Rabobank

IAC
WAGENINGEN UR

"Assessment of Resources, Markets and the Potential for Market Development in Value Added Cassava Products in West Africa."

Mission Report

November 2005

Rabo International Advisory Services (RIAS) BV

Colophon

Title	"Assessment of Resources, Markets and the Potential for Market Development in Value Added Cassava Products in West Africa."
Version, date	30 November 2005
Project Number	0517
Authors	Sander Essers, Frans Goossens and Wim Verzijlenberg
Project	"Assessment of Resources, Markets and the Potential for Market Development in Value Added Cassava Products in West Africa."
Contact address for this publication	Rabo International Advisory Services (RIAS) BV Croeselaan 18 Postbus 17100 3500 HG Utrecht Tel +31 (0)30 2163670 Fax +31 (0)30 2163677 RIAS@rn.rabobank.nl

TABLE OF CONTENTS

Acronyms and abbreviations

APEX-CI	Association pour la Promotion des Exportations en Côte d'Ivoire
BSF	Belgian Survival Fund
CASPA	Composante d'Appui au Secteur Privé Agricole - Benin
CFC	Common Fund for Commodities
CIRAD	Centre Internationale pour la Recherche Agricole et Développement
CSRS	Centre Suisse de Recherches Scientifiques
DPME	Direction de la promotion des petites et moyennes entreprises - Benin
FAO	Food and Agricultural Organization
FRI	Food Research Institute (Ghana)
HQCF	High Quality Cassava Flour
IAR	Institute of Agricultural Research, in Sierra Leone
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
I2T	Société Ivoirienne de Technologie Tropicale
KNUST	Kwame Nkrumah University of Science and Technology
MAEP	Ministry of Agriculture, Livestock and Fisheries - Benin
MICPE	Ministry of Industry, Commerce and Employment Promotion - Benin
MT	Metric Tons
MTI	Ministry of Trade and Industry
NEPAD	New Partnership for Africa's Development
NGO	Non Gouvernemental Organisation
PDFM	Projet de Développement de la Filière Manioc
PDRT	Programme de Développement des Plantes à Racines et Tubercules
RTIP	Root and Tuber improvement Programme - Ghana
SAP	Structural Adjustment Programme
SME	Small and Medium Enterprise
UEMOA	Union Economique et Monétaire de l'Afrique de l'Ouest
UNDP	United Nations Development Programme

1. Background of the report

Background for this study is the project proposal "Market-led Development of Enterprise-based Cassava Processing Systems in West Africa". This proposal had been elaborated on the basis of three independent proposals originated from Benin, Ivory Coast and Ghana on cassava processing and value addition, after inclusion of Sierra Leone and consultation with some key stakeholders. The Consultative Committee of the Common Fund for Commodities (CFC) has recognised the importance of cassava and the need to strengthen commercially sustainable links between smallholder farmers, processors and end-users through the production of intermediate value-added products in West Africa.

The objective of this comprehensive study is to assess the resources, markets and potential for market development in value added cassava products in Benin, Ghana, Ivory Coast and Sierra Leone.

2. Introduction

Growing importance of cassava
In West Africa, the importance of cassava as a commodity is steadily expanding for at least 5 decades. The crop was originally a famine-reserve and rural food crop. It gained importance as food crop both for urban and rural consumers and as new cash crop for smallholders. At the moment, cassava is the main staple of many rapidly expanding urban poles in West Africa. This evolution is reflected in the contribution of the cassava economy to the region's gross domestic product. Many subsistence and small farmers, looking for new cash crops and opportunities, are interested in growing cassava. West African Governments, as well as the New Partnership for Africa's Development (NEPAD) are giving priority to cassava in their regional agricultural development, industrialisation and poverty reduction strategies.
Stakeholders in the cassava production and marketing chains recognise that research, extension agencies and development projects were relatively successful in the area of screening and dissemination of improved planting material. However, national programs have had greater difficulty in developing and disseminating appropriate cassava processing technologies, in assisting farmers to more effectively access new markets and in structuring supply chains. On the contrary, the emerging cassava marketing chains are highly informal which leads to high unit costs and reduces competitiveness of cassava. Cassava is in competition with imported cereals, such as wheat and rice. There is a general recognition that if the processing and marketing problem is not fully addressed, it risks imperilling gains attained so far. Clearly, diagnosing processing, marketing and demand constraints and opportunities at national, regional and international level is needed to orient future efforts in the cassava sector.

The study
The study adopted a supply chain approach in which value addition and market development of cassava products are seen as the main focus within the cassava supply chain, in which several stakeholders have their role, benefits, opportunities and constraints. The main goal is to identify opportunities to develop improved and new markets for cassava farmers, processors and better products and product access for end-users. To this end Benin, Ivory Coast, Ghana and Sierra Leone were visited in September/October 2005. Stakeholders in the cassava chain and Government officials were interviewed and literature and project documents studied.

Organisation of the report
Chapter III presents a diagnosis of the cassava chain in the four countries involved. Chapter IV looks at ongoing initiatives and potential for synergy and complementarities. Chapter V summarises opportunities and constraints. Chapter VI presents a justification, rationale and strategy for interventions that take into account and build on all elements presented in previous chapters. In annexes 1 to 4, detailed diagnoses for each of the four countries involved are presented.

Focus
This report looks at the potential of traditional products and alternative products that can be produced in a competitive way on a relatively small or medium scale. The study is limited to four countries (Benin, Ivory Coast, Ghana and Sierra Leone) and deals with production aspects and four categories of cassava processing and utilisation:

i. consumption of traditional forms (gari, dried roots, paste, attièké) of cassava in present and new markets;
ii. bread, bakery products and snacks: substitution of wheat flour and product development on the basis of cassava flour;
iii. cassava used as animal feed in the domestic and international market;
iv. industrial use of cassava starch/flour and derivatives (ethanol, glucose syrups, industrial use in textile, paperboard, etc...).

3. Cassava chains in Benin, Ivory Coast, Ghana and Sierra Leone

3.1. Overview of supply chains of traditional and novel cassava products

In West Africa, cassava is primarily produced for food (90% or more). Small quantities are used on the farm as feed (less than 10%). The agribusiness sector is hardly using cassava as an industrial raw material (less than 1%). In Asia and Latin America, the crop is processed into several secondary products of industrial market value. These products include chips, pellets, unfermented flour, adhesives, ethanol and starch, which are vital raw materials in livestock feed, textile, confectionary, plywood, bakery, food and soft drinks industries, etc. Although theoretical growth potential in the non-human food segment is high, traditional forms of cassava products will continue to dominate West African cassava-marketing channels in the short and medium future. Nevertheless, West African governments see the development of these markets as new opportunities for their farmers and as a growth engine of their economies.

Traditional processing systems produce a wide range of products that are produced and marketed by small informal actors. The hundreds of traditional product forms can be classified in five broad families, namely: (a) gari (roasted granulated form); (b) fermented paste (agbelima, chikwangue, placali, …); (c) dried roots, sometimes with some fungal growth, or dried after soaking (+ lactic acid fermentation) (chips, kokonte, lafun, cossette,..) and milled into flour; (d) attiéké (fermented, granulated and steamed form); (e) boiled fresh roots that are eaten, sometimes after pounding (foofoo) into a fine paste. Gari, attiéké and paste are relatively more important in forest and coastal areas where drying is difficult, while dried roots are more popular in savannah and transitional zones. Overall, gari production is expanding in relative terms.

Cassava cultivation that was originally introduced in the coastal and humid areas of West Africa is gradually but steadily expanding to dryer areas where it replaces cotton as a cash crop or it is introduced in the farming system to fill the food gap during the hunger season. During the 1970s, 80s and 90s, cassava cultivation in these four countries was mostly based on traditional low-yielding cultivars, with average yields of 5-10 MT/ha and manual processing. Cassava gradually became a basic rural and urban food staple and an important cash crop. A growing part of the harvest is being sold as gari, paste or chips. The transition is more advanced in Ghana and Benin than in Sierra Leone and Ivory Coast. In Sierra Leone, the evolution from food security to a cash crop has only started since the recent period of civil strives. In Ivory Coast, cassava was still a subsistence crop, although some industrial use existed before the war. This transition process of cassava from food security to cash crop is characterised by a stepwise adoption of high-yielding cultivars and mechanisation of certain processing stages (grating, pressing, drying and milling). This type of production and processing is found in all coastal, forest and savannah zones with market access of West Africa. Women using low technology processing equipment process most cassava. Although these basic technologies appear to be adopted easily (except for the financial barrier) by rural women, significant differences in quality of equipment and profitability and productivity exist in the region.

Small, medium and large initiatives to process cassava into industrial product forms (flour, starch, ethanol) are undertaken in different West African countries, although with limited success until now. Leading countries are Nigeria and Ghana, while Ivory Coast lost momentum because of the war. The rationale of governments is to create new opportunities for farmers in order to allow expansion of production and to diversity away from traditional cash crops. Meanwhile, other countries (e.g. Benin, Cameroon, Sierra Leone,) are setting up trials, pilots and research, financed by governments, donors and NGOs. Technically, cassava can easily be processed into several secondary products of industrial market value. Constraints and bottlenecks are mainly of an economic, organisational and managerial nature: economies of scale, energy cost, competition in a world market and substitution. Viability of the initiatives depends on the price and availability of

cassava as industrial raw material, where competition exists between local consumers and industrial users of fresh roots, but also between locally produced cassava derivatives and imported alternatives. At the moment, prevailing farming systems do not succeed in making cassava available as primary commodity for industrial use at stable and competitive prices (for example a stable and bulked supply at a price of less than US$15/MT at farm gate). The supply chain is not well-enough organised to ensure a constant outlet at reasonable price to the cassava growers. In addition, industrial demand for cassava starch and high quality cassava flour (HQCF) is very limited at the moment in West Africa.

3.2. Cassava production

Volumes

Cassava production in West Africa has doubled from 25.8 million MT in 1990 to 56.7 million MT in 2004 (FAOSTAT). The four countries visited represent nearly 30 percent of total regional production. About two third or 38 million MT is produced in Nigeria. In volume terms, Ghana, Benin, Ivory Coast and Sierra Leone are respectively the 2nd, 3rd, 4th and 7th producer of fresh cassava roots in the region.

Cassava is the main food staple in Ghana and Benin. Ghana has seen a dramatic increase during the last decade as cassava production in 2004 was approximately four times greater than it was in 1990. Its expansion was significantly faster than population growth rate. In Benin, cassava production more than doubled in line with population growth, as farmers were desperately looking for new opportunities and cash crops (instead of cotton).

In Ivory Coast, cassava production stagnated since the early nineties, as the civil war had an impact on availability of rural labour. Traditional cash crops and yams, maize and rice are important and cassava is seen as a subsistence crop. Nevertheless, some food industries in Ivory Coast used cassava as a raw material during the nineties. In these three countries, expansion of supply was a combination of an upward production trend (based on expansion of the acreage) as well as a strong cyclical fluctuation of supply.

During 1990-2004, production of fresh cassava roots has tripled in Sierra Leone, as (i) cassava was key in providing food security to the rural population during the period of civil strive; (ii) fertiliser had become scarcer while cassava can do without to some extent; (iii) rice imports have made domestic rice production less attractive; (iv) farmers have few alternatives. Cassava leaves are (also economically) important as vegetable, especially in Sierra Leone, where harvesting of leaves may compete with root yield.

Cultivars

Research institutes in all four countries are involved in screening and distributing IITA and other cultivars. Ghana, Ivory Coast and Benin introduced a first generation of TMS-cultivars during the eighties and nineties with good performance in the field of yield and disease tolerance. At the moment, participative screening approaches are used in order to take into account characteristics such as taste, multiple uses (poundable or not, gari and boiled roots, bitter or sweet). Some cultivars that respond to these specific requirements asked by farmers have been released by research institutes. In Sierra Leone, the Institute of Agricultural Research (IAR) is quite advanced in screening about 50 IITA-cultivars for different uses. All research institutes are screening cultivars with high starch content for industrial purposes.

Table 1: Cassava root production (x 10^3 MT)

Cassava Production (x 10^3 Mt)	Year								
	1980	1985	1990	1995	2000	2001	2002	2003	2004
Benin	583	699	937	1,238	2,350	2,704	2,452	3,675	4,000
Côte d'Ivoire	1,010	1,250	1,393	1,608	1,691	1,688	1,515	1,505	1,500
Ghana	1,858	2,300	2,717	6,611	8,107	8,966	9,731	10,239	9,739
Sierra Leone	95	110	123	219	241	300	340	377	390
Total	3,545	4,359	5,171	9,676	12,389	13,657	14,038	15,797	15,629

Source: FAOSTAT (2005)

Crop husbandry and yields

Cassava yields in all four countries are still far below their theoretical and on-farm potential. Yields generally vary between 5 and 15 MT per hectare, depending of cultivar, agro-ecological conditions and crop husbandry practices. Table 2 presents the evolution of average yields. In Sierra Leone and Ivory Coast, cassava is traditionally seen as a subsistence crop, which is reflected in the stagnating and low yields partly due to mixed cropping). In Benin and Ghana, yields are characterised by an upward trend and increased by 50-100 percent since the early eighties. Growth potential is still significant.

Cassava is generally produced in mixed and sole cropping systems. The average farm in the region is still cultivating less than 1 hectare of cassava. Crop husbandry practices are based on low input – low output practices. Farmers generally do not use fertiliser. A slight tendency to sole cropping exists, often in transitional and savannah areas with good market access.

Table 2: Cassava yields

Cassava Yield (Hg/Ha)	Year								
	1980	1985	1990	1995	2000	2001	2002	2003	2004
Benin	65,857	68,852	79,771	78,369	107,118	112,622	92,667	123,630	133,333
Côte d'Ivoire	52,332	56,054	55,059	51,871	52,844	52,750	48,087	50,168	50,000
Ghana	80,765	79,323	84,170	119,924	122,812	123,436	122,489	126,850	124,235
Sierra Leone	38,000	45,833	59,903	58,453	51,816	54,545	55,738	50,881	52,000

Source: FAOSTAT (2005)

Spatial distribution

Cassava is mainly produced in the forest belt and transitional zones of Ghana, Benin and Ivory Coast. During recent years, its cultivation is expanding steadily to more arid production areas in the northern regions of these countries where food security aspects of cassava cultivation are more important. Even in dry growing conditions, its yields are acceptable compared to coarse grains. In Sierra Leone, cassava is cultivated in the whole country. In all countries, the transitional areas have the highest cassava surpluses per farm, most competitive prices and least problems of drying. In the southern forest zones, cassava prices are higher because of the nearby urban demand from coastal centres (Freetown, Abidjan, Accra, Lomé, Cotonou, Lagos, etc...) but cassava also competes with cash crops (cocoa, palm oil, coffee) and numerous other food crops (lowland rice, bananas, plantains, cocoyam, maize, vegetables).

Market supply and price cycles
The West African cassava sector is characterised by strong cyclical fluctuations of market supply (cyclical surplus production by traditional farmers) and prices. Cassava prices were depressed in 1997, 2000, and 2004, but were high in 1999, 2002 and 2005. In Nigeria, Benin, Ghana, Togo and Ivory Coast, cassava price fluctuations appear to be correlated. In Ghana, farmers reacted to high 2002 prices by expanding acreage attributed to cassava, which led to a price collapse in late 2003 and 2004. In reaction to these low prices, they stopped planting for the market, which led again to a shortage in 2005. Late 2003, prices of fresh roots at farm gate reached a bottom level in most coastal countries: Ghana: US$ 25/MT, Nigeria: US$ 30/MT, and Benin US$ 20/MT or lower. Below this level, harvesting and processing using paid labour is not or hardly profitable and farmers mainly harvest for home consumption and urgent needs. Early-2004, cassava prices started rising in Ghana. In Benin, prices started rising only in 2005. In October 2005, prices for fresh roots were at record levels (up to US$ 90/MT in Ghana and Benin). Consequently, most industrial processing initiatives were interrupted. Lower prices can be expected in late 2006 and certainly in 2007, as farmers again increased acreage attributed to cassava. At the moment, they are desperately looking for planting material.

Sierra Leone appears to have a segmented market. Prices for cassava roots at farm gate are low (US$ 20-25/MT) for a longer period. The country's cassava economy is less integrated in the region because of the long period of war and uncertainty. As cassava gained importance during the war, the overhang of non-harvested cassava is estimated at approximately 30% of total production. The national non-farm demand for cassava is limited. The country still has a dominantly rural population and its main staple food is local or imported rice.

3.3. Processing, product forms and actors

3.3.1. Traditional products

Gari
Demand and market share of gari appears to be on the rise in Western Africa. Gari processing is expanding to central and northern Ghana, to central and northern Sierra Leone and is making progress in Benin. Rural processors perceive gari as an interesting product, because it is a convenience food with very good storability and on average a better market demand than other product forms. It can compete with rice in terms of convenience and price in urban and rural markets. In the dryer parts of West Africa where firewood is expensive, gari being precooked adds to its advantages over cereals, such as maize, sorghum, millet and imported rice.

Gari processing is labour-intensive, but it provides interesting labour opportunities to rural women and poor. Profitability depends on access to good processing equipment, to raw material and to markets (or good roads). Key elements of professional processing are: (a) access to a power-driven grater instead of manual grating; (b) a good press; (c) the capacity of the stove in terms of kg of gari per day.

In Sierra Leone, gari processing is expanding as rural processors are convinced that market opportunities for gari are better. Gari is cheaper than rice and is considered a convenience food by rural consumers. A limited number of professional gari processors exist in Bo. They have managed over the years to establish: (i) a quality product and brand name ("Bo gari") and retail packaging, and resulting premium prices; (ii) a network and active sourcing of raw roots; (iii) satellite production units in cassava production areas; and, (iv) market chains to Freetown and Guinea. Many other groups have been established all over the country and are trying to copy this concept.

In all four countries, gari processing technology can be upgraded significantly with respect to labour efficiency and hygiene, energy use, and in some cases product quality, hygiene and

labelling. This relates especially to the processing plant layout, the primitive and sometimes risky pressing, the sieve and inefficient roasting technologies. The effluents are usually not collected but left in the open, which causes environmental damage as well as economic losses (starch is not collected). Many types of graters are used. Sometimes manual grating is still used, but it does not allow making profits with gari processing, as labour productivity is too inefficient. Quality of presses is generally low. Often wood and stones are used instead of the screw press or other types. Inefficient pressing requires a higher energy use during roasting because of the remaining moisture. Roasting is often done over a partly open fire in a small to medium round pan with a maximum yield of 35 kg/day, while larger rectangular iron sheets with a capacity of 100-120 kg/day are in use elsewhere (Sierra Leone, central Ghana). Smoke and vapours affect processors – mainly women with small children at their side-, and firewood is used in an inefficient way. Even so-called improved roasting pans offer room for improvement. Both women and men do roasting. Peeling is a time-consuming activity for which no solution has been found yet. Peels are not always recuperated. Sieves are often primitive or absent. Weighing scales are usually absent. Sanitary conditions are lacking at processing sites.

Processors have limited investment capacity. Most graters and good presses have been financed by donor-funded projects, NGOs, government initiatives, etc... Even settled processors hardly invest significant amounts in equipment. The use of matching grants and credit was significantly more efficient in the case of existing processing groups compared to new groups.

Most medium-size enterprises that tried to develop gari-processing lines in an "industrial" way have failed, as they cannot compete with informal women groups. The energy cost was too high compared to firewood. Also peeling was a constraint. In the short term, upgrading of existing women-owned processing workshop appears to be the most promising approach. Upgrading of gari-processing could be used in order to pull the cassava sector.

Projects involved in processing never succeeded to develop a successful prototype of a gari processing plant. Most prototypes were too expensive (heavy infrastructure), equipped with non adapted equipment (low labour productivity), localised in wrong places, design mistakes (e.g. too hot in the building), and could not compete with informal sector initiatives. Women groups were often not interested in using these "improved" plants, but constructed their very basic low cost processing plants. Often management of units, financed by NGOs and projects, was problematic as the units were given to new groups without experience in the sector or the proposed management structure was too expensive.

Agbelima/paste/ placali

This category of products also makes use of graters and mills, but no press is needed. The same groups that are involved in gari processing therefore often produce it. Instead of pressing and roasting, the paste is milled to remove all fibres and fermented. It is then transported to urban consumption centres in 100 (or more) kg bags, where it is sold to consumers in small quantities. Also in this segment, growth is generally combined with the adoption of small equipment, such as graters and mills. Presently, processing cassava into agbelima is more profitable than into gari, in Ghana.

Dried roots, chips

Dried (split) cassava roots are the cheapest form of storable cassava. They are typically popular in transitional and savannah areas where sun-drying is relatively easy, compared to forest zones. Peeled roots or chips are often slightly moulded or fermented to a certain degree, according to climatic conditions, local taste and consumption habits. They are milled or pounded into (fermented) flour that does not comply with standards for wheat substitution. The fermentation alters the sensory characteristics of the roots in a way that is often appreciated by local consumers. The process is mainly manual and offers some potential for mechanisation in the short and medium term. In areas/seasons with dry climatic conditions, reduction of chip size, e.g. by a slicer or shredder can speed up drying, thereby avoiding fermentation and mouldiness, and

a next milling step can turn it into flour (see also: HQCF). As faster drying of intact cassava pieces results in less cyanogen removal, this accelerated process should only be applied for non-consumable products (e.g. glue-extender in the plywood industry), or the cassava cultivars used should be low-cyanogenic or "sweet".

Soaked roots, cossettes, lafun, kokonte, toh
Roots are peeled and undergo a form of lactic-acid fermentation by retting in water for several days until soft, before being sun-dried. The dried roots are then milled or pounded into flour that does not comply with standards for wheat substitute. The fermentation improves safety and alters sensory characteristics of the roots in a way that is appreciated by its users. The process is strictly manual and offers some potential for mechanisation by reducing chip size by a slicer or shredder to speed up softening. This causes less development of taste and smell, but also the release (and possible loss) of some of the starch.
Only a few pilot enterprises were supported to produce fermented and unfermented high quality cassava flour.

Traditional starch
At village level, starch is produced as by-product of gari or lafun, or as main product with second quality of lafun or agbelima as by-product. The traditional starch is used for clothes or consumed at local level in the form of tapioca, often with special flavours (vanilla, banana). Some NGOs are encouraging this form of utilisation as income generating activity. The product is sold at weekly or seasonal village markets. Trade is organised by women and petty traders. Small trade flows of starch to Guinea, Senegal and other more arid countries (Mali, Niger, Burkina Faso, …) in the region exist. The traditionally produced starch is generally of a good quality but the degree of fermentation differs. Because of the nature of processing and its irregular characteristics, traditional starch can generally not be used for industrial purposes. The transaction cost of bulking would also be too high. Therefore, the product has no immediate potential to be upgraded to a SME-scale, but remains interesting as income generating activity for rural women.

Attiéke
Attiéke is a popular form of cassava in Ivory Coast that does almost not exist in the neighbouring countries. It is peeled, grated and fermented. After granulation, the product is dried in the sun and steamed. From a consumer point of view, its product characteristics are comparable to those of gari: convenience food, very popular in both urban and rural environments.
Traditional attiéke is typically a product with a high moisture content, which implies short shelf life. The main constraint of industrial attiéke-processing is the drying stage. Small and medium-size formal enterprises in Ivory Coast are experimenting with dehydrated attiéké for the export market. This product is however too expensive for the home-market, where local women are more competitive. Furthermore, consumers in Ivory Coast prefer the specific taste of "home-made" attiéke.

3.3.2. New products

In most West African countries, trials for production of cassava derivatives at a SME or industrial scale take place. Especially when cassava prices are at a cyclical bottom level, political pressure to create new opportunities is important (see: Ayenso starch factory in Ghana, ethanol factory in Benin). The technical know how to process cassava is available in the region. The main constraints to these emerging initiatives are the following:

- Limited effective demand for the final product (starch, unfermented flour, ..) in the home market, which leads to insufficient economies of scale for processing units; the domestic textile industry was the traditional client for native cassava starch, but collapsed;
- Very competitive imports of substitutes (starch, ethanol, wheat flour) at world market prices; the starch market consists of numerous sub segments for different modified starches;

- Fluctuating prices of raw material (fresh roots) and inexistence of stable supply lines; compared to other competing regions in the world, the price level of fresh cassava in West Africa is on average relatively high (if farmers have access to urban markets);
- High energy cost of drying, as large-scale sun-drying is insufficiently developed.

For specific segments such as unfermented cassava flour or animal feed, initiatives at a small or medium scale might be competitive if short supply lines are organised between processor and final user of the product, and adapted equipment/technology is introduced. Higher yields and mechanised agriculture can reduce the cost of roots and contribute to competitiveness of the final product.

Unfermented high quality cassava flour
The market for high quality cassava flour (HQCF) as substitute to imported wheat is emerging in Nigeria, Ivory Coast and Ghana. In Benin and Sierra Leone, a broad interest exists at government level but only a limited number of small trials were organised yet. In Ghana, part of the HQCF is turned into instant foofoo that finds its ways to the supermarkets.

Market demand for HQCF remains limited at the moment although small and medium bakeries have shown an interest during recent years. In order to be interesting for these bakeries, cassava flour should be significantly cheaper (30% in Benin) than wheat flour. Especially during period of low cassava prices, HQCF is able to compete with imported wheat flour. In 2005, cassava prices were very high, which reduced potential of cassava flour. In 2006-2007, cassava prices will be lower again. At village level, demand for HQCF does not exist or is extremely limited yet because of highly traditional rural consumption habits. It is necessary to develop supply lines with clients in urban centres in order to match supply and demand.

RTIP (Ghana) is working in this niche with a few private entrepreneurs. In Benin, small trials were organised by the ngo VECO. In Sierra Leone, IAR organised some trials but no private initiatives or pilots exist yet. In Ivory Coast, some SME organised trials or produced HQCF and starch during the nineties but most initiatives were interrupted because of the situation of political instability.

The key constraint to produce high quality cassava flour is the drying process. In Asia, sun-drying on concrete drying floors is well developed. In Africa, processors are used to fermented forms of cassava, where shortening of the drying process has less importance, Cassava should be dried in hygienic conditions before fermentation starts in order to obtain HQCF. In Ghana, grits (grated fresh root material that is pressed and subsequently dried) are used as intermediate to speed up the drying process. The problems of sun-drying are poor hygienic conditions and humid weather conditions in forest areas and rainy seasons. Attempts to use mechanical dryers failed, although technically a good final product was obtained. The cost of energy was too high, which made the final product uncompetitive.

Good quality unfermented flour could be obtained from shredded or sliced cassava pieces during the dry season, as long as drying takes place within one or two days. As this process reduces cyanogens levels only little compared to both the grating step and slow drying, this method is probably only suitable for low cyanogen cultivars, or non-consumption purposes. Farmers do not have adapted drying floors and are not trained in this form of drying that requires certain discipline and rigidity. It is therefore necessary to develop pilot schemes and train processors in the production of this flour.
The plywood industry is seen as an important potential client for cassava flour, but effective demand is yet unclear. In Ghana, FRI and Agro-Amasa have established cassava flour use in the plywood industry.

Wheat substitution in bread
Technologies exist for the use of cassava as a partial substitution for wheat in bread making with unfermented cassava flour (HQCF). In the case of bread, a maximum substitution level of 15% is

recommended, depending on the type of bread. Above this level, organoleptic differences become problematic. A 30-100% substitution with unfermented high quality cassava flour (HQCF) in some biscuits, doughnuts and other snacks is possible without technical problems. Cassava flour, prepared using traditional methods of slow drying, is often partially fermented and frequently of poor quality, thus making it unsuitable as a substitute for wheat flour in bakery products.

At the moment, small bakeries are more interested in using cassava flour than industrial users. Cassava flour is generally cheaper than imported wheat flour. Therefore, most observers are convinced that small-scale bakeries are using cassava flour already. At the moment, cassava roots are too expensive in Benin and Ghana to compete with wheat flour, but lower prices are expected in 2006-2007. In Benin, the bakery association agrees to pay up to US$ 360/MT of cassava flour, compared to a market price of US$ 540/MT of wheat flour. Industrial bakeries and millers are still reluctant to use composite flour, as stable large-scale supply of HQCF is not guaranteed yet. In Nigeria, government recently adopted a law that obliges bakeries to use at least 10% cassava flour. This might be a breakthrough for the use of HQCF in the region.

Animal feed for the domestic market

At the moment, the industrial feed millers in Nigeria and Ghana are not using cassava chips. Maize is their most popular energy source, as the use of cassava also requires utilisation of additives and minerals. Smaller medium-size mills and large farms that blend their own feed may use cassava chips/meal during periods when these are locally available at low prices. Peasant farmers are sometimes feeding cassava peels and wastes to their pigs, poultry and goats. However, the potential for cassava in the domestic feed market is significant in the medium term. Small-scale pelletisers are not available at village level.

Two models for cassava feed processing exist:

- On-farm chipping, drying & utilisation have been traditionally practiced in Latin America and Asia. In Brazil, feed for cattle during the dry season is produced; in Colombia, dried cassava is used to feed pigs, poultry and cattle. In China and Vietnam, small-scale farmers are using cassava chips to feed pigs. The use of cassava chips and dried cassava leaves (milled) mixtures as protein source is being tested in Latin America and Asia. Manual chipping equipment has been developed but is not used in West Africa.
- On-farm chipping and drying for off-farm utilisation. In this case, small farmers organisations or cooperatives engage in a common activity of chipping & drying cassava. The cassava is sold to a marketing structure/cooperative/association, which sells the combined volumes to large-scale feed processors. A second option is for farmers to negotiate directly with feed processors. In this case, supply lines have to be organised.

The main constraint in the West African context is that most smallholders are not used to intensive forms of animal rearing. Often they are not interested in investing labour or money in the production of animal feed. However, research shows that the use of cassava instead of maize can reduce the cost of feed by 20-30%. In order for cassava to be competitive, a price for dried cassava chips, which is 50-70% of the maize price, is required to compensate for the cost of extra nutrients.

Potential of this niche depends on viability of the domestic suburban pig and poultry sector that also competes in international markets.

Options to develop this niche are: (a) promotion of cassava pellets (introduction of small-scale pelletisers at the level of farmer groups); (b) linking farmer groups with large feed millers and organisation of supply lines for cassava chips; (c) utilisation of cassava chips and cassava peels in feed.

Export of cassava chips

At the moment, export of cassava chips or pellets for the European feed sector is not a viable option given the huge gap between current international prices for cassava pellets (US$ 110/MT, cif Rotterdam, August 2005) and the corresponding fob price for cassava chips in West Africa

(US$ 70/MT). Future potential depends mainly on (a) the evolution of the international price of cassava pellets, (b) the farm gate price for fresh roots, and (c) the capacity of West African countries to reduce the costs of bulking, drying, logistics and transport. In the nineties, Ghana and Benin were able to export cassava chips when the reference price (cif Rotterdam) was above US$ 150/MT. At current price levels, the region is not able to export cassava chips or pellets in a profitable way. Therefore, private investors are not interested.

Industrial starch

The installed capacity of native starch production in the region is sufficient to satisfy regional demand at the moment. In the past, the regional textile industry was the main consumer of cassava starch. However, this demand almost disappeared as numerous factories were closed because of cheap Asian imports of textiles. At the moment, the starch industry cannot compete with imported native starch that is available at world market prices of US$ 200/MT. Presently, main constraints in Ghana, Benin and Ivory Coast are: (a) high price of raw material, (b) high energy cost for drying; (c) disappearance of clients and absence of the home-market or regional market; factories cannot benefit from economies of scale; (d) demand for very small volumes of modified starches.

- In Ivory Coast, Nestlé is a main consumer of starch (1200 MT in 2000) that is produced by small processing plants. Also the textile industry used to be a client, but strongly reduced its activities in recent years.
- In Ghana, the Ayenso starch factory has a capacity to process 100 000 MT of cassava per annum (1% of national production) into 20 000 MT of native starch, mainly for domestic use and regional exports. In 2004, its production cost was more than US$ 250/MT. The high price of cassava root in 2005 will have increased the production cost even more. Production is now far below its capacity. Unilever Ghana uses 70-100 MT per annum of native starch, demand may rise to 150-200 MT.
- In Benin, the starch factory Elite Entreprises (capacity 360 MT of native starch per annum) at Pobè has stopped all activities. The factory was constructed in 2000 and financed by African Development Fund. Its production cost of starch amounts to 680 US$ per MT versus a world price of about US$ 200. The company produced 100 MT of starch in 2002, 30 MT in 2003 and 5 MT in 2004.
- In Sierra Leone, no starch is being produced industrially.
- In Nigeria, approximately 20 factories were producing cassava starch, mainly for the domestic textile industry. Most factories closed down, because of the crisis in the textile sector and low prices of imported (maize, wheat, cassava, potato) starch.

At the moment, the potential to develop new initiatives for native starch in the region is very limited. The industrial capacity exceeds market demand. Furthermore, the starch market is a highly competitive but also very segmented market (native starch as well as numerous types of modified starches). Therefore, industrial initiatives cannot survive merely on the basis of domestic demand.

Ethanol and industrial alcohol

In Nigeria, dried cassava roots are being used as a substrate for ethanol production by several distilleries. Present conversion systems of cassava chips/flour to fermentable sugar greatly increases production costs, and thus, cassava will only be considered as a substrate in industrialised countries where readily fermentable materials such as molasses are not sufficiently available. In Nigeria and Ghana, interest in cassava was triggered by the collapse of the sugarcane industry and high cost of imported alcohol. However, the process involving starch hydrolysis is more expensive than molasses-based processes. In Benin, the sugar factory has restarted and produces more molasses than sugar. It seems to have large stocks (2000 m^3) of ethanol, as the price of ethanol from neighbouring Nigeria is lower.

At the moment, the price for fresh cassava and dried roots in Ghana and Benin is too high. In Benin, a recently constructed ethanol factory interrupted all activities because of insufficient competitiveness. Profitability was based on the assumption of availability of dried cassava roots at a price of 50 USD/MT, which is far below the market price in recent years. Also some SME-initiatives stopped all activities because of the low extraction rate and high price of raw material.

Ethanol production in order to substitute imported ethanol should take place at an industrial scale in order to obtain an acceptable quality and economies of scale. Constraints are not of a technical, but of an economic order. Most countries do not encourage alcohol production at a village level.

Glucose syrup
Technically, cassava flour can be used to produce glucose syrup. Most West African countries are users of imported glucose syrups for their food industry. No industrial producer of these syrups exists. Some small-scale processors are involved in trials to produce these glucose syrups for utilisation by the local confectionary sector.

3.4. Marketing

Growing urban demand
Future increases in cassava consumption will depend on: (a) population growth and urbanisation rate; (b) how well cassava is processed into convenience food for urban consumers and on its ability to compete with imported cereals in terms of cost and availability; (c) cassava's ability to fill the hunger gap ("lean months") in more arid savannah areas of West Africa.

Population growth is to about 2.8 % per annum in most countries in West Africa, urban growth being generally significantly higher (4-6% per annum) than rural growth (0-1%). A 5% annual urban growth rate implies a 63% increase of urban population and demand for food in 10 years. The low growth rate or stagnation of the number of farm households, implies that marketed surplus of cassava per household has to increase sharply (+ 63% in 10 years) in order to feed urban centres. Therefore, high-yielding cultivars and labour-saving technologies are required. In the future, urbanisation and rural exodus will be a driving force behind market demand for cassava. At the moment, gari and fermented paste are the most popular forms of cassava.

Exports of chips
Exports of cassava chips from the four selected countries have been at very low levels since 1998. Only between 1994 and 1997, most countries were able to export cassava chips to Europe for the feed sector.

Ethnic market exports
At the moment, limited quantities (mainly gari, but also instant foofoo and attiéké) are exported to Europe for the so-called ethnic market. These exports are organised by small and medium-size enterprises that are based in the coastal zone. They make use of women groups to produce gari that is packaged by exporters/SMEs. Most exporters do not specialise in cassava, but export all types of food on command. Generally, profit margins are good, but growth potential in this niche is limited. Generally, much higher prices can be obtained than in the local market.

Regional trade
The importance of regional trade flows from the transition zone in Ghana, Benin and Ivory Coast to Sahelian countries (Mali, Burkina Faso, Niger) is growing rapidly, certainly during the hunger season when sorghum and millet stocks are exhausted. Also Sierra Leone is exporting gari and locally produced starch to neighbouring Guinea.

Generally price differentials are too small to allow profitable permanent trade flows in east-west direction. Only temporarily east-west flows of gari and agbelima exist between countries in function of regional surpluses and shortages. Major constraints are: (a) borders; (b) lack of regional price information; (c) limited price differentials. In 2005, significant price differentials for gari between Sierra Leone and Nigeria/Benin existed (Sierra Leone: US$ 333/MT compared to US$ 545/MT in Benin). These differences were not exploited by traders because of the inexistence of established chains, of transport costs and absence of market information.

Urban centres in Central Africa with high purchasing power and limited domestic agricultural production (Libreville, Brazzaville, Pointe Noire) have a certain potential for regional exporters. Informal trade flows exist already.

The Economic Community of West African States (ECOWAS) is in place to stimulate co-operation and market integration in the region.

Local marketing chains
Marketing of traditional forms of cassava is mainly informal. Because of the lack of standards, the perishable nature of the product, small transactions at the farm gate and the very high cost of bulking the product, informal and labour intensive trade systems are more competitive than large scale and formal trade.

Livelihood and food security of stakeholders along the chains
Informal processing provides important labour opportunities to micro entrepreneurs, petty processors and traders. In case of surplus production, market power of cassava producers is very weak, certainly in landlocked areas. This counts especially if the farmer offers already harvested – and thus perishable- roots. Although the informal (and therefore untaxed) trade across borders may be an annoyance to governments, especially in times of scarcity, it contributes to economic growth and regional food security. If production falls below demand, farmers and petty processors benefit from very high prices for processed cassava. In the four studied countries farmers have shown to be able to respond quickly to the market and to be able to produce more than the demand. Therefore, rural food security does not seem to be at stake if external outlets for cassava products are identified. Food security of urban poor can be at stake due to higher food prices in case of scarcity. As the price cycle for cassava is 3 – 4 years, one can expect that some years farmers and processors benefit, while other years urban consumers benefit from the price fluctuations. The stable international markets for imported substitutes such as wheat flour or rice show somehow the upper level for urban prices of cassava products.

3.5. Equipment manufacturers

Some equipment has been developed to a satisfactory level. This includes graters that can handle 500 – 2000 kg/hr, depending on the size and type of mill, feeder mechanism, the condition of the grater drum and on the engine. During field visits, we have seen screw presses and hydraulic presses, of which a type from India, in operation by Agro-Asama (Ghana), was most sophisticated and probably most efficient. The included manometer makes product standardisation easier.

A critical issue is the drying step that is used in some processes, such as HQCF and starch. Sun-drying is unreliable in humid or rainy conditions and vulnerable to hygienic problems. Heat-forced drying is more reliable, but fuel costs can amount to ½ or more of the cost of the final

product. Several prototypes, mostly batch-wise electricity or fuel-driven systems are in use, of which no energy efficiency or cost per kg product seems to have been calculated. A flash dryer or spin flash dryer is sometimes referred to as being the answer. In Benin, at the Elite starch factory, the fuel costs for the flash dryer were US$ 190 /MT of native starch produced, which is very high, compared to the international native starch price of about US$ 200 /MT.

Peeling is a labour intensive process. A woman can peel between 25 and 50 kg/hr. This is sometimes aggravated in the case of improved cultivars with a peel that sticks to the root. Peels are sometimes not used. Although some equipment has been developed that scrapes off part of the peel, no machines have yet been developed that effectively remove the whole peel. It is very well possible that for gari, HQCF, starch and feed complete peeling is not necessary.

Fire places with integrated roasting pan and chimney have been developed that minimise smoke contamination during processing, and that are probably more energy efficient than traditional square or round roasting pans over open fires. However, the size is smaller and they can yield some 35 kg of product per day, while "unimproved" pans can handle up to 100 – 120 kg/day.

Lay out of processing plants has been worked upon and sometimes resulted in beautiful and expensive buildings, that however do not comply with the demands of processors.

In Ghana, FRI improved graters and presses. Other countries are not aware of these results. The parastal GRATIS is a manufacturer of processing equipment and training of operators. Also the NGO FINIC in Sierra Leone is successful in this field. In Benin PTAA is mainly engaged in testing of processing equipment, but less in the design. In the region, too much research effort on equipment takes place, without benefiting from regional experiences. Some reinventing of the wheel seems to take place as successful prototypes are not easily adopted in other countries, while not enough attention for cost-effectiveness exists. Exchanges between institutes are limited.

4. Past and ongoing activities and institutional actors

4.1. Governments, research institutes and donors

Ghana
In Ghana, IFAD is the only donor that is directly involved in cassava processing at the moment. The IFAD-funded Root and Tuber Improvement Programme (RTIP, phase 2: 2006-2012, US$ 24 million) is funding: (a) participative distribution of improved planting material; (b) upgrading of traditional processing equipment; (c) innovative processing; (d) strengthening of processing groups. The first phase of the project (1998-2005) mainly focused on the multiplication of planting material. Important funds will be available to upgrade traditional processing. Also other donors invest in this traditional processing in an indirect way through their food security and rural enterprise development projects. During the first phase of the project, pilots were organised in the field of HQCF and gari processing.

The Food Research Institute (FRI) is a national centre of excellence for food research in Ghana. FRI has gained know-how in traditional and innovative cassava processing. The FRI's mission is to conduct market oriented applied research and provides technical services and products to the private sector and other stakeholders. During recent years, FRI implemented a project, financed by DFID, to develop the industrial use of cassava by solving technical bottleneck. FRI is equipped with analytical laboratories, an engineering and maintenance workshop and test kitchen, a pilot plant equipped with operational wet and dry processing lines, etc. The research and development programmes of the Engineering Unit are aimed at upgrading traditional technologies through the use of simple but effective machinery and promoting the most cost effective methods of processing. Quality of the results of these activities is quite diverse: FRI developed an excellent grater and screw press, but was not able yet to solve the problem of solar drying and to design a successful prototype of a processing plant.

Kwame Nkrumah University of Science and Technology (KNUST) at Kumasi is involved in research on product development (glucose syrup and ethanol) on the basis of cassava flour and starch. Other universities and research centres are involved in research on production aspects and screening of cultivars.

Ivory Coast
In Ivory Coast, a very limited number of ongoing project activities exist in the field of cassava production and marketing chain because of the political crisis situation.
The international development banks (World Bank, African Development Bank, IFAD) interrupted their interventions. Most other donors are focusing on post-conflict interventions. Switzerland is financing the "Centre Suisse" that focuses traditionally on root and tuber processing.

The "Société Ivoirienne de Technologie Tropicale" (I2T) was established as a partnership between the State and French partner institutions to promote the adoption of improved agro-processing technologies in Ivory Coast. The I2T has its own engineering studies department, equipment manufacturing workshop, product quality testing laboratory and documentation centre. Small and medium-scale technologies have been developed, tested and piloted for cassava flour, fresh and dried attiéke and starch. I2T works in partnership with the "Centre Internationale pour la Recherche Agricole et Développement" (CIRAD) and other national research institutes. Centre Suisse de Recherches Scientifique (CSRS) has been working for years in the field of post-harvest. I2T is also working together with APEX-CI (Association for the Promotion of Exports of Ivory Coast), a partnership between government, donors and the private sector, in order to promote exports. APEX-CI intends to work on exports of attiéke.

Benin

At the national level, cassava processing falls under the responsibility of the Ministry of Industry, Commerce and Employment Promotion (MICPE). It is working in close collaboration with the Ministry of Agriculture, Livestock and Fisheries (MAEP).
The research institute INRAB is involved in cultivar research. PTAA is testing cassava-processing equipment.

Four ongoing projects are supporting the development of cassava chains in Benin:
Programme de Développement des Plantes à Racines et Tubercules (PDRT). IFAD and Government of Benin finance the PDRT project for a total amount of US$ 22 million for 7 years (2002-2008). Objectives of the project in the field of root and tuber production are: (a) to train approximately 15 000 farmers, (b) to make specific inputs available to farmers; (c) to double cassava yields through distribution of improved cultivars. In the field of processing, the project aims: (a) to organise groups of processors; (b) to upgrade processing equipment. PDRT is mainly working with small-scale farmers and informal processing groups.

Projet de développement de la filière manioc au Bénin (PDFM). The PDFM project, initiated by the President and financed by Government of Benin, has started in 2000. During the first five years, total financing amounted to approximately US$ 5 million. The project strategy is based on: (a) capacity building and skills training of processors; (b) organisation of processors in associations and groups, as well as the creation of an "interprofession" in order to manage the chain; (c) making working funds available (through a credit line of nearly US$ 2 million in 2002/2003, but farmers did not reimburse). During its first years, the project trained farmers, processors and equipment manufacturers. Farmer-multipliers of planting material were organised and supported and micro-projects were financed.

Composante d'Appui au Secteur Privé Agricole (CASPA/PADSA II). The component is part of the PADSA II project that is financed by DANIDA. (2005-2013). Four marketing chains have been identified, namely cassava, shea butter, maize and cashew. A detailed action plan is not available yet. However, the project is mainly going to work with women groups and upgrading of small-scale processing.

Projet de développement de la filière manioc (VECO-Bénin). The ngo VECO is implementing a project financed by the Belgian Survival Fund (BSF). Four products/uses for cassava have been identified: starch, unfermented flour, lafun and animal feed. Unfermented flour has been tested at a pilot scale. The program is mainly working through women groups, rural micro-enterprises, small-scale bakeries, farmers, etc.

Projet de mise en place de bases d'appui pour la transformation et la conservation des produits agricoles au Bénin. The project was initiated in 1999 by the « Direction de la promotion des petites et moyennes entreprises » (DPME) of the « Ministère de l'Industrie, du commerce et de la promotion de l'emploi (MICPE) » in close collaboration with MAEP. The objective was to construct four processing units, of which two exist already in the Plateau department. The units are not used yet and are characterised by structural errors in their design.

Sierra Leone

In Sierra Leone, IFAD is presently formulating a new regional development project for the eastern part of the country. The project will include access to credit and support to cassava production and informal processing. FAO supports the distribution of improved cultivars at a small scale. Some international NGOs have occasionally donated processing equipment and are supporting the formation and training of women groups to engage in gari processing and seem to donate sets of equipment to the so-established groups. Effectiveness of these interventions is very irregular. It is recommended to upgrade established groups/processors in order to minimise management failure. The local NGO FINIC designs and manufactures cassava-processing equipment.

The Institute of Agricultural Research (IAR) is a key actor as it is multiplying and testing a broad range of IITA-cultivars for different uses, and developed some initiatives in the field of upgrading traditional processing. All stakeholders agree that IAR has the required know-how to support development of the cassava chain.

5. Opportunities and constraints

In all four countries involved (Ghana, Benin, Ivory Coast, Sierra Leone), governments and research institutes are willing to strengthen cassava production and processing as part of their food security, rural poverty reduction and industrialisation strategies. They are focusing at different levels: (a) informal grassroots processing; (b) SME-processing; (c) industrial processing (starch, ethanol). Until today, the first level has the highest potential, while also in the second level some successes were obtained. The industrial level is facing problems with raw material supply and international competition. Table 3 summarises a swot analysis for the cassava sector in the four countries involved in the project.

Cassava production
All countries have ongoing programs to screen and multiply new cultivars, mainly in close collaboration with IITA. At the moment, participative screening techniques are preferred as utilisation constraints are a key condition to adoption of new cultivars. National governments cover this field through their research institutes and ongoing donor-financed projects. IITA identified cultivars for industrial utilisation. Research institutes can/have adopt(ed) these cultivars.

Cassava processing
Ghana has important ongoing initiatives in the field of upgrading of traditional processing and flour production, financed by RTIP2. The ongoing projects failed to develop a good prototype for gari processing. The domestic feed niche is relatively neglected, although Ghana has a tradition in poultry and pig production.

In Sierra Leone, Government is interested in developing new opportunities for cassava and in encouraging and upgrading traditional cassava processing. No ongoing initiatives exist. Potential exists to organise pilots in the field of HQCF and to promote and upgrade gari processing.
In Benin, government is interested in HQCF production. Market potential exists as bakeries have shown their interest. Funding is available for traditional processing (gari, lafun) in Benin, but research and ongoing projects failed in developing good prototypes. Only very small trials exist in the field of HQCF-production (ngo VECO).

In Ivory Coast, small ongoing initiatives exist (I2T, CSRS) in the field of attiéke processing and screening of cassava cultivars. Some SME-experience exists in cassava starch production.

A CFC initiative could have value added in following fields:
- organisation of regional exchanges in order to optimise utilisation of means (e.g. equipment development, adaptive research, pilot testing…);
- adaptive research on key bottlenecks (cost-effective drying, development of the domestic feed market and testing of pelletisers);
- development of a prototype and pilots for upgrading of traditional cassava processing; multiplication of a good concept can be financed by existing projects, and:
- design of pilots and promotion of HQCF.

Upgrading traditional processing
This evolution in this market segment during the past 3 decades is based on a stepwise distribution of high yielding cultivars and simple processing equipment (presses, graters, stoves). These technologies were adopted by informal processing groups of women and entrepreneurs. Also in the future growth rates of this market segment will remain high. There is room for establishing pilot processing plants that are improved with respect to layout, labour productivity, hygiene, environmental aspects and equipment. Especially the pressing and roasting equipment can be improved. Studies towards the success and failure of gari production units could reveal ways for future chain improvement by developing a cost-effective prototype. Until today, government initiatives and research institutes failed in developing a cost-effective and affordable

prototype of a group-owned cassava processing facility. Pilot activities should be low cost and based on a participative exchange and testing with existing processors, with regards to plant lay-out, equipment and organisation.

Cassava flour
Wheat substitution can be up to some 15% in bread, and to a much higher level in pastry. The introduction of pilot plants in this area seems a valuable option. Development of good and cheap solar dryers, as well as (hybrid) forced dryers is necessary in order to produce cassava flour that can compete with imported wheat flour. Contacts with bakers etc. exist in some countries (Ghana, Benin) and have to be established in other countries. This sector could be developed gradually.

Cost-effective drying as basis for an industrial use of cassava
The industrial use of cassava in Asia is based on efficient root production, chipping, drying and pelletising. These chipping, drying and pelletising equipment does not exist in Africa. In West Africa, the key constraint to process cassava into flour and starch in an industrial way is to develop and promote cost-effective drying. The market of unfermented cassava flour offers better opportunities than the starch market. Most efforts and trials of mechanical drying in the past failed, rather because of economic than technical reasons. The use of petrol and gas as energy source leads to non-competitive starch and high quality cassava flour. Solutions are: (a) the use of extremely cheap sources of energy that are only available in most oil producing countries; (b) the use of solar energy (possibly in combination with fuel or gas).
Only investments in technical drying solutions that have the potential to become cost-effective should be considered.

Cassava in the domestic animal feed market
The demand for animal feed, as well as possible linkages with feed industries and animal production units should be explored. This counts for both roots and leaves, as the latter may compensate for the nutritional deficiencies of cassava roots compared to other sources. Adapted equipment should be introduced and tested, mainly chippers, drying floors and small-scale pelletising equipment. The balance between leaf harvesting for vegetable dishes, for animal feed, and root yield should be carefully observed. Attention should be given to the toxicity aspects. Given the low raw root price, cassava feed could play an economic role within the country and region. The chain should be build up from scratch.

Comparable constraints in the region
Problems faced in the field of cassava processing in different countries are essentially the same, although: (a) Ghana and Ivory Coast are a bit more advanced in some aspects of innovative processing of unfermented flour; (b) Sierra Leone is more advanced in retail packaging of gari at village level; (c) Benin has experience with a small flash-dryer, etc.
The joint constraints are: (a) cost-effective and hygienic drying techniques; (b) the design of improved processing plants for gari and paste that are acceptable to processors; (c) the organisation of supply lines and integration of the chain; (d) no experience or pilot testing in the local feed market (cultivars, chipper, pelletiser, …).

Table 3: Swot analysis of the cassava sector

Strengths	Weaknesses
Traditional processing - Farmers want to produce cassava as food and cash crop. - Cassava has potential to fill the seasonal hunger gap in semi-arid and arid zones. - Gari is a convenience food that can compete with rice. SME and industrial processing - Periods of low prices of raw material - Adapted cultivars identified and available at the level of research stations. - Tradition of cultivating cassava	Traditional processing - Small marketable surpluses per farm - High cost of logistics - Fluctuation of supplies and prices - Processors do not invest. - No adapted financing mechanisms available SME and industrial processing - High cost of mechanised drying - No experience in improved sun-drying techniques - No small-scale pelletising equipment available. - Irregular quality (fermentation, impurities) - High labour costs for peeling - Demand at local market too small in order to obtain economies of scale. - Large scale industry for primary processing of fresh roots restricted due to high transaction cost of bulking raw material - No adapted financing mechanisms
Opportunities	Threats
Traditional processing - Growing interest of population in cassava production and processing - Growing urban demand - Growing demand from semi-arid and arid zones during the hunger season. SME and industrial processing - Political goodwill to develop industrial processing. - Growing interest for cassava flour as substitute to wheat flour - Domestic feed market	Traditional processing - Competition with imported cereals (rice, wheat) - Limited investment capacity - Competition between food and cash may interrupt the chain SME and industrial processing - Cyclical fluctuation of raw material prices - Competition between cassava for consumer and industrial use. - Competition with local and imported cereals (maize, wheat flour)

6. Recommended areas of intervention

6.1. Justifications and Rationale

In West Africa, cassava as a food security and new cash crop ranks high on the political agenda. The wish to improve and develop cassava agro-food chains is strong. Several donors and organisations are or will be involved in cassava chain development. However, good examples of supply chain development and of prototypes and management structures for improved small and medium-scale processing plants are rare or absent. Furthermore, individual countries often do not benefit from lessons learned and experiences in the region. Therefore, the CFC could make a significant contribution by practical studies, prototype development, regional exchanges and dissemination of results.

The build-up of experience and knowledge, and the regular exchange between West African countries combined with linkages with other organisations and programs could contribute significantly to the development of the cassava chain. A CFC initiative could enhance regional collaboration and focussed exchange of experiences by creating a regional planning and exchange platform in order to tackle common problems.

A possible intervention should use a supply chain approach.
In Ghana and Benin international donors and initiatives are engaged in improving parts of the chains. In Sierra Leone, very few initiatives exist at the moment as most donors are still in a post-conflict approach. In Ivory Coast, donors did not restart development initiatives yet. Among these initiatives in Ghana and Benin, there are niches where the CFC can play a useful or even crucial complementary role. In Sierra Leone, the impact of an initiative could be significant.
The three axes where the CFC can play a complementary role are the following:

a) High quality cassava flour (combined with adaptive research in order to bring down the cost of drying significantly);
b) The design of a new prototype for a small-scale gari processing plant;
c) Use of cassava in the domestic feed market.

Niche 1: High Quality Cassava Flour (HQCF)
In all 4 countries, a desire exists to start or advance with the production and utilisation of HQCF as wheat flour substitute for alimentary and for non-food purposes (plywood industry, etc.).
Potential internal market demand exists. Ghana and Benin have built up some little experience, and effective demand is growing hesitatingly. Presently, however, these chains do not function.
Main bottlenecks are:

I. **Expensive/inefficient drying techniques.** The lack of experience in West Africa with simple equipment, practices and management for sun-drying under prevailing weather conditions, and at the same time the often prohibitive costs of fuel-driven mechanised drying and the lack of good fuel-driven mechanised drying equipment.
II. **Level and stability of root supply and price.** In Ghana and Benin the strong cyclical fluctuations in price/availability of raw material over the years, especially near the cities, hinders a sustainable production flow, as in some years farmers can get much more for their roots than can be obtained by wheat substitution.
III. **Chain integration.** Farmers and other stakeholders are highly market and opportunity oriented. They pop out easily if current prices or other stimuli interfere. Low trust is involved herein. This leads to a stop-and-go of innovative SME-initiatives.

Niche 2: Upgrade gari processing
In Benin, Ghana and Sierra Leone, there is room and a desire to upgrade the concept of an informal gari processing plant. Main bottlenecks are:

I. **Management.** Few processing units are operational (profitable); much of donated equipment is idle due to management and maintenance problems.
II. **Prototypes.** No good pilot model exists for a gari processing unit that conforms to standards of ergonomics, hygiene, and labour productivity that is affordable to replicate.

Niche 3: Cassava as domestic feed
In all 4 countries and for the regional market, cassava could eventually play a useful role as feed for the poultry and pig production, but this sector has hardly developed. Main bottlenecks are:

I. Lack of concentrated livestock industries;
II. Lack of regular supply of cassava roots at competing prices;
III. Lack of nutritional quality of cassava and hence of confidence of the resulting feed;
IV. The absence of small-scale equipment (chippers and pelletisers) and distribution of specific cultivars (thin peel, no peeling required).

No donor is involved in developing the niche of domestic feed. Therefore, the CFC could make a significant contribution by practical studies, prototype development and dissemination of results. The latter has to be done along the project, by building good institutional linkages with relevant parties.

6.2. Objectives and activities

Goal
The overall goal of the intervention should be to contribute to the enhancement of cassava chains in West Africa.

Specific objectives
The specific objective will be to build competitive and market-based cassava root commodity chains supported by relevant, effective, and sustainable services.

Activities

Niche 1: CFC could engage in supporting the taking-off of the HQCF chain by the following:
- Study the possibilities for sun-drying and hybrid drying and develop pilot plants;
- Carefully locate the plants in the dryer Northern part of the countries, where the supply and price of roots, and drying conditions are more favourable;
- Link up with other programs (e.g. RTIP in Ghana, PRS in Benin, IAR in Sierra Leone) for the dissemination of short-cycle cassava cultivars, to break the 3-4 years' price cycle especially for supplying this drying plant;
- Experiment with different management and contract options for connecting farmers to the plant.

Niche 2: CFC could engage in supporting the upgrading of the gari chain by the following:
- Studying the success and failures of gari production units in West Africa will reveal ways for successful organisational and management structures and cost-effective prototyping.
- Develop, upgrade and establish small pilot processing plants that are improved with respect to layout, labour productivity, hygiene, environmental aspects, equipment and by-product use. With the improved gari processing, starch as by-product should be valued, as a local market exists.
- The participatory development and establishment of pilot plants is a delicate process in its own right. Thorough participation of existing/established processors in the design is the least; location at or upgrading of the plants of established processors is the ultimate form.
- Capacitating of gari processors is crucial, as is the organisation of property and management.

- A small to medium processing plant that combines options for gari and flour production could offer the flexibility to adapt to market and climatic conditions through the year. Starch and peels should be valued and utilised. Such a multifunctional unit requires greater management skills, but this would make best use of comparative advantages.
- Several technical and managerial issues are not clear yet that need study.

Niche 3: CFC could engage in testing approaches to develop the use of cassava in the domestic feed industry

The idea is twofold: (i) to develop a pilot supply chain for the use of cassava as animal feed; (ii) to set up a small pilot project with farmers' groups or cooperatives, possibly adapting existing cassava-pelleting technology to local circumstances and to see if cassava pellets could be economically produced and introduced in the domestic feed sector.

In all 4 countries and for the regional market, cassava could eventually play a useful role as feed for the poultry and pig production. This has to be gradually explored and built-up, taking care of:

- Establish contacts (and later durable linkages) with livestock sector stakeholders, upstream and downstream;
- Introduce a good mix of roots, leaves and peas for making a complete animal feed;
- Establish good sun-drying conditions and practices for root pieces
- Prepare a feasibility study for a pilot project: (a) to introduce cassava chips and residuals as animal feed; (b) to introduce pelleting equipment at the level of farmer groups and cooperatives; (c) to promote utilisation of hard cassava pellets in the domestic feed industry.
- Implement pilot activities.
- The approach is based on following guiding principles :
- sensitivity to stakeholders inputs, and their participation at all levels of project conception, planning and implementation;
- the intervention must be demand – driven (and responsive);
- in promoting the local production and utilisation of chips and pellets, a holistic attention should be given to the entire cassava commodity production to utilisation chain;
- the features, constraints and socio-economic peculiarities and relevant previous experiences of all stakeholders in the production to consumption chain should be given painstaking attention and be reflected in the programme design and the choice of recommended options;
- a clear cut linkage of pilot pellets – producing groups with upstream (i.e. dedicated dried cassava chips producers) and downstream (animal feed compounding) operators should be provided.
- The advantages of either loose chips, cassava pellets and pellets of balanced feed mixes, for different uses and users should be carefully evaluated.

6.3. Relation to trade agreements and other initiatives

- The proposed activities are in line with ECOWAS policies to promote co-operation and integration and decrease dependency of commodities from third countries, and do not pose any threat to the aims of the Community. All 3 advanced intervention options implicate to enhance storability, transportability and marketability of the root crop and thus respond to the paragraph III.C.2. of the Document de base-resume executive. The proposed initiatives should be in line with ongoing projects and programmes in the countries as mentioned in chapter 4, and an exchange should be pursued with existing relevant activities elsewhere. These include the Small Scale Cassava Processing and Vertical Integration of the Cassava Sub-sector in Southern and Eastern Africa (CFC/FIGG/12/PHASE I, the Cassava Enterprise Development Project in Nigeria[1], and the experiences acquired by IITA Nigeria and CIAT Colombia.

[1] 1 No results have been found on this project as it has started only recently.

Annexes

Annex 1: Benin
Annex 2: Ghana
Annex 3: Sierra Leone
Annex 4: Ivory Coast

ANNEX 1

Benin

November 2005

Rabo International Advisory Services (RIAS) BV

TABLE OF CONTENTS

List of tables

List of figures

List of acronyms

ADEX	Association de Développement des Exportations
BSF	Belgian Survival Fund
CASPA	Composante d'appui au Secteur Privé Agricole
CEBENOR	Centre Béninois de Normalisation et de la Gestion de la Qualité
CNEX	Conseil national pour l'exportation
DPME	Direction de la Promotion des petites et moyennes entreprises
DPP	Direction de la Planification et de la Prospective
ECOWAS	Economic Community of West African States
GDP	Gross Domestic Product
HDI	Human Development Index
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
INRAB	Institut National des Recherches Agricoles
MDG	Millennium Development Goals
MAEP	Ministère de l'Agriculture, de l'Elevage et de la Pêche
MICPE	Ministère de l'Industrie, du Commerce et de la Promotion de l'Emploi
MT	Metric tonnes
NGO	Non gouvernemental organisation
SDDR	Schéma directeur de la politique de développement agricole
ONASA	Office National pour la Sécurité Alimentaire
PDFM	Programme de Développement des Plantes à Racines et Tubercules
PDRT	Projet de Développement de la Filière Manioc au Bénin
PSO	Plan stratégique opérationnel
PTA	Programme de technologie agricole et alimentaire
UEMOA	Union Economique et Monétaire de l'Afrique de l'Ouest
UNDP	United Nations Development Programme

Currency equivalents

Currency Unit	=	FCFA
€ 1.00	=	FCFA 655
FCFA 1.00	=	€ 0.001527

INTRODUCTION

This report is based on a number of reference studies that are listed in annex as well as on data that were collected during interviews with key stakeholders in October 2005.

Figure 1: Map of Benin

1. General context

Benin has an area of about 115 000 km^2 that can be divided into three agro-ecological zones. The rainforest zone is located in southern Benin. The transitional zone covers the central part of Benin, while savannah vegetation covers the northern part. Rainfall is highest and most reliable in the south of the country and decreases gradually to an average of 1 000 mm in the north. The duration of the wet season shortens from south to north. The forest and transitional zones have a bimodal rainfall pattern allowing two growing seasons. The dry northern savannah is characterised by one rainy season and one growing period. Rainfall is a predominant factor for farming systems, cropping patterns and yields.

Benin's population is estimated at 6.9 million inhabitants. Urbanisation is progressing with already more than 45% of the population living in urban areas. Urban centres are concentrated mainly in the south. Main consumption centres are Cotonou, Porto Novo, Bohicon and Abomey. Population growth is about 2.5%. The UNDP Human Development Index (HDI) ranks Benin 158th out of 173 countries, with a HDI of 0.420 (2002). Despite significant improvements over the last decade, social indicators of development remain low. Poverty remains predominantly a rural phenomenon.

Since the mid-nineties, the economy is growing at a steady rate of about 4%, which is below the 7%-rate required to achieve Millennium Development Goals (MDGs). Agriculture contributed 36.3% to GDP in 2004, services 49.6% and industry 14.1%. Agriculture and trade with Nigeria are driving forces of the economy. About 70% of the active population is working in agriculture. The agricultural sector is also responsible for about 90% of export earnings, mainly from cotton. Main food crops are cassava, yam, maize and sorghum. Cassava and maize used to be food crops, but gain importance as cash crops.

The Government of Benin is undertaking efforts to reduce rural poverty and to diversity its agricultural production and export earnings. The objective is to reduce dependency of the economy on cotton. Cassava production and processing is a cornerstone of this strategy, which is reflected in the ongoing projects and initiatives (see: chapter 5). Government strategy is described in following documents: ***« Schéma directeur de la politique de développement agricole » (SDDR) and « Plan stratégique opérationnel »*** (PSO).

Benin is member of ECOWAS and UEMOA, which facilitates growth of regional trade flows with neighbouring countries.

2. Cassava chains

2.1. Overview of supply chains of traditional and novel cassava products

The supply chain for cassava products in Benin includes mainly traditional products that are processed by individual or organised women. Main processed cassava forms in Benin are gari (65%-75% of fresh roots) and lafun (15-20% of fresh roots). Lafun is fermented flour from milled dried retted roots (cossettes). Also boiled roots are consumed at local level. In southwest Benin, agbelima (fermented past) has some importance. At village level, also very small quantities of tapioca/starch are produced. This traditional starch is a typical by-product of lafun or gari processing and is mainly consumed at household level or sold in local retail markets.
In the past, some efforts were undertaken to develop processing and marketing chains for novel cassava products (native starch, ethanol, exports of cassava chips,..). These efforts were no success for different reasons: (a) fluctuating prices of raw material; (b) strong competition from informal processing groups for raw material; (c) strong international competition in the market for final products (ethanol, starch, wheat flour, ..); (d) excessive processing and logistical costs.
At the moment, Government is very much interested in: (i) developing the chain for unfermented high quality cassava flour (HQCF) in order to substitute imported wheat flour, and (ii) upgrading production, processing and marketing chains for traditional cassava products. The overall goal is to create new opportunities for farmers and to diversity agriculture.

2.2. Cassava production

Volumes. Since 1991, production of fresh cassava roots in Benin has tripled (table 1). The country produced about 2.96 million MT of fresh cassava roots in 2004 compared to approximately 1.05 million MT in 1991. Expansion of cassava production largely exceeds population growth, which is a strong indication for production growth as well as the importance of traditional processing. Approximately 250,000-300,000 hectares were attributed to the production of cassava in 2004. According to DPP/MAEP, quality of statistics was low during recent years, because of weak capacity of the ministry in rural areas. However, the statistics should reflect a correct trend.

Table 1: Cassava production, yield and acreage in Benin

Year	Production (000 MT)	Yield (MT/ha)	Acreage (ha)
1991	1 046	8.30	126 015
1992	1 041	8.38	124 238
1993	1 147	8.49	135 000
1994	1 146	8.14	140 674
1995	1 329	7.84	157 950
1996	1 457	8.72	167 076
1997	1 918	10.33	185 784
1998	1 989	10.50	189 400
1999	2 113	10.45	202 117
2000	2 350	10.71	219 404
2001	2 703	11.26	240 048
2002	3 155	9.27	264 610
2003	3 055	12.36	297 271
2004	2 955	..	..

Source: acreage and yield: FAOSTAT (2005); production: SS/DPP/MAEP

Crop husbandry. The average farm cultivates about 0.6 hectare of cassava, but this acreage varies between 0.06 ha in Mono and 1.18 ha in Alibori. Production is scattered and surplus production per farm is generally small. Mixed cropping is still dominant, although sole cropping is practiced, certainly in the transitional zone. Plant density is low (5000-8000 compared to 10000 that is recommended). Less than 5% of farmers are using chemical fertiliser. Cassava is generally harvested between the 10th and 18th month.
Harvesting takes place all year long, although slightly higher volumes are harvested during the dry season in December-March, while planting takes place from May to November.

Spatial distribution. About 85% of all cassava roots are produced in southern and central Benin, where agro-ecological conditions are best adapted to the crop. Main food crops in the southern and central zone are maize and cassava, while farmers in the northern savannah are involved in production of sorghum and millet. According to national statistics, the departments Plateau-Ouémé (33% of national production), Mono-Couffo (20%), Collines-Zou (17%) and Atlantique (17%), are the main producers of cassava.

Cultivars. According to estimations made by INRAB, farmers are growing approximately 350 local cassava cultivars. Since the 1980s and as reaction to the outbreak of some cassava diseases, INRAB screened, multiplied and distributed tolerant IITA-cultivars, such as: TMS 30572, TMS 30555, TMS 30001 and TMS 4(2)1425. Yields of these TMS cultivars were high, but the cultivars were not always adapted to farmers' needs which led to a low adoption rate. Since 1992, INRAB selected and distributed other cultivars to farmers, namely BEN86052 and RB89509. Farmers more easily adopted these cultivars, as they were adapted to mixed-cropping systems. Nevertheless, adoption rate of new cultivars remains low but is steadily growing as result of ongoing projects (PDRT and PDFM). It was estimated at about 10% in 2002.

Yields. Although the quality of yield data is considered as low and data are sometimes contradicting, it is generally accepted that yields are low, but increase gradually as the percentage of high-yielding cultivars is increasing, and that they are still far below theoretical potential. According to FAOSTAT (2005), the average yield has always been below 12 MT per hectare (table 1) before 2003. A recent survey (2004), organised by PDRT/MAEP, concluded that the average yield for cassava is 15.89 MT/hectare (table 2).

Table 2: Cassava yields (MT/ha) in Benin (2004)

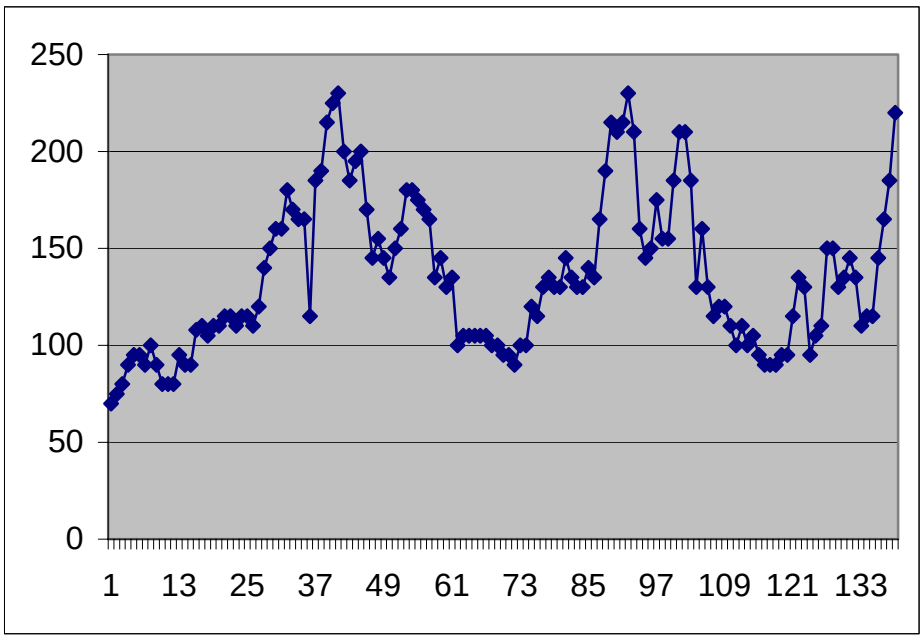
	Average	Lowest	Highest
Local cultivar	15.61	10.58	26.08
Cultivar RB	14.2	9.66	29.20
Cultivar BEN	16.87	9.60	24.58
Cultivar TMS	26.14	8.70	30.87
Average Benin	15.89		

Source: survey PDRT/MAEP

Farm gate prices and production cost. Farm gate prices for fresh roots generally varied between 15 and 35 Fcfa/kg during 1997-2004. Since early 2005, prices increased sharply up to 50-60 Fcfa/kg because of a shortage of fresh roots (see: supply and price cycle). It is expected that farmers will expand the acreage attributed to cassava, so that prices will drop again to a lower equilibrium which should be in the range of 15-30 Fcfa/kg, depending on market access. Production cost of fresh roots amounts to 9,8 Fcfa/kg for traditional cultivation and 9,7 Fcfa/kg for improved cultivating. Including labour for harvesting, costs vary between 12 and 17 Fcfa/kg, depending on yields and level of inputs. Fertiliser is generally not used.
The average farm gate production cost of dried roots was estimated at 45 Fcfa/kg (2003).

Supply and price cycle. Figure 2 presents the evolution of cassava prices during 1994-2005. This period is characterised by a strong cyclical component with high prices in 1997-1998, 2001-2002 and 2005 (price fluctuations up to 300%). This cyclical component is synchronised with prices in neighbouring countries (Ghana, Nigeria, Ivory Coast and Togo). Many farmers expand the acreage attributed to cassava when the prices are high, but reduce acreage significantly when prices are low. This behaviour has led to gluts and depressed farm gate prices in 2000 and 2004, but high prices in 2002 and 2005. Since January 2005, the price of cassava and its derivatives has doubled in Benin (fresh roots from 12 000 Fcfa/MT to 25 000 Fcfa/MT).
These cyclical fluctuations lead to a stop-and-go effect on industrial utilisation of cassava roots (for starch and ethanol). The present price level is not sustainable. Towards the end of 2006 and 2007, prices for fresh roots and other cassava products will decrease as supply will increase. Farmers are already expanding the acreage attributed to cassava.

Figure 1: Cassava price in Benin (gari, Bohicon, 1994-2005, Fcfa/kg)



Source: ONASA

2.3. Processing, products and their actors

2.3.1. Traditional products

Actors
In Benin, cassava processing is highly traditional, although processors are rapidly adopting basic equipment (graters, presses and stoves) in order to mechanise crucial steps and solve labour bottlenecks (manual grating). Also peeling and harvesting are perceived as a major bottleneck, but no solution that is acceptable to smallholders and processors exists yet. Women dominate cassava processing, which is an important income generating activity in rural areas. These women are generally organised in informal groups or associations at village level. These groups often organise saving mechanisms in order to guarantee working capital to their members. They also buy truckloads of fresh roots and firewood as a group, and pay labourers for peeling. Others, who have access to a privately owned grater at village level, are working on an individual basis. Access to a grater is a key barrier to commercial gari and agbelima production. In some cases, an entrepreneur invests in the required equipment (grater, press, stove, sacs) and pays female labourers for peeling and roasting. In other cases, women groups receive support from NGOs (working capital, equipment, training) and development projects to start processing activities.

In 1997, about 270 processing groups were registered. Given the expansion of cassava production in Benin since 1997, the number of processing groups could be as high as 500 at the moment. Only few groups financed their own equipment without external assistance. Most groups received grants in kind (grater, press), credit, etc.

All past efforts to produce these traditional products at a more industrial scale (medium-size enterprise) by local entrepreneurs have failed.

Product forms

Gari. Gari is popular in most southern departments: Ouémé-Plateau, Mono-Couffo, Zou-Collines and the Bassila region in Dongo. Gari is produced all year long, although supply increases slightly in January-February.

A typical gari processing plant consists of 5-7 stoves for roasting, a small grater, a few presses (or just some wood and stones). Core labour for handling, roasting etc. is provided by a group of 12-20 women. For peeling, additional labourers are paid (800 Fcfa/day). A unit processes about 350 – 600 MT of fresh roots per annum. A major constraint to output of the plant and productivity of labour is the capacity of the stoves. The capacity ranges from 35 kg to 135 kg per stove (or women) per day. At the market for gari has an atomised structure and no individual groups has an impact on prices, returns to labour are correlated to the turnover per women and per day. The group does not seem to invest in improved presses. Hygienic working conditions are very poor, although it does not necessarily have an impact on quality of gari. Women are not aware of environmental impact and generally do not capture effluents. The stoves generally do not have chimneys, which has a negative health impact on women and their little children.

MICPE and MAEP have constructed two gari processing units that are not operational yet. As the design of the plants was a top-down initiative, these units are not adapted to the specific requirements for competitive gari processing (high energy cost because of the use of electric engines and a generator, capacity of stoves too small, stoves are in a closed building (too hot), etc. During the next years, the projects PDRT and PDFM are going to strengthen approximately 60 gari processing groups. Most will be existing groups.

An optimal prototype for an improved processing unit does not exist yet. This model should have following requirements: (a) a labour productivity that is comparable to private units (capacity of stoves should be at least 80 kg per day and per women!!!!); (b) an acceptable investment cost; (c) improved hygienic conditions (chimneys, drying floor, sanitary facilities, storage); (d) minimised negative environmental impact (higher energy-efficiency of stoves, capture of effluents, recuperation of starch), etc.

The price for gari is presented in figure 1. During recent years, prices fluctuated between gari prices fluctuated between 150 and 250 Fcfa/kg. In October 2005, gari prices rose even up to 250-400 Fcfa/kg depending on the level in the chain (wholesale or retail and market access).

Traditional starch. At village level, small quantities of starch are produced for use at household level or sale in local markets (human consumption, cloths). NGOs are promoting the use of specific flavours (vanilla, banana) in order to encourage human consumption. Quality is good but irregular, as most starch is fermented to some degree. Demand for this starch is low and transaction size is very small. Growth potential of this market is limited.

Lafun/cossette. Lafun is a (fermented) flour of milled cossettes or dried retted roots. Consumption of Lafun mainly takes place in central Benin. The main production zones are the departments Collines, Borgou, Donga and Plateau. Quality of lafun is variable and depends on moisture content, impurities and contaminations.

2.3.2. Novel products

Unfermented flour. Production of high quality cassava flour is considered as a strategic option in Benin. However, little experience has been gained until today. The ngo VECO-Benin organised some small trials and pilot activities at village level. VECO concluded that: (a) demand for unfermented flour comes from small and medium-size bakeries in small urban centres, while potential demand at village level is almost inexistent; (b) women are interested in these new opportunities; (c) at the moment, the price of gari and lafun is very good, which implies that competition between wheat flour and high quality cassava flour is high; (d) investment in drying facilities is required.
At the moment, small and medium-size bakeries are interested in this flour and were trained by ADEX (in collaboration with Alitech). Bakeries accept to pay 200 Fcfa/kg for unfermented flour, as long as the price of wheat is about 300 Fcfa/kg.

In the present context the cost of energy and raw material are the main constraints to produce unfermented cassava flour at an industrial scale. Cost-effective drying remains therefore a challenge. Technically, the drying constraint has been solved using different types of dryers (batch, flash-dryer) using different energy sources (fuel, gas), but none of these solutions was competitive in financial terms. They all led to a high quality flour that was too expensive to compete with imported wheat. Elite Enterprise is using a flash-dryer with an energy cost of about 125 Fcfa/kg of dried starch or flour. Given a cost of raw material of about 140-180 Fcfa/kg, the final product cannot compete with imported starch or wheat flour.

The use of solar drying or a combination of solar drying and forced drying is required to develop and produce competitive high-quality cassava flour.
Benin is importing about 84 000 MT of wheat per annum, of which part is exported to Nigeria.

Industrial starch. The starch factory ***Elite Enterprises*** at Pobè has a capacity to produce 30 MT of native starch per month. The factory has interrupted all activities in 2005 because of the high price of raw material and energy, and the crisis at the level of its clients (textile industry). The factory was constructed in 2000 and financed by African Development Fund (Fcfa 100 million). Its production cost of native starch is approximately 370 FCFA/kg (680 $US/MT compared to world market prices of approximately 200 $US), which is twice the price for imported native starch. The company produced 100 MT of native starch in 2002, 30 MT in 2003 and 5 MT in 2004. Its clients were three textile factories of which two interrupted their activities (SITEX and COTEB). The third (CTB) client decided to import modified starch that is cheaper and better adapted to its specific technical requirements.

The installed capacity in Benin is sufficient to satisfy national demand for native cassava starch at the moment. However, the industry cannot compete with imported products. A future option might be to use the factory to produce unfermented cassava flour, but cheaper fresh roots and a lower cost of fuel will be required. Furthermore, a combination of solar drying and industrial drying will be required to bring down drying costs significantly (at least by 50%).
Demand for native cassava starch collapsed in the region. Traditionally, the main users of native starch in Benin and in the region were textile industries. This sector is in a deep crisis because of cheap Chinese imports of textiles. Also in Nigeria, most starch factories lost their clients and most closed their doors. In Benin, demand used to be around 500 MT per annum. At the moment, the users of starch are importing small volumes of modified starch that responds better to their specific uses.

Ethanol. The company ***Yueken International Benin SARL*** in Savalou, constructed in 2002, has a capacity to process 10 000 MT of dried roots into 3 000 MT of ethanol 95% per annum. According to its business plan and in order to produce ethanol at a competitive price, the company is able to pay 30 Fcfa/kg of dried roots, which is below the market price for dried roots and therefore

not acceptable to farmers. The market price for dried roots was never below 40 Fcfa/kg. So, the company was not able to buy sufficient quantities raw material within an acceptable radius. Farmers in the Savalou are extremely disappointed, as many expanded production in order to anticipate demand from the factory.

Two medium-size private initiatives (AGRI-MAXI, SOTABE) have existed in the past with capacities of up to 50 MT of ethanol per annum. Farmers received 15-20 Fcfa/kg of fresh roots. The high processing cost and low extraction rate (60% of optimal extraction) did not allow making profits, so that activities were interrupted.

Industrial gari processing. During the nineties, ***Etablissements Adeossi et fils*** based at Savè was involved in industrial processing of gari, but has interrupted its activities since 1999. Main constraints were: (a) high energy cost; (b) labour constraint for peeling; (c) maintenance.
Also Alitech (Cotonou) concluded that it is difficult to compete with women groups and stopped all production activities for gari, lafun and fermented flour. The company wants to focus on unfermented cassava flour, flavoured and enriched starch.

Animal feed. During the period 1991-1996, Benin succeeded in exporting small quantities of dried roots to the European market (Bretagne, France) to be used as animal feed. Quality was good, but trade was interrupted when the international price for pellets dropped below US$ 150/MT. Cost of logistic to export cassava is extremely high in Benin. Cotonou has no facilities for bulk transport (conveyor belts). Farm gate price for dried roots (bulk) were 34 Fcfa/kg, compared to 7 Fcfa/kg in Thailand.
VECO intends to organise some small trials to replace maize in animal feed by cassava, but mainly at village level.

2.4. Marketing

Local trade and flows
Cassava trade is mainly informal. Volumes are expressed in local units. Generally 50 kg polypropylene bags are used at wholesale level. All packaging material is imported. At retail level, often small plastic bags are used. The introduction of improved packaging material at a larger scale has failed.

The main fluxes for gari are: (a) south-north from Collines to Parakou, Malanville and Niger; (b) north-south from Zou and Collines towards Cotonou and Bohicon; (c) east-west from Plateaux towards Porto-Novo and Cotonou; (d) west-east from Mono-Couffo towards Cotonou and Porto-Novo.

The main fluxes for lafun are: (a) from central to north Benin (Malanville); (b) the central – south axe towards southern cities. Also Nigeria is exporting periodically some dried roots to East-Benin (Oueme and Plateau).
Unfermented cassava flour is mainly consumed in urban centres.

Exports
Region. Benin is exporting gari to Niger and Burkina Faso, which is a growing market. Exchanges with Nigeria fluctuate as they depend mainly on changes of the exchange rate Fcfa-Naira. Exchanges with Togo depend mainly on local seasonal shortages or surpluses and resulting price differences.

Gari is also exported to Central Africa (Libreville, Pointe Noire, …), recently making use of the Lomé port. These exports are probably less than 500 MT per annum.

Ethnic market. Benin is exporting small quantities to the ethnic market in France. This market segment has a limited growth rate and potential, but value added can be quite interesting. A

limited number of small and medium-size enterprises are generally intermediaries between processing groups and foreign clients. In Benin, no specialised enterprises exist. Most of them react to diverse market opportunities and trade different goods and products.

Dried roots Europe. During the period 1991-1996, Benin succeeded in exporting small quantities of dried roots to the European market (see above).

3. Past and ongoing activities and institutional actors

3.1. Projects

Four ongoing Cassava promotion projects are supporting development of the cassava chain:

Programme de Développement des Plantes à Racines et Tubercules (PDRT). The PDRT project is financed by IFAD and Government of Benin for a total amount of US$ 20 million for 7 years (2002-2008). Objectives of the project in the field of production are: (a) to train approximately 15 000 farmers, (b) to make specific inputs available to farmers; (c) to double cassava yields through distribution of improved cultivars. In the field of processing, the project aims to (a) organise groups of processors; (b) upgrade processing equipment.

Projet de développement de la filière manioc au Bénin (PDFM). The PDFM project, initiated and financed by Government of Benin, has started in 2000. During the first five years, total financing amounted to Fcfa 3.7 billion. The project strategy is based on: (a) capacity building and skills training of processors; (b) organisation of processors in associations and groups, as well as the creation of an ***"interprofession"***; (c) making working funds available (through a credit line, but farmers did not reimburse). During its first years, the project trained farmers, processors and equipment manufacturers. Farmer-multipliers of planting material were organised and supported. Furthermore, micro-projects were financed.

Composante d'Appui au Secteur Privé Agricole (CASPA/PADSA II). The component is part of the PADSA II project that is financed by DANIDA. (2005-2013). Four marketing chains have been identified, namely cassava, shea butter, maize and cashew. A detailed action plan is not available yet.

Projet de développement de la filière manioc à Djidja (VECO-Bénin). VECO is a Belgian ngo that implements a project financed by the Belgian Survival Fund (BSF). The project focuses on the development of the cassava chain. Four products/uses for cassava have been identified: starch, unfermented flour, lafu, animal feed. The program will mainly work through women groups, rural micro-enterprises, small-scale bakeries, farmers, etc...

Projet de mise en place de bases d'appui pour la transformation et la conservation des produits agricoles au Bénin. The project was initiated in 1999 by the ***« Direction de la promotion des petites et moyennes entreprises »*** (DPME) of the ***« Ministère de l'Industrie, du commerce et de la promotion de l'emploi (MICPE) »*** in close collaboration with MAEP. The objective was to construct four processing units, of which two exist already in the Plateau department. The units are not used yet and are characterised by structural failures in their concept.

3.2. Other institutional actors in the cassava chain

Ministries. The Ministry for Agriculture, Livestock and Fisheries (MAEP) is responsible for all production aspects and is also involved in most traditional processing initiatives. The Ministry for Trade and Industry (MICPE) is responsible for processing, through two departments: (a) DPME for promotion of small and medium-size enterprises; (b) DPI for industrial initiatives.
The ***"Cellule d'Assistance Technique"*** (CAT) is a unit, responsible for implementation of all private sector development initiatives and projects of MICPE.

University of Benin. The Technology department is leading a training program on vitamins-enriched gari production with women in the department of Atlantic. It concerns nutritional and hygienic aspects and management.

Research. The *"Institute national des recherches agricoles du Bénin"* (INRAB) has a mandate to screen and release cultivars. INRAB has always been in close collaboration with IITA (Ibadan). Also the University of Benin is undertaking research initiatives in the field of roots and tubers. Most of them have a more theoretical than an applied character.

Equipment. The « *Programme de technologie agricole et alimentaire* » (PTAA), a branch of INRAB, is testing and designing cassava processing equipment. PTAA also looks at cost-benefits aspects but only in a very late phase. The structure is mainly focused on testing of existing "second and third best" equipment, manufactured by private companies and less on innovative design of equipment.

Quality control. DANA, an agency within MAEP, has a mandate to analyse quality of food produce. The structure has received support from PADSA I and will also receive support from PADSA II.

Standards. CEBENOR (Centre Béninois de Normalisation et de la Gestion de la Qualité) is developing standards for cassava and its derivatives. During the coming years, field tests will take place. CENEBOR receives financing from PADSA II (component C).

Other food security and private sector development initiatives

Other institutional actors are:

→ *"Office national d'appui à la sécurité alimentaire"* (ONASA), that is collecting and publishing price information including cassava prices;

→ « *Conseil national pour l'exportation* » (CNEX).

→ *"Association de Développement des exportations*" (ADEX), financed by Government and World bank, supports small and medium-size export initiatives (grants, training, studies, consulting, …).

4. Summary of opportunities and constraints

Gari. The market for traditional products has been gradually expanding for the last decades. Women groups are adopting processing technology, but potential to upgrade facilities is significant. Several donors are already active in this segment. Past experiences have shown that support to and financing of new processing groups often fails. It is more efficient to upgrade equipment of existing groups. No optimal pilot plant exists yet.
It is recommended not to intervene in the field of working capital, but to focus on access to hardware and preferably through existing processing groups in order to minimise failures.

Lafun/cossette. The production of dried, retted roots can be technically improved by the introduction of a chipper, designed by IITA, and improvement of the drying process.

Unfermented flour. At the moment, industrial bakeries are not interested in HQCF as supply problems have not been solved yet. However, small-scale bakeries are interested as cassava flour might reduce their production cost. Upstream, small women groups are interested as they are looking for new opportunities. A potential exists to link this demand and supply. It is necessary to improve and promote cheap solar drying techniques at village level.

Starch. The market for traditional starch exists and has some growth potential, but limited value added for a project. The market for industrial starch has no potential to be developed. NGOs are already working in the niche of traditional starch.

Ethanol. Some private companies exist but failed because of : (a) low extraction rate; (b) high cost of raw material. As private sector initiatives are required and profitability is uncertain, limited potential in this niche exists at the moment in Benin.

Animal feed. At the moment, Benin has no potential in the international feed market because of the high cost of raw material and logistics. Farmers can be taught how to use cassava as animal feed at their village level in order to replace maize in feed.

Conclusion: Three niches exist at the moment in Benin: (a) upgrading of traditional processing of cassava; (b) developing small-scale initiatives in the HQCF market; (c) promotion of cassava as animal feed.

Table 3: Summary of opportunities and constraints

Form	Opportunity	Constraint
Raw material		Cyclical price component
Gari	Market demand is growing	Processing equipment can be improved. Processing groups do not have the capacity to finance their own equipment.
Lafun/cossette/dried root	Market demand is growing (although fluctuating.	Processors do not finance their equipment.
HQCF	Bakeries are interested	Only competitive at a small-scale
Traditional starch	Teach people how to use flavours	Limited growth potential. Market segment exists already.
Animal feed, local markets	Cassava can compete with maize	Farmers are not used to intensive animal husbandry. Availability of additives and minerals

Animal feed, international market	None	Low international market price. High cost of logistics
Industrial starch	None	High cost of industrial drying; research required.

5. Possible institutional project links and organisation

Four projects are involved in developing the cassava marketing chain. Two are focusing on production and processing (PDFM, PDRT); two are focusing on processing and post-harvest (VECO, CASPA/PADSA II). Except for VECO, all projects are encouraging gari processing.

An interesting niche could be to design and test pilot initiatives and concepts in the following fields: (a) unfermented cassava flour; (b) gari processing; (c) animal feed (national market).

References

DDI/MICPE. Projet pilote d'appui à la création d'activités industrielles. Etude de faisabilité de l'implantation d'unités industrielles de transformation du manioc au Bénin. Rapport définitif réalisé par Sodjinou Epiphane.

ESC Manioc. Rapport diagnostic du secteur manioc. September 2004

PDRT. Etude de marché national sur les racines et tubercules et produits dérivés. Volume I : rapport principal. Cotonou. January 2003

Annex 1A: Programme of the identification & formulation mission

Assessment of Resources, Markets and the Potential for Market Development in Value Added Cassava Products in West Africa.
Country visit to Benin: 1–8 October 2005

Members

- Dr Sander Essers, cassava processing specialist, Wageningen University (country visits Ghana, Benin, Sierra Leone)
- Dr Frans Goossens, economist (country visits Bénin, Sierra Leone)
- Dr Diallo Souleymane, economist, CIRES, Abidjan (country visit Côte d'Ivoire)
- Mr. Wim Verzijlenberg, project manager, RIAS (country visit Ghana)
-

During the visit to Benin, the team consisted of Goossens and Essers

Date - heure	Nom structure	Personnes rencontrées	Contacts
Lundi 03/10/05 09 h 00	Ministre de l'industrie, du commerce et de la promotion de l'emploi (MICPE)	Mme Marcelle G. Attiogbe da Silveira, administrateur du commerce M. Adebo A. Gafari, conseiller technique à l'industrie et aux PME	21 30 70 10 21 30 76 45
10 h 00	Association des boulangers (Anapeb)	M. Emile Gangbo, président	21 30 23 39
11 h 00	Alitech	M. Gabriel Romain Monteiro, gérant Alitech	95 05 74 80
14 h 30	Programme Technologie Agricole et Alimentaire (PTAA)	Dr. Pascal Fandohan, chef programme M. Ahouansou Mogia, ingénieur agricole M. Megnanglo Michel, ingénieur agricole M. Agossou Klotoé, ingénieur agricole Mme Detongaon Nadia, nutritionniste M. Kiki Denis,	21 21 41 60
17h00	Ong VECO	Mme Rita Kestier, chargée de programme Mme Chiaratou Oceni, responsable commercialisation manioc M. Honorat Emougou, chargé de programme	21 32 46 67

		manioc	
Mardi 04/10/05 9h00	Alitech (entreprise de transformation du manioc)	M. Gabriel Romain Monteiro, gérant Alitech	
16h00	Faculté des sciences agronomiques, Département de Nutrition et Sciences Alimentaires	Prof. Joseph D. Hounhouigan	21 36 20 98 hounjos@intnet.bj
19h00	PADSA II, Composante d'Appui au Secteur Privé Agricole (CASPA)	M. Jean Noël De Meester, coordonnateur	21 31 76 01
Mercredi 05/10/05 10h00	Entreprise informelle de transformation de manioc en gari, village Mowodani		
11h30	Association Elite Industrielle (usine de transformation de manioc en amidon) à Pobe	M. Montcho Adrien, gérant	95 28 76 62
13h30	Base d'appui à la transformation de manioc à Keitou-Vedji		
16h30	Base d'appui à la transformation de manioc à Mowodani		
Jeudi 06/10/05 10h00	Programme de Développement des Plantes à Racines et Tubercules (PDRT)	M. Eric K. N'Da, coordonnateur national	21 1 26 70 ndakeric@yahoo.fr
10h00	Projet de Développement la Filière Manioc (PDFM)	Mme Adjade Omonlara, coordonnatrice nationale	95 79 26 99 90 94 42 57
15h00	Ministère de l'Agriculture, de l'Elevage et de la Pêche (MAEP), Direction Programmation et Prospective (DPP)	M. Bonaventure G. Kouakanou, directeur M. Medenou T.K. Christophe, directeur adjoint	21 30 02 89 21 30 02 89 90 90 94 49
16h30	Office d'Appui à la Sécurité Alimentaire (ONASA)	M. Dossou Michel Mitchozounou, directeur technique	21 33 15 02 90 03 75 33
Vendredi 07/10/05 10h00	Réunion de restitution, MICPE, présidée par M. Adeso Gafari CTI/MICPE	Mme Ernestine Attanasso (MICPE, directrice du commerce extérieur), Mme Marcelle A. da Silveira (DCE/MICPE), Mme Chiaratou Oceni (VECO-Bénin), Mme Effiboley (PDFM), M. Eric N'Da (PDRT/MAE),	

		M. Frans Goossens (RIAS), M. Sander Esser (WUR), M. Pognon (DCE/MICPE), Mme Clémentine Francisco (ADEX), M. Abou Oceni Hanzize (CAT/MICPE), M. El-Hadj Gado Moubarak (CAT/MICPE), M. Pascal Houssou (DCE/MICPE), Mme Omonara Adjadi (PDFM/MAE)	
15h00	MAEP, DPP, service statistique	M. Edgard Yves Didavi, statisticien	
16h00	Centre Béninois de Normalisatin et de gestion de la qualité, MICPE	M. Claude Laleye, directeur	21 33 31 18
19h00	Cellule d'Appui Technique, MICPE	M. Abdou Hanzize Oceni, directeur	21 31 10 58 95 95 07 18

ANNEX 2

Ghana

November 2005

Rabo International Advisory Services (RIAS) BV

TABLE OF CONTENTS

Currency equivalents

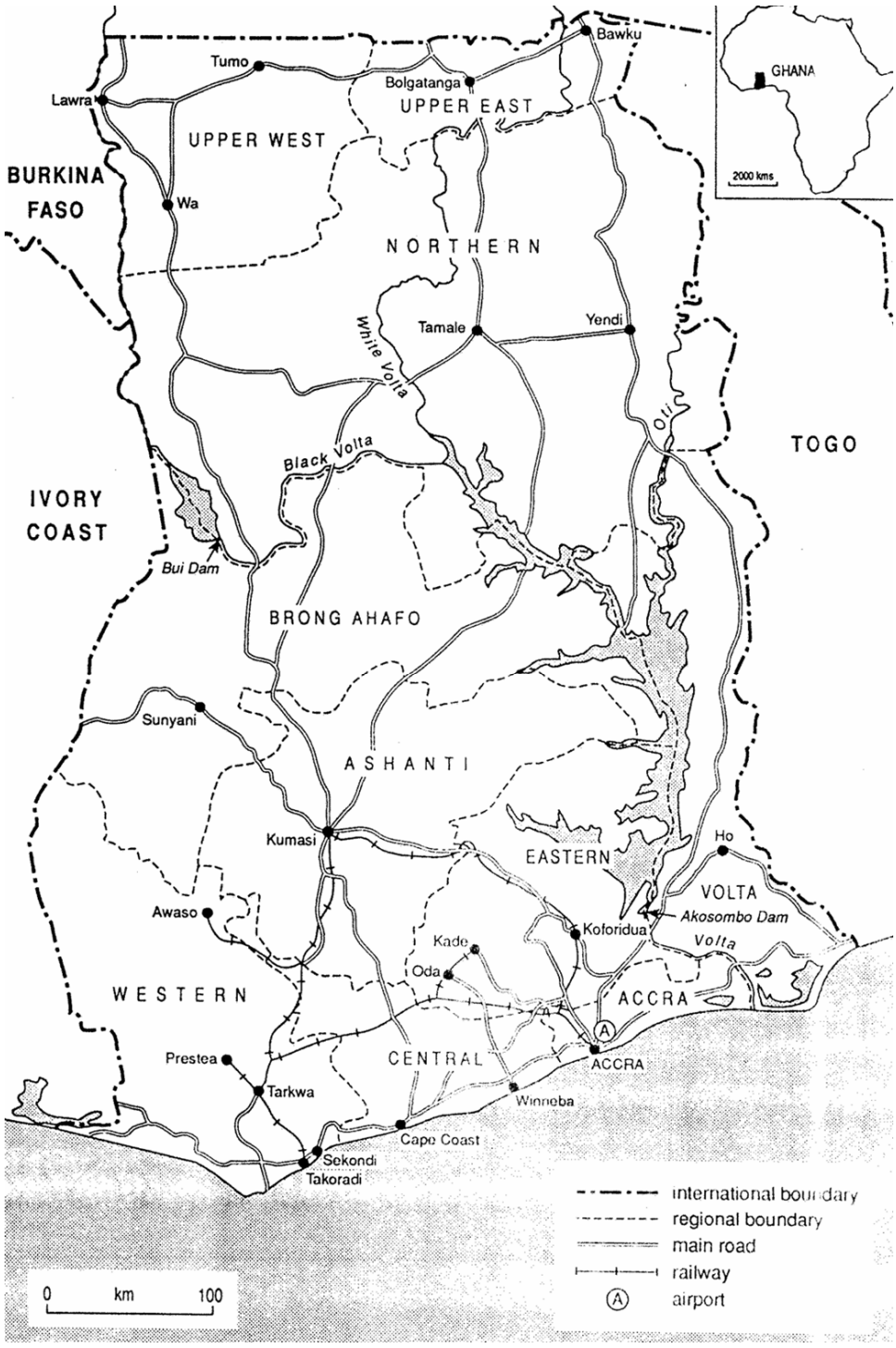
Currency Unit	=	Cedi (¢)
€ 1.00	=	¢ 10 500
US$ 1.00	=	¢ 8 686
¢ 1.00	=	US$ 0.0001143

List of acronyms

CFC	Common Fund for Commodities
CSIR	Council of Scientific and Industrial Research
FAO	Food and Agricultural Organisation
FRI	Food Research Institute
GDP	Gross Domestic Product
HDI	Human Development Index
HQCF	High Quality Cassava Flour
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
KNUST	Kwame Nkrumah University of Science and Technology
MEST	Ministry of Environment, Science and Technology
MT	Metric Tons
MTI	Ministry of Trade and Industry
NEPAD	New Partnership for Africa's Development
NGO	Non Governmental Organisation
PSI	Presidential Special Initiative
RTIP	Root and Tuber improvement Programme
SAP	Structural Adjustment Programme
SME	Small and Medium Enterprise
UNDP	United Nations Development Programme

Figure 1: Maps of Ghana

Annex 2 Ghana



INTRODUCTION

This report is based on a number of references that are listed in annex, as well as on data that were collected during interviews with key stakeholders in Ghana in September-October 2005, and the team members' earlier studies and experiences.

1. General context

Ghana is a country of 238,533 km2 on the South coast of West Africa. The population is estimated at 21.8 million people (UN, 2005) and growing at 1.8% per annum. About 37% is living in urban areas, which are mainly in the southern and central part of the country. Rural exodus is high, due to a lack of income opportunities in the rural areas, especially in the Northern regions.

GDP has grown last years from USD 5.0 billion in 2000 to 8.6 billion in 2004, with agriculture responsible for some 36% of GDP. The UNDP Human Development Index (HDI) ranks Ghana 129th out of 175 countries, with a HDI of 0.567 (2003). Despite improvements over the last decade, social indicators of development remain low. In 2002, life expectancy at birth was estimated at 55 years, adult literacy rate at 74% and infant mortality rates at 55 pro mille.

Ghana has three distinct agro-ecological zones: the rainforest zone in the south, the transitional zone covers the central part. The savannah zone covers a small coastal area and the vast Northern part. Soils in the transitional and savannah zones have generally poorer physical characteristics than those of the forest zone. Rainfall is highest and most reliable in the extreme southwest of the country (over 2 000 mm) but decreases gradually to an average of 1 000 mm in the northeast and in the south-eastern coastal areas. The duration of the wet season shortens from south to north. The forest and transitional zones have a bimodal rainfall pattern allowing two growing seasons. The dry northern savannah is characterised by one rainy season and one growing period. Rainfall is a predominant factor for farming systems, cropping patterns and yields.

Agriculture is still the backbone of the Ghanaian economy as it contributes to some 36% of GDP, it accounts for over 55% of foreign exchange earnings and caters for the livelihood of most Ghanaians. Agriculture is therefore very essential to Ghana's development and economic progress. Because of this, certain strategies have been envisaged to make Ghana a leading agro-based industrial economy.

Ghanaian farmers are desperately looking for new markets. Each time farm gate prices for a crop are interesting; smallholders expand acreage significantly during the next cropping season which leads to overproduction, depressed prices and strong cyclical price fluctuations.

2. Cassava chains

2.1. Overview of supply chains of traditional and novel cassava products

Cassava is the main energy source in the diet of rural poor and provides a regular source of income for smallholders, processors and rural dwellers. The traditional food products made from cassava are gari, agbelima (fermented cassava pulp) and kokonte (dried roots). Gari is the most important for trade. The processing of cassava into gari is extending to non-traditional areas such as the Upper East and Northern Regions. The growing demand for gari in the rapidly expanding towns and in countries sharing boarders with Ghana such as Burkina Faso, and Ivory Coast, has been an important factor in this growth. Gari processing in Ghana is mainly at the artisanal level with women making up 95% of the processors. The production of gari per month and per group ranges from 0.5 to 24 MT. The overall quality of gari produced is poor, although good quality gari is produced in Volta region.

The country has an industrial processor of cassava starch (ASCo). Furthermore, an estimated 9 small to medium players exist, of which Asama Agro (intermediate processing) and Elsa Foods (mainly final processing and trade) are the biggest.

2.2. Cassava production

Volumes. Cassava is produced in all regions of Ghana, except for some district in the north. The transitional zone is the main surplus area. Cassava is grown both for home consumption, as food security crop and as cash crop.

Cassava production in Ghana rose sharply from 2.7 million MT in 1990 to 10.2 million MT in 2003 and 9.7 million MT in 2005 (table 1). The cyclical component of cassava prices is extremely strong. Many farmers expand the acreage attributed to cassava when the prices are high, but reduce acreage significantly when prices are low. This behaviour has led to gluts and depressed farm gate prices in 2000 and 2004, but high prices in 2002 and 2005. During the first half of 2004, cassava prices were at a bottom level, but picked up late 2004 (the gari price doubled at farm gate during 2004) and has risen further in 2005 to record heights.

Key issues of cassava production in Ghana during the next decades are: (i) participative screening and release of high yielding, multiple pest and disease-resistant cultivars (including resistance to the virulent form of cassava mosaic disease (CMD); (ii) proven sustainable crop and soil management technologies; (iii) mitigation of the strong cyclical fluctuations of prices and surplus production.

Cultivars. Ghana distributed TMS-cultivars during the late eighties and early nineties. The RTIP project also released some new cultivars since 1998. Poundability is an important characteristic for Ghanaian farmers.

Table 1: Cassava root production in Ghana (x 10^3 MT)

Cassava Production (x 10^3 Mt)	**Year**								
	1980	**1985**	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**
Ghana	1,858	2,300	2,717	6,611	8,107	8,966	9,731	10,239	9,739

Source: FAOSTAT (2005)

Table 2: Cassava yield in Ghana (Hg/Ha)

Cassava Yield (Hg/Ha)	Year								
	1980	1985	1990	1995	2000	2001	2002	2003	2004
Ghana	80,765	79,323	84,170	119,924	122,812	123,436	122,489	126,850	124,235

Source: FAOSTAT (2005)

2.3. Processing, products and their actors

2.3.1. Traditional products

Processing of cassava into traditional foods. The traditional food products from cassava in Ghana are gari (grated, fermented and roasted), agbelima (grated, inoculated and fermented roots), fufu (boiled and pounded roots) and kokonte (sun-dried and milled roots). They are produced both for household consumption and for trade. Gari is the most important for trade. In recent times, agbelima has become an ingredient for the production of maize-based traditional foods like banku and kenke.

Gari processing in Ghana is mainly at the artisanal level with women making up 95% of the processors. The outputs per month range from 0.5 to 24 MT. The difference in the outputs is directly related to the access or non access of processors to improved processing technologies such as motorised graters, presses and stoves. The gari processing industry is not guided by any set of rules with regards to processing practices or quality characteristics of products. The overall quality of gari is very poor in non-traditional producing areas; although there are a few places where good quality gari is produced such as the Volta region. Gari from this region sells for as much as 75% top up, over the price of gari from other areas.
Gari units seem to make most profits during the low season and less or no profit at all during the high season, when cassava is in abundance (according to Ms. Dienabe Ouane)
The processing of cassava into gari is extending from the Volta Region to non-traditional areas such as the Upper East and Northern Regions. Processing of cassava into gari is an industry that is growing rapidly in seven of the ten regions where cassava is produced in appreciable or large quantities.

Agbelima. Processors of agbelima also make use of graters and mills. The same groups that are involved in gari processing therefore often produce it. Instead of pressing and roasting, the paste is milled to remove all fibres, inoculated and fermented. It is then transported to urban consumption centres is 100 (or more) kg bags, where it is sold to consumers in small quantities. Also in this segment, growth is generally combined with the adoption of small equipment, such as graters and mills. Agbelima production can be more profitable than gari. In September 2005, in Greater Accra, the price for (wet) agbelima was only some 11% lower then for (dry) gari, while the latter uses 2 to 3 times as much raw material, and fire wood and labour for roasting.

The constraints identified for the cassava sub-sector can be grouped into four broad categories, and these are; (i) the supply of fresh roots; (ii) processing technologies; (iii) marketing infrastructure, and (iii) finance.

Supply of fresh roots. For farmers and processors with access to improved processing technologies, the major constraint cited was inadequate supply and high cost of cassava roots. Transportation of roots from the farms to the processing centers was cited as being responsible for the high cost.

Processing technologies and practices. Despite the wide availability of cassava processing equipments in Ghana, many processors were found to be using manual graters especially in the Upper East and some parts of the Northern Regions. This was found to limit output of gari to 15 – 20 kg per family per day, and as low as 25 kg per week for individual processors. With this technology, net profits are less than 1 USD per day.
In communities where processing equipments, especially motorised graters, are available, they are owned by individuals who carry out the grating operation for gari processors for a fee. In some of these communities, only one grater was available and this meant that all processors waited in line for hours to grate their cassava, and at times until very late at night. The long waiting times were at times due to low output of the graters. However, the availability of a grater in the village allows women to process gari in a professional, although not optimal, way. With this technology, net profits vary between 3 and 5 USD per day.

The quantity of gari produced in many areas was also limited because adequate and efficient roasting pans and stoves were not available. In many areas visited, roasting of gari was still done with small round pans with capacities of 500g – 2 kg gari per batch or 25 – 40 kg per day. In the centers where long trays were available, the output was up to 150 kg per day per person, but the stoves were not fitted with chimneys, thereby exposing processors and non-processors to huge amounts of smoke, and polluting the air. However, 150 kg per day per person should be seen as a target for professional gari processors. It allows processors to make a net profit of 7 to 9 USD per day.

In all the gari processing facilities visited, no attention was paid to the effect of the processing operations on the environment or to product quality. Most of the processing facilities visited were dirty; grated cassava mash was left to ferment in open baskets, exposed to the elements of weather, animals and flies. Gari produced in these centers was of varying colour, particle size and level of fermentation.

Flour. A key constraint to the production of good quality cassava flour was the non availability of drying facilities with appropriate equipment. At present, cassava flour is produced by sun drying cassava grits or chips. During the dry season, it is possible to produce good quality cassava flour, but during the rainy season, this is impossible because the grits or chips will not dry within 24 hours stipulated for the production of good quality cassava flour. This scale of production is not compatible with the use of cassava flour at an industrial level.

Finance. Many of the processors' groups indicate that they would have bought their own graters and presses but for the non-availability of funds, and no access to credit. The acquisition of these equipments according to them would increase their output and make the processing of cassava into gari a profitable venture. Owners of graters in the villages indicated that their business was profitable.

2.3.2. Novel products

SME processors. A very dynamic sector of processors is emerging in Ghana. Most of them are involved in product development, processing and marketing of cassava as well as other roots and tubers (yam, cocoyam, etc.). They are well equipped with graters, dryers, presses and fryers. Quality of final product and packaging material is good. These processors play a key role in development of new products and marketing know-how (packaging, quality, storability, etc.). Some processors are trained by RTIP. These processors are often not interested in the local market. Profit margins in the export market are more interesting. These high profit markets allow a small group of processors to operate at an inefficient scale.

Subcontracting is preferred for gari, because the specific taste of small-scale processing is required. At the moment, the number of SME cassava processors in Accra is limited to about 9; most of them started their activities during the second half of the nineties.

New forms of cassava for human consumption. Exports of processed cassava to Europe are growing steadily, but growth potential is limited. Meanwhile, a small market for quality products (instant fufu, etc.) develops. Distribution is via local supermarkets in Ghana. Quality requirements in both markets are comparable (improved packaging, brands, hygiene, etc.). Per unit profit margins of these high-value added products in the export markets are high, which results in retail prices that are too high for the local market. Most SME processors and exporters involved in these chains are based in southern Ghana.

Cassava flour. Efforts by RTIP and other agencies such as CSIR-FRI and IITA to make cassava an industrial raw material in Ghana during the 1990s have had limited success. Two studies carried out in 2003 and 2004, indicated that several processors and industries were willing to use cassava flour in their production, but were not doing so because of the non availability of the commodity in the right quantity, quality and at the right time (Addy, P.S. et al. 2004; Ameleke, G. et al. 2003).

There is a very small production of cassava flour, which is being used mainly by bread bakers and producers of buns and doughnuts. Cassava flour is also used in combination with flour from other R&T crops to produce instant fufu flours. Some cassava flour is also used in the plywood industry as glue extender, but the level of production of cassava flour is still unable to meet the requirements of the industry. For example, the Western Veneer & Lumber Company (WVLC) has been using cassava flour supplied by Amasa Agro-processing industry in its production for about 1 year. This agro processor is unable to produce enough flour for this industry and is also unable to supply the orders from four other plywood companies that wanted to use cassava flour. In 2001, the plywood industries used a total of 2 850 MT of wheat flour in their production process.

A key constraint to the production of good quality cassava flour was the non availability of drying facilities with appropriate equipment. At present, cassava flour is produced by sun drying cassava grits or chips. During the dry season, it is possible to produce good quality cassava flour, but during the rainy season, this is impossible because the grits or chips will not dry within 24 hours stipulated for the production of good quality cassava flour. This scale of production is not compatible with the use of cassava flour at an industrial level.

Cassava starch. The Ayensu Starch Company Ltd. (ASCo) is the first of ten proposed starch factories under the Presidential Special Initiative (PSI) on cassava. It is the only company processing cassava at an industrial level in the country. The starch factory has an installed capacity of 20 000 MT of native starch per annum, and has been operational since 2003.

The domestic market for starch in Ghana is estimated at 5 000-6 000 MT per annum. The factory has been exporting most of its production through an international trading company under a three-year contract agreement. ASCo is also searching for local markets. The efforts are paying off with some interest being expressed by multi national companies such as Unilever, Nestle and Guinness.

For the supply of its raw material, the ASCo mobilised and organised a 10 000-member farmers' association within 40-km radius of the factory. These farmers supply fresh cassava roots to the factory gate on agreed terms. At the start of the relationship, the factory provided credit to the farmers in the form of land preparation, and as cash advance before the harvest. These amounts are deducted from the money due to the farmers when they supply fresh cassava roots to the factory. In 2004, variable costs were estimated at US$ 235/MT starch, while fob cost for native starch in Vietnam and Thailand was/is US$ 150-190. Fixed costs are relatively high, as the factory worked at 30% of its capacity in 2004. In 2005 with the staggered price of cassava roots, profitability must have been even more negative.

Key constraints are: (a) prices for raw material are too high for ASCo to be competitive; (b) the domestic market for starch is too small; (c) supply lines for raw material are not organised; (d)

extraction (20-22%) is sub-optimal; the factory is not using the best cultivar available which has a negative impact on the starch content and extraction rate, and power cuts interfere with extraction.

Feed market. Short-term demand potential for cassava is to be found in the domestic feed market. It is however crucial to solve the supply line problems, namely drying of chips, organisation of poor farmers in supply lines. At the moment, export of cassava pellets for the European feed sector is no viable option given the huge gap between current international prices for cassava pellets and the fob price for cassava chips in West Africa.

2.4. Marketing

The main marketing constraints are poor roads, high cost of transportation, lack of storage structures, small transactions, and lack of information on markets and prices. These put together, result in farmers and processors selling their produce at un-remunerative prices offered by middlemen who come to buy gari.

Rapid expansion of cassava production in Ghana has led to gluts and depressed farm gate prices during 2003-2004, but also in 2000-2001. All farmers in Ghana were facing depressed prices early 2004, but glut in the market was not an overall phenomenon. Gari processors in areas with good market access, who were mainly using family labour, were still making money. However, the situation was problematic for: (i) farmers using paid labour for harvesting and processing; (ii) farmers cultivating non poundable cultivars with a shorter cycle; (iii) peasant farmers in remote areas or low surplus areas, as traders concentrated purchases in accessible zones; (iv) processors of dried roots (compared to gari). Nevertheless, farmers agreed that they are willing to flood the market with gari if prices are picking up and demand is guaranteed. Women groups were saying: "Prices are low, but we continue because there is no alternative".

In 2005, prices for cassava roots and foods had increased sharply. In September in a village in Greater Accra, dry grit price was ¢ 4000/kg (¢ 1000 in 2004). Gari (dry product) ¢ 6400/kg and Agbelima (wet product) ¢ 7200/kg.
The traditional processed forms of cassava will continue to dominate cassava-marketing channels and demand in the short and medium future. Demand for gari appears to rise. Gari processing is expanding to central and northern Ghana. Rural processors perceive gari is an interesting product, because it is a convenience food with very good storability and generally a good market.

Of recent, important seasonal trade flow of gari exist between the transition zone in Ghana and the Sahelian market (Burkina Faso, Niger) during the hunger season (February – July). The Tachiman area in central Ghana became the centre of a gari industry where several groups of 20 to 70 women established processing centres. Some of these groups are the most advanced in gari processing. Technologies (roasting) were developed by local NGOs and could be used as a model for other groups. The flows are poorly described and documented. However, they are quite important as market prices of gari increase during the period February-July. Gari is an interesting product in markets where energy to prepare food is expensive.

In Ghana, a seasonal price fluctuation with typically high prices during January-March and low prices during May-June characterises the cassava sector.

3. Past and ongoing activities and institutional actors

3.1. Projects

In Ghana, IFAD is the only donor that is directly involved in cassava processing at the moment. The IFAD-funded Root and Tuber Improvement Programme (RTIP, phase 2: 2006-2012, US$ 24 million) is funding: (a) participative distribution of improved planting material; (b) upgrading of traditional processing equipment; (c) innovative processing; (d) strengthening of processing groups. The first phase of the project (1998-2005) mainly focused on the multiplication of planting material. Important funds will be available to upgrade traditional processing. Also other donors invest in this traditional processing in an indirect way through their food security and rural enterprise development projects. During the first phase of the project, pilots were organised in the field of HQCF and gari processing.

The Food Research Institute (FRI) is a national centre of excellence for food research in Ghana. FRI has gained know-how in traditional and innovative cassava processing. The FRI's mission is to conduct market oriented applied research and provides technical services and products to the private sector and other stakeholders. During recent years, FRI implemented a project, financed by DFID, to develop the industrial use of cassava by solving technical bottleneck. FRI is equipped with analytical laboratories, an engineering and maintenance workshop and test kitchen, a pilot plant equipped with operational wet and dry processing lines, etc.. The research and development programmes of the Engineering Unit are aimed at upgrading traditional technologies through the use of simple but effective machinery and promoting the most cost effective methods of processing. Quality of the results of these activities is quite diverse: FRI developed an excellent grater and screw press, but was not able yet to solve the problem of solar drying and to design a successful prototype of a processing plant.

Kwame Nkrumah University of Science and Technology (KNUST) at Kumasi is involved in research on product development on the basis of cassava flour and starch. Other universities and research centres are involved in research on production aspects and screening of cultivars.

3.2. Other institutional actors in the cassava chain

The Ministry for Food and Agriculture (MOFA) was the implementing agency for RTIP, and would also be responsible for implementing the second phase. Strengths are its commitment to RTIP and R&T sector, and in selection and multiplication of planting material. Weaknesses are high turnover of effective staff as well as limited capacity in following fields: (i) economic and marketing analysis; (ii) demand led post-harvest interventions (processing and marketing); (iii) private sector enterprise development.

The President's Special Initiative (PSI) for agribusiness/cassava, under the responsibility of the Ministry of Industry, Trade and PSI, led to the establishment of a factory for export-oriented starch production near Accra. The ministry is interested in promoting cassava as industrial crop, but has limited experience in the R&T sector.

The various research institutes involved in root and tuber production and processing fall under the Council of Scientific and Industrial Research (CSIR) of the Ministry of Environment, Science and Technology (MEST).

4. Summary of opportunities and constraints

4.1. Constraints

Drying of cassava. A major constraint to the development of industries that will use these commodities is the problem with drying. The process of producing good quality cassava flour demands that the grits or chips dry within 24 hours of their production. Drying the grits or chips in the sun does not ensure this, as humidity and/or rains may interfere. A second constraint is the cost of procurement, running (fuel!) and maintenance of dryers that are available for these operations.

Huge fluctuations of root supply and prices. A 'pig-cycle' or 'cobweb' of approx. 3 – 4 years exists in the region (Nigeria, Benin, Ghana, and Ivory Coast). Farmers shift to more profitable crops when cassava production is oversized and prices have dropped, and replant again massively when the subsequent underproduction leads to increased prices. Price fluctuation is about 1:4 between peak and low-price years.

Price differences between dry and rainy seasons within years exist due to the availability of other products for substitution in the wet season, the hard soil in the dry season that makes harvesting more difficult, and the lower availability of labour. During the rainy season, drying of roots is more difficult.

Additional (ad hoc) disturbing factors that crash market possibilities for local produce, or stepping out of cassava production by disappointment or loss of confidence in the outlet also exist. E.g.: The Ayensu starch company in Ghana has stimulated the farmers to produce cassava and promised them a reliable market. In the end, they got less for their product, as transport costs were deducted, which was not known to them.

Price fluctuations trigger shifts in processing and products. For cassava products, another mechanism causes additional price and supply fluctuations. Cassava is in Ghana in the first place a staple crop. The local market for traditional food products competes with industrial use. With the relatively short growing cycle of cassava (unlike e.g. oil palms or cocoa) and a choice of markets nearby, (farmer-)processors can shift their processing from one product to another, interrupting (thereby destroying) an infant supply chain. This seems especially the case near urban centres. This is illustrated by the encountered example: In 2004, a small chain for cassava flour was initiated by a private entrepreneur: Eighteen farmers in Safo Ano had engaged in processing roots into grits. Processors were paid 1000 ¢/kg, which was competitive. In September 2005, although prices for dry grits have risen stepwise to 4000 ¢/kg dry grit, only one of the 18 was still on the job. The others had engaged in processing into agbelima, which is less demanding and gives a much higher price (preliminary calculations indicated almost 4x higher on a dry weight basis) in September 2005. Due to lower cassava production this year, markets for Agbelima in Accra and Togo are favourable. (see: annex 2B)

Lack of credit facilities and working capital. Most entrepreneurs stressed the same problem: no loans can be obtained for sourcing the roots and building up confidence. The companies often cannot comply with their promised payments to farmers, because of a lack of working capital. The firms then lose their credibility. Banks are not interested in financing cassava processing; they are not suited to handle or serve the agricultural sector. The government is not supportive enough in this respect, as would be their role/task. Support could be given in the form of bank guarantees etc. There is a preferential interest rate of 15% if it involves export, compared to 27% without this preferential treatment, but it is hardly ever possible to get a loan anyway.

Processing: equipment, efficiency and energy questions. Some equipment has been developed to a satisfactory level. This includes graters that can handle 500 – 2000 kg/hr, depending on the size and type of mill, feeder mechanism, the condition of the grater drum and also on the engine. We have seen screw presses and hydraulic presses, of which a type from India in operation by Agro-Asama was most sophisticated and probably most efficient. It has a manometer, which can result in a more continuous product quality and less breakdown of the hydraulic system.

A critical issue is the drying step that is used in some processes, such as HQCF and starch. Sun-drying is unreliable in humid or rainy conditions and vulnerable to hygienic problems. Forced drying is more reliable, but fuel costs can amount to half or more of the total production cost. Several prototypes, mostly batch-wise electricity or fuel-driven systems are in use, of which no energy efficiency or cost per kg product seems to have been calculated. At Amasa Agro, 20 gallons of diesel would suffice for 1 – 1½ MT of grit, which implies a cost of some US$ 52/MT product. A flash dryer or spin flash dryer is sometimes referred to as being the answer. (In Benin, at the Elite starch factory, the fuel costs for the flash dryer were € 190 /MT of starch produced, compared to an international native starch price of about $200/MT.)

Peeling is a labour intensive process. A (female) labourer can peel 25-50 kg/hr. This is sometimes aggravated in the case of improved cultivars with a peel that sticks to the root. Peels are hardly ever used. In fact, we have hardly come across cassava by-product use. No mechanical peelers are known here.

Scale of operation, management and integration of the chain. The irregular supply of roots or products at an acceptable price is a main bottleneck to establishing a cassava chain at industrial scale. If a product is not delivered one year or season, then the chain breaks and the buyer may not be interested anymore to buy the product. Or, as a big client said: "We cannot afford to be blackmailed by one of the intermediate producers". The price is an important factor, but a constant and reliable supply is crucial. We have witnessed this problem with a small-scale flour production unit and with root supply to the Ayensu starch factory. Hardly any contracts or structures are in place for vertical integration of the chain to guarantee its sustainability and success.

International markets, prices and efficiency. Of several products, inefficiencies in the chain are such that even in years with optimal conditions, like abundant root supply and low root prices, product prices are not competitive in the world market. This counts at least for starch and ethanol. This is caused partially by extremely low world market prices, due to highly efficient and subsidised production systems elsewhere, and logistical problems and other inefficiencies in organisation of the chain here. An example of the latter is that Thailand out competes easily on the cassava feed market.

4.2. Opportunities

HQCF. The processing of cassava into flour has a great potential for a rapid expansion of the industrial uses of cassava. In 2003, Ghana imported approximately 300 000 MT of wheat flour. By substituting 10 % of wheat flour in all breads produced in Ghana, and using cassava flour in the extension of glue in the plywood and paper board industry, the country can save at least $600 000 annually. The advantage of cassava over wheat flour is the cost. The potential is, however, not exploited because cassava flour is not available in the right quality and quantity.

Most cassava flour processing units are operating at a very low level with an average production of less than 100 kg per week, with variable quality. This scale of production cannot meet industrial demand for the commodity. The availability of fresh cassava roots for processing into cassava flour is often not a constraint. It was the case, though, in September 2005, as root

demand (and price) for traditional food purposes surpassed the ceiling at which cassava flour is competitive to wheat flour.
The major constraints to the production of large quantities of cassava flour appear to be: (a) the organisation of supply lines from farms to processing units, (b) the lack of drying equipments and facilities, and the fuel cost of forced drying.

Domestic feed. A second industry with potential for a rapid expansion of the use of cassava is the animal feed industry. It is unlikely that cassava will completely replace maize as the basic energy source in livestock feed but the inclusion of cassava roots and leaves in the ration will bring down the costs by providing the energy and some of the protein cheaply. A lot of work has been done and documented to show the advantages of including cassava in poultry and small ruminant animal feed.

Improved traditional products. A third industry with potential is the upgrading processing and packaging of traditional products such as gari, agbelima, kokonte, and fufu flour for local and specialised domestic and export markets.
The two entrepreneurs identified packaging these flours for sale, focused on the export markets. The expansion of the markets to include the local market will mean increased production. This will contribute significantly to the growth of the rural economy, because these industries rely on small scale processors in rural areas.

REFERENCES

Addy, P. S.; Kashaija I. N., Moyo M. T. ,Quynh N. K. , Singh S., Walekhwa P. N. Constraints and opportunities for small and medium scale processing of cassava in the Ashanti and Brong Ahafo Regions of Ghana. ICRA Working Document Series 117, Ghana – 2004

Ameleke, G., Abusah, D., Dziedzoave, N., and Krampah, L. Baseline information on the uptake of cassava as an industrial commodity and the livelihood status of small scale processors in Atebubu and Sene Districts of the Brong Ahafo Region, Ghana. Final report on Project output 3.7 (CSIR-FRI/RE/AG/2003/003) of 'DFID/CHCP Sustainable Industrial markets for cassava project' 2003.

Annex 2A: Case of a rural micro processor in Greater Accra

The rural processor buys ¼ acre (costs ¢ 1.000.000), uproots himself ('manpower'), hires women to peel (5.000/bag) and to carry it to the mill (5.000/bag). This yields 10 bags of peeled cassava roots. The miller charges also 5.000/bag for grating. Pressing is free. The bags now contain about 100 kg of grated mass, are transported to his home, where the contents are spread out on mats to dry in the sun. He turns the crumbs regularly to speed up drying and avoid fermentation. The result is 10 bags of dry grit, of 48 – 60 kg each, at the end of the day.

Costs	**in ¢**
¼ acre of cassava (→ 10 bags of roots)	1.000.000
harvesting ('manpower' = own labour)	pm
peeling 5000/bag	50.000
headloading 5000/bag	50.000
grating 5000/bag	50.000
pressing	-
drying ('manpower' = own labour)	_____pm
total: (=1.900 – 2.400/kg)	Cedis 1.150.000

He gets for the resulting 480-600 kg (4.000/kg) ¢1.900.000 – 2.400.000

He could get for the same investment, but less work: ¢ 8.000.000 if agbelima. Last year, the demand for agbalima was lower, making the flour production more interesting.

Annex 2B: Programme of the identification & formulation mission CFC RIAS/WUR

Assessment of resources, markets and the potential for market development in value added cassava products in West Africa.
Country visit to Ghana: 25 September – 4 October 2005

Members:
- Dr Sander Essers, cassava processing specialist, Wageningen University (country visits Ghana, Benin, Sierra Leone)
- Dr Frans Goossens, economist (country visits Bénin, Sierra Leone)
- Dr Diallo Souleymane, economist, CIRES, Abidjan (country visit Côte d'Ivoire)
- Mr. Wim Verzijlenberg, project manager, RIAS (country visit Ghana)
-

During the visit to Ghana, the team consisted of Verzijlenberg and Essers

Date - hour	Name structure	Persons met	Contacts
Monday 26/09/05			
09 h 30 – 12.15	Food & Flour (Ghana) Ltd.	Dr. David Pessey, director	21 30 70 10 21 30 76 45
15 h 00 – 17.00	Food Research Institute (FRI)	Dr. Paa-Nii T. Johnson, head of processing & eng	21 30 23 39
Tuesday 27/09/05 10.00 – 12.30	FAO	Mr. Robert van Otterdijk, agro-industries and post-harvest systems officer	
Wednesday 28/09/05 9.15 – 12.15	field visit to Amafro, Sano Afo village (leaving 7.00, return 15.00)	Dr. David Pessey, general director Mr. Kasima, director of Amafro F&F Mr. Jason Oto, district manager of F&F Mr. Abraham Tawire, farmer + village processor, 5 other villagers, incl. the Chief of Youth	
Thursday 29/09/05 10.00-12.00	Elsa foods Ltd.	Mrs. E. Afriyie Maldini, managing director	
14.00-15.30	Dutch Embassy	Mr. Arie van der Wiel, embassador, Ms. Claudia Maarschalkerweerd, secretary commercial affairs	
Friday 30/09/05			

11.00-12.30	UNILEVER	Mr. Charles A. Cofie, chief executive officer Mr. Kwaku Booteng, supply chain officer Mr. Kofi Essuman, supply chain officer	
14.00-16.00	Amasa Agro-Processing Co. Ltd., Motherwell Farms	Mr. Kwasi Oware, director	
Saturday 01/10/05			
10.00-12.30	Food Research Institute (FRI)	Dr. Nanam T. Dziedzoave, post-harvest specialist	
Monday 03/10/05			
	Ministry of Food and Agriculture	Dr. J.A. Poku, director of crops	Phone +233 21 665066 Fax 21 761715/662471 cropserv@gh.com
Tuesday 04/10/05			
	Food Research Institute (FRI)	Dr. Wisdom A. Plahar, director Dr. Paa-Nii T. Johnson, head of processing & eng Dr. Nanam T. Dziedzoave, post-harvest specialist	+233 21 777330 / 761209

ANNEX 3

Sierra Leone

November 2005

Rabo International Advisory Services (RIAS) BV

TABLE OF CONTENTS

List of tables

List of figures

List of acronyms

AGOA	African Growth and Opportunity Act
BAFCO	Banyanie Agro Food Processing Enterprise
CDE	Centre for Development of Enterprises
FINIC	(Private company for Agro processing equipment & training)
GSA	Gari Sellers Association, Bo
IAR	Institute of Agricultural Research
MAFF	Ministry of Agriculture, Forestry & Food Security
MTI	Ministry of Trade and Industry
NAFSL	National Association of Farmers of Sierra Leone
NARCC	National Agricultural Research Co-ordinating Council
SAP	Structural Adjustment Programme
SLEDIC	SL Exports Development & Investment Corporation

Currency equivalents

Currency Unit	=	Leone (LE)
USD 1.00	=	LE 2900
LE 1.00	=	USD 0.00035

Figure 1: Map of Sierra Leone

INTRODUCTION

This report is based on data that were collected during interviews with key stakeholders in Sierra Leone in October 2005, as well as on a number of references that are listed in annex.

1. General context

Sierra Leone is a country of 72,300 km^2 on the Southwest coast of West Africa. Mean annual rainfall is 3000 mm/year; higher in the coastal areas and a bit lower in the North. The population is estimated at 4.9 million people in mid 2000 and growing at 2.6% per annum. Massive unemployment, underemployment, and chronic poverty affect the Sierra Leone population, despite the sizeable potential that exists for the development of agriculture, agro-based industries, mining, fisheries, hydropower and tourism. The country has endured a severe civil war from 1992 till 2002, from which it is now recovering. The civil war continued for over a decade, leaving 20 000 persons killed, displaced half of the population, wrecked most of the infrastructure, businesses and much of the housing stock, and caused a cumulative decline of 48% in GDP per capita in 1999. The estimated GDP per capita had further declined by about 40% reaching about US$ 142 only in 2000. It has been estimated through the most recent household survey of 1989/90 that some 82% of the population lived below the poverty line, and about 49% lived in severe poverty. By 2000, Sierra Leone was placed at the bottom of the United Nations Human Development Index. At the moment, the political situation is stable and people are highly motivated to maintain peace.

The country is well endowed with natural resources. The economy is dominated by agriculture and mining. During the pre-war years about 47.3% of GDP was generated from agriculture, while mining contributed nearly 13.7%, making a total of 61% for both sectors. According to estimates from the Ministry of Agriculture, Forestry and Fisheries (MAFF), 80% of the population is small-scale farmer. There is 5.2 million ha of arable land, of which 6% is under cultivation; 85% is upland and 15% is lowland. The majority of farmers cultivate rice as main crop, whilst root & tuber crops such as cassava and sweet potatoes, and cereals such as millet and maize, are gaining momentum. The upland soils are low in fertility and moisture holding capacity. Since the late 1970s, food crop production had fallen far below population growth, resulting in increased imports of the main staple food, rice. The current strategy of MAFF is not only to achieve food self-sufficiency, but also food crop diversification, of which cassava ranks first.

2. Cassava chains

2.1. Overview of supply chains of traditional and novel cassava products

Cassava is mostly eaten boiled, boiled and pounded, fermented in water and grated (foofoo), as ***kondogbala or tui*** (a paste from cooked flour), in the processed form of acheke (steamed, fermented granules) and, increasingly, gari (roasted granules). Small quantities of starch are made traditionally, mainly in the North, and used for starching clothes and for petty trade, mainly to Guinea.

2.2. Cassava production

Volumes. Cassava is the second most important food crop in Sierra Leone (after rice). It constitutes a significant portion of the diet of the rural population. Production estimates (table 1) show a tripling of fresh root production between 1990 and 2004. These statistics are, however, considered to be underreporting. According to the Institute of Agricultural Research (IAR), cassava production has doubled over the past 5 years. Reasons for the increase in cassava production are: (i) cassava was key in providing food security to rural population during the 10 year period of civil strive; (ii) fertiliser had become scarcer by SAP-induced liberalisation, while cassava can do without better than other crops; and (iii) earlier government intervention of rice imports had made domestic rice production unattractive. No cyclical pattern of rising and falling supplies and prices over the years has been observed. Production of fresh roots is still on the rise, by increasing planting density and by area expansion.

The production of cassava roots is significantly higher than consumption. Observers assume that oversupply (non harvested cassava) amounts to about 30%. There is an apparent glut, as marketability of surplus is limited. There is a risk of disappointment, as the unprocessed overproduction of cassava cannot find its way to the market.

Farm gate prices, presently at US$ 20–30/MT for fresh roots, are low compared to those in other countries in the region. The cassava yield is estimated at approximately 4-5 MT/ha. This is low, but the figure is somewhat misleading as it is partly due to intercropping. The IAR is organising trials with the latest IITA cultivars in different agro-ecological zones. Improved cultivars are being distributed by IAR, but still at a small scale. Although most traditional cassava is of "sweet" or "poundable" (probably low cyanogenic) cultivars, more bitter/toxic cultivars have been observed. Awareness of and interest in toxicity aspects exists at high governmental levels. Cassava leaves are important as vegetable in the Leonean kitchen and are therefore also economically important.

Table 1: Cassava root production in Sierra Leone (x 10^3 MT)

Cassava Production (x 10^3 Mt)	**Year**								
	1980	**1985**	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**
Sierra Leone	95	110	123	219	241	300	340	377	390

Source: FAOSTAT (2005)

Crop husbandry. Cassava is grown by smallholders in mixed cropping with many other crops, and of lately also in sole stands. No fertiliser is applied. Production techniques are traditional. Planting density was 3-5000 stands/ha, but this has now doubled in some places, also at the expense of the intercrops. Although cassava seems to have no fixed calendar in Sierra Leone, there are preferential months for planting. In the North, planting is mainly from September/October until December/January, in the Southern and Eastern Provinces, in May –

June. There exists a fine-tuning with the calendar of other crops in the same field (e.g. rice) and water regime. Harvesting is year-round (but mainly June-August) and depends on maturity of roots, the calendar of other crops in the same field, the water regime, and labour and market conditions.

Spatial distribution. Most cassava is grown in the Northern and Southern provinces. In Bonthe district in the South, cassava is the main staple. Although Bo is renown for its gari processing, cassava production is low as the youth is more interested in diamond mining in this mining area. Therefore, cassava processors in Bo create satellite processing units in cassava production areas. Cassava leaves are consumed throughout the country as an important vegetable.

Cultivars and yields. IAR is testing the newest generation of IITA-cultivars. Selection criteria are dry matter content, yield and "poundability". The new cultivars (silica 1, 2, 3, 4 and 5) yield 11-15 MT/ha on farmers' fields (20-30 MT/ha on-station), compared to some 6 MT/ha for the traditional cultivars. Local cultivars are more palatable and comply with the preferred "poundable" cooking quality; some new cultivars can be used for gari, some for foofoo and some are even acceptable when boiled. Traditional cultivars needed some 12 months, while some new cultivars can mature within 6 months. This allows for two crops per year.

Table 2: Cassava yields in Sierra Leone

Cassava Yield (Hg/Ha)	**Year**								
	1980	**1985**	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**
Sierra Leone	38,000	45,833	59,903	58,453	51,816	54,545	55,738	50,881	52,000

Source: FAOSTAT (2005)

Farm gate prices and production cost. Farm gate prices for fresh roots generally varied between US$ 15 – 30/MT. In town (Bo or Freetown), prices for fresh roots were approximately US$ 50/MT in October 2005. Gari costs between US$ 120 for provincial quality and 330/MT for "Bo gari". Consumers accept to pay a premium price for "Bo gari". Exact figures cannot be given, as the units ("sac") for both fresh roots and gari could not be measured and were claimed to contain 50 – 75 kg by different respondents.

2.3. Processing, products and their actors

2.3.1. Traditional products

Product forms

Gari. In Sierra Leone, rice is the first staple food, but production and consumption of gari is on the rise. The popularity of gari was enhanced by the eating habits of Nigerian ECOMOC soldiers. Gari is considered as a convenience food that can compete with rice. Rice consumption is growing by 5.5% and production by 2% annually. This gap could be filled with gari. The gari in Sierra Leone is little or not fermented: from 0 to 3 days, depending on moisture content, dewatering (pressing) speed and taste preference.

There are 4 professional gari processors in Bo. They have managed over the years to establish: (i) a quality product and brand name ("Bo gari") and retail packaging, and resulting enhanced price; (ii) a network and active sourcing of raw roots; (iii) satellite production units in cassava production areas; (iv) market chains to Freetown and Guinea.

Although professional in several aspects, there is room for improvement of processing with respect to labour efficiency and hygiene, energy efficiency, (in some cases) product quality and labelling. This relates especially to the primitive and risky pressing and the roasting. The bags with grated pulp are pressed between a large spring frame of loose wooden poles. In this way, it takes 2-3 days before dewatering is sufficient for roasting, thereby limiting increased production.

The pressure obtained by this spring press has more than once caused severe accidents as the poles may slip loose and be launched. The pressed-out juice is usually not collected but left in the open, which may cause environmental problems. Roasting is done in a large rectangular iron sheet (approx. 180 x 90x 10 cm) over a partly open fire. Maximum production per tray is 75 – 100 kg/day. Smoke and vapours affect the processors. Roasting is sometimes done by men as the work is considered to be heavy and bad for the health of women and their children. Sieves are often primitive or absent. Weighing scales are absent. The common measure is a cup, and there are speculations about the weight (approx. 250 g). All retail packaging used in Bo mentions 1kg, irrespective the quantity it contains. Our weighing revealed 580 g for the green bags and 780 g for the red BAFCO packages priced Le 1.000, and about 1100 - 1200 g for the green Le 2.000 priced package.

Apart from the introduction of an engine-driven grater since the eighties, very limited investments have been made in the private sector to upgrade processing equipment. Extremely limited investment capacity exists at the moment. Profit margins seem very narrow and credit is difficult to obtain. Some processors are not able to own the equipment, but hire it (price in Bo for a grater: US$ 20/month).

"Bo gari" can compete in price with rice, while "village gari" costs about half that price because of its lower quality, and prices for fuel wood and labour are higher in Bo. Bo gari costs now Le 60 - 75.000/bag of 60-70 kg; in Mayema district's mining area, the price is 35 – 45.000/bag, in more remote areas gari costs Le 25.000/bag. Gari prices rise during the planting season, when labour is scarce.

There is an increase in the number of gari processors, due to post-conflict initiatives of several NGO's, the EU and other international organisations. The ownership and management is usually in the hands of women groups or individual entrepreneurs that make use of hired -mostly female- labour. Although numerous sets of equipment seem to have been distributed, many are not operational anymore, due to management and maintenance problems.

Kondobala (mainly eaten in the North) are dried cassava pieces that are pounded or milled into flour. The flour is poured into boiling water and kneaded to make a stiff paste.

To is blanched cassava root that is dried. This is a way of preserving cassava for the lean months.

Cassava starch. Some cassava starch is produced at village level for domestic purposes (mainly for clothes) and sold locally or exported to Guinea. In Makeni, the price of starch was Le 200-250/cup in October 2005, compared to Le 150/cup for village gari, and LE 400/cup for rice. Considering that a cup may contain 200 g, the local price of starch is US$ 330-420/MT, which is nearly twice the world market price.

2.3.2. Novel products

Cassava flour. Production of unfermented cassava flour has not been developed, although IAR organised some small trials. However, this niche is seen as an interesting opportunity.

Cassava starch. Some cassava starch of irregular quality is produced at village level, sometimes as by-product of gari processing. No medium or larger scale starch industry exists in Sierra Leone.

Ethanol. No ethanol is being made from cassava in Sierra Leone. Government is not interested in ethanol production at a small scale as it does not want to encourage alcohol consumption.

Animal feed. No animal feed industries of some importance seem to exist. Cheap poultry imports from the EU hinder the establishment of poultry farms around Freetown.

2.4. Marketing

Packaging. In Bo, retail packaging of gari was successfully introduced and adopted by the private sector. Informal processors have easily adopted this packaging material.

Local trade and flows. Cassava trade is mainly informal. Volumes are expressed in local units. Main consumption centres are the capital (Freetown) and the mining areas.
Surplus production in the forest area is limited, as farmers are cultivating a broad range of products (lowland rice, maize, cocoyam, banana, yam, fruits, palm oil, etc..). The forest zone is probably not able to produce a significant surplus per farm. On the contrary, the northern transitional zone is considered as being a more important surplus production zone.

Exports. Some regional trade flows exist. Small quantities of gari and starch are exported to neighbouring Guinea. Given the low price level in 2005, Sierra Leone should be able to export processed cassava in the region (Benin, Ghana, Nigeria).

Ethnic market. Some gari seems to be exported to the UK by small exporters.

Export of dried roots to Europe. In October 2005, Sierra Leone has the lowest price level for cassava in the region. Merely on the basis of farm gate prices for fresh roots, the country should be able to export dried roots/chips. However, the basic constraint is probably a lack of infrastructure (appropriate drying, storage and transport), finance and organisation.

3. Past and ongoing activities and institutional actors

3.1. Projects

Cassava promotion projects
Any CFC initiative should be complementary to ongoing initiatives. At the moment, the support for the cassava sector is very limited.

Only some international NGOs (Care, Oxfam, World Vision) are financing small-scale income generating initiatives (demand-driven) as part of their post-conflict programme. Part of these activities involve the cassava chain. World Vision has occasionally donated some processing equipment. CARE is supporting, through BAFCO (founded in 1999), the formation and training of women groups to engage in gari processing and seems to donate sets of equipment to the so-established groups. BAFCO is working with World Vision in Bonthe district (Southern Sierra Leone) and in Bo. BAFCO has written an interesting training manual for cassava production, gari processing and marketing, and setting up an agro-business, and trains women in these skills. Their own processing unit in Bo is however desolate and not operational anymore.
IFAD is presently formulating a new regional development project for the eastern part of the country. The project will include access to credit and support to cassava production and informal processing. FAO supports the distribution of improved cultivars at a small scale.

3.2. Other institutional actors in the cassava chain

Ministries. The Ministry for Agriculture, Forestry & Food Security (MAFF) is responsible for all production aspects and is also involved in most traditional processing initiatives. The Ministry for Trade and Industry (MTI) is responsible for post-harvest activities, such as processing.

Farmers organisations. The National Association of Farmers of Sierra Leone has been initiated by the president in 1987. Its leaders are democratically elected in 2003. Farmers are organised in community groups: 149 rural counties/chiefdoms and 30 in Freetown; grouped into 12 rural districts and 2 in Freetown. Together with IAR, they campaign for higher cassava production, although a market is absent.

Large scale producers. After our visit we received information from Mrs. Doris Kargbo on the indigenous NGO UPWARDS (United Programme for Women in Agriculture, Rural Development and Social Services) which is working on modalities for the establishment of mechanised large scale cassava production schemes (1,500 ha in Bombali district) and supporting some 500 small-scale cassava producers. The organisation is seeking for support for establishing industrial processing.

Research. The Institute of Agricultural Research (IAR, director dr. Jalloh) is one of the two pillars of the National Agricultural Research Co-ordinating Council (NARCC). It has a mandate to screen and release cultivars and to divulgate processing equipment. IAR is in close collaboration with IITA (Ibadan), with the National Association of Farmers, and with Njala University. The Institute of Home Sciences of Njala University College also does research on cassava processing and flour utilisation for bread and cake baking.

Equipment. The local metal workshop (FINIC) develops and produces good gari-processing equipment in Freetown, and is developing its own medium scale processing and training centre. FINIC sold in 2004 75 graters to projects of EU and 12 to projects of the Int. Rescue Committee; this year they sold only 10. They developed an interesting –but expensive- press. UNIDO is analysing the option of setting up an Agricultural machinery centre near FINIC, with GRATIS from Ghana to provide equipment and training. The Ministries have bought some Chinese and Indian

graters. Also other private sector initiatives exist. For example, the small local metal workshop of mr. M.B. Tolly in Bo also makes graters since the eighties. Competition is felt. Prices and performance have to be compared.
Peeling is considered by all processors to be a highly labour consuming task, for which no mechanised solution has been found yet.

4. Summary of opportunities and constraints

Given the low cassava price level, the lack of rural income generating activities and relative absence of other donors, several opportunities for chain development exist.

Gari processing. National rice production is lower than consumption, which leads to a seasonal food gap. Gari seems to be increasingly filling part of that gap, and can thus replace part of the rice import. As gari processing is not yet widely spread, the number of processing units can be expanded. The district of Bombali seems favourable, given its cassava production and market access.

There is room for upgrading and establishing pilot processing plants that are improved with respect to layout, labour productivity, hygiene, environmental aspects and equipment. Especially the pressing and roasting equipment can be improved. With the improved gari processing, starch as by-product should be valued, as a local market exists.

Studies towards the success and failure of gari production units could reveal ways for future chain improvement by developing a cost-effective prototype and organisational structure.

The stakeholder dialogue indicated that the focus of support for gari production should be with existing small gari processors, as those have shown their interest and management capacity, while their profit margins seem too marginal for investing in upgrading. Farmers are tired of forming new groups for each different purpose. A fabric of elected farmers with chiefs exists and can be utilised. Private, not public management is considered best for durable enterprise development.

A processing plant that combines options for gari and flour production could offer the flexibility to adapt to market and climatic conditions through the year. Starch and peels should be valued and utilised.

Cassava flour as wheat substitute. Given the low price of raw cassava and the long dry season, it should be possible to produce high quality cassava flour that can compete with wheat flour. Wheat substitution can be up to some 15% in bread, and to a much higher level in pastry. Piloting in this area seems a valuable option. Development of good and cheap solar dryers, as well as (hybrid) forced dryers is necessary to that end. Contacts with bakers etc. have to be established. This sector could be developed gradually.

Starch. The international market for starch is highly competitive (native starch prices at approximately 200 US$/MT), making it difficult for an emerging industry to comply with the required price level. Regional starch demand is decreasing, due to the declining textile industry. Other countries in the region have starch production capacity installed (Benin, Ivory Coast, Ghana), but fail to operate at world market prices, due to cassava supply and price fluctuations and high energy costs. Apart from traditional processing for domestic purposes, limited short-term opportunity is seen for industrial starch production by lack of important regional demand.

Ethanol. The demand for ethanol has not been explored. The production of ethanol at industrial level was not considered to be the priority and depends on private industrial initiatives. Government is not in favour of encouraging ethanol production at a small scale.

Animal feed. The demand for animal feed, as well as possible linkages with feed industries and animal production units should be explored. This counts for both roots and leaves, as the latter may compensate for the nutritional deficiencies of cassava roots compared to other sources. The balance between leaf harvesting for vegetable dishes, for animal feed, and root yield should be carefully observed. Attention should be given to the toxicity aspects. Given the low raw root

price, cassava feed could play an economic role within the country and region. The chain should be build up from scratch.

Conclusion

Three niches exist at the moment in Sierra Leone: (a) upgrading of traditional gari processing; (b) developing small-scale initiatives in the HQCF market; (c) promotion of cassava as animal feed. Fields for exploration or research are: organisational aspects of vertical integration in the chain and stakeholder involvement; technical and economic studies on solar drying, forced drying and hybrid drying systems; possibilities for mechanical peeling; effect of inclusion of the inner peel on sensory, safety and nutritional aspects of gari; selection of cultivars for different end-products.

Table 3: Summary of opportunities and constraints

Form	Opportunity	Constraint
Raw material	Low raw root price Over supply of raw roots	Transport and fuel costs Small scale production and quantities Raw root market is limited
Gari	Market demand is growing Prices are good for quality gari Room for improving processing plants and equipment	Processing plant and equipment suboptimal Processing groups do not have the capacity to innovate and finance their own equipment.
HQCF	Low raw root price Bakeries can be interested, then a growing market	Drying outside the short dry season: high fuel costs → profitable production not year round Hybrid drying needs research Combination with other products involves complex management
Animal feed, local + regional markets Dried root pieces	Cassava is a cheap source Combination with c. leaves and/or intercrops such as mucuna, cow pea, soy bean, ..	Farmers are not used to intensive animal husbandry Poultry farming is small scale Leaf collection may compete with use as vegetable and with root production No availability of concentrates (protein and minerals) yet
Animal feed, international market	None	Low international market price. High cost of logistics
Traditional starch	Gari processors can benefit from starch + optimise quality Local prices are good	Limited growth potential. Market segment exists already.
Industrial starch	Limited for world market	High cost of industrial drying; research required.

5. Possible institutional project links and organisation

The Ministry of Trade and Industry supports the development of SME's and is involved in the CFC initiative of cassava enterprise development since beginning of 2004.
The Ministry of Agriculture, Forestry & Food Security supports the production and harvesting of cassava, has established Agricultural research stations in different agro-ecological zones, and is working closely with the National Association of Farmers, through the Institute of Agricultural Research (IAR). As the IAR has experimental centres in many places, they have capacity to monitor pilot activities in their neighbourhood.
The NGO UPWARDS is establishing mechanised large scale cassava production in Bombali district and seeks support for establishing industrial processing.
The Institute of Home Sciences of Njala University College does research on cassava processing and flour utilisation for bread and cake baking.

References

Jalloh, A., J.A. Edwin and M.T. Dahniya (2000): Cassava development strategy for Sierra Leone – The Sierra Leone country case study for the Global Cassava Development Strategy. www. Worldbank.org

Annex 3A - PROGRAMME OF THE IDENTIFICATION & FORMULATION MISSION CFC RIAS/WUR

Assessment of resources, markets and the potential for market development in value added cassava products in West Africa
Country visit to Sierra Leone: 10 – 17 October 2005
Members:

- Dr Sander Essers, specialist in cassava processing Wageningen University (country visits Ghana, Bénin, Sierra Leone)
- Dr Frans Goossens, economist (country visits Bénin, Sierra Leone)
- Dr Diallo Souleymane, economist, CIRES, Abidjan (country visit Côte d'Ivoire)
- Mr. Wim Verzijlenberg, RIAS (country visit Ghana)

During the visit to Sierra Leone, the team Essers/Goossens was accompanied by Mr. Osman Bangura, Assistant Secretary, Ministry of Trade and Industry

Date - hour	Name structure	Persons met	Contacts
Monday 10/10/05	(Travel from Accra to Freetown)		
15.00 – 18.00	Ministry of Trade and Industry	Mr. Osman Bangura, Assistant Secretary	+232.76670401
Tuesday 11/10/05 09.00	Ministry of Trade and Industry	Mr. Sadiq M. Kapuwa, Deputy Secretary	
09.30	Ministry of Trade and Industry	Hon. Mrs. Theresa Koroma, Deputy Minister; Mr. Banerd Jayah, Deputy Director of Trade; Mr. Mohammed Sillah, Senior Industrial Dev. Off	
10.00	Ministry of Trade and Industry	Mr. J.W.A. Jackson, Director of Industry; Mr. Chris Jassabe, Managing Director SLEDIC; Mr. Christian MacCauley, Director of Trade	
11.30	National Association of Farmers of Sierra Leone	Mr. Murray E.S. Lamin, Nat. Secretary General; Mr. Andrew R.C. Conteh, Asst. Nat. Secr. Gen.	
12.15	National Agricultural Research Co-ordinating Council (NARCC)	Prof. Dr. Edward R. Rhodes, Chief Executive Director	
13.30	FINIC (Agro processing equipment & training)	Mr. Melvin Kamara, Director	
16.00	Ministry of Agriculture, Forestry & Food Security	Mr. Patrick Hanmer, Director General	
16.15	Ministry of Agriculture, Forestry & Food Security	Mr. Foray Kargbo, Director of Crops	
Wednesday 12/10/05 14.30 – 15.30	(Travel from Freetown to Njala and Bo) Institute of Agricultural Research (IAR)	Dr. Abdulai Jalloh, Director	

17.00 – 19.00	Private Gari processing unit in Bo	Mr. Edward P. Magao, retired manager; Mamie Magao Kabba, manager	
Thursday 13/10/05 07.30	(Travel from Bo to Makeni, then to Freetown) Private Gari processing unit in Bo	 Mr. Edward P. Magao, retired manager; Mrs. Mamie Magao Kabba, manager	
09.00	Private Gari processor in Bo	Ms. Isata Kallon, Chairperson Bo gari marketers	
09.30	BAFCO Gari processing unit in Bo	Mr. Mathew Hanciles, manager; Mr. Augustin Amara, manager/trainer	
11.00	Communal Gari processor between Bo and Makeni	Mr. Bangura, gari community member	
15.00	Ministry of Agriculture, Forestry & Food Security, District Unit Bombali, Makeni Bombali Women Farmers Cooperative Association / Nat. Farmers Association Bombali	Mr. Peter A. Kamara, District Director; Mr. Yusuf Bangura, Regional Mon. & Eval. Off.; Ms. Ramatu Fonnah, Secretary / Chairperson; Ms. Ema Kamara, Chairlady Women in Agricult.	
Friday 14/10/05	Stakeholder Dialogue meeting with:		
10.00 – 13.00	Ministry of Trade and Industry Ministry of Trade and Industry Ministry of Trade and Industry Ministry of Trade and Industry Ministry of Trade and Industry National Association of Farmers of Sierra Leone National Association of Farmers of Sierra Leone Ministry of Agriculture, Forestry & Food Security Ministry of Agriculture, Forestry & Food Security Ministry of Agriculture, Forestry & Food Security Institute of Agricultural Research (IAR) FINIC (Agro processing equipment & training) FINIC (Agro processing equipment & training)	Mr. Sadiq M. Kapuwa, Deputy Secretary Mr. Osman Bangura, Assistant Secretary Mr. A.B. Kebbay, Director of Export, SLEDIC Mr. G.C MacCauley, Director of Trade Mr. Mohammed Sillah, Senior Industrial Dev. Off Mr. Murray E.S. Lamin, Nat. Secretary General, Mr. Leslie T. Thomas, member Mr. Emmanuel K. Alien, Director Rice Research Mr. Mohammed L. Yillah, Seed Multiplic. Project Mr. Foray Kargbo, Chief Agriculturist Dr. Abdulai Jalloh, Director Mr. Melvin Kamara, Director, Mr. F.K. Bangura, Agricultural Officer	
13.30 – 14.00	Ministry of Trade and Industry	Hon. Mrs. Dr. Kady Sesay, Minister Mr. Javomgbo, Permanent Secretary Mr. Sadiq M. Kapuwa, Deputy Secretary Mr. A.B. Kebbay, Director of Export, SLEDIC Mr. Osman Bangura, Assistant Secretary	
Saturday 15/10/05	11.00 – 14.00, Ministry of Trade and Industry	Mr. Osman Bangura, Assistant Secretary	
Monday 17/10/05	(Travel from Freetown to Accra and Amsterdam)		

ANNEX 4

Ivory Coast

November 2005

Rabo International Advisory Services (RIAS) BV

TABLE OF CONTENTS

List of tables

List of figures

List of acronyms

CIRES	Centre Ivoirien de Recherches Economiques et Sociale
CNRA	Centre National de la Recherche Agronomique
COSCA	Collaborative Study on Cassava in Africa
CSRS	Centre Suisse de Recherches Scientifiques
HQCF	High quality Cassava Flour
I2T	Société Ivoirienne de Technologie Tropicale
SME	Small and Medium Enterprise

Currency equivalents

Currency Unit	=	FCFA
€ 1.00	=	FCFA 655
FCFA 1.00	=	€ 0.001527

Figure 1: Map of Ivory Coast

1. General context

In Ivory Coast, cassava is one of the most important food crops. It is the second staple food in terms of volume of production. It provides about 30% of the total food production against 34% for yam, 22% for cereals and 14% for the other crops. It provides, on average, 10% of the daily per capita energy intake and the fourth source after rice (20%), yam (17%) and corn (15%) (Nweke et al., 2000). Traditionally, cassava is considered as a subsistence culture, produced for rural household consumption needs. However, since the beginning of the years 1990, cassava has become a true cash crop.

2. The cassava chain in Ivory Coast

2.1. Cassava production

Cassava remains relatively modest in the Ivorian agricultural sector in spite of the volume of production. Table 1 shows the acreage attributed to the principal agricultural speculations in Ivory Coast. According to the Agricultural National Census (RNA) of 2002, cassava occupies about 71,124 ha corresponding to 1.64% of the total agricultural acreage. Cassava occupies 7% of total food crops acreage and it ranks fourth behind yam (32%), rain fed rice (31%) and corn (17%). In spite of the weakness of the acreage devoted to cassava, it has a high potential of progression because of its present low yield.

In Ivory Coast, cassava is cultivated on all the national territory with a clear dominance in the southern half. Its production is characterised by a continuous growth since the accession of the country to independence. It passed from 450,000 tons in 1960 to 1,465,000 tons in 1990 (Koné, 1997). Table 2 presents the evolution of the production and the availability of cassava (kg of cassava per capita) between 1995 and 2004. The figures indicate that the upward trend of production which had prevailed since the years 1960 started an inversion since 2001. This result can be explained by several factors among which the migrant population exodus consecutively to the land conflicts towards the end of 1990 in some production zones. This caused a decline of production and a significant reduction in the availability of agricultural labour. Stagnation, then fall of the production on one hand and the demographic growth on the other hand, contributed to a reduction of per capita availability of cassava which thus passed from 101 kg per capita in 1995 to 93 in 2002.

Table 1: Acreage of various crops in total land cultivated

Crops	Acreage (ha)	Part (%)
Cocoa	1777550	41.04
Coffee	602075	13.90
Yam	310580	7.17
Cotton	260116	6.01
Rain fed rice	248762	5.74
Palm oil	194790	4.50
Corn	168139	3.88
Cashew tree	133273	3.08
Rubber	116050	2.68
Cassava	71124	1.64
Irrigated Rice	54489	1.26
Mango	45895	1.06
Groundnuts	45281	1.05
Banana plantain	35704	0.82
Millet	29688	0.69
Coconuts	29663	0.68
Passion Fruits	28344	0.65
Barks	27195	0.63
Pineapple	15639	0.36
Banana	7204	0.17
Other crops	129883	3.00
Total	4331444	100

Source : RNA, 2002

Table 2: Evolution of cassava production and per capita availability in Ivory Coast

	Year									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Production	1608000	1653000	1699000	1692000	1681000	1691000	1688000	1514730	1505030	1500000
Availability (kg per capita)	100.7	101.0	101.9	99.6	97.2	96.1	94.3	93.4	-	-

Source : FAOSTAT, 2004

2.2. Cassava processing

Cassava processing is done either in an artisanal way, or in an industrial or semi industrial way. The first mode remains however the most dominant processing mode. Most attiéké (the most popular product form in the domestic market) comes from individual processing units or groups of processors.

2.2.1. Artisanal processing

Processing and marketing of cassava products are done by women. According to the COSCA (Collaborative Study on Cassava in Africa) study data, 97.5% of the sales and 97% of the purchases of cassava roots are carried out by women.

Essentially, the cassava products derived from traditional processing include attiéké, placali, atoukpou and dried cassava. Processing, as well as marketing, is done within the informal sector, so that it is difficult to have reliable figures on the volume of products. Marketing as well as the processing of these products is subjected to a strong seasonal variation. Although one can find these products on the market all the year, the volume of activity varies according to seasons': low level between October and May and relatively high level between June and September.

Very little information on the effective processing costs is available. We give in appendix the attiéké cost structure for traditional technology starting from 100 kg of fresh cassava.

2.2.2. Industrial and semi-industrial processing

The industrial and semi-industrial cassava processing are still marginal in Ivory Coast. One can divide the actors of the industrial and semi-industrial processing into two groups: actors of the industrial processing and micro enterprises.

Ivorian Society of Tropical Technology (I2T). The first experiments of modernisation of cassava processing were done by the I2T. Created in 1970, the mixed investment company I2T has as vocation not only research & development, but also development and selling of processes and technology in the agro-alimentary sector. The company's factory in Toumodi has three lines of production: flour, dried attiéké and starch. The factory's capacity was about 1,300 tons of dried attiéké and 27,000 tons of food grade flour per year. The factory demand for fresh cassava was 20,000 MT per year. Dried attiéké was sold to urban consumers of the Sahelian countries, the product having some difficulties to be sold on the national market where it competes with fresh attiéké produced by traditional processors. Until 2002, the factory was rented and run by a private operator (AFRIFOOD) who supplies BLOHORN with flour.

In addition, I2T engaged with another private operator in attiéké drying for export towards Canada. The objective was to provide 15 tons of dried attiéké per month at a cost of 100 FCFA/kg.

NESTLE – Ivory Coast. NESTLE-CI manufactures a varied range of agro-alimentary products of which culinary broth 'beef-cubes'. The production of those cubes is based on starch, which is used as raw material. Since 1997, the company undertook the production of starch flakes from local cassava. This starch is used to substitute 20% to 50% of imported corn starch that is used as binder. It uses the existing yam flake production line for the production of cassava flakes, the supply of fresh cassava being ensured by contracted producers. From 1997 to 2000, the volume of cassava used by NESTLE went from 3,750 tons per year to 5,200 tons. It yields 1,200 tons of cassava starch in 2000. Moreover, this company accounts for approximately 55% of the market of Ivory Coast's 'beef-cubes' against 33% for CHOCODI and 12% for BLOHORN. It also provides the mass partial of 'beef-cubes' to the other Nestle factories of the Western and Central African countries, that is to say a total of 22,000 tons in 2000, in progression of 6% per year.

CIVOMA. The Compagnie Ivoirienne de Cassava (CIVOMA) is a private company involved in cassava processing based in Toumodi. It produces food grade flour, starch and dried attiéké. In addition, it produces non-food flour for textile industry and ensured the supply of cassava flour to BLOHORN until 1999.

AFRIFOOD. This company does not have its own processing line. It rather had a contract with I2T for using its factory in Toumodi. The most important part of its production was sold to BLOHORN.

BLOHORN. Traditionally working on cotton seeds and soy processing into oil and the valorisation of the oil cakes, BLOHORN was also involved, these last years, in the manufacturing of beef-cubes and cattle feed and poultry feed. It has been producing in particular the 'beef-cubes' since 1996 and has approximately 12% of the domestic market of Côte d'Ivoire which is estimated at 12 000 tons per year. It uses approximately 10% of cassava flour in the manufacturing of the 'beef-cubes', which corresponds to approximately 84 tons per year. This raw material is provided partly by AFRIFOOD.

Local textile industry: Gonfreville, UTEXI, COTIVO
Starch is used to tighten fibres on the surface of cotton thread and is also used to finish fabrics and to give them weight and rigidity.

In Ivory Coast, Gonfreville and UTEXI are supplied with cassava flour by the small industrial and semi-industrial processing units like the Union des Coopératives des vivriers de Bouaké (UCVB) and Ets Traoré. Because of the current crisis, it is impossible to know the level of activity of the structures located in the zone controlled by the rebellion, in particular in Bouaké. Actually, most textile industries of the area which were the principal buyers of starch and cassava flour stopped all activities at least during the first period of the crisis. In addition, the factory of CIVOMA in Toumodi had to stop its activities during a certain period. It was started again by a group of local investors who work also in the sector of shea butter and cotton production. The resumption of the activities of the factory is planned for the end of 2005. Apart from these cases, the other units continue to function in spite of the political and economic situation.

Semi-industrial processing: SME and micro enterprises
In Ivory Coast, we have a few small units of semi-industrial cassava processing owned by individual operators or groups of cassava producers or processors. The capacity of these small units remains relatively modest in comparison with the potential of the national and regional market for traditional cassava products.

They include:

- The Union des Coopératives des vivriers de Bouaké (UCVB) which installed a semi-industrial factory of attiéké which produces also cassava flour for textile industries (Gonfreville, UTEXI COTIVO);
- In Trianikro, in the department of Dimbokro, a co-operative set up a factory to produce fresh attiéké;
- In Songon, in the Commune of Yopougon (Abidjan), a complete line of attiéké manufacturing was installed in 2001. This factory was created by the Syndicat des producteurs et vendeurs d'attiéké de la Côte d'Ivoire with the Fonds de Développement de la Formation Professionnelle and technical support of JPR Consultant and I2T. With a total cost of FCFA 25.6 million (including the acquisition of the complete line of manufacture of attiéké, the construction of a building and the installation of a drying space), the factory has a capacity of 4 tons per day;
- In Toumodi, a private operator installed a processing factory for cassava starch and cassava fibre production for cattle feed. With a total cost of FCFA 50 million, the manufacturing unit can produce 900 kg per hour, which is equivalent to 1350 tons per year. Implemented with a financial support of Fonds Sociaux and I2T's technical support, the factory focuses on the local industry of paperboard manufacture (SONACO in particular) and the sub regional market like Senegal where an important demand for starch exists.

2.3. Domestic marketing of cassava and its products

The marketing of cassava and its products is carried out, like the majority of agricultural products, within an informal framework. The configuration of the national distribution chains of the cassava and the derived products resulting from the artisanal processing is presented in a diagrammatic way in appendix (Graphic A1).

The sale of tubers of cassava is carried out according to two modes: (i) sale "on foot" (the purchaser estimates the produce and carries out the harvest), and (ii) the sale after harvest which can be made at the farm gate or at producers' home or at the market (rural or urban). The first mode is practiced by only 12.8% of the producing villages against 87.2% for the second. The producers sell their production of cassava either directly to consumers, or to the middlemen (intermediate) in the form of fresh or derived products. Another part is sold as raw material to individual processors or processor groups.

The available figures indicate that 97.5% of the sales and 97% of the purchases of roots of cassava are carried out by women. The processing operations, purchase and sale of the derived products are exclusively (100%) ensured by women.

Transport of cassava to the cities and villages supply of food products relies on a traditional marketing system. According to the complexity and variability (due to transaction locations), one distinguishes three types of very close distribution systems, namely:

(1) A direct marketing chain or direct sales: the producer, or generally his wife, sells directly to local consumers, along the roads or at farm gate. Transactions are small and distance covered by salesmen is short (maximum 30 km). This chain ensures the provisioning of rural markets.

(2) A medium marketing chain (with short and average distance). It is characterised by the presence of a middleman between the producer and the consumer: a wholesaler who collects the products at producers' level and resells to retailers or urban consumers. The transport services use low capacity means of transport such as taxi-brousse, trucks (when several traders join). This chain developed considerably with the use of the large trucks which contributed to the

reduction of transportation costs. It is the most important marketing chain if the number of operators is taken into account.

(3) A long marketing chain: it is the most important marketing chain in terms of flow of products, convenient to cases with a long distance between production zones and consumption areas. It is characterised by the existence of several intermediaries (purchasing, shippers, conveyors, wholesalers, carters and retailers). The average tonnage transported ranges from 10 to 30 tons per trader. This chain ensures marketing of the most important part of cassava surplus. It contributes to the supply of urban centers like Abidjan and even the sub region (Burkina Faso, Ghana and Mali).

As a whole, these various chains operate independently from one another; they often coexist in the same location without any articulation. Thus, the chain connecting producers and consumers can be rather long and complex and the number of actors varies from one type to another. Like other food products, cassava and its products' marketing chains do not have significant connections with the formal financial systems. These channels are competitive and can be considered as overall atomistic. Because of multiple intermediaries along the marketing chains, it is necessary to examine entry and exit conditions as well as the public regulations of foodstuffs markets. The actors of the marketing chains of the fresh cassava can be divided in three main groups: private agents, official associations and professional organisations and structures.

2.4. Local consumption and export

2.4.1. Domestic demand

According to available figures, the quasi total of the cassava production of the Ivory Coast is intended for the human consumption which absorbs approximately 90% of the production against 5% for the animal feeds and 5% for the remainder. As a whole, more than 75% of the cassava production is intended for subsistence of farming households and only 25% is marketed. From a yearly average level of 43 kg per adult equivalent in Abidjan and 35 kg in the other cities in 1979, cassava consumption passed to 52 kg per year and 37 kg per year in Abidjan and Bouaké, respectively, in 1997 (Akindès, 1999). Thus, cassava seems to have been one of the principal recipients of the devaluation of CFA francs in 1994. Also, the demand increase induced by the relative price change follows this monetary adjustment, i.e. it translates by an increase in the price of cassava. In particular in Abidjan where, according to OCPV data prices went from 38 FCA/kg in 1988 to 67 FCFA/kg in 1999 at wholesale level against 97 FCFA/kg and 115 FCFA/kg respectively at retail level.

Cassava is consumed in several product forms. Most popular are attiéké, flour, gari and starch to which one can add some traditional dishes containing cassava like placali (traditionally obtained from the preparation with water of fermented cassava paste), atoukpou (cassava fermented pulp, compacted and steam-cooked), etc.

Attiéké. Attiéké (cassava granules) is prepared from fermented cassava pulp and steam-cooked. This process makes it possible to obtain the fresh attiéké that is usually sold on local markets. There is a dried form which is obtained from the fresh product. Dried attiéké, still called attiéké, is similar with couscous. The Attiéké dish is a typical food in Ivory Coast and whose traditional processes of production are well-known and widespread. Its trade is very flourishing everywhere in urban environment of Ivory Coast. Taking into account the informal character of production and marketing of fresh attiéké, one does not have reliable figures on the volume of attiéké. Its price on the domestic market varies between 175 FCFA and 200 FCFA per kg. For years, industrial or semi industrial processes for dried attiéké have been developed in order to support the expansion of the market through the prolongation of the shelf life. This should indeed facilitate

the export of attiéké. However, dried attiéké is not competitive on the local markets where it is sold between 285 FCFA and 330 FCFA per kg.

Cassava flour. The current market of cassava flour produced in artisanal ways from small dried pieces of cassava is limited primarily to the preparation of the "toh", a traditional dish consumed mainly by populations originated from the centre and the north of the country.

The rapid urbanisation of Ivory Coast has induced a high consumption of convenience food such as bread, biscuits, cakes and pastry makings. This evolution offers a significant potential for the market of unfermented cassava flour. Studies carried out on the potential use of cassava indicate that it is possible to add up to 10% of cassava flour into the manufacture of bread and 35% for biscuits and pasta products without deterioration of quality or taste of these various products. Moreover, the incorporation of cassava flour in bread would allow Ivory Coast to save foreign currencies estimated at approximately 3 billion FCFA per annum.

Apart from the unfermented flour, there is a market for non food flour for industrial use. It is estimated at approximately 11000 MT/year. The local production of non food grade flour is made by production facilities of intermediate size such as the UCVB and Ets Traoré in Bouaké, etc.

Gari. Gari is obtained by roasting fermented cassava pulp. Gari production is localised in the Eastern areas towards the Ghanaian border. Its production and its consumption knew a notable expansion these last years, in particular in the urban centers like Abidjan. It will be difficult for Ivory Coast to compete with countries with long tradition of gari production and consumption like Nigeria, Benin, Togo and Ghana. The national demand for gari is estimated at approximately 1500 to 2000 tons per annum. The largest part of this demand comes from Abidjan and cities of the Eastern regions where important foreign communities originated from the above mentioned countries live.

Starch. Starch is a raw material essential for the activities of several industries in particular textiles industries, plywood and cardboard factories. The potential of the Ivorian demand is estimated at approximately 9000 tons per annum for starch and its derivatives, which is equivalent to 45000 tons of fresh cassava.

2.4.2. Export

Cassava being a non durable product, export is rather composed of derived products resulting from first processing activities. The export of some cassava products is done through informal marketing chains and escapes from any official control, so it is almost impossible to get statistics on trade flows. Some years, only a few dozen tons of processed cassava is recorded as exports by the Ivory Coast customs service, the remainder of exports made by the informal marketing chains whose starting point was, until the outbreak of the crisis, the Bouaké wholesale market. Table 4 indicates that exports from Ivory Coast still remain very modest in spite of the increase of starch whose outflows went from only 1 ton in 1997 to 129 tons in 2002 and 118 tons in 2003. On the other hand, cassava flour which was officially listed as exports disappeared from the statistics records since 2001.

Table 3: Evolution of cassava exports (metric tons)

Product	Year								
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Dried cassava (cossettes)	0	0	8	16	33	13	62	12	3
Starch	0	0	1	2	16	17	27	129	118
Tapioca	0	0	0	0	0	0	55	0	0
Flour	299	823	6	11	9	11	0	0	0

Source : FAOSTAT, 2004

3. Initiatives for the promotion and the development of cassava

3.1. The Ministry of agriculture

The cassava strategy of government is implemented by the Ministry of Agriculture and Rural Development (MINADER). It relies primarily on the Master Plan for Agricultural Development 1992 - 2015. This plan had several objectives among which the improvement of productivity and competitiveness of the agricultural sector, research on self-sufficiency and food security and the diversification of agricultural production.

A national cassava project was elaborated. Its general objective consists of developing the cassava chain in order to fight against food insecurity and poverty. More specifically, it aims at:
- increasing production and productivity by implementing research results, multiplication and distribution of disease resistant cultivars of cassava;
- developing processing of cassava and its by-products in order to widen the field of the product use;
- research and technological innovation activities for small scale processing units;
- organising Agricultural Professional Organisations and creating a permanent framework of dialogue within the channel.

The project is articulated around five components:

- production: it consists in encouraging production through research on cultivars, the improvement of farming techniques, improved disease control and distribution of disease tolerant cultivars;
- processing : it aims at developing simple and cheaper technologies for the processing of derived products (food-grade flour, attiéké, starch, dried attiéké, etc.) ;
- conservation of cassava and cassava products: it consists in seeking simple techniques likely to prolong shelf life;
- marketing: it aims at improving distribution chains, particularly the short and medium marketing chains for domestic marketing, and to support promotion of cassava and the there from derived products on local and international markets;
- consumption: it aims at promoting the consumption of cassava (human and animal consumption) and its products on the national, West African and international markets.

3.2. Ministry in charge of industrial development

The Ministry for the Industry and the Promotion of the Private Sector prepared in 1989 a National Plan called "Schéma-Directeur de l'Industrialisation". This plan puts the agro industry sector at the heart of the national industrialisation strategy. It was re-examined and corrected in 2002 to adjust the weaknesses detected during implementation. Thus, the value adding of the cassava and yam chains, which did not explicitly appear in the initial plan, were identified as crucial channels for the agro-industrial development of Ivory Coast. In the specific case of cassava, the plan identified more than 28 projects for cassava processing units of attiéké, food-grade flour and starch for the domestic, sub regional and international market. The crisis, which Ivory Coast has been facing since September 2002, did not allow the suitable execution of this plan.

3.3. Research institutes and centers

Several research centres and institutes are involved in the cassava channel in Ivory Coast. Their interventions are as well upstream as downstream of the production sector and aim at improving the performance of the chain. The most important centres are: Centre Ivoirien de Recherches Economiques et Sociales (CIRES), the Centre National de la Recherche Agronomique (CNRA), the Centre Suisse de Recherches Scientifiques (CSRS) and the Société Ivoirienne de Technologie Tropicale (I2T).

CSRS: The Centre Suisse de Recherches Scientifiques (CSRS) conducted the last years several studies on cassava. These studies cover both agronomic and biotechnological aspects. The fields of intervention of the CSRS include:

- agronomic research through the screening and distribution of new cassava cultivars. These cultivars are more performing in terms of diseases resistance and have better roots yields. It is the case for example of the Oko-Iyaw/ TME 7 cultivar still called Yavo. This research has been undertaken in collaboration with NESTLE, the Compagnie Ivoirienne de Cassava (CIVOMA), the University of Abidjan-Cocody, and IITA;
- identifying production systems which can reconcile the yield objective and environmental protection. Accordingly, the Centre has undertaken a collaborative project in Abengourou with GTZ and NESTLE; the results of this project show that traditional systems characterised by mix cropping (cassava-groundnuts) or slash and burn techniques without manure are less productive than the "cassava-soy" and "cassava-leguminous plant (macuna)" inter cropping systems proposed by the centre. In addition those systems led to soil protection;
- food technologies, mainly on attiéké. This project is to reduce the processing period while preserving the organoleptic qualities of attiéké. It is implemented in collaboration with the University of Cocody through the Laboratory of Biochemistry and the Unité de Formation et de Recherche en Biosciences and the Department of Agronomy and of Food Sciences of the Federal Polytechnic School of Zurich in Switzerland.

The Centre's research perspectives are as follows: (i) to continue the evaluation of improved cassava cultivars and to form a bank of plant material able to meet the requirements of the actors of the cassava channel; (ii) to identify and standardise a high quality attiéké in order to conquer the international market; (iii) to continue research in order to find answers to cassava related pathologies.

CIRES: The Centre Ivoirien de Recherches Economiques et Sociales (CIRES) has conducted several studies on economic aspects of cassava. The Research Division on Rural Economics and Sociology has identified cassava as strategic food crop in its research program 2005 – 2010.

CNRA: The Centre National de Recherche Agronomique (CNRA) research activities on the cassava chain began in 1980 with the Institut des Savanes (IDESSA). These activities form part of the Roots and Tubers Programme which was located in the centre of the country. Because of the crisis it has been moved to the southern zone. Traditionally, CNRA's activities on cassava cover three principal fields:

- genetic improvement of cassava cultivars. Currently, nearly 350 cultivars are being screened in different centre's research stations. Contrary to CSRS, CNRA is mainly interested in bitter cassava cultivars for starch production;
- improved crop husbandry practises.;
- plant protection.

The future activities scheduled by the CNRA will also include biotechnology and post harvest aspects. Research will be focussed on these fields to propose elements on the level of the cassava processing and also to propose a bank of disease-free plant material.

3.4. The private sector

The private sector's strategies for cassava development and promotion consist of three main intervention axes: (i) initiatives related to upgraded small-scale cassava processing, (ii) establishment of partnership with research centres in order to benefit from economies of scale, and (iii) partnerships with producers.

Small processing units are generally created by individual processors or producers' groups in some cassava production zones. Generally, it is small investments for traditional processing units for attiéké, flour or starch production. This kind of actors has difficulties to establish relations with other actors, because of the weakness of their means and of the absence of a structured cassava chain.

On the other hand, the interest of some industrial companies for cassava has led to partnerships between industrial enterprises and research centres to solve constraints which slow down the development of the chain. Thus, the NESTLE's Research & Development Centre in Abidjan carried out research in collaboration with the CSRS in order to identify cassava cultivars for starch manufacturing. In the same way one noted collaboration between CIVOMA and the CSRS for the identification of a cassava cultivar with high content of dry matter for its factory in Toumodi.

In addition to these interventions, some private companies like NESTLE are supplied directly by cassava producers. The enterprise pays a higher price than traditional traders while securing a regular provisioning. Thus, in Abengourou, NESTLE has an agreement of partnership with farmers. The company pays 45 FCFA per kg at its factory against an average price of 30 FCFA per kg in the traditional marketing chain.

3.5. Associations of promotion of the private and agricultural sector

APEX-CI: The objective of the Association pour la Promotion des Exportations de Côte d'Ivoire (APEX-CI) is to identify growing markets or those with a strong potential for value-addition of cassava and its by-products. The achievement of this objective will also help to improve producers' income. APEXI-CI initiated many initiatives together with national operators (CNRA, ANADER, CSRS, I2T, CIRES, and Nestle) and international partners. These interventions include field studies, data collection, documentary reviews, studies on the European market and studies on processing technologies. APEX-CI is preparing a proposal to be submitted to the Ministry of Agriculture for the development of cassava production and value adding of the products derived thereof. This strategy is based on four products: attiéké, starch, fresh cassava and dried cassava.

ASDV-CI: The Association for the Development of food agriculture in Ivory Coast (ASDV–CI) was created in 2003 by eight (8) structures of which the Organisation of the Volunteers for Local Development (OVDL - ONG), the Rural Animation of Korhogo (ARK), URESCO-CI, ANOPACI, Founds of Ivoiro-Switzerland of Economic and Social Development (FIDES), CSRS and the University of Cocody. Its principal objective is to reduce poverty in rural areas by adopting a strategy of food crop intensification. To this end, ASDV finances investments and working capital (primarily inputs) related to the food crops with the support of FISDES. In the same way, it encourages processing and marketing of food crops.

For the specific case of cassava, the ASDV-CI initiated a study in partnership with I2T to determine the environment of cassava processing as well as other products. It has scheduled to support women associations involved in attiéké processing. Thus a program has been elaborated in that direction for the period 2006 - 2010.

4. Constraints and opportunities

4.1. Constraints related to the production

Low yields. The yields of local cultivars are relatively weak as compared with those recorded by new cultivars available at the research centres. This weakness results in a relatively high price, so that the use of cassava as substitute to cereal derivatives (wheat, starch, …) becomes less profitable than the importation of these products. An effort of extension of new cultivars can offer new investment opportunities in cassava processing.

High production cost. For the yields recorded by farmers, the production of cassava presents relatively high costs. One hectare of cassava requires 195 663 FCFA, which exceeds the poverty line of 1998.

Lack of favourable political framework. Besides the "Plan National de Développement de la Culture du Manioc" initiated in the years 1970, Côte d'Ivoire did not have a true and specific policy specific for the cassava crop in contrary to products like coffee, cocoa, cotton, palm tree, rubber or rice. This resulted in an absence of research efforts. Even the recently renewed interest expressed in research centres like CSRS, CNRA and CIRES did not have a true impact. Admittedly, one observes development projects at the level of certain ministries like the Ministry of Industry and the Ministry of Agriculture, but the socio-political crisis that the country is facing since September 2002, did not allow the true implementation of these initiatives.

Lack of appropriate credit scheme. Cassava production, as well as its processing and marketing, remain relatively marginal activities in the Ivorian economy. In spite of the large production volume, cassava is still a subsistence crop. According to available data, subsistence farming remains the production target of more than half of the peasants who produce this crop. Like the majority of the food crops, the financial structures do not give attention to the actors of the cassava chain.

Price variability. Cassava prices are subject of strong seasonal and cyclic variations. The examination of the trend of wholesale and retail cassava prices collected by the OCPV on markets in the city of Abidjan illustrates this situation. The average price trend on the markets over the period 1998 – 1999 is presented in annex (tables A8 and A9). This strong seasonal and cyclic variability constitutes a true constraint for the development of a true cassava processing industry because of the resulting instability in the raw materials supply.

4.2. Constraints related to marketing

Cassava marketing, as it appears in this context, seems to result from an "accidental" surplus emergence largely dependant on farmers' food consumption needs. Thus, cassava marketing promotion requires the identification of socio economic determinants which influence the households' selling decisions. Those factors are still badly known.

In addition, some cassava products have difficulties to compete in the domestic market because they don't meet the organoleptic requirements of domestic consumers, and artisanal processors seem to be more competitive. The generalisation of industrial processing, like dried attiéké, should be done rather by aiming at export because an empirical study carried out with CIRES indicates that the consumer's choices of Côte d'Ivoire are relatively homogeneous and do not offer possibilities of market segmentation (Pokou, 2004). The negligence of local attiéké

consumers' organoleptic requirements by modern processors is one of the major obstacles to the development of the dried attiéké consumption in Côte d'Ivoire.

4.3. Constraints related to processing

Industrial processing of cassava is still marginal. It encounters several technical and economic constraints. At the technical level, the available equipments are often unsuited to the needs. Indeed, the industrial processing units generally use large scale processing lines which are not adapted to domestic market exiguity, absence of supply lines of raw material that correspond to the demand of those great processing units.

Consumers consider that dried attiéké prices are relatively high and not competitive as compared with the artisanal processed products' prices. Artisanal processing technologies are well known by women, and organoleptic quality of artisanal processed products is preferred to industrial processed products. In other words, the consumption patterns do not favour industrially processed products. Thus, the domestic market is restricted at about less than a hundred tons per year. Moreover, dried cassava granules do not know a better fate on the international market since relevant consumers are national groups having a cassava consumption pattern

Beyond these considerations, each type of product faces specific constraints, such as processing costs, availability of adapted technology, likely to reduce these costs and to improve product quality. Concerning the processing costs, we present in appendix, data processing factors' cost and margins (Tables A3 to A7).

In addition, the comparative analysis of the production factor costs indicates that Ivory Coast has a median position in the West African Monetary and Economic Union zone. Even if its hydroelectric potential allows Côte d'Ivoire to be relatively competitive, it has very high costs for water, telecommunications and labour. Moreover, the generalisation of the standardised VAT with 18.6% contributes to reduce the competitiveness of local productions in general and those which were subjected to reduced VAT rate in particular.

Dried cassava (cossettes) and cassava flour:
- The lack of equipment for cassava cutting and an adequate method for product drying;
- The absence of hygiene in the traditional methods, which limits access to the international markets and local agro food industries.

Attiéké. The traditionally processed fresh attiéké has a high water content, which makes its marketing very difficult, particularly in sub regional markets. Fresh attiéké cannot be stored more than a week. On the other hand, the dried product has a longer shelf live and seems to be more adapted to export. But, until now, only I2T's processing unit in Toumodi makes it possible to produce sufficient quantities of dried attiéké. At this level, the major handicap is the fact that production costs are relatively high. Moreover, despite the sub regional market opportunities for this product, there was neither sufficient investment, nor a true effort of promotion for large scale consumption.

Gari. Gari production remains localised in the Eastern region of the country. In other parts of the country gari manufacturing is ignored and there were no initiatives for its promotion as a new value-added cassava product.

Starch. The starch from traditional processing does not always meet the required standards for industrial use. The product is not standardised. Hence, companies are obliged to either invest in the production of their needed starch or to import it. The international starch market is characterised by important economies of scale.

4.4. Opportunities

Cassava's capacity to adapt to local conditions. Cassava has the advantage of a great capacity of adaptation to extreme climatic and soil conditions so that it is produced in all climatic zones of the country. Taking into account the low rainfalls recorded in recent years, this crop has to be developed around the country, in particular in the northern region, in substitution with other traditional cultures like millet and sorghum.

Urbanisation. Like numerous African countries, Ivory Coast has an accelerated urbanisation which induces an increase in the urban food demand. Under these conditions, the demand for cassava should increase during the next decades since it is well established in the consumption pattern of the populations, both in urban and rural areas.

Cassava flour (unfermented). Urbanisation involved a fast growth of demand for convenience food, such as bread, biscuits, pastry makings and pasta products all produced from imported grains. Substitution of part of the imported wheat flour can be an important opportunity for the development of cassava. Indeed, according to estimates of an interdepartmental study, an incorporation of 10% of cassava flour in the bakers' flour would involve an additional demand for fresh cassava of 75,000 tons per year.

Regional export of attiéké. The regional market opportunities for dehydrated attiéké are estimated at 3,000 tons per year. It is therefore a considerable outlet for national cassava production. However, conquering these market prospects requires some investment efforts. It is in particularly important to offer to SME/SMI and micro-enterprises some competitive technologies.

Starch. The potential of the domestic starch market is approximately 3,200 tons of native starch a year, which is equivalently of 15000 tons of fresh cassava. Most of the starch used by local industry is provided by the imports and the share of the local transformers remains almost zero. The import price of the kilogram of starch (CIF Abidjan) lies between 329 and 861 FCFA.

Animal feed. Ivory Coast has an emerging modern livestock sector and numerous commercial farms. The related feed requirements are an interesting opportunity for the cassava sector.

5. Development paths to be privileged

The main opportunities for cassava in Ivory Coast are:

a) The presence of relatively well-developed agro-food and feed sector, as potential client for HQCF;
b) The presence of a large number of commercial farms that are potential users of cassava-based feed ;
c) The presence of two strong institutional actors: I2T and CSRS.

The development of cassava in Ivory Coast must take into account broadly all discussed aspects. It is however possible to undertake specific actions in a separate way. The actions to be undertaken could be:

- Encouraging the production through the popularisation of new cultivars made available by agronomic research centers such as CNRA and CSRS;
- Promote the consumption of cassava products by the urban population
- Carrying out efforts for launching new technologies adapted to the capacities of SME/SMI and micro-enterprises undertaken in order to produce a line of cassava based processed goods

References

Assanvo, B. J. (2000), Enquête de consommation et de production d'attiéké réalisées à Abidjan, Dabou et Jacqueville. Rapport de recherche, Centre Suisse de Recherche Scientifique, Abidjan.

Dao, D. (2004), Rentabilité comparative de la culture du manioc et analyse de la filière dans la région d'Abengourou. Rapport de recherche, Centre Suisse de Recherche Scientifique, Abidjan

Diallo, S. S. (2000), Déterminants socioéconomiques de la décision de commercialisation et de la contribution du manioc au revenu des producteurs en Côte d'Ivoire : une analyse économique à partir des données de l'étude COSCA. Memoire de DESS en Economie Rurale. CIRES, Abidjan

Pokou, K. (2004), Analyse économétrique de la demande des traits caractéristiques des produits de manioc en milieux urbains de Côte d'Ivoire : cas de l'attiéké, Rapport de Recherche, CIRES, Abidjan

République de Côte d'Ivoire (2002), Mise à jour et finalisation des travaux du schéma directeur de développement industriel (SDI) : Etude relative aux transformations agro – industrielles. Opportunités de transformation agro-industrielles et analyse de compétitivité, Filières féculents. Ministère de l'Industrie et de la Promotion du Secteur Privé. Abidjan

Scott, G. J; Rosegrant, M. W. and Ringler, C. (2000), Roots and Tubers for the 21st century : trends, projections and policy options. Food, Agriculture, and the Environment, Discussion paper 31, IFPRI, Washington.

Sylla, K. ; Diarra, I.; Diallo, S. S. and Troupa, G. F. (2004), Technical efficiency of yam and cassava producers analysis in Côte d'Ivoire using a multi-product DEA model, Paper prepared for Agricultural Economics Society, London, may 2004.

Sylla, K. ; Koné, M. ; Dibakala, G. M. et Diallo, S. S. (2002), La coordination des chaînes de commercialisation des produits alimentaires en Côte d'Ivoire et en Afrique de l'ouest centrale. Rapport de recherche, CIRES, Abidjan.

ANNEX 4A

Table A1 : Earnings from the sale of 1 ha of cassava in a tradition and modern marketing channel

	Mean
Average yield (truck)	7.00
Average weight of a truck (kg)	2500
Total weight	17500
Hypothesis I : NESTLE purchase	
Unitary price (FCFA / truck)	350000
Gross income (cassava)	350000
Total gross income (including groundnut income)	400000
Hypothesis II : Other purchase	
Unitary price (FCFA / truck)	48000
Cassava income	336000
Groundnuts income	50000
Total gross income (including groundnut income)	386000
Gross margin	
Hypothesis I	74903
Hypothesis	60903

Source : Dao, 2004

Table A2 : Attiéké cost structure (for 100 kg of fresh cassava)

Items	Average
I Production value (FCFA)	4355.15
Output (attiéké in kg)	46.80
Producer's price	93.71
II Variable costs (FCFA)	3898.97
Raw materials	2843.20
Grinding and other inputs	442.20
Packaging	65.57
Transportation	233.80
Labour	307.00
III Fixed costs (FCFA)	120.60
Equipment	120.60
IV Cost price of 1 kg of attiéké	85.89
V Gross margin	335.58

Source : Own calculations

Table A3 : Costs and margin of a processing unit for cassava flour production (Capacity: 50 tons of fresh cassava per day or 2,500 of flour)

	Costs (FCFA/kg)		%
Flour sales price (at factory level)	275.0		
Processor's net margin		122.3	
Dumping	26.98		17.7
raw materials (Cassava roots)	25.00		16.4
Lubricant	0.22		0.1
Electricity	29.52		19.3
Gas	18.6		11.8
Water	13.30		8.7
Maintenance – repair	10.28		6.7
Manager / production chief	4.80		3.1
Labour for production	4.80		3.1
Labour for collection and marketing	1.32		0.9
Administration	2.40		1.6
Financial fees	12.06		7.9
Packaging (plastic sachets of 5kg)	4.00		2.6
Total costs (by kg of fresh cassava)		152.7	100.0

Source : Côte d'Ivoire, 2002

Table A4 : Costs and margin for a fresh attiéké processing line (184 tons per year)

POSTE	Coût (FCFA/kg)		%
Fresh attiéké sales prices	200.0		
Processor's net margin		64.6	
Dumping	11.49		8.5
raw materials (Cassava roots)	25.00		18.5
Lubricant	0.75		0.6
Electricity	12.25		9.0
Gas	5.02		3.7
Water	2.96		2.2
Maintenance – repair	3.24		2.4
Manager / production chief	8.33		6.2
Temporary personal	12.50		9.2
Manager	11.11		8.2
Financial support (2)	8.89		6.6
Employees (5permanents)	16.67		12.3
Cassava transportation fees to factory	5.25		3.9
Financial fees	5.91		4.4
Sac trade – packing fresh attiéké (plastic sachets of 5kg)	6.00		4.4
Cost price		135.4	100.0

Source : Côte d'Ivoire, 2002

Table A5 : Costs and margin for a small scale starch processing unit (Capacity: 5 tons of cassava per day ; or 175 tons of starch per year)

Poste	Costs FCFA/kg	%
Starch price selling (factory level)	375.0	
Processor's net margin	151.6	
Dumping	29.9	13.0
raw materials (Cassava roots)	25.0O	11.2
Lubricant	0.79	0.4
Electricity	43.31	19.4
Gas	0.00	0.0
Water	14.0	6.3
Maintenance – repair	8.04	3.6
Manager / production chief	35.09	15.7
Labour for production	28.07	12.6
Labour for collect and marketing	6.43	2.9
Administration	14.04	6.3
Financial fees	15.51	6.9
Sac trade – packing fresh attiéké (plastic sachets of 5kg)	4.00	1.8
Cost price (per kg of starch)	223.4	

Source : Côte d'Ivoire, 2002

Table A6 : Costs and margin for a dried attiéké processing unit (200 tons per year)

Poste	Costs in FCFA/kg	%
Dried attiéké selling price (factory level)	500.0	
Processor's net margin	215.2	
Processor's net margin	40.63	14.3
Dumping	25.00	8.8
raw materials (Cassava roots)	24.36	8.6
Lubricant	71.54	25.1
Electricity	3.16	1.1
Gas	15.35	5.4
Water	8.91	3.1
Maintenance – repair	26.74	9.4
Manager	11.88	4.2
Administration	9.51	3.3
Employees (5permanents)	17.83	6.3
Cassava transportation cost to factory	5.61	2.0
Financial fees	18.68	6.6
Sac trade – packing fresh attiéké (plastic sachets of 25kg)	5.60	2.0
Cost price	284.8	100.0

Source : Côte d'Ivoire, 2002

Table A7 : Costs and margin for a dried attiéké processing unit (1 dried attiéké ton per day)

	Costs in FCFA/kg		%
Dried attiéké selling price (factory level)	500.0		
Processor's net margin		170.7	
Processor's net margin	10.44		3.2
Dumping	200.00		60.7
raw materials (Cassava roots)	5.11		1.6
Gas	60.81		18.5
Maintenance – repair	3.16		1.0
Technician / production chief	7.58		2.3
Temporary employees	2.27		0.7
Manager	10.10		3.1
Administrative assistant	8.08		2.5
Employees (2permanents)	6.06		1.8
Attiéké transportation cost to factory	4.77		1.4
Financial fees	5.36		1.6
Sac trade – packing fresh attiéké (plastic sachets of 25kg)	5.60		1.7
Cost price		329.3	100.0

Source : Côte d'Ivoire, 2002

Table A8: Evolution of fresh cassava price in Abidjan (FCFA/kg, wholesale, 1988 – 1999)

Year	January	February	March	April	May	June	July	August	Sept.	October	November	December	Total
1988	42	43	39	39	50	41	38	37	36	31	32	33	38
1989	32	30	34	36	34	34	35	34	31	30	30	32	32
1990	32	33	35	40	39	42	39	43	41	43	42	44	39
1991	38	37	42	40	44	47	44	51	54	50	44	41	44
1992	55	45	47	46	48	50	52	50	47	49	48	47	48
1993	43	48	65	62	38	45	44	43	43	42	45	42	46
1994	45	43	46	50	42	39	38	41	42	47	41	46	43
1995	56	54	48	57	56	62	78	75	68	70	76	79	65
1996	75	73	77	54	68	81	96	82	72	82	69	73	74
1997	76	75	60	71	81	81	77	71	69	75	74	68	73
1998	79	100	85	82	126	104	93	105	95	98	80	87	95
1999	79	81	76	79	69	65	77	58	55	57	59	45	67
Total	53	54	54	54	58	56	57	56	54	54	52	51	54

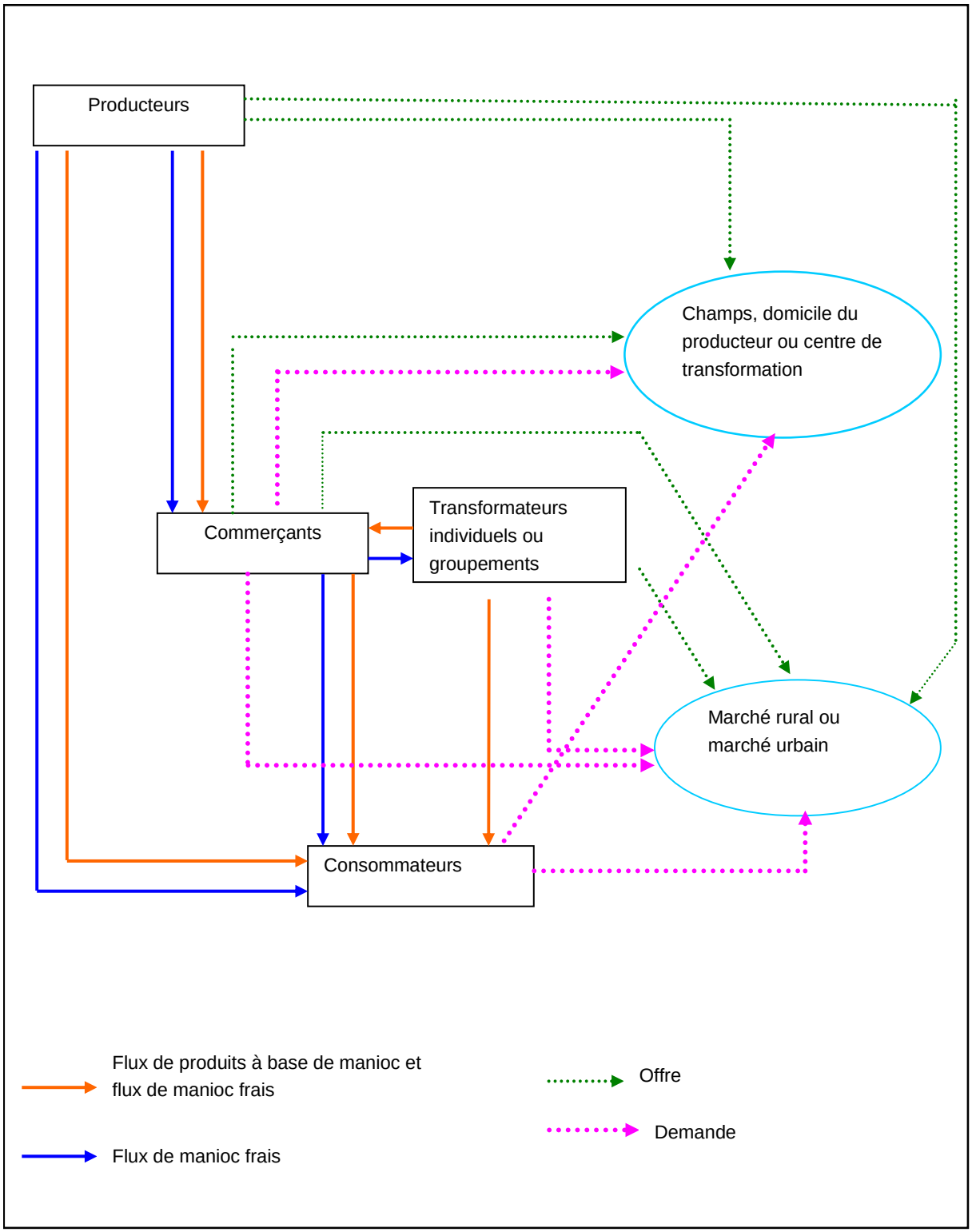
Source : OCPV

Table A9: Evolution of the fresh cassava price in Abidjan (FCFA/kg, retail, 1988 – 1999)

Year	January	February	March	April	May	June	July	August	Sept.	October	November	December	Total
1988	103	101	114	114	101	104	101	103	84	81	75	83	97
1989	75	66	71	70	76	92	78	92	73	85	71	81	77
1990	88	90	98	100	103	128	93	96	85	88	93	78	93
1991	57	84	61	95	95	101	95	90	93	88	86	82	85
1992	85	86	84	89	88	101	97	89	93	84	89	90	89
1993	84	85	85	85	77	88	99	81	89	93	83	86	86
1994	92	91	107	113	118	106	97	95	94	92	107	109	101
1995	118	107	102	118	118	144	118	136	108	148	129	170	127
1996	226	159	121	111	139	140	143	130	116	124	119	91	134
1997	121	127	91	86	108	156	128	98	116	123	120	117	115
1998	165	139	178	191	206	162	153	191	117	190	125	111	166
1999	161	141	138	138	118	107	117	82	108	88	101	84	115
Total	114	105	104	109	112	117	108	107	97	103	98	96	106

Source : OCPV

Graphique A1 : Circuits traditionnels de commercialisation du manioc et des produits dérives



Source : Diallo, 2000

Annex 4B – Programme of the identification & formulation mission CFC RIAS/WUR

Meetings in Ivory Coast: 11 – 19 October 2005 by Dr Diallo Souleymane, economist, CIRES, Abidjan

MEETINGS					
Date	**Heure**	**Nom et Prénoms**	**Function**	**Structure**	**Contact**
11/10/ 2005	9 H 30 - 11H	M. YEO Guéfala	Direction Général	Société Ivoirienne de Technologie Tropicale (I2T)	04 BP 1137 Abidjan 04 (RCI), Tel : (225) 21 27 90 50 / (225) 21 27 90 51 / Fax : (225) 21 27 90 49, Email : yeoguefala@yahoo.com
		M. MALAN Michel			
20/10/ 2005	9H30 – 11H	M. AKA Désiré	Formateur, spécialiste manioc		
12/10/ 2005	10H00 - 11H30	M. KONE KEMIEN Alain	Responsable Administratif et financier	Association pour le développement des Cultures Vivrières Intensives (ADCVI)	Abidjan, Cocody deux plateaux Rue de l'ENA, 28 BP 840 Abidjan 28, Fax : (225) 22 41 52 67 , Tel (225) 22 41 58 31: (225) 07 56 29 86, Email : adcvi@afnet.net
12/10/ 2005	13H - 14H	Mme KIPRE	Commerçante individuelle	Privé indépendant	Abidjan, Cocody Cité des Arts, Tel : (225) 07 72 81 78
12/10/ 2005	16H00 - 17H30	M. KOLOH Bamba	Opérateur/ transformateur	Privé indépendant	Toumodi, Côte d'ivoire, Tel : (225) 05 84 00 42/ (225) 08 40 79 18, 01 BP V32 Abidjan 01.
13/10/ 2005	8H00 - 10H00	Justine Assonvo	Chercheur	Centre Suisse de Recherche Scientifique (CSRS)	Centre Suisse de Recherche Scientifique, B.P. 1303 Abidjan 01 (Côte d'Ivoire), Tel : (225) 23 47 27 97, Fax : (225) 23 45 12 11. Site Web : http://www.csrs.ci
		Hyppolyte KOUADIO	Chercheur		
13/10/ 2005	11H 05- 12H00	M. KEI	Gérant	Entrepreneur individuel	Songon/ Kassemblé, Côte d'Ivoire, Tel : (225) 07 74 83 45
	12h14 – 13h	Mme NANDJUI	Productrice Ebrié d'attiéké	Productrice individuelle d'attiéké	Songon, Yopougon
14/10/ 2005	14H30 - 16H30	N'Goran ASSOUMOU	Chef d'exploitation	Association pour le Promotion des Exportations de Côte d'Ivoire (APEX-CI)	Association pour le Promotion des Exportations de Côte d'Ivoire, 01 B.P. 3485 Abidjan 01-Immeuble CCIA 3ème étage, Tel (225) 20 21 75 74/20 31 57 00, fax :(225) 20 21 40 31. Site Web : http://www.apexci.org

		Christophe KOUAME	Chef de cellule coopération internationale	Centre National de Recherche Agronomique (CNRA)	Contacts : Centre National de Recherche Agronomique, Adiopodoumé km 17, route de Dabou , 01 B.P. 1740 Abidjan 01 (Côte d'Ivoire), Tel (225) 23 47 24 24, fax :(225) 23 47 24 11. Site Web : http://www.cnra.ci
19/10/ 2005	10h00 - 13H00	Boni N'ZUE	Sélectionneur manioc		
19/10/ 2005	15H00 - 16H00	Daouda DAO	Coordonnateur	Centre Suisse de Recherche Scientifique (CSRS)	Contacts : Centre Suisse de Recherche Scientifique, B.P. 1303 Abidjan 01 (Côte d'Ivoire), Tel : (225) 23 47 27 97, Fax : (225) 23 45 12 11. Site Web : http://www.csrs.ci