of the roots for example leads to delays in feeding of the graters

especially where labour is a constraint. Hand peeling is responsible for up to 5% loss of the root fresh according to one of the small-scale processors. Most of the processors also use only one washing bay, one pressing machine and one fermentation bay for all the products.

Productivity and competitiveness is also affected by the fact that the enterprises are not operating at full capacity due to inefficiencies in marketing. Most of the products are only being processed on order. The processing therefore operates on had hoc basis. Low capitalization of the enterprises also leads to ad hoc operations as the processors cannot buy large quantities of roots.

Adherence to food safety quality and hygienic practices is not being observed in most of the operations especially in Gari processing and in waste disposal (peels and effluent). Proper dressing of the people working in the processing does not conform to accepted industrial standards.

Washing of the roots in some areas in also faced with problems due to lack of running water.

There is also no system in place to test the quality standards of the processed products. This is critical if the processed products are to be used as industrial raw material in food, plywood, etc. Use of cassava flour in baking has to adhere to certain minimum standards, e.g. has to be sweet variety, cynogen levels must be minimized or completely lacking, has to be white and uniform. Maintaining these standards for flours processed by farmers groups have been found to be difficult in Uganda, Kenya and Malawi.

The specific factors affecting competitiveness of processing of various products are listed below.

Starch:

Factors affecting competitiveness of the Ayensu Starch Factory

- Cost of raw material (strong agitation to pay high prices)
- Availability of raw material (factory is only operating two days a week).
- Quality of raw material (some roots are delivered more than 24hrs after harvest, roots are of different varieties with different starch contents).
- Recovery rate is only 18%, Thailand recovers up to 25% on average.
- High cost of electricity coupled with frequent power outages.
- High costs of transportation (especially for raw materials)
- High costs of production, attributed to high cost of raw materials, irregular supplies and quality of the material.

According to ASCo data, the cost of production of cassava starch is Cds1,566,153/mt (US$174/mt)[7] of which the raw material contributes 65%, without factoring in cost of planting material and interest on advances to the farmers by the factory. When all costs

[7] This is US$4 higher than Thailand's FoB (Bangkok) price of starch (see table below).

are factored in, the raw material cost contribution is 76%. Production costs can therefore be reduced significantly by lowering the cost of raw material.

Small-scale processing (starch, chips and flour):

- Operation on ad hoc basis, due to lack of markets as opposed to lack of raw materials (the processing is only done to meet orders that have been placed with the firms or targeting certain market days).
- Losses due to inefficiencies associated with hand peeling.
- Inefficient drying technologies affecting the quality of chips and flour.
- There is lack of synchronization between different stages of processing and this adds to inefficiency.
- Processing of glucose is still under investigation and suitable technology has not been developed yet.
- Conformance to food safety is wanting in most operations, (peeling, drying, effluent discharge and waste disposal etc.).

An integrated high quality cassava flour with a viable and efficient cassava chips processing industry as shown in the figure below is proposed. The idea is to have a chips processing investment that supplies quality dried chips to either flour manufacturers, pellet manufacturers or exports of the chips.

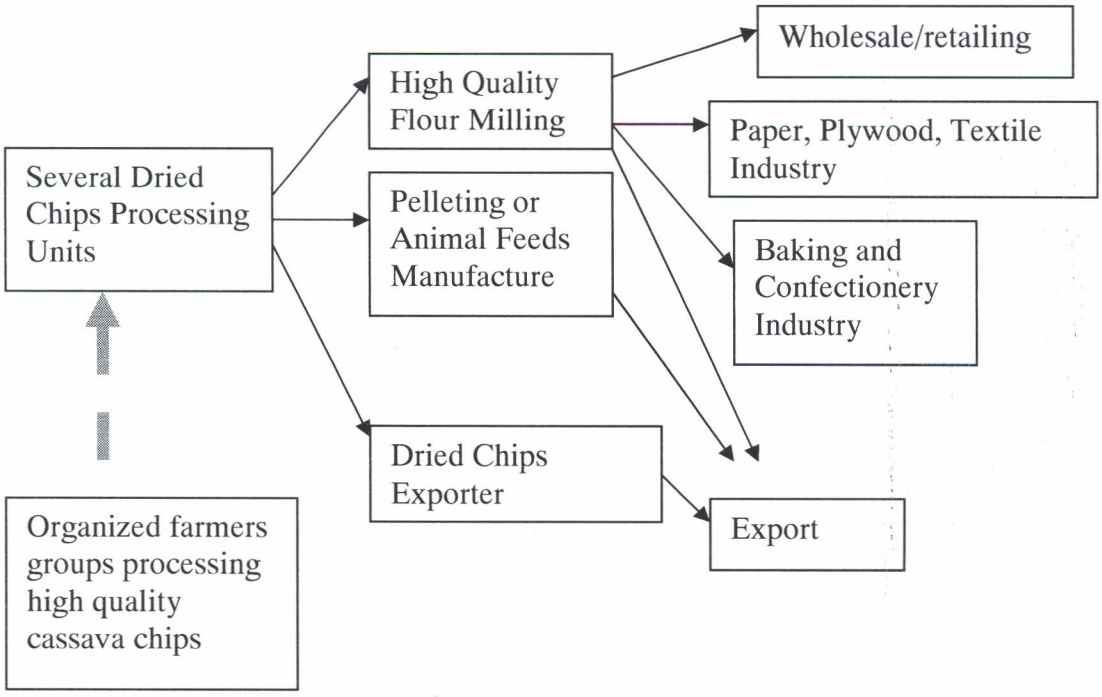


Figure 4 An integrated cassava production, processing, marketing and export model.

By-Product Utilization and Environmental Impact

Some of the processing enterprises are using cassava peels and pulp as animal feed. Ayensu starch factory for example sells the pulp waste to pig farmers at Cds6,000/bag of 25kgs (approx. US$26.7/MT).

Waste disposal is a major problem especially among the small-scale processors. The effluent is drained into a small pond or hole adjacent to the washing bay and the pressing unit. It is then scooped with a basin and poured on the adjacent ground. Although the amount of the effluent is small the long run implications could be grave as the waste accumulates. Figure 4 below demonstrates a gari processing site with poor effluent and waste disposal. In the background of the bottom upper photo are decomposing cassava peels, while a stream of effluent from the pressing machine is evident in the center of the lower photo. Within this particular site there are four processing enterprises.

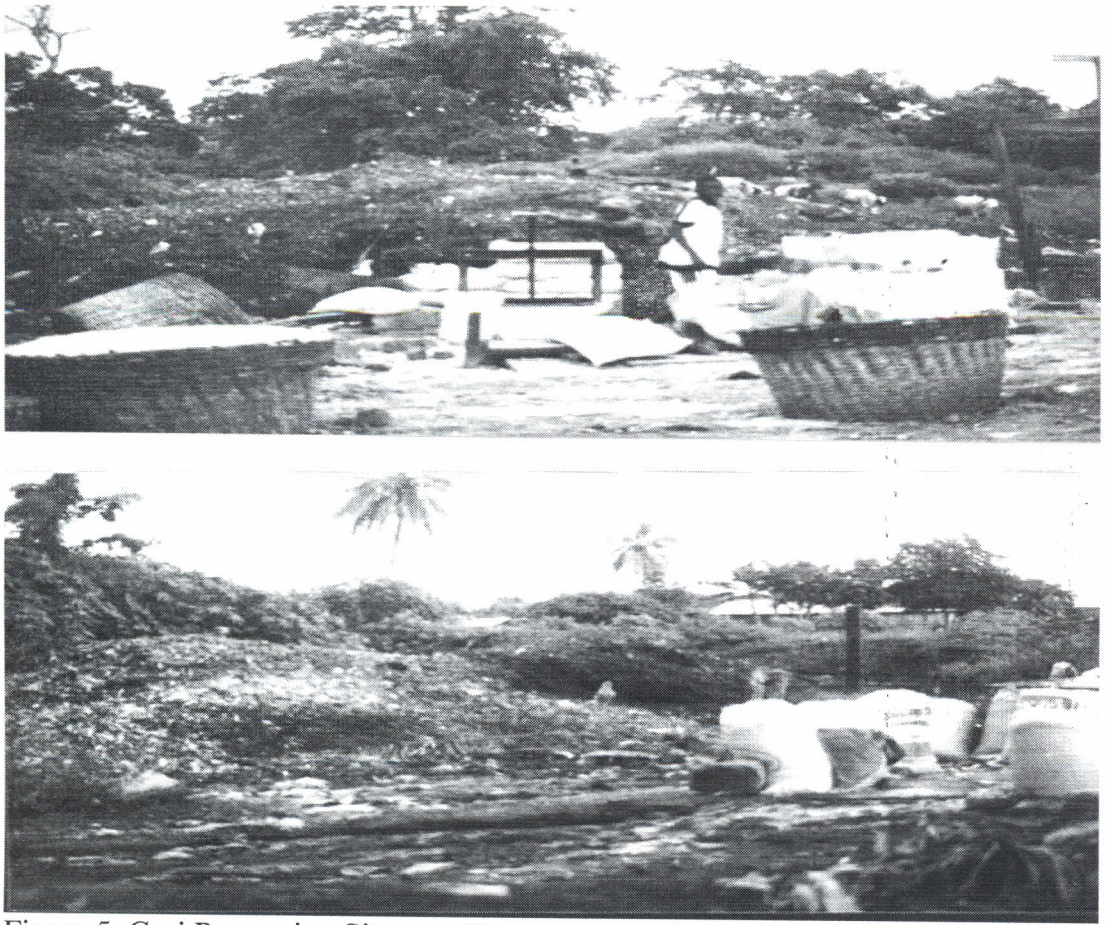


Figure 5. Gari Processing Site near Techmani showing poor waste and effluent disposal.

Some of the enterprises do not have running water and this compromises the quality of the processed product especially flour for food uses. The affected areas are in the

washing bay in which water has to be recycled as it is brought in a basin. The quality of the water being used especially where it is drawn from shallow wells cannot be authenticated.

Peelers, graters, millers and pressers in the different processing areas of cassava products were lacking proper dressing for handling of food substances e.g. headgear, white overalls, trimmed nails, etc. Processors were carrying out the activities using their normal dressing and even wearing wigs and earrings, which could pose a threat to quality of the product being produced.

MARKETS FOR CASSAVA PRODUCTS

The largest market for cassava in Ghana is in food, while industrial utilization is still limited but with potential for expansion. The main marketed processed cassava product is Gari. Other forms in which cassava is marketed as a processed product are kokonte, agbelima and high quality flour (unfermented). Cassava is also marketed in raw form and used to prepare a number of dishes such as fufu and banku. Banku and Fufu are served in most low to medium class hotel outlets in the country.

The potential for industrial use of cassava depends on specific industry needs and is presented in table 5. Industrial use of cassava will occur through substitution of the existing starches and flours, mainly corn and potato starches and wheat flour. For substitution to occur there has to be a policy commitment or an aggressive campaign to popularize cassava usage while at the same time ensuring competitive pricing. The current national average prices of raw cassava are not competitive.

The starch market has been estimated at about 5000MT per annum, which is relatively small. The main potential users of starch include pharmaceuticals, textiles, paper converters, and biscuits industry. The potential for adhesives exists in plywood, packaging industry, while the potential for flour exists in plywood, pastries, textile and glucose manufacture. The market for paper and packaging industry has been estimated at 840MT per annum.

The potential adhesive market is estimated at over 3,300MT per year based on the 1999 import statistics (table 6). The actual usage by two plywood manufacturers for the year 2002 was 1,549.5MT of adhesives. There are two types of adhesives in use, natural and synthetic adhesives. Synthetic adhesives are most popular because they are cheaper.

Whether existing industries will be convinced to use cassava, as raw material will depend on, pricing[8] of the product, availability and technical knowledge of how it can be used. In one of the plywood manufacturing companies, they have used cassava flour (kokonte) since 1970s, except at times in which the price increases to levels close to wheat flour prices. The same experience was reported by a textile manufacturing company in

[8] The current national raw root average prices as shown in figure 5 cannot guarantee a cheaper substitute for wheat or imported starch.

Akosombo. The team was actually surprised that the textile manufacturer was using flour instead of starch.

Use of flour in the baking industry is being introduced by RTIP programme but has not picked on well especially for bread manufacturing as the consumer attitude has been negative. The use of cassava flour in pastries, pies, cakes, biscuits and doughnuts is however, acceptable to consumers.

Table 5. Ghana Current and Potential Usage of Cassava Flour/Starch

Industry	**Annual Usage**	**Equivalent Raw Roots**[9]
Plywood (flour and Glue)[10]	40.5MT of kokonte actual for one firm, 205.2MT potential for other two. Actual potential is probably more than 900MT*	4,500MT
Textiles[11]:	240MT of cassava flour actual usage by one firm. Other estimates 480*	2,400MT
Pharmaceuticals	350MT/annum usage of two companies visited during the study	1,750MT
Paper/packaging:[12]	166MT/annum based on data from only one company. Other estimates (840*)	4,200MT
Food:	120MT*	600MT**
Animal Feeds	500MT (one factory assuming 50% substitution of maize). Comprises about 10% of national demand.	25,000
Total Estimated potential		43,105MT

Source: Field survey
**Day, G. et al, May 1996*
** refers only to flour used in pastries and baking industry.

Table 6. Imports of Adhesives Into Ghana 1995-99

Year	CIF Value ©	Net weight (kg)
1995	1,518,439,257	3,409,012
1996	2,387,892,180	2,183,560
1997	2,957,874,421	1,718,032
1998	8,283,473,342	5,882,054
1999	8,424,921,051	3,300,278

Source: Ghana Statistical Service

Given that Ghana imports all its wheat requirements. The government could require 10% of wheat flour to be replaced with cassava flour. The total wheat imports for 2002 was 182,681MT (table7). A ten per cent replacement will mean 18,268MT of dry weight

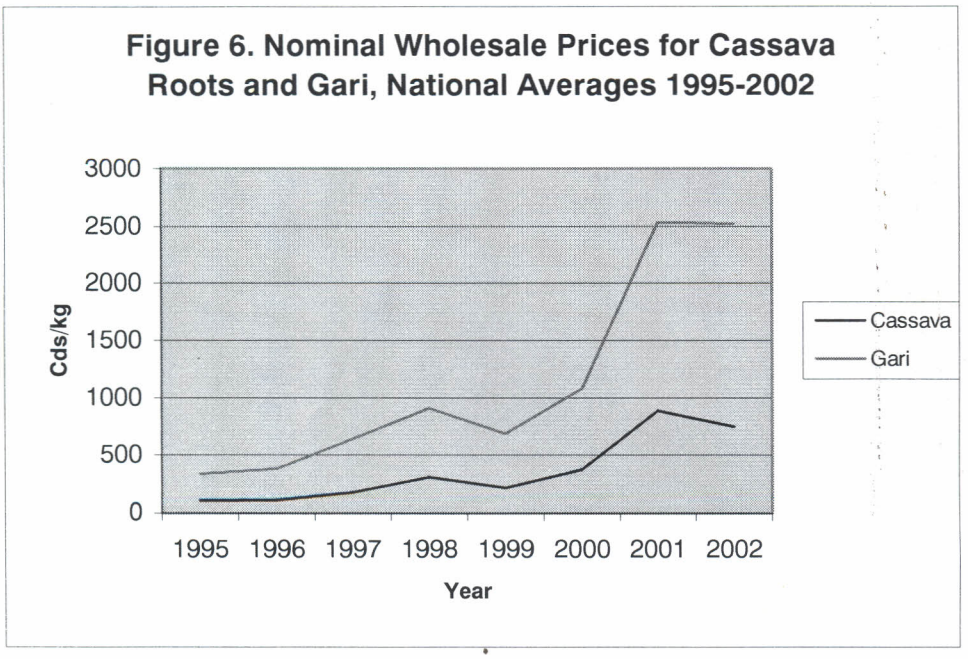
[9] Assumes 20% recovery. Actual recovery for Amasa-Agro and Ayensu starch is 18-20%
[10] Most of the plywood manufacturers were using wheat flour, but one has been blending cassava and wheat flour since 1970s.
[11] One of the factories was actually using cassava flour popularly known as kokonte in Ghana.
[12] One company was using cassava flour, while the other companies visited were using imported corn or potato starch

cassava equivalent or 91,340MT of raw roots. Such a policy move may however, not be popular with the industry and a more subtle approach of presenting cassava as a cheap and quality substitute may be preferable.

Table 7 Wheat Imports into Ghana In Volume and Value

Year	Volume (MT)	Value US$Million	Value/MT
1991	42,037	11.53	274.28
1992	26,886	17.54	652.38
1993	28,528	26.96	945.04
1994	30,319	31.97	1,054.45
1995	30,257	33.00	1,090.66
1996	97,381	32.27	331.38
1997	219,615	66.03	300.66
1998	484,926	84.18	173.59
1999	181,645	102.70	565.39
2000	196,700	72.03	366.19
2001	168,816	64.25	380.59
2002	182,681	78.59	430.20

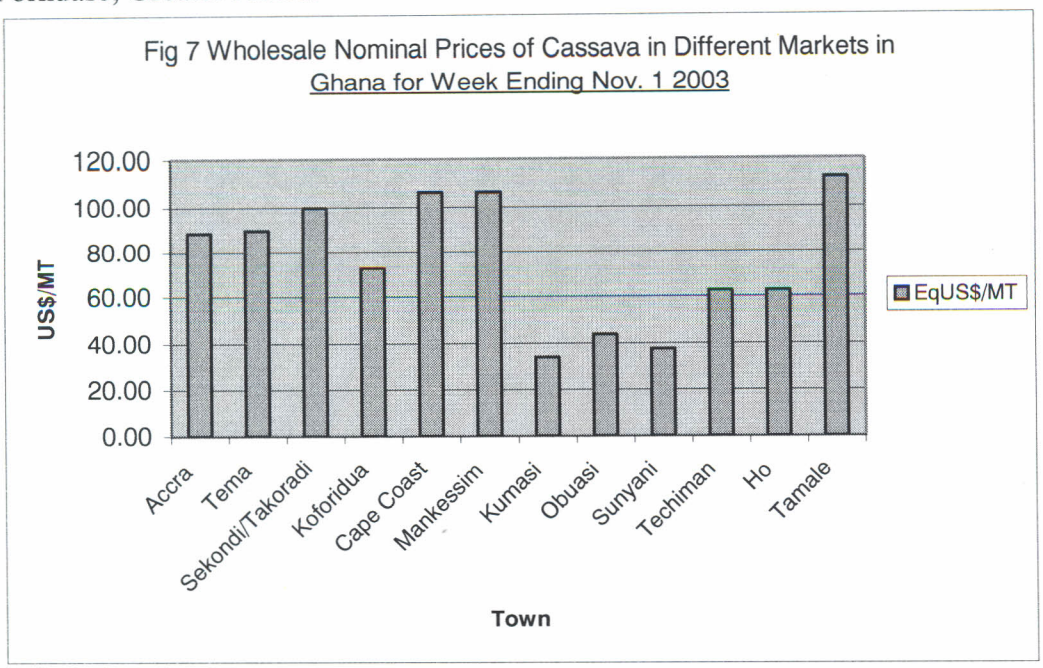
Source: Ministry of Trade and Industry



Source: MOFA, 2003.

Cassava prices differ by region as shown in figure 7 below. Efforts should be made to recommend locating of processing industries based on relative prices of raw materials. Areas with high prices reflect high consumer demand relative to supplies of the

commodity. While the prices given below are wholesale prices, the farm-gate prices are much lower, for example in Mampong the farm-gate price at the time of the study was Cds140/kg, while Amasa Agro-Processing was paying a farm-gate price of Cds300/kg in Porkuase, Greater Accra.



Source: MOFA, 2003.

Potential export markets

According to industry sources in Ghana, there is huge potential export market for cassava products mainly chips, pellets and starch in the European market. However, Ghana's potential to enter into world market is limited by high domestic prices of raw materials (figure 6 above), inability to supply large orders and lack of grades and standards for Ghana cassava products. The European market prefers cassava in pellet form for its livestock feeds industry because it has less environmental effects (dust pollution) and is usually of better quality than chips. Within the region, potential exists in Burkina Faso, Niger, and South Africa (starch). Niger imported 35,902MT of cassava products in year 2000, while South Africa imported 11,117MT.

Lack of formal grades and standards for cassava products in Ghana is also another factor that would affect its ability to penetrate the international market. Ghana can however adopt internationally accepted standards for chips and pellets, which are reproduced below;

- Free from foreign materials
- Free from abnormal odour
- Free from abnormal colour
- Not rotten or mouldy

•Free from live insects
•Crude fibre max. 5%
•Moisture max. 14%
Source: Food Market Exchange website, 2003.

Table 8 Comparison of world market prices and Ghana prices for cassava starch and pellets/chips for Nov. 1 – 15th 2003

Product	**FoB US$/MT**	**Ghana Prices**		
Flour/Starch super high grade	160-170 Bangkok	Ayensu starch $200 FoB Tema	Amasa-agro Starch US$1,166/MT local sales	Other Small scale processors
Hard pellets	US$82-83 Koh shipped to EU US$71-72 Kon shipped to China			
Hard pellets	US$117-118 Rotterdam			
High Quality Cassava flour			US$388/MT local sales	
Gari			US$333/MT local sales	US$202/MT wholesale

Source:Foodmarketexchange website. 2003. and Field Survey

Table 9 Selasie Farms/Groceries Exports of Cassava Products to USA and UK

Product	2002	2003 (Jan. – Oct.)	Prices (Cds/kg)
Kokonte	5000kgs	12,000kgs	7,000
Banku		7,200kgs	10,000
Gari		1,200kgs	8,000

Source: Field survey

The size of the above markets are not known. Selasie relies on requests from potential customers in UK and USA before processing the flours for export. No efforts have been made by the exporter to expand the size of exports.

A number of small-scale cassava processors have also exported cassava products (kokonet, gari and banku (mixed flour) to USA and Europe. ELSA foods in Accra have been placing large orders of high quality flour with Amasa-Agro[13], which they blend and export to Rwanda and Burundi. Between November and December 19th 2003, they have ordered 12MT of high quality flour.

Ghana's competitiveness in the international market is affected by;

- Domestic pricing far exceeds world market prices (table 8 above),
- Lack of grades and standards for locally manufactured cassava products[14]
- High cost of production, processing and transportation

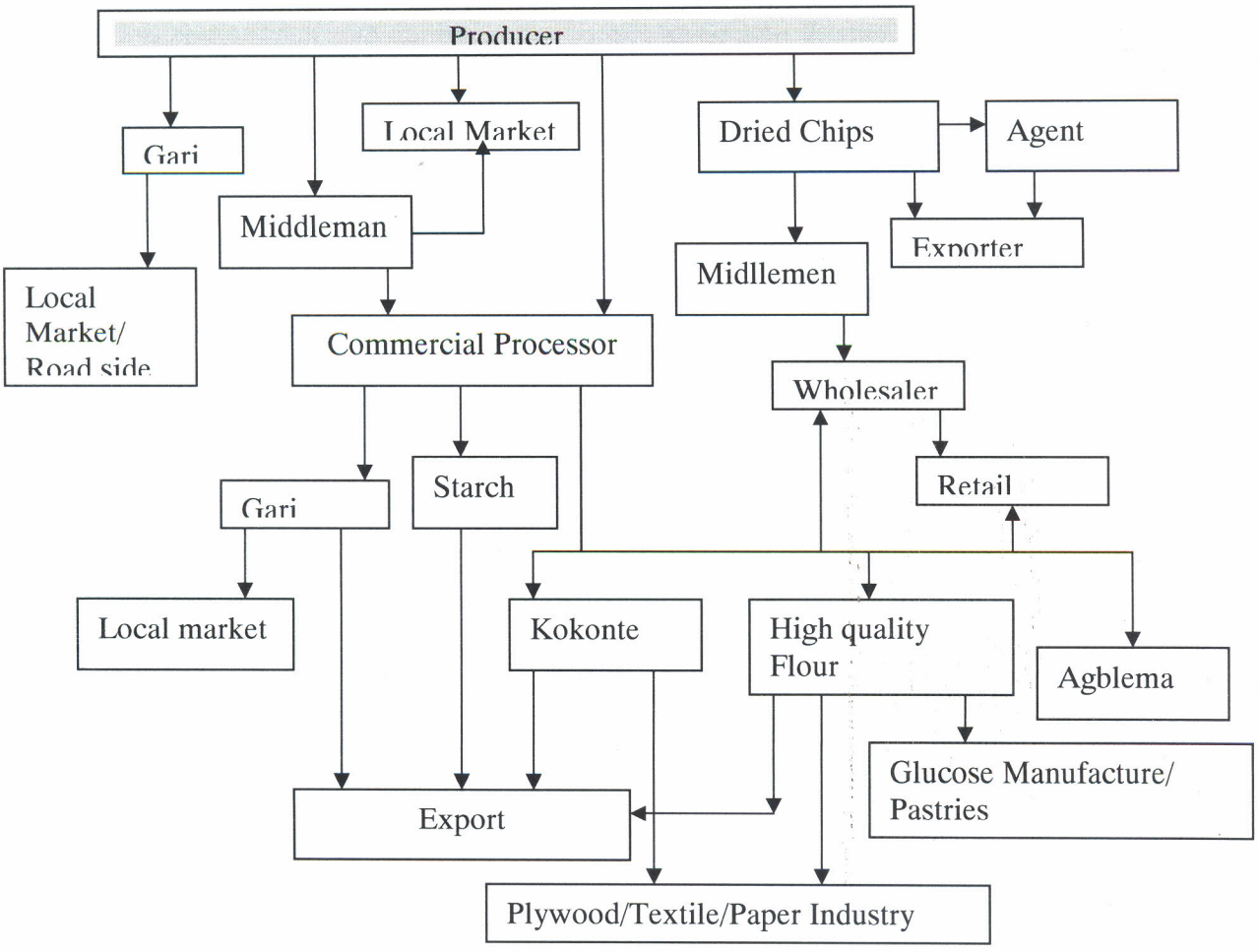
[13] Amasa-Agro is a small-scale cassava processor located in Purkuase area of Greater Accra. It specializes in high quality cassava flour, gari, high quality kokonte, agbelima and starch. It is being supported by DfID and RTIP through Food Research Institute (FRI).

[14] Ayensu starch factory is however moving towards establishment of cassava standards for cassava starch. Its cassava starch has so far met international standards from the analysis already carried out.

Ghana Cassava Value Chain

Figure 8, below demonstrates the current cassava value adding chain in Ghana. The most important in terms of volume is the producer-gari-local/road side market chain. Other important chain is the producer-middlemen-fresh roots market chain. Other emerging chains in terms of importance is the producer-commercial processor chain. The chain involves direct link between large processor and root producers. It may or may not involve contracting.

Figure 8. Ghana Cassava Value Chain



Summary of Findings and Identified Gaps

Production:

Land preparation: there is need for mechanization of land preparation to reduce costs especially in areas with labour shortages.

Harvesting technologies are labour intensive and inefficient especially as relates to supply of large quantities of raw roots to main processing factories. Poor harvesting technologies also lead to root damage while harvesting.

Actual costs of production are not generally known, and this has resulted with different agencies having their own costs of production, which they use for negotiating prices with farmers.

Poor infrastructure, roads and transport systems within cassava farming areas are a limiting factor to efficient and lead to costly delivery of harvested roots to markets.

Effective logistical linkages between producers, processors and end users of cassava products are lacking and this contributes to losses of harvested roots and marketing inefficiencies. Poor linkages between the different components along the production to utilization chain, also leads to a situation in which producers are unaware of the client requirements in terms of varieties, and root qualities.

Factors that will influence farmers' decision to grow and supply cassava to a processing firms include:

- Farmers ability to access alternative markets
- Type of linkages between the farmers and the processors
- Availability of harvesting labour at the required time
- Transport availability and cost
- Price being offered by the processor and terms of payment

Processing

Large processing units such as Ayensu starch factory are unable to get sufficient supplies for optimal operations and this contributes to inefficiencies and high costs pf their operations.

High prices of roots to processing firms is a major contributor to high costs of production.

There are cases of inefficient processing technologies especially among the small-scale processors and lack of effective linkages to markets. The problem is largely due to lack of information and accessibility to these technologies. Specific technological gaps include, dryers, gari roasting, and peelers.

Poor or lack of by-product utilization and waste disposal is widespread.

Most of the small-scale processors operated under limited economies of scale as a result of under capitalization and lack of market intellegency.

Processors lack grades and standards for processed products and roots being supplied to processing firms.

Processors face competition from imported products such as starch and wheat flour.

There is insufficient sensitization among potential industrial cassava users

Most cassava processors lack effective market linkages (processor-markets)

There is lack of clear policy support for use of cassava products in the industrial sector

Marketing/ Export

Most of the small-scale processors and especially farmers cooperative lack economies of scale and are therefore not in a position to take large contracts. Potential users like the plywood industry expressed apprehension on the local industry ability to supply quality cassava flour and adhesive on regular basis and in sufficient quantities. Some of the current operators indicated that they have been unable to enter into some contracts because they could not meet the large order required by the clients.

Lack of market information on potential local and regional demand for various cassava products is also a limiting factor to cassava processors in the country. This is compounded by lack of known grades and standards for various products which the processors can use in their marketing strategies.

Small-scale processors with potential for export lack knowledge of export procedures. One of the processors had a large pending order of high quality cassava flour for export to Burkina Faso because they were unsure of the procedures and potential tariffs.

High cost of interior transportation and lack of bulk loading facilities at the port of Tema are limiting factors to cassava domestic and export trade as they lead to high costs of cassava products.

RECOMMENDATIONS

Production Level Interventions

The focus on production would be first to lower the cost of production and increase returns per unit area. The measures would include the continued supply of improved and

high yielding planting materials especially to areas targeted for production of raw materials for industrial use. Training of farmers to improve on agronomic and crop husbandry practices is also highly recommended as a way of reducing costs of production.

Preparation reliable farm budgets that can be used for extension services to demonstrate to farmers that cassava farming is a profitable business.

Promote contract farming and ensure that cassava varieties are promoted on the basis of intended end users needs, e.g. high starch content varieties for the fields supplying starch factories. Cultivation and harvesting should be programmed to meet specific daily factory intake needs.

Introduction of improved harvesting tools to increase efficiency of root harvesting and reduce root damage during harvesting.

Construction of feeder roads and appropriate transport systems for efficient delivery of roots from fields to collection centers.

Processing Level Interventions

Starch: The current installed capacity for production of starch is sufficient to meet local demand, which is currently estimated at about 3,000MT per year. The starch needs are for different industries, and each industry has its own specifications and standards for starch. The focus should be textile industry, pharmaceutical industry and the paper and packaging indutry. Discussions with the pharmaceutical industry in Accra indicated willingness to use locally produced starch provided the Food and Drug Board (FDB) sanctioned it, and that it met the British Pharmacobia specifications, which are currently in use. The relevant intervention would be working with Ayensu starch company, the pharmaceutical industry and the Food and Drug Board to come up with the required standards of the starch. The other consideration is the price. Local starch has to be competitively priced as the industry has the import option.

In order to penetrate international markets reduction of cost of production must be achieved through, improved starch recovery during processing[15], reduction of cost of raw materials, efficient collection and delivery of raw roots to factories, and standardization of varieties being processed for various products. The high cost of fuel, electricity and transportation should also be addressed as they affected the competitiveness of the Ghanaian factories in the world market.

Introduction of internationally acceptable grades and standards for the starch. For the starch exports, standards depend on the target uses for which the importing client has specified. So far Ayensu starch has been declared of good quality from analysis done by the Danish International Starch Institute.

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[15] While Thailand is able to recover 25% of starch for each metric ton of cassava processing Ayensu and Amasa Agro are only recovering 18%.

Expansion of investment in cassava starch production is not recommended, rather efforts should be made to get the Ayensu starch factory running regularly and a market base, grades and standards established before further expansion. Supplies of raw materials at competitive prices should also be guaranteed.

Chips/Pellets and High Quality Cassava Flour: The focus should be for domestic market (feeds), regional and international. It is however, recommended that productivity and competitiveness issues be addressed for the industry to be able to penetrate any of these markets. Competitive pricing of the raw tubers should be the first step. Other interventions include improving on the quality of processed chips and going a step further to process pellets, which is the preferred commodity in the world market. The cassava chips can be processed by individual farmers or organized farmers groups who are located in areas that are accessible and in places where raw materials are fairly priced. The chips enterprises should then be linked by upstream pelleting companies, which are better capitalized and with more skilled management.

Currently Ghana does not have a pelleting company, but GAFCO has pelleting facilities at its animal feeds manufacturing unit. For export purposes it is recommended that a potential investor in pelleting be identified and linked to the chips processing units. However, this option should only be pursued when it is established that Ghana can supply pellets in the International or regional markets at competitive prices. At present this is not the case.

Drying is a major challenge in Ghana especially during the rainy season. This affects the quality of chips. FRI has introduced solar dryers in some areas but no assessment has been done to determine the quality of chips dried under the solar driers. Needless to say, high quality chips in terms of colour, lack of ordour and less that 14% moisture content are necessary to penetrate the international market. For chips going into flour making for bakeries and confectionery industry or in making of pellets it is important that they be of the highest quality possible.

The efficiency of the chips and flour processing firms will also depend on how fast they are able to dry the chips. One firm has a drying unit with an engine with an estimate cost of Cds 60million (US$6,700). Although this method of drying does not achieve as much brightness of chips as drying under sun, it is fast and helps to reduce the chances of fermentation during drying in wet areas.

The other recommended intervention would be addressing the high costs of transportation and bulk cargo handling facilities at the Port of Tema.

Support to the chips making groups include, training, credit and setting up the drying facilities. The groups should be linked with flour millers, animal feeds manufacturers, pelleting companies and exporters of dried chips.

Introduce grades and standards for cassava chips, flour and pellets. These grades should be known to all interested parties and conform to acceptable market domestic and international standards.

Strong and effective linkages along the value chain, producer-processor-user/export is highly recommended. This can be facilitated through formation of a cassava working group that brings together all institutions and projects working on cassava development and the private sector.

The government needs to come up with a clear policy in the use of cassava in the industrial sector, including setting up standards for uses in various industrial applications. Export policy support for cassava products should also be developed.

Provide capacity building in business and financial management, marketing especially in export trade, and quality control to small-scale processors and the farmers cooperative societies involved in cassava processing.

Help cassava processors especially small-scale operators to achieve environmental and waste management systems including by-product utilization.

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ANNEX I: TERMS OF REFERENCE

Tasks to be performed	Expected Duration	Expected results
1. Organize and analyze existing data and information on cassava including; - Existing government policies on cassava and cassava products (production, processing, importation and export regulations etc) - Past efforts to promote cassava production and processing - Ongoing support activities (including actors) that target the cassava sector - Impact and desired impact of past and ongoing programs - Government support institutions including their mandates	3 days (Accra)	Elaboration of support institutions serving the cassava sector their specific mandates; interventions, results and gaps in past and ongoing programs
2. Production profile; - Main regions involved in cassava production - Production systems-large/Medium/Small - Total annual national yields - Area under cultivation - Forms of cultivation (small scale/rotation plantation, - Yield /hectare - Production capacity at optimal conditions	3 days (elsewhere)	- Production Capacity Capabilities to supply industry -Production constraints

3. a. Utilization Study - Analyses of all post harvest activities (including storage, handling and transportation) - Level of cassava utilization - Processing capacities (breakdown of large/small and medium scale) - Processing technologies in use - Productivity and competitiveness of the small and medium scale enterprises in terms of production yields, efficiency of operations, conformance to food safety quality and hygienic practices 3. b. By-product utilization - Current utilization of by-products (stem and leaves) - Waste management and disposal (environmental concerns)	2 weeks (elsewhere)	- Utilization data and industrial capacity to consume the cassava tubers (as raw material) - By-product utilization constraints and opportunities
4. Market survey - Domestic consumption of cassava and by-products (Including major consumers) (metric tones/year) - Consumption patterns (food, non food based cassava products) - Potential markets for cassava products (flours, starch etc). - Current market prices for cassava based products including animal feed (pellets and chips) - Market structure (supply-market chains)	1 week (elsewhere)	- Regulatory activities and coordination framework upgraded - Market constraints and opportunities
5. Data analysis and proposals of interventions	2 days (home-base)	Results of the survey and recommendations
6. Preparation of final mission report	5 days (home-base)	Mission report prepared
7. Debriefing in Vienna	2days	Final Mission report submitted and accepted

ANNEX II: List Of Individuals Interviewed And Institutions Visited

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
Food Research Institute P.O Box	Dr. Paa Nii-Johnson: Food Scientist Mr. Nanam Tay Dziedzoave Dr. W. Amoa-Awua: Food Scientist Cletus Gyato – Engineer		
Amasa Agro-Processing	Mr. Oware Proprietor and CEO	Cassava farming Processing cassava flour, starch, gari, kokonte, agblema	Working with support from DfID funded project. Has secured a number of contracts locally and in the region too supply mainly cassava flour and starch. Volumes????. Mr. Oware is the chairman of …, a 68 member farming association growing over 750Ha of cassava in total.
Plant Protection and Regulatory Services Directorate P.O. Box M 37 Accra	Milly Kyofa-Boamah Deputy Director Tel. 233-21-302638 Email:mkyofabo@hotmail.com Dr. Kujo Director	Research on diseases and pests Regulatory	
Ministry of Food and Agriculture	Ms. Adelaide Boateng-Siriboe Deputy Director, Policy, Planning, Monitoring and Evaluation Directorate P.O. Box 40 Accra Samuel Oku Statistics Research and Information Directorate Tel. 670574	Responsible for policy formulation, implementation, monitoring and evaluation for all agriculture commodities including cassava Responsible for agricultural commodity data collection analysis and presentation	

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
			flour at the factory but they have never gone back. The factory is willing to work with government to develop a formula for using cassava flour in plywood manufacture. They would require an assuarance that supplies will be reliable, quality and standards maintained and that prices remain lower than wheat flour.
Logs and Lumber Limited	Mr. Emmanuel Owusu Ansah Imports Manager Tel. 024-862770 Mr. James Nuako Glue supervisor	Using 99Mt of adhesives per year which is 100% imported. Uses between 250kgs and 550kgs of wheat per week (the factory only operates 4 days a week).	Cost of Adhesive is EU32/25kg bag (CiF, Tema). Adhesive attracts a duty of 10% and 12.5% and 0.5% ECOWAS levy. 1% inspection fee and 0.5% export development fund. The 10% duty is reduced to 5% because it is for industrial use. The adhesive is urea formulated and is imported from Saudi Arabia.
Forest Research Institute Kumasi	Dr. Darkwa Plywood Adhesive researcher	Is involved in identifying the potential use of cassava flour in the plywood manufacturing industry under the DfID funded program	From the trials carried out it appears there is potential for 100% substitution of wheat w cassava flour as a glue extender. Also investigating the potential production of cassava based adhesives.
Adidwan Food, Farming and Marketing Co-operative Society P.O. Box 1 Mampong	Paul Akrofi – President Edward Dwomosapplio- Secretary	Co-op is involved in two main crops; maize and cassava. Its focus on maize in production and marketing, while the focus on cassava it has been, production, processing Gari and marketing. They are currently in the process of establishing a cassava flour processing and marketing business with support from RTIP.	Implementation of the cassava flour processing activities have been hampered by poor installation of the milling machine (it has never worked since installation four moths ago). The group does not have a marketing strategy in place and are apprehensive about processing flour for which they have no assured market. They also have a newly constructed solar drier which has not been used.
Mampong Agriculture Research Station	Mr. James Duko Cassava Research Officer	Primary as Well as Secondary Multiplication of improved cassava varieties for the communities in the region.	The station has over 20ha of mature cassava but has been unable to get a market. They have offered to sell at Cds250,000/trailer of 3MT, but so nobody has shown interest.
Ms. Akosina Konadu Bread and Pastries Baker Mampong		Has been trained under the RTIP programme is baking using cassava-wheat composite flour. Uses cassava/wheat composite flour in	Combination of cassava and wheat flour has to be 20:80, higher ratios result to smaller doughnuts. Customers prefer big size doughnuts. Prefer cassava flour because it is

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
	Accra Oku-samuel@hotmail.com		
Agricultural Engineering Service Department P.O. Box MB 82, Accra Tel. 233-21-777789/87	Mr. Director Mr. John Mensah Technician	Research and design of agricultural equipment and machinery	Has designed cassava grating machines (of one and five ton/hr capacities) Have designed a manual cassava harvesting machine from a Thailand prototype (cost about Cds30,000. with a wooden handle or cds140,000 steel handle). Also have power tillers. Also working of prototype heat/air dryers. The Rural Technology Information Unit Links technology/information seekers with technology/information suppliers
Western Veneer & Lumber Co. Tel. 3561 Fax. 4716 Takoradi	Mr. Mozu, Production Manager Mr. J. W. K. Cuentsir: Quality Control Department	Using cassava flour in plywood manufacture	Currently using 750kgs of cassava flour per week. Uses a combination of 20% cassava to 80% wheat flour (40kgs of water + 45kgs of glue + 20kgs of wheat flour + 5kgs of cassava flour).
Paper Conversion Co. Ltd P.O. Box 520 Takoradi Tel. 031-22009 Mobile: 024-546917	Mr. P. K. Diensali Customer Service Manager	Using Industrial Starch for Corrugated Paper Manufacture, Facial and Toilet tissue papers	Uses between 83kgs and 250kgs of cassava starch per year depending on production. The starch is manufactured locally.
Cabisco Ltd P.O. Box 417 Cape Coast	Mr. F. K. Bangah Managing Director	A Biscuit Manufacturing Co. Has tried using biscuits, but has discontinued as the business is operating at very capacity at the moment. They are concentrating on bread baking for which they use 100% wheat.	
Ministry of Trade and Industry P.O. Box Accra	Mr. Addo, Chief Director Mr. Adisi, Statistics Dept.	Ministry responsible for promotion of industrial growth in the country, including agro-processing.	
Naja David Veneer & Plywood Ltd (BonoPlax) Tel. 36685 Kumasi 024-412333	Mr. Akuffo Owoo General Manager Email: ndvp@africaonline.com.gh	Potential substitution of the 18MT of wheat flour used per week as glue extender. Also potential to replace the 9.75MT of adhesive used per month.	The company's production manager who is a Philippino has experience in using cassava as a glue extender from his work in Asian countries. Scientists from the Forest Research Institute had requested for permission to test cassava

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
		doughnut and other pastries baking, whenever the flour is available.	cheaper and also promotes the farmers who are their customers.
Ms. Efua Serwa Bread and Pastries Baker Mampong		''	''
Ms. Rita Sarpong MOFA Mampong-Ashanti P.O. Box 174 Accra – Ghana	Ms. Rita Sarpong Trainer/Home Economics	Has been responsible for organizing women for training in cassava composite flour baking under the RTIP programme in Mampong.	
Asueyi Gari Processing Group Techmani	Ms. Akua Fokuo Member	There are four groups processing Gari at this market. It is probably one of the largest concentration of small-scale gari processing in the country. Each of the groups operates in their independent premises but all located next to each other.	Effluent and waste disposal is a big problem in this area. The wholk place is highly contaminated as all the peels are heaped next to the processing site and have been decomposing. The liquid effluent flows free within the processing area.
RTIP MOFA Kumasi P.O Box 7728 Kumasi	Salome Danso Monitoring and Evaluation Officer	Responsible for monitoring and evaluation of root and tubers improvement programme activities in the country.	Porgramme has so trained 1878 people in the production and utilization of cassava based recipes. The programme has focused more on domestic utilization than industrial use of cassava.
Bakers Association Kumasi Chapter	Mrs Comfort Akwofua President	Some of the members have been trained on using cassava composite flour in baking. The main opportunity exists in baking of pastries and not bread. Uptake has been slow due to non-availability of cassava flour.	Kumasi has got over 200 bakers who are members of the bakers association. The baking enterprises differ in size, ranging from a capacity of 100kgs of wheat flour per day to 2500kgs of flour per day. Most of the bakers prefer baking bread as it has higher demand. Pastries are mainly baked on order.
Mr George K. Davis P.O. Box 4870 Kumasi Tel. 031-24653	Bread and Pastries baker	Has tried using cassava flour after being trained by RTIP. Supply of the flour is a problem. One has to go out of his way to look for it, while wheat flour is readily available.	The visited bakers were using clear ovens for baking. The bread is placed in aluminum trays.
Transport and Commodity General Ltd	Mr. Mathias Loh Finance Director	Company was dealing in export of cassava chips in 1993 after they	The company faced many problems including declining world prices of cassava chips, poor

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
P.O. Box C66 Cantonments Accra Tel. 022-300423	Mr. Guzzy Tandoh Proprietor	secured a contract to supply a European client with cassava chips. At the time price of cassava chips was US$109/mtt FoB Tema. The cassava export business has since stopped. The company also supplied local feed millers and poultry farmers with chips for feed formulation.	infrastructure making their business very expensive to operate and competition from local market uses which were offering higher prices than would be competitive in the world market.
Ghana Agro-Food Company Ltd TEMA	Joe Omari Feed Mill Manager Tel. 024-328171 (cell) Tel. 022-216469 (dir) Email: joeomari@GAFCO.africaonline.co.gh	The company was using cassava in feed formulation in 1996/97/98 and then stopped after customers complained of the poor performance of the feeds. The company carried out tests and found out that the cassava chips had bacteria growth which was traced to the poor drying methods the farmers were using. The chips were discontinued in 1998.	GAFCO is the largest wheat flour miller in the country. It is also the largest animal feeds miller in the country. Monthly production at peak is 2000MT.
Akosombo Textiles Limited P.O. Box 17 Akosombo Tel. 0251-20211/21115	Mr. S. L. Asieli General Services Manager Slasiedu@yahoo.com Mr. Ambrose Asare Weaving Manager	The factory has been using local cassava flour (Kokonte) in textile manufacture since 1970s.	On average they use 20MT per month. They are supplied by two suppliers, one based in Accra and the other based in Kumasi. The factory gate price if Cds2700/kg for flour from Accra and CDS2750/kg for flour from Kumasi. The Accra supplier supplies in bulk and therefore gives discount price. Factory is satisfied with quality of the flour they receive. The factory is owned by Chinese Cha group of companies which has branches in Nigeria, DRC, Togo and UK.
Juapong Textiles Ltd P.O. Box 1 Juapong Tel. 0251-20208	Mr. Victor Otta Production Supervisor	Factory undertook some tests on cassava starch sometime ago but were not impressed by the results. They never bothered to find out why the results were not impressive.	Factory is using potato based starch imported from Netherlands (the company is Dutch owned) and synthetic starch Vicol. Total usage is 12MT and 3mt per month of potato starch and Vicol respectively.
Afrimart - Pokuase	Kennedy Amissah	Small-scale glucose producer using	Processing started only two months ago.

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
	Production	high quality flour cassava flour. Flour is supplied by Amasa-Agro cassava processors which also works with FRI. the glucose is sold to a biscuit manufacturer.	Currently producing 150kgs of glucose per week. Each bag of 50kgs of cassava flour produces 38-42kgs of glucose. Room for improving processing techniques (pressing, boiling and waste disposal) exists.
Phyto Riker Pharmaceuticals Ltd (Gihoc) Tel 400984 Accra	David Dankwa Commercial Manager Email: ddankwa@phyto-riker.com	Potential use of cassava starch in tablet manufacturing.	Currently using imported corn starch. Uses over 100MT of starch per year. Current import price is US$400/mt FoB.
Ghana Printing and Packaging Industries Ltd P.O. Box SC 376 Tema Tel. 233-22-2187/8/9 Fax.233-22-208073 Email: gppi@gppi.net	Gladstone Kwame Ahadzi Accounts Officer	Potential use of cassava starch	Currently using maize starch imported through the mother company (Embacci) in Ivory Coast.
Letap Pharmaceuticals Plot No. 107 Ring Road South Industrial Area P.O. Box GP 3346 Accra Ghana Tel. 224613 Email: letap@ghana.com	Haren Patel	Potential use of cassava in manufacture of pharmaceuticals. Current usage of starch is 200-300MT of corn starch per annum.	Company willing to try using cassava starch on the following basis; Approved by Food and Drug Board Meats the European Phamarcopia specifications Priced competitively.
Directorate of Crop Services MOFA P.O. Box M37 Accra Tel. 233-21-665066 Email: cropserv@gh.com	J. A. Poku Ag. Director	Responsible for crop development programmes. Is directly responsible for coordination of RTIP activities.	
UNIDO- Ghana Field Office P.O. Box 1423 – Accra Ghana Tel. 233-21-773890/6	Akmel Propser Akpa – Resident Rep. Email: akmel.akpa@unido.org Solomon Boateng National Programme Coordinator Email: unidopso@ghana.com		UNIDO is currently supporting two projects with cassava component in Ghana.
UNIDO Vienna International Conference Centre P.O. Box 300	Kawira Nabea Bucyana Industrial Development Officer, Food Unit Email K.Bucyana@unido.org		

Institution	**Person Interviewed and Position**	**Relevance to Cassava Industry**	**Remarks**
A-1400 Vienna, Austria Tel. 43-1-26026-3846			

Annex III List of RTIP Installed Improved Gari Processing Stoves as at December 2001

Region	No. of Stoves
Greater Accra	11
Eastern Region	12
Brong-Ahafo	20
Northern Region	12
Total	55

Annex IV: RTIP Pilot Cassava Flour Processing Centres as At December 2001

Region	Site	District	Remarks
Eastern	Amanase	Suhum-Kraboa	
		Asuogyaman	
		Fanteakwa	
Brong-Ahafo	Asuye	Techiman	
		Atebubu	
Ashanti	Adiwan	Sekyere West (Gari)	
		Atwima	
		Amansie West	
Volta	Sokode	Ho	
		Nkwanta	
		Kete-Krachi	
		Sogakope	

Annex V Manufacturers Of Root And Tuber Crop Processing Equipment

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
CASSAVA GRATER	Souvolgas Manufacturing Company	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	St. Micheal Metal Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Syltra Machine Shop	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	CSIR – Food Research Institute	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	R..P. Engineering Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Nyimpa tila Mmoa Welding Shop	Hopper, grating rotor presser discharge sprout. 3.5kwl belt driven	500 – 750 kg/h
	Metals and Motor Engineering Works Ltd.	Hopper, grating rotor presser discharge sprout. 5kwl belt driven	500 kg/h
	Roland Welding and Machine Shop	Hopper, grating rotor presser discharge sprout. 5kwl belt driven	500 kg/h
	Hormeku Engineering Works Ltd.	Hopper, grating rotor presser discharge sprout. 6kwl belt driven	500 kg/h
	SIS Engineering Ltd.	Hopper, grating chamber, discharge sprout Manal	300 kg/h
	M. Agbi Metal Works	Hopper, grating roller presser discharge sprout. 7.5 – 10 kwl belt driven	300 kg/h
	Der Metallabeiter Foundation	Hopper, grating rotor presser discharge sprout.	2 tonnes/h
	Agricultural Engineers Ltd.	Hopper, grating rotor presser discharge sprout.	
	CSIR-Industrial Research Ltd.	Hopper, grating rotor presser discharge sprout.	40 kg/h

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Intermediate Technology Transfer Unit (ITTU) Tamale		
CASSAVA GRATER	I.T.T.U. Koforidua		
	I.T.T.U.Tema		
	Agbah Mechanical Engineering Workshop	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Agbenyegah S.F. Metal Workshop	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Alfrednero Metal Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Anthony Technical Engineering	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Biggy Best Enterprise	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Brother J.K. Agbavitor Enterprise	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	City Welding and Trading Enterprise	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Daamdamel Welding and Fabrication Shop	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Danmens Mechanical Engineering Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	David K. Dagbui Metal Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Department of Agricultural Eng. School of Engineering	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Emmanuel Abbah Manufacturing and Welding Shop	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	GHANKRAH Engineering Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	J.K. Todozdzi Metal Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Mawuli Engineering Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Philip Kwaku Agbeviade Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Sam Alor Metal Works	Hopper, grating rotor presser discharge sprout. 7.5 – 10 kwl belt driven	500 – 750 kg/h
	Rural Technology Service Centre Mampong Ashanti		
	Rural Technology Service Centre Techiman		
	Rural Technology Service Centre Drobo		
	Sasakawa Global 2000		
	Entecel		
CASSAVA DOUGH PRESS	Agbemskod Engineering Ltd.	Metal Basket, Ram & Delivery Sprout. Manual	50 kg/batch
	GHANKRAH Engineering Works	Metal Basket, Ram & Delivery Sprout. Manual	50 kg/batch
	Hormeku Engineering Works Ltd.	Ram, Bottom Plate with Sprout. Manual	50 kg batch (domestic) 500 kg batch (industrial)

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Mawuli Engineering Works	Perforate/Cage or Metal Basket Screw Assembly with Ram Discharge Sprout. Manual	50 kg batch
	Metals and Motor Engineering Works	Ram, Perforated Cage or Metal Basket, Collection Chute. Manual	50 kg batch
	SIS Engineering Ltd.	Fixed and Movable Board, two vertical screw located at end of board Manual	50 kg batch
	Intermediate Technology Transfer Unit (ITTU) Koforidua		
	Intermediate Technology Transfer Unit (ITTU) Tamale		
CASSAVA DOUGH PRESS	Intermediate Technology Transfer Unit, Takoradi		
	Intermediate Technology Transfer Unit (ITTU) Wa		
	Farmers Technical Services and Technology Training Centre (FATECO)		
	CSIR – Food Research Institute		
	Rural Technology Service Centre, Mampong	Double Screw Press	
	Rural Technology Service Centre, Drobo	Double Screw Press	
	Sasakawa Global 2000	Double Screw Press	
	Entecel	Double Screw Press	
FERMENTATION RACK	Rural Technology Service Centre, Mampong Ashanti		
	Rural Technology Service Centre, Techiman		
	Rural Technology Service Centre, Drobo		

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Entecel		
BAGGING STAND	Rural Technology Service Centre Mampong Ashanti		
	Rural Technology Service Centre, Techiman		
	Rural Technology Service Centre, Drobo		
	Entecel		
GARI ROASTER	Industrial Research Institute	Rotation of Drum 30 rmp	8 kg per batch for 15 minutes
	SIS Engineering Ltd.	Roasting Bowl, with Stainless Steel, Stirring Mechanism Fire Place 1 kwl belt driven, Fuelwood for Heating	240 kg/h
MECHANICAL DRYER	CSIR – Food Research Institute	Walk in Dryer	0.5 ton/batch 1 ton/batch
CHIPPING MACHINE	Intermediate Technology Transfer Unit (ITTU) Tamale		
	Intermediate Technology Transfer Unit (ITTU) Koforidua		
	Intermediate Technology Transfer Unit (ITTU) Takoradi		
	Sasakawa Global 2000		
	Entecel		
GAS DRYER	Viva Sabat Enterprise	LPG & HP for Blower Unit	500 kg/batch
	R.P. Engineering Works	Burners, Valve Body Drying Chamber, Blower Unit, Kerosine Burner or Electric Heating Element (2.2kwl), 6-20 Element 7.5-15 kw Motor for Blower	
	Intermediate Technology Transfer Unit (ITTU) Koforidua		
	Intermediate Technology Transfer Unit (ITTU) Tema		

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Intermediate Technology Transfer Unit (ITTU)		
	Takoradi		
KONKONTE CRUSHER	Agbah Mechanical Engineering Workshop	Hopper, Crushing Chamber, Delivery Sprout. 5-7.5 kwl belt driven	500 kg/h
	Agbemskod Engineering Ltd.	Hopper, Crushing Chamber, Delivery Sprout. 5-7.5 kwl belt driven	500 kg/h
	J.K. Todoadzi Metal Works	Hopper, Crushing Chamber, Delivery Sprout. 5-7.5 kwl belt driven	500 kg/h
	Danmens Mechanical Engineering Works	Hopper, Crushing Chamber, Delivery Sprout. 5-7.5 kwl belt driven	500 kg/h
	Metals and Motor engineering Co. Ltd.	Hopper, Crushing Chamber, Delivery Sprout. 5-7.10 kwl belt driven	500 kg/h
	Roland Welding and Machine Shop	Hopper, Crushing Chamber, Delivery Sprout. 5-7.10 kwl belt driven	500 kg/h
	Der Metallabeiter Foundation	Hopper, Crushing Chamber, Delivery Sprout. 5-7.10 kwl belt driven	3 tonnes/h
	Intermediate Technology Transfer Unit (ITTU) Tamale		
	Intermediate Technology Transfer Unit (ITTU)		
	Koforidua		
	Intermediate Technology Transfer Unit (ITTU), Wa		
HAMMER MILL	Department of Agricultural Engineering. School of Engineering	Milling Chamber, Hopper, Delivery Chute, Sieves 7.5 kwl belt driven	800 kg/h
	Danmens Mechanical Engineering Works	Milling Chamber, Hopper, Delivery Chute, Sieves 7.5 kwl belt driven	800 kg/h
	Homeku Engineering	Milling Chamber, Hopper,	500 kg/h

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Works Ltd.	Delivery Chute, Sieves 7.5 kwl belt driven	
	Metal and Motor Engineering Company Ltd.	Hopper, Crushing, Chamber, Sieving System, Delivery Sprout, 7.5 kwl belt driven	500-750 kg/h
	Intermediate Technology Transfer Unit (ITTU) Tamale		
	Intermediate Technology Transfer Unit (ITTU) Koforidua		
	Intermediate Technology Transfer Unit (ITTU) Wa		
	Intermediate Technology Transfer Unit (ITTU) Cape Coast		
PLATE MILL (CORNMILL)	Agbah Mechanical Engineering Workshop	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Agbenyegah S.F. Metal Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Azameti Metal Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Danmens Mechanical Engineering Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	David K. Dagbui Metal Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Delali Machine and Welding Shop	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Emmanuel Abbah Manufacturing and Welding Shop	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	J.K. Todoadzi Metal Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	Mawuli Engineering Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	R.P. Engineering Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	500 kg/h
	City Welding and	Hopper, Milling Unit, Discharge	500 kg/h

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Traditing Enterprise	Sprout. 7.5 kwl belt driven	
	Agbemskod Engineering Ltd.	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	400-500 kg/h
	Sam Alor Metal Works	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	400-500 kg/h
	Dan Wright Metal Construction Co.	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	200 kg/h
	Homeku Engineering Works Ltd.	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	200 kg/h
	Metal and Motor Engineering Co. Ltd.	Hopper, Milling Unit, Discharge Sprout. 7.5 kwl belt driven	200 kg/h
	Roland Welding and Machine Shop	Hopper, Grinding/Milling Chamber, Delivery Sprout 7.5-10 kwl belt driven	200 kg/h
	Intermediate Technology Transfer Unit (ITTU) Tamale		
	I.T.T.U Koforidua		
	I.T.T.U. Tema		
	I.T.T.U. Takoradi		
	I.T.T.U. Wa		
	I.T.T.U. Cape Coast		
	I.T.T.U. Bolgatanga		
	Intermediate Technology Transfer Unit (ITTU) Wa		
FLOUR SIFTER	CSIR – Food Research Institute		
	Intermediate Technology Transfer Unit (ITTU) Wa		
	Intermediate Technology Transfer Unit (ITTU) Takoradi		
	Agricultural Engineering Ltd.		
FUFU MACHINE	Agbemskod Engineering Ltd.	Hopper, Crushing Chamber (2 stainless steel rollers) 3 kwl belt driven	
SIFTER	Rural Technology Service Centre Mampong Ashanti		

Equipment	Manufacturing Company	Main Components Including Power Required	Capacity and Efficiency
	Rural Technology Service Centre Techiman		
	Rural Technology Service Centre Drobo		

Annex VI Address of Roots and Tubers Equipment Manufacturing Companies

AGBAH MECHANICAL ENGINEERING
AIRFORACE
WORKSHOP
P.O. Box 0219, TAKORADI
Location: Kokompe No. 2, Plot No 5,

AGBEMSKOD ENGINEERING LTD.
AGRICULTURAL
P.O. BOX 1, KANESHIE – ACCRA
Location: Plot No. 105, South Industrial
UST,
Area near Agbogbloshie Market Accra

AGBENYEGAH S.F. METAL WORKS
MANUFACTURING
P.O. Box 233, HO.
Location: C.K. Road, Ho.

ALFREDNERO METAL WORKS
SERVICES AND
P.O. BOX 0823, Takoradi
CENTRE
Location: Kokompe No. 1, Plot No. 40A

Road.

C/O STAFF SGT. LOKKO,

STATION,
TAKORADI
Location: Kokompe No.1 plot No. 4,
Takoradi

DEPARTMENT OF

ENGINEERING
SCHOOL OF ENGINEERING,

KUMASI.
Location: UST Campus

EMMANUEL ABBAH

& WELDING SHOP,
P.O. BOX 137, Ho.
Location: Near Light House, Ho.

FARMERS' TECHNICAL

TECHNOLOGICAL TRAINING

(FATECO)
P.O. BOX 9899,
ACCRA.
Location: Agbogba, Old Abokobi

ANTHONY TECHNICAL ENGINEERING WORKS
P.O. BOX 81,
AGONA SWEDRU
Location: Mangoase, Agona Swedru Area,

BIGGY BEST ENTERPRISE WORKS LTD
P.O. BOX 76,
KPANDU
Location: Tsakpe New Town, Dpandu Ashaiman

BROTHER J.K AGBAVITOR ENTERPRISE
C/O P.O. Box 100
AKATSI
Location: Accra-Aflao Road near the point Drinking Bar, Akatsi Area

CITY WELDING & TRADING ENTERPRISE
P.O. Box 647, HO.
Location: Near Mortar Barracks, Ho.

DAMDANIEL WELDING & FABRICATION MANUFACTURING SHOP
P.O. Box 33, HO.
Location: Housing Junction, Ho.

DANMENS MECHANICAL ENGINEERING WORKS
P.O. Box K.36,
TODORADI
Location: Kokompe No. 1, Plot 5, Tadoradi 15,

DAVID K. DAGBUI METAL WORKS
VIVA SABAT ENTERPRISE
P.O. Box A. 156,
CAPE COAST,
Tel: 042-33372
Location: Adisadel Village, Cape Coast.

GHANKRAH ENGINEERING

P.O. BOX A.167,
CAPE COAST
Location: West Adisadel Industrial

Plot No. 40, Cape Coast

HORMEKU ENGINEERING

P.O. Box 20,
ASHAIMAN
Location: Near Main Lorry Park,

INTERMEDIATE TECHNOLOGY TRANSFER UNIT
P.O. Box A.185,
CAPE COAST
Location: West Adisadel Industrial

J.K. TODOADZI METAL WORKS
P.O. Box 643, HO.
Location: Light House, Ho.

SOUVOLGAS

COMPANY
P.O. Box 68,
AGBOZUME, V.R.
Location: Klidor/Agbozume

ST. MICHAEL METAL WORKS
P.O. Box 500,
TAKORADI,
Tel: 3735
Location: Kokompe No. 1 Plot No.

Takoradi.

SYLTA MACHINE SHOP
P.O. Box 166, HOHOE.
Location: Near GOIL Petrol Station, Hohoe.

CSIR-FOOD RESEARCH INSTITUTE
ENGINEERING
P.O. Box M.20,
ACCRA.
Location: Broz Tito Avenue, Cantonments.
Okponglo, Behind Standards Board
Highway,

AGRICULTURAL ENGINEERS LTD.
SHOP
P.O. Box 12127,
ACCRA-NORTH
Location: Ring Road West Industrial Area,
Adisadel
Accra.

AZAMETI METAL WORKS
METAL
P.O. Box 309, HO.
Location: Old Housing, Opposite R.C. Girls
School, Ho.

Road and

DAN WRIGHT METAL CONSTRUCTION
CO.
P.O. Box 924,
MAMPROBI, ACCRA
Board
Location: Edward Mudhalana Road, near
White House,
Chorkor, Accra.

DELALI MACHINE AND WELDING SHOP
MACHINE
P.O. Box 196,
AGONA SWEDRU
Location: Temple Junction, Bibianiha,
Agona Swedru
Timber

M. AGBI METAL WORKS

METALS AND MOTOR

CO. LTD.
P.O. Box 6233,
ACCRA – NORTH.
Location: Kaneshie – Mallam

Near First Traffic Light.

NYIMPA H/A MMOA WELDING

P.O. Box A.63,
CAPE COAST.
Location: Swedru – Kokompe,

Cape Coast.

PHILIP KWAKU AGBEVIADE

WORKS
P.O. Box 3,
ABOR-WEME
Location: Off Main Accra-Aflao

Behind police station, Abor.

R.P. ENGINEERING WORKS
P.O. Box A.332,
CAPE COAST
Location: Former Meat Marketing

Premises, Opposite Central Gate of
University of Cape Coast.

ROLAND WELDING &

SHOP
P.O. Box 124m
ASHIAMAN
Location: Opposite Ashiaman

Market.

SIS ENGINEERING LTD.

P.O. Box K.53
NEW TOWN- ACCRA
Location: Tantra Hill near Taifa function,
Kumasi.
Nsawam Road

P.O. Box 45,
UST, KUMASI
Location: Carpenters' Line, Anloga-

MAWULI ENGINEERING WORKS
P.O. Box 379,
AGONA SWEDRU
Tel: 041-286
Location: Wawase, Oda Road, Opposite
Greenfield Hotel,
Agona-Swedru

SAM-ALOR METAL WORKS
P.O. Box 076,
TAKORADI.
Location: Tanokrom, Axim Road,
Takoradi.