DRAFT

ACTION PLAN FOR A CASSAVA TRANSFORMATION IN NIGERIA

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1. EXECUTIVE SUMMARY

Cassava production in Nigeria is increasing at 3% every year but Nigeria continues to import starch, flour, sweeteners that can be made from cassava. This paradox is due to how cassava is produced, marketed, and consumed in Nigeria, in a largely subsistence to semi commercial manner. To fully exploit cassava's immense potential, especially as a replacement of imported raw materials and as an export commodity, there is a need to change how cassava is grown and traded in the country using a value-chain development approach. Nigerian cassava-based industrial products are just a fraction of imports, and the growth potential is huge.

A Cassava transformation that builds upon previous two efforts has been embarked upon under the Agricultural Transformation Program of President Goodluck Jonathan and implementation by the Honorable Minister of Agriculture, Dr Akin Adesina. The cassava transformation seeks to create a new generation of cassava farmers, oriented towards commercial production and farming as a business, and to link them up to reliable demand, either from processors or a guaranteed minimum price scheme of the government. The overarching strategy of the cassava transformation is to turn the cassava sector in Nigeria into a major player in local and international Starch, Sweeteners, Ethanol, HQCF, and dried Chips industries by adopting improved production and processing technologies, and organizing producers and processors into efficient value-added chains.

Implementation of the value-added chain activities will be driven by the private sector with support from the public sector. A Cassava Market and Trade Development Corporation (CMTDC) will be established as the primary vehicle for implementation of value-added chain activities. Primary activities of CMTDC are market development, including advocacy with potential users of cassava-based products and policy makers, to ensure reliable demand. From the public sector, the Federal, State, Local governments, and NGOs will organize and train farmers in modern production methods, and disseminate to them improved varieties and inputs required to grow them.

Experience from around the world has shown that crop campaigns to raise productivity require a close partnership with research and development of enabling technologies. The transformation plan will invest significantly in the development of improved production methods, new varieties, disease and pest diagnostic surveys, and the development of novel cassava products. The transformation plan will support the production of high starch and early varieties – 8-10 month crop –, and varieties with increased nutrition to enhance health status, especially children, of consumers.

Expected impact includes the creation of one million jobs, half on-farm and half of-farm, and increase a US$450 increase in the income of 1.8million cassava farmers from an increase in

average productivity of 12.5ton/ha to 25ton/ha and the creation of strong supply chains to the industry.

2. PROGRAM PROFILE

TITLE: ACTION PLAN FOR A CASSAVA TRANSFORMATION IN NIGERIA

GOAL: To increase income by at least US$400 every year in 1.8million farm families and to add a million jobs to the Cassava Sub-Sector in Nigeria through a doubling of production, processing, and marketing of cassava in the cassava growing belt of Nigeria over a period of four years

OBJECTIVES:

1. Link demand for cassava-based products in the industrial, export, and traditional food sectors to reliable supply by an introduction of a package of improved production, supply chain management, favorable policies, and advocacy with end-users.
2. Raise productivity through the demonstration and adoption of improved production technologies by clusters of farmers and the establishment of a network of agro dealers to supply the needed inputs of: fertilizer, stem cuttings of improved varieties, and herbicide.
3. Build around farm clusters market institutions for the long term sustainable development of the cassava sector through the establishment of a Cassava Market and Trade Development Corporation (CMTDC).
4. Implement government policies that incentivize use of cassava for import substitutions and create input markets by working closely with the Ministries of Agriculture, Finance, Commerce and the National Assembly.
5. Continually monitor and evaluate progress to identify the most promising interventions for continuous improvement of strategies to reach the end goal.

EXPECTED OUTPUTS:

1. Strong value added chains of starch, HQCF, sweeteners, dried chips, high quality garri, and fuel ethanol in Nigeria.
2. A doubling of average cassava productivity from 12 to 25 ton/ha in target clusters by 2014.
3. Generation of one million jobs in the rural areas of Nigeria over the next four years of the program.
4. An increase in income of 1.8 million participating farm families by US$450 every year.
5. Strong market institutions establish for long term sustainability of the cassava sub-sector.

TIME-LINE: 4 years

BUDGET SUMMARY: NGN 4,190,490,000 (tentative, in preparation)

3. INTRODUCTION

Background

Cassava has played and continues to play a remarkable role on the agricultural stage of Nigeria. Since its debut in the late 1600s on Portuguese trade ships from Brazil into Nigeria, it has gone from minor crop to a major crop that accounts for between 40-50% of all calories consumed in Southern and Central Nigeria (Maziya-Dixon 2001). Nigeria is the world's largest producer of cassava. Its current production was estimated in 2009 to be 36.8 million metric tons (FAOSTAT 2010). Total area harvested in 2009 was 3.13 million ha, with an average yield of 11.7 t ha–1 (FAOSTAT 2010). It is produced predominantly (99%) by small farmers with 1-5 ha of land intercropped with yams, maize, or legumes in the rainforest and savannah agro-ecologies of Southern, Central, and lately Northern Nigeria.

Systematic interventions in the cassava sector began in the early 1980s with the introduction of high yielding, early bulking varieties resistant to the cassava mosaic disease (CMD) and cassava bacterial blight (CBB), produced at the International Institute for Tropical Agriculture (IITA) in the 70s', and the establishment of small-scale processing facilities. These two key interventions increased profit margin for producers and processors alike and drove down prices of cassava food products for the rural and urban consumer. "The cassava transformation", as the rapid increase in production and marketing has been termed, spun an entire food industry and transformed the crop from a rural subsistence crop to a cash crop and urban food staple (Nweke et al. 2001).

The second wave of cassava transformation began with the Presidential Initiative on Cassava, started in 2003. The initiative sought to position cassava as a commodity crop and foreign exchange earner, beyond its traditional role as a food crop. A number of projects were embarked upon to build flour and sweetener processing factories in the country. Increased productivity of cassava by small scale farmers in Nigeria was addressed via the production and dissemination of over 100 million bundles of certified stock of improved cassava varieties over a period of three years, and a fast-track farmer participatory selection of new varieties.

Multiplication centers were established across the country to facilitate farmer access to improved cassava varieties. Local fabricators were trained by the National Centre for Agricultural Mechanization (NCAM) and other relevant agencies to build and sell thousands of grating, de-watering, and drying machines. Six farm-gate primary processing Centers for training extension and farmers in production of cassava flour, chips and pellets were established. State extension personnel were also trained in improved production technologies. The Presidential cassava initiative raised the profile of cassava in Nigeria and demonstrated the immense potential of the country to increase production within a short time; in 2006, cassava production rose as high as 45million metric ton, up from 35million tons when the program started in 2003. Two large

cassava flour mills and 136 small mills were also established in the country during the same period.

More recently, two projects financed by the USAID and Netherlands' Directorate General for International Cooperation (DGIS) have sought to build cassava value-added chains for starch, sweeteners, and high quality cassava flour (HQCF). The USAID funded project, Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites (MARKETS) was started in 2005 to partner credible cassava processors with smallholder farmers to develop efficient value added chains for starch and sweeteners in Nigeria. The project also introduced best farming practices to lower production costs. In Ondo state, MARKETS is partnering with MATNA Nigeria Limited, one of the two large starch mills in the country, and in Ogun State, MARKETS is working with EKHA Agro, the only cassava-based sweetener processing plant in Nigeria to build robust supply chains. A computer-based system called the Cassava Supply Management System (CSMS) was designed to coordinate production, harvesting, and collection of cassava from a network of approximately 400 farms per processing plant, enabling these plants to reach 60-80 percent of processing capacity in five years.

The second project, Cassava +, was launched by the International Fertilizer Development Center (IFDC) and Dutch Agricultural and Trading Company (DATCO) with funding by the Netherlands' Directorate General for International Cooperation (DGIS). The three year project has as mission to shift cassava from a subsistence crop to a cash crop and is working with farmers to supply raw materials for high quality cassava flour (HQCF) in Taraba, Kwara, Kogi, Osun, and Rivers States. The projects hopes to increase productivity of 160,000 farm families by developing sustainable and productive cassava and rotation cropping systems and linking them to reliable demand via DATCO. In addition the project seeks to develop agro-dealers and other farm service providers and link them with participating farmers.

Cassava transformation under the Agricultural Transformation Program of President Goodluck Jonathan and being implemented by the Honorable Minister of Agriculture, Dr Akin Adesina, seeks to build upon the gains in all aforementioned efforts. The new cassava transformation will drive development in the cassava sector through value-addition to realize opportunities that exist in the industrial and export sectors for cassava. The plan will build market and production support around farmers and processors by tackling existing technical and policy challenges.

The Opportunity

Cassava, in its processed form, is a reliable and convenient source of food for tens of millions of rural and urban dwellers in Nigeria. It is estimated that more than 90% of cassava production is processed into food (Nweke et al. 2001; Philip et al, 2006). But a significant industrial demand exists for cassava, primarily as substitution for imported raw materials and semi-finished

products. There is a potential demand of 250,000 ton/year in the High Quality Cassava Flour (HQCF), primarily from 10% replacement in bread flour and for use in bouillon, noodles, and the adhesive industry (dextrins); a demand equivalent of 1.15 million tons of fresh roots. Similarly, demand for native and modified starches exceeds 230,000 tons/year in the food, paint, and pharmaceutical industries, another million tons of fresh roots. In the sweetener industry, an annual demand of 150,000 tons exists for high fructose syrup, as part replacement for imported sugar, and 40,000 tons/year for glucose (40,000ton/year); this requires an additional 950,000 tons of fresh roots.

The dried cassava chips value-chain has a potential demand of 900,000 tons per annum with 300,000 tons going to the regional food market, an estimated 80,000 tons/year to the local animal feed market, and 520,000 tons destined for the China export market. The dried chips markets requires 3.4 million tons of fresh roots. Lastly, Nigeria has adopted the policy of blending gasoline with 10% ethanol, the E-10 policy. These represent a potential one billion liter per year market for fuel ethanol and, a potential demand of 2.3 million tons of fresh roots, assuming 50% of feedstock of E-10 comes from cassava. Cassava, Sugarcane, and sweet sorghum are currently the most economic feedstock for fuel ethanol production in Nigeria but cassava is by far the most widely grown (NNPC 2011).

Garri is a widely consumed Nigerian food; an estimated 4.2 million tons were produced in 2009 (NBS 2010). However, poor packaging and inconsistent quality limits Nigeria's participation in lucrative export markets in North America and Europe targeted at West Africans in the diaspora, and from large supermarkets. Where garri has been packaged well and is of good quality, it finds a ready market in large supermarkets patronized by middle class Nigerians and beyond the shores of the country. The size of the high quality garri market is estimated conservatively to be 455,000 tons/ per year, 65,000 tons from export to the diaspora and 390,000 demand from super markets, equivalent to 2.73 million tons of fresh roots per year. Combined, opportunities for cassava in the industrial, export, and retail industries comes to 12.7 million tons of fresh roots from 510,337 ha of land; creating over a million jobs (Table 1).

Table 1. Estimated demand of cassava in the industrial and export markets, acreage required and estimated number of jobs created (assumes one direct job per hectare for production and one direct job in the processing and other downstream sectors)

Value-Added Chain	**Estimated Demand**	**Fresh root equivalent to meet estimated demand (metric tons)**	**Acreage required (25ton/ha)**	**Number of Job created (one direct job on-farm per ha and one off-farm)**
Starch	230,000 tons	1,150,000	46,000	92,000
Flour	250,000 tons	1,000,000	40,400	80,000
*Sweeteners	190,000 tons	950,000	38,000	76,000
Dried chips for export and animal feed	900,000 tons	3,360,000	134,400	268,560
**Fuel Ethanol (E-10)	0.5 billion liters	3,571,428	142,857	285,714
High quality garri for export and supermarkets	455,000 tons	2,730,000	109,200	218,400
Total		**12,758,429**	**510,337**	**1,020,674**

*Assumes 50% replacement of imported sugar in the Sweetener industry
**Assumes 50% from cassava as feedstock

The Challenge

Thailand is the largest exporter of cassava products, exporting a little under US$1billion of cassava products in 2009, and has efficient cassava value-added chains. A comparison of the Nigerian and Thai cassava sectors reveals the Nigerian cassava sector is plagued by low productivity; average yields are 11.7ton/ha, compared to 22tons/ha in Thailand (Table 2). Thai cassava yields have increased at an average of 1.7% every year in the last 15 years while yields in Nigeria have stagnated (FAOSTAT 2010). Low productivity leads to high costs per unit production, costs of root production per ton is US$10 per ton higher in Nigeria than in Thailand, and an inability of Nigerian cassava products to compete with imported substitutes leading to a lack of demand for cassava by industrial users who prefer to import raw materials. Higher productivity in Thailand is mostly due to higher incidence of fertilizer use and mechanization. There is little or no use of chemical fertilizer in cassava production in Nigeria and farming is by manual labor, especially weeding, which is a major cost of cassava production. In Thailand, weeding is done by hand-controlled tractor (cultivator) or herbicide.

Table 2. Characteristics of cassava production in Nigeria and Thailand

	Nigeria	**Thailand**
Cassava production ('000t) 2009	36,804	30,088
Cassava harvested area ('000ha) 2009	3,126	1,326
Cassava Yields (t/ha) 2009	11.7	22.7
Utilization - Main	Garri (60%)	Starch - native and modified (40%)
-Major other uses	Fufu (20%) Lafun (10%) Tapioca - 5% Starch- native (3%) Animal feed (2%)	Fuel Ethanol (20%) Chips/pellets (40%)
Farm Size (ha/Farm)	1-2	4-5
Cassava area (Ha/farm)	0.5-1	2-3
Crop System (%) - monocrop	10	95
-intercrop	90	5
Time of Planting	Apr-June	Apr-May
Land Preparation	Manual/tractor	Tractor
Weed control	Manual	Tractor/herbicide/manual
Fertilization -organic	none	medium
-chemical	very little	medium
Labor costs (US$/day)	3-4	4-5
Production costs (US$/ha)	450-900	650-800
Production costs (US$/t fresh roots)	37.99	28.68

Sources: FAOSTAT 2009; IITA cassava handbook; Reinhardt Howeler (CIAT, Bangkok), TTDI

The Thai cassava sector is dominated by large processors that require 10-30tons of fresh roots per hour and have therefore established efficient supply chains. The principal users of cassava in Nigeria, about 70% every year, are village-level garri processors that require limited quantities of fresh roots per day. Large processing plants in Nigeria who need larger quantities are faced with high transaction costs, of collecting small amounts of cassava over a large area with bad roads, and adversarial relationships between the producer and processor. These processing plants therefore operate below capacity while a significant percentage of farmers are left with unsold harvest.

Nigerian cassava farmers produce for an inelastic food market. This leads to wide swings of prices every other harvest, in the absence of a minimum price guarantee schemes by government. For example, the price of a ton of cassava in 2007 was N5,000-N6,000 in central Nigeria due to overproduction, partly in response to an appeal to farmers by the last Presidential cassava initiative to increase cassava production for new markets of high quality cassava flour, starch, and chips, markets that were only partly achieved. Because of the depressed prices, many farmers switched to other crops and production output fell. By March and August 2009 cassava sold at farm gate in most of central Nigeria for N12,000 – N15,000 per metric ton; given the good prices many farmers went back to cassava production, leading to an overproduction. In 2011 cassava roots are selling for between N5,000 – N8,000 a ton; essentially completing the burst-boom cycle of cassava that occurs every three years; cassava in Nigeria is a 15-18 months harvest and two crop cycles is 3 years.

Other challenges are policy inconsistencies, for example a lack of enforcement of the 10% inclusion of cassava flour in bread flour has left two large and hundreds of small processors with unsold inventories and farmers with nowhere to sell their cassava harvest. Additional policies are needed to create reliable demand and help strengthen cassava value-added chains still very much in its infancy. They include: provision of incentives for users of cassava products, cash back incentives to exporters, and a levy on imports of competing products. Lastly, government policies that ensure reliable supply, such as fertilizer availability and the credit to farmers to purchase the fertilizer also need to be promulgated.

Overview of a Plan to develop the Nigerian cassava sub-sector

The overarching strategy of the cassava transformation is to turn the cassava sector in Nigeria into a major player in local and international Starch, Sweeteners, Ethanol, HQCF, and dried Chips industries by adopting improved production and processing technologies, and organizing producers and processors into efficient value-added chains. The strategy consists of two pillars:

1. Incentivize the formation of clusters of farmers around small and large scale processing factories and disseminate to them improved production packages to increase productivity.
2. Ensure farmers a market for their cassava roots via the creation of effective supply chains to existing cassava processing factories, and establish factories. Also, establish a guaranteed minimum price scheme with government as buyers of last resort.

A key part of the cassava transformation plan is organizing farmers into clusters of 5-50 ha for ease of mechanization, adoption of improved technology, and coordination of supply. A rapid survey of the cassava sector will be conducted to identify locations of processing and production.

Following, farmers will be invited to organize themselves into clusters, to facilitate acquisition of modern method of cassava production, in exchange for access to inputs, training, and a guaranteed market. Farmers will receive training, prior to and during planting, in crop management and integrated soil fertility management (ISFM) practices that they have been are specific to their locations. Lastly, working with the Growth Enhancement Support program of the Federal Ministry of Agriculture, key input agro dealers will be identified and linked to farmer groups. Financing for farmer groups and processors will be through the Nigeria Incentive-based Risk sharing for Agricultural Lending (NIRSAL).

The action plan will concentrate on import substitution for high value products that can be made from cassava like HQCF, starch and sweeteners, while positioning itself to take advantage of opportunities in the export sector. To successfully use cassava as substitutes for imported industrial raw materials, the Nigerian cassava value-added chain has to compete with the corn starch and corn sweeteners, from the US and Brazil, and with wheat flour from the US that are produced with reliable electricity, water, government subsidies, guaranteed price, and have highly efficient supply chains for evacuating the product. Cassava value chains in Nigeria will have to evolve efficient production and processing capabilities in regions with good infrastructure, the staple crop processing zones (SCPZ), and backed by policies that help it compete.

Policy interventions to support the industry include: market policies, such as 10% Cassava Flour substitution for bread wheat flour and blending and 10% ethanol in petrol (E-10), and fiscal policies, including tax holidays for investors putting processing plants in staple crop processing zones (SCPZ). Other policies include increased import levies on commodities that Nigeria can produce, for example starch, sugar and wheat flour, incentives for investors establishing blending plants for ethanol, and guaranteed minimum price for cassava products.

Roles and responsibilities will be defined for the public and private sectors. A Cassava Trade and Marketing Development Corporation (CTMDC) run by the private sector will build market institutions around farmers. The Federal ministry of agriculture will be responsible for technology development and transfer, in collaboration with State governments and non-go government organizations, who will provide extension support.

Experience from around the world has shown that crop campaigns to raise productivity require a close partnership with research and development of enabling technologies. The transformation plan will invest significantly in the development of new varieties, improved production methods, disease and pest diagnostic surveys, and the development of novel cassava products. The transformation plan will support the production of high starch and early varieties – 8-10 month crop –, and varieties with increased nutrition to enhance health status, especially children, of consumers.

Strategic applied research will be conducted to identify or develop improved agronomic practices for cassava, a combination of best varieties, fertilizer recommendations, cultural practices, and integrated pest and disease management (IPDM), as well as suitable crop rotations or crop/livestock production systems. Cassava has high disease and pest incidence roots. We have to stay a step ahead of the pests and diseases of cassava, we will build disease diagnostic and pest surveys into the R&D plan. Considerable effort will also be expended on novel products, for example cassava bread made with 100% cassava flour, that increase the overall profitability of the value added chain.

4. VISION OF SUCCESS AND OBJECTIVES

Within four years, an increase in cassava production by 12 million tons through intensification of production with yield increase from 11.7tons/ha to 25ton/ha on 510,337 ha of cassava clustered around large, medium, and small scale processing plants. By the end of this phase we will demonstrate a US$450 increase/year in income of one million rural farming households that produce cassava and a total increase of US$810 million/year contribution of the cassava sector to the country's GDP.

OBJECTIVES:

1. Link demand for cassava-based products in the industrial, export, and traditional food sectors to reliable supply by an introduction of a package of improved production, supply chain management, favorable policies, and advocacy with end-users.
2. Raise productivity through the demonstration and adoption of improved production technologies by clusters of farmers and the establishment of a network of agro dealers to supply the needed inputs of: fertilizer, stem cuttings of improved varieties, and herbicide.
3. Build around farm clusters market institutions for the long term sustainable development of the cassava sector through the establishment of a Cassava Market and Trade Development Corporation (CMTDC).
4. Implement government policies that incentivize use of cassava for import substitutions and create input markets by working closely with the Ministries of Agriculture, Finance, Commerce and the National Assembly.
5. Continually monitor and evaluate progress to identify the most promising interventions for continuous improvement of strategies to reach the end goal.

5. CASSAVA VALUE-ADDED CHAINS

High Quality Cassava Flour (HQCF)

High Quality Cassava Flour (HQCF) is produced by grating peeled fresh cassava roots, de-watering to a final moisture content of 35-45%, followed by drying in a flash dryer, and milling with a hammer mill. HQCF is used in 10% replacement of wheat flour in bread, in bouillon seasoning cubes, noodles, and in the adhesive industry (dextrins); the bulk of cassava roots that goes into HQCF production come from small holder farmers close to the processing plants. There are two large processors of HQCF in Nigeria, with installed capacity of >10,000 tons of flour per annum (>50ton/day), namely Thai farms and DATCO. They each have different supply chain models. Thai Farm International, with an installed capacity of 60t of HQCF/day (18,000t/year), buys roots directly from about 1,000 farmers, who deliver surplus cassava roots (as they produce mainly for home consumption) to their factory in Ogun State. Thai farms recovery rate is 27 to 28% (3.6 to1), which is due in part to the use of mechanical peelers and efficient raspers; they currently are working at 20 to 30% capacity, due to failure of wheat millers to purchase HQCF.

The second HQCF processor is DATCO; the company has developed a split processing technology for cassava consisting of wet processing at the farm level using an Automated Mobile Processing Units (AMPU) followed by drying and milling of the wet cassava cake at a central location (Figure 1). The company currently operates in Osun, Taraba, Rivers and Benue States. DATCO has a combined installed capacity of 40,000 ton of HQCF per year.

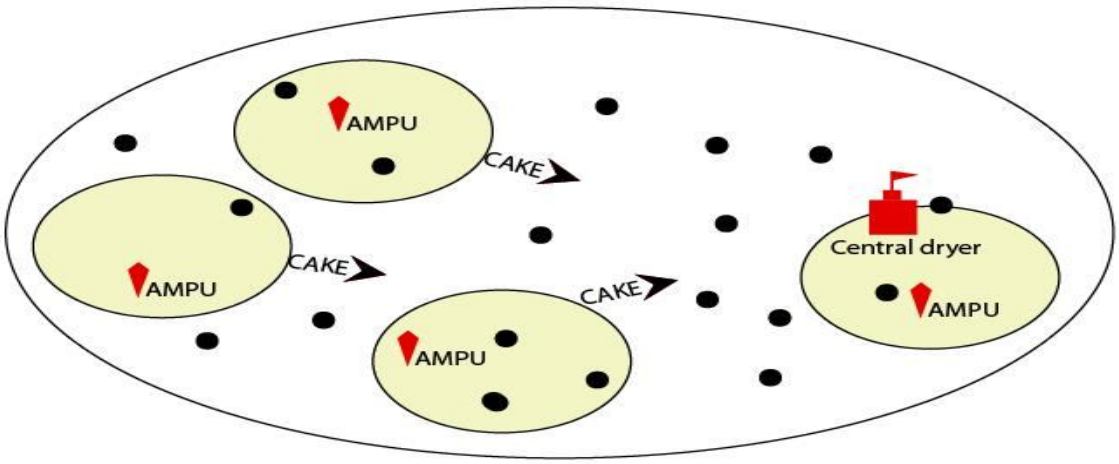

Figure 1. DATCO HQCF supply chain involving a mobile cassava processor, the Automated Mobile Processing Units (AMPU). It produces cassava cake - that is of high quality & with a shelf life of 5-7 days. The cake is transported by truck to a central dryer.

In addition to the two large mills, there is a medium sized mill, Godoligo farms located in Obudu, Cross River State, with an installed capacity of 5ton of HQCF per day or 1,500 tons/year. Godoligo farm obtains its raw materials from a 400ha nucleus cassava farm and 400 ha of out-grower farms. There are 103 small HQCF processing plants with a capacity of 1-2 tons/day. Eighty five of these SMEs are registered with the Nigerian Cassava Processors and Marketers Association (NICAPMA), an association of all cassava processors and marketers in the country. NICAPMA's 85 SMEs are spread all around the country (Table 4), and produce predominantly HQCF from cassava wet cake and cassava roots obtained from a network of farmers close to them. As of September 9, 2011, only 14 of these SMEs are currently functional and in operation due to a lack of purchase of flour by the wheat flour millers.

Table 4. Total number of SME HQCF Processing Plants in Nigeria and their installed capacity

S/N	**Geo-political Zone**	**Number of SME Factories (NICAPMA Members)**	**Installed Capacity as at September 2010 (ton/day)**
1.	North – Central	16	36
2.	South – West	51	122
3.	South – East	5	12
4.	South – South	13	34
	Total	**85**	**204**

Source: Received from NICAPMA by C: AVA (2011)

The principal challenge faced by the HQCF value-chain in Nigeria is the lack of enforcement of government policy on the 10% replacement of wheat flour with HQCF in bread. This has led to a collapse of demand for HQCF. Nigeria imports about 4 million ton/year of wheat; with a recovery rate of 75% for the production of wheat flour, an equivalent of 3 million ton of wheat flour/year. A total of 2.2 million ton/year is used for bread making; 500,000t for biscuits/snacks; and 300,000t for noodles. At a 10% replacement rate, this translates to 220,000 tons of HQCF for the bread making industry and another 50,000tons for biscuits, and 30,000 tons for noodles.

Other constraints facing the value-added chain include scattered nature of farm lands and poor road infrastructure that increases the transaction costs for supply of raw materials to HQCF processors, and the high cost of raw materials due to the low average yield per hectare on farmers' field, 8 – 11t/ ha. Low productivity is in turn due to poor access and late supply of

inputs, and lack of access to credit by farmers. On the processing side, there are quality issues with HQCF from SMEs; when HQCF is used as substitute in wheat flour quality specifications and compliance standards are high and requires an in-house laboratory to ensure each batch going to the flour mills meet the required standards. Another constraint is the lack of suitable mechanical peelers by SMEs that increases the cost of production.

A general problem for all sizes of HQCF millers is the high cost of diesel fuel to run the factories, due to erratic power supply, lack of working capital given that commercial banks shun the agricultural sector, and the low price offered by the flour mill that barely offsets production costs. While the ideal price for HQCF is N80/ Kg, flour millers offer less than this amount which makes it difficult for HQCF producers to break even.

Starch

Cassava starch is an important domestic and industrial raw material used in the manufacture of various products including food, adhesives, thickening agents, paper, and pharmaceuticals. It has many remarkable characteristics including high paste viscosity, high paste clarity and high freeze-thaw stability, which are advantageous to many industries. The Nigerian demand for starch is estimated at 230,000 tonnes per year; with 60,000 tons of starch used by Nestle and Unilever alone (UNIDO 2006). Of the 5 modern large-scale cassava starch factories existing in Nigeria, only two are in operation, Nigeria Starch Mill (NSM), Ihiala, with an installed capacity of 15,000 ton of starch/year and MATNA Starch mill, Akure, with installed capacity of 5,000 ton/year. In addition to these two large mills, there are hundreds of small village-level processors who produce starch around Warri in Delta State for food and other industrial non-food applications, such as for use in textile mills, plywood, cardboard, and in the paint industry.

The starch value-chain is characterized by difficulty in securing sufficient fresh roots to run the large mill at full capacity; both NSM and MATNA run at 40 and 60% capacity respectively. Currently, the MATNA mill works a single shift and sources cassava from 1,200 hectares of small holder farms located 650km from the mill. The plan going forward is to improve this supply by clustering 2,500-3,000 hectares of farms within 300km of the mill for a two shift operation. In the long term, the mill will operate three shifts using fresh roots from 4500-5000 hectares of cassava of which at least 2/3 is from within 300km. NSM on the other hand has a nucleus farm of 500Ha that meets roughly 20% of its raw material needs. The rest of its raw material comes from white Zimbabwean out grower farmers, some 700 km away in Shonga, Kwara state. Sourcing cassava from such a long distance adds N7,000 to each ton of fresh cassava roots.

A study of USAID MARKETS revealed commercial starch processors of Cassava need consistent volumes to be profitable. Solutions include The Cassava Supply Management System (CSMS), a database for managing supplier relationship, it includes: a system for planning

harvest; a record of deliveries for accounting; manages complex supplier network; efficient allocation of transport fleet; Standard Operating Procedures Developed: Harvest, Transport and Delivery.

Aside from the challenge of a consistent supply of fresh roots to feed the factory, starch value suffers from similar raw material production constraints of high transaction costs due to poor road infrastructure, high prices of raw materials due to low productivity and uncertain availability of inputs (stems, fertilizer and other chemicals as at when due). On the side of the mills, challenges include, high energy costs, loans and extension services to farmer groups, management of mills operations require more time to organize management of suppliers for optimum production.

Sweeteners

Cassava starch and HQCF can be used as raw material for sweeteners, primarily high fructose syrup (HFS), glucose, and sorbitol. Sweeteners are obtained by hydrolysis of cassava starch or flour or wet cake, to produce glucose, which is further purified to produce HFS or hydrogenated to produce sorbitol. One ton of starch yields 900kg of glucose, 550 tons of HFS (55% purity), and 1.1 ton of sorbitol (70% purity). The annual demand for these sweeteners in Nigeria is: 150,000 tons of HFS, as part replacement for imported sugar in the soft drink and juice industry, 40,000 tons/year of glucose, and 14,000 tons of sorbitol. The sweetener industry is a strong growth market that is expected to grow by 50% over the next ten years. Ekha Agro Nigeria Limited, is currently the only cassava processor, producing sweeteners, liquid glucose, from cassava for supply to Guinness PLC.

But the soft drink industry, specifically The Coca-Cola Company (TCCC) Nigeria, has recognized the viability of HFS from cassava as an alternative to sugar for beverage applications and has been in discussion with Thai Farms International Limited, a company based in Ogun State currently producing food and pharmaceutical grade cassava flour and intends to integrate to HFS production. Furthermore, some groundwork has been done by both Corn Products International and Cargill, who are global sweetener supply partners with TCCC. There is interest by both Cargill to set up HFS factories in Nigeria. These plants will supply TCCC. The implementation timeline will be in the range of 12 – 18 months, driven by ingredient approval, supplier approval, investment in storage and material handling infrastructure, ingredient integration and people & process capability development. TCCC Nigeria has offered to develop a road map in conjunction with a large processor interested in the development of sweeteners. Similarly, DATCO has an interest to produce Sorbitol in Nigeria to supply Unilever. DATCO is also in negotiations with two beer companies, SAB Miller and Heineken to establish glucose factories in Nigeria.

Dried Cassava Chips

Cassava chunks, produced by peeling and sun drying of storage roots is a major article of trade in Taraba, Benue, Nasarawa, Plateau and Kaduna states between the dry season months of December and March. In the mid-90s cassava chunks collection and warehousing was a very lucrative business in Nasarawa and Benue states when Nigerian Yeast and Alcohol Manufacturing Company Plc (NIYAMCO), Bacita was in active production of ethanol. Open Local Purchase Orders were issued to suppliers. At that time, an average of forty 911 Mercedes Benz trucks were loaded at Doma Market on daily basis, each carrying about 10 metric tons. When the company ran down, the market collapsed and threw many cassava merchants and cassava farmers into serious financial crises. In effect many jobs were lost as those who planted cassava, processed and stored the chunks entered into huge debits. The company has not come out of its problem till today.

There was another alcohol company called Albani in Lagos which has also run down. The major problem these companies faced was the importation of alcohol into Nigeria at the expense of local industries. The principal market for chips currently is the Dawanu Market in Kano, a major food stuff market serving the Sahelian West African region; cassava chips and chunks are traded as far as Niger, Chad, Central African, and Southern Sudan republics. An estimated 300,000 MT of chunks are traded every year. Animal feed millers, the other potential users of dried chips, have not adopted widely the use of chips for animal feeds. Grand Cereal and Oil Company based in Jos are the only feed millers that use cassava chunks. The total estimate used for animal feed is 80,000 tons of chunks.

An importer of dried chip from China has expressed interest in importing 520,000 tons of chips every year from Nigeria or 10,000 tons per week. This brings the total potential demand of chips and chunks to 900,000 tons per annum. Therefore to produce 900,000MT, a total of 3.36 million MT of cassava roots are needed. If the average yield/ha of cassava is 25 MT the area to be cultivated will be 134,280 hectares. If one cluster for the production of chips is about 120ha, 1,119 locations will be required. An estimated 268,560 jobs will be created. The only way chips from Nigeria can be competitive is to produce at a price that is cost effective for the producer, processor and exporter and to identify a cheap means of transport of dried chips from the hinterland to the ports and an elimination of all import tariffs at the ports in China.

The principal constraints of the dried cassava chip market is the low productivity of cassava, leading to high prices of dried chips, high transport costs, and lack of strong markets, as demonstrated by the wide swing in prices of dried chips due to oversupply by farmers at harvest and a lack of storage capacity. Over the course of a single year, a 100Kg bag of chips can be bought from farmers for as little as N2,000 and as much N3,000. At N3,000 per 100kg bag, this

translates to N30,000 per ton of which N6,000 goes to transport cost and a little above N5,000 per ton of fresh roots, assuming fresh roots make up 80% of the cost of dried chips and a conversion ratio of fresh roots to chips of 3.73. But at N20,000 per ton of dried chips, the cost of fresh roots falls to under N3,000 per ton which is not profitable for a producer.

Other constraints in the dried chips value-added chains and ways to resolve them include:

- Urgent and aggressive support for elimination of import tariffs for dried chips in China
- Increasing the capacity of third-party independent inspection organisation like SGS, Intertek, Bureau Veritas to conduct pre-shipment inspection to obtain Quality certificate, Quantity and weight certificate, which are required by the Chinese customs. At the moment SGS/Intertek.Nigeria is not functional and they do not have advanced equipment in Nigeria and can only conduct moisture content test.
- Creation of a window to interface with the key commodity association – NICAPMA; NICAPMA in collaboration with NAFDAC & SON should be used to ascertain quality and ensure compliance by all HQCF producers.
- Access to credit: majority of cassava farmers and processors live in areas that are resource-poor, highly heterogeneous and risk prone. Consequently, conventional financial institutions are not inclined to provide loans to these without collateral. There is a need to improve access of credit to farmers and processors. Credit could also be given out to farmers and processors through partnership with some NGOs that are involved in credit schemes using social collateral for loan disbursement.

Fuel Ethanol (E10)

At the instigation of the Federal Government of Nigeria, the Renewable Energy Division (RED) of the National Nigerian Petroleum Corporation (NNPC) began working in 2005 on a plan to develop a program to make ethanol in Nigeria from sugarcane and cassava, and biodiesel from palm oil. The goal of the program was the adoption of E10+ standards across Nigeria, a potential demand for fuel ethanol greater than 1 billion liters per annum, as well as significant market penetration by biodiesel. Given the potential of the E-10 program to create a huge market for cassava, detailed feasibility studies were completed for integrated cassava and ethanol plant projects, the results confirmed the assumptions of the benefits of the E-10 program were indeed correct. Although none of these studies have been implemented due to policy inconsistencies, the potential impact on the cassava industry is huge (Table 1)

Fuel ethanol can be produced by large >25 million liters per year plants or small 10,000 liters a year plants. Large scale ethanol plants are more energy efficient and require a large network of farmers to supply raw materials on a daily basis, some 1,000 – 2,000 tons of fresh cassava roots per day. Supply chains for fuel ethanol will require a new generation of cassava farmers who produce cassava as a full-time business. These farmers will be in the age bracket of 20 – 35

years, have a minimum of an OND or HND and will be linked up to technology, finance, and tractor hiring units. Average farm size will be a minimum of 10 hectares in a highly productive manner, yields of at least 25 MT/hectare with 25% Starch content.

Constraints in the fuel ethanol value-added chain is the inconsistency of the E-10 government policy and the infrastructure required to truck fuel ethanol to fuel depots where they can be mixed and transported to fuel stations. Other constraints include the large CAPEX for setting up a fuel ethanol processing plant.

High Quality Garri

With a share of 70% of all cassava fresh roots harvested, garri will continue to dominate the cassava sector in the short term. The growth rate of garri has been put at least 4-6% per annum, primarily due to population growth and increasing urbanization, and export to the regional West African market. It already provides livelihoods to more than 5 million farmers and processors (often poor rural women) in Nigeria, as well as to numerous equipment manufacturers, wholesale and retail traders, and transporters. In addition, small-scale garri processing has gradually become the main source of non-farm rural employment in many countries.

Garri processing operations in Nigeria can be described at 5 levels of capacity. The common terms used to describe these capacity levels are household (or cottage), micro, small, medium and large. Household level processing typically does not employ any outside labor. The household consumes virtually all of the processed products and sells a small amount to raise income for additional household needs. At present, close to 50% of Nigerian processors fall within this category.

At the micro processing capacity the employment of one or two units of labor may take place while processing garri products. This enterprise typically uses batch processing. Batch processing may take four hours per day and this would be sufficient for the owner/operator. Roughly 40% of processors in Nigeria fall into this category of operation. The small and medium processing operations typically employ three to ten workers and represents 10% of all garri processing. Large scale garri processing is virtually non-existent in Nigeria. Large-scale operations are defined as enterprises employing 10-30 or more labourers. Large-scale operations would also have the capacity for large tonnage processing with wider marketing opportunities.

Garri chains are almost completely informal, poorly organized, with little or none quality standards both at the processing and marketing stages. Processing equipment (graters, presses, mills, fryers) are often of poor quality. The end result is a poor quality product that is not accepted in supermarket chains in export markets of North America and Europe.

Constraints of the sector include access to credit by farmers and processors to obtain inputs and processing equipment respectively. The chains have high unit costs; generally a low labour productivity and a low innovation rate (artisanal mechanization) and deliver products of an irregular quality.

6. TRANSFORMATION STRATEGY

In designing a transformation strategy for cassava in Nigeria, previous efforts to develop cassava in the country provide some guiding principles. These insights can be summarized as follows:

1. Nigerian cassava-based industrial products are just a fraction of imports, so growth potential is huge – if factories are profitable.
2. Existing factories must become and remain profitable as a means of lowering barriers of entry to others.
3. Incentives must be created for farmers, processors, users, financiers, and other actors along the value chain in exchange for long term beneficial relationships
4. Reliable supply of raw materials at competitive prices must be pursued via encouragements for farmers to form clusters of 10-50 ha, widespread dissemination of improved production methods, and the inputs required to implement those packages.
5. Supportive and consistent trade policies, as well as access to credit must be put in place.
6. Clear communication of development intentions to private and public stake-holders, both State, Local government, and civil society, and definition of their roles.
7. Market institutions to support cassava farmers and processors.

Implementation of the transformation strategy will be by a team of subject matter specialists in the following areas namely: production, processing, policy, capacity building, engagement of partners, and crop breeding. The team will have a leader responsible for overall programmatic direction of the strategy. All members of the team are members of the Agricultural Transformation Implementation Council (ATIC).

6.1 Current Production Level and Yearly Target under the Transformation Agenda.

6.1.1 Yearly production target levels

In calculating yearly production target levels for the cassava transformation, we need to define a baseline demand for cassava as food. There is a national requirement of 25M tons of fresh cassava roots for garri, 6 M tons for other traditional food products, 1.5M for production of dried chips, and an estimated 3.5M tons lost to wastage before or during peeling and processing, to give a total base amount of 36M tons. FAO production figures in 2009, 36.8 M tons, is close to this base line as prices for cassava roots was high in 2009, suggesting supply was close or lower than demand. We therefore assume 36M is the base-line demand for the traditional food market

of cassava in Nigeria. To this demand for food, we add an estimated 4% annual increase due to population growth and potential for export of more garri and dried chips to the Sahelian West African region.

Production figure for 2011 is estimated at 40M tons of cassava based upon projections of 3.982M ha of land planted to cassava in the 2010 wet season (NAERLS Agricultural Performance Survey 2010). Cassava is currently suffering a depression in price, N3000-N5,000 from N8,000-N12,000 in 2009 due to oversupply at the moment. However, this figure will be verified by a survey of cassava production in Nigeria to be carried out at the onset of the project. We envisage that, based upon reinstatement of demand for HCQF by flour millers, additional demand for dried chips, strengthening the cassava starch value-added chain, the debut of cassava as feedstock in the fuel ethanol industry, and new markets created by high quality garri for local consumption and export, the demand for fresh roots will rise. Table 5 shows the expected demand for fresh and roots based upon the base and new demands.

Table 5. Current production level and yearly target increase under the transformation agenda

Source of demand	Fresh root demand (in Millions of metric tons)				
	2011	**20112**	**2013**	**2014**	**2015**
Base-line for food (4% per annum increase	36.00	37.44	38.94	40.50	42.11
HCQF	0.35	1.15	1.17	1.20	1.22
Sweeteners	0.01	0.02	0.95	0.98	1.01
Dried chips	1.87	2.24	2.61	2.98	3.17
Fuel Ethanol	0	0	0.8	1.2	1.5
High Quality Garri	0.5	0.75	1	1.5	2
Surplus (purchase by govt)	1.7	0.8	0.3	0.2	0.2
TOTAL	**40.43**	**42.40**	**45.77**	**48.55**	**51.21**

6.2 Low hanging fruits' interventions to stabilize the cassava sub-sector

6.2.1 Tackling the cassava glut

Based on reports received from large cassava growers, represented by white Zimbabwean farmers, and small holders, and a survey of the current price of cassava per ton, N3,000 to N5,000, there is a glut of cassava in Nigeria. Except government intervenes to create demand for the harvest of this year, there is going to be a significant reduction of cassava in the area of cassava planted in 2012 and an concomitant increase in prices of fresh roots and of garri,- the

food of low income rural and urban populations in 2013. If the cassava transformation is going to succeed to raise productivity and secure demand in industrial and export markets, we must immediately act to stabilize the cassava sub-sector. Three immediate 'low hanging fruit' interventions are apparent:

6.2.2 An agreement by government with flour millers to resume the purchase of HQCF.

The resumption of purchase by the three largest flour millers of HQCF this year is a demand of over 90,000 tons of HQCF and a fresh root demand of over 360,000 tons. We propose an immediate meeting with the chairmen of flour millers to obtain their agreement to comply with the government policy on 10% replacement of wheat flour in bread with HQCF. Control of quality of HQCF will be in independent hands, executed by an internationally recognized independent quality and quantity inspection company whose findings are binding on both buyer and seller. Support for this service will be requested from donors like the Dutch Government or the USAID to assist the Federal Government in establishing a relationship with an independent inspection company. Quality of goods will always be determined at the point of departure from the cassava processor and on arrival at the wheat millers' premises.

6.2.3 Support for the export of dried chips to China.

A Chinese importer of dried chips has made a request for 520,000 tons of dried cassava chips. However, costs of raw material, processing, transport, whare-housing, transport and import tariffs make dried chips from Nigeria uneconomic for export to China. Federal Ministry of Agriculture and Natural Resources (FMANR) will commission a feasibility study on the export of dried chips to China that takes a close look at the value-added chain and investigate possible growth enhancement support to exporters, including frontloading tax incentives for exports of dried chips and the use of existing government owned storage facilities by exporters. The Federal Ministry of Agriculture and Natural Resources (FMANR) will work with Nigeria's embassy in China and the Chinese government to eliminate import tarrifs on imported cassava chips. This intervention, if done as soon as possible, is capable of removing over a million tons of the harvest this year.

6.2.4 Minimum price guarantee to farmers.

A minimum price guarantee mechanism, that offers a fair price for farmer's harvest, will have to be implemented this harvest season on a scale capable of absorbing 1.6 million tons of cassava in the form of garri and dried chips, destined for the food reserve. Assuming a 50:50 proportions of garri and chips, this is the equivalent of 135,000 tons of garri and 214,000 tons of dried chips. A feasibility study on the cost and logistics of doing this will also be commissioned by the FMANR.

6.3 Production Strategy

6.3.1 Staple Crop Processing Zones (SCPZ)

A key component strategy of the Agricultural Transformation Agenda of President Jonathan and the Honorable Minister, Dr Akin Adesina, is attracting private sector agribusinesses to set up processing plants in zones with high food production, or staple crop processing zones (SCPZ), to process commodities into food products, . The government will encourage investment in SCPZ by putting in place appropriate fiscal, investment and infrastructure policies, including tax breaks on import of agricultural processing equipment, tax holidays for processors who re-locate to the SCPZ; supportive infrastructure, especially complimentary investment in roads, logistics, storage facilities and power. SCPZ will link farmers in clusters to food manufacturing plants.

Similarly, the production strategy of the cassava transformation makes SCPZ the priority location of its interventions. For cassava we define SCPZ in two ways: regions of existing processing facilities and regions of high cassava production. On the first definition of SCPZ – regions of existing processing plants - we will create incentives for commercial farming and out grower schemes for existing processing plants by offering smallholders credit, inputs, guaranteed markets, support for land clearing and mechanization, on- and off-farm training in exchange for clustering together into farms of 5-50 hectares or larger. While contiguous nature of the farms helps with mechanization, they don't necessarily have to be at one single location. Each cluster of farmers will be tied to known and verified demand for a cassava product. Besides the clusters will be locations of where minimum guaranteed price or buy back by government will emphasize.

6.3.2 Setting up commercial cassava farms

Research and experience in Africa reveals that yield increase is easier on larger farms, at least ten hectares. Besides the existence of larger scale commercial farms can provide jobs and technical know-how to area farms. Furthermore, commercial farms help large scale cassava processors lower production cost and obtain enough low-cost raw material from farmers to feed their factory.

The clusters will be identified by a survey, at first a desk study to review recent cassava production and processing statistics, and existing farmer groups, followed by a visit to a short-list of sites to pick out eventual sites. A survey instrument will be developed for this purpose in collaboration with the NAERLS crop survey, and complimented with surveys by the team and new methods of satellite imagery of the entire country. Enumerators from the NAERLS, National Office of Statistics, ADPs, and NGOs active in the area will collect key information from farmers that include: telephone numbers, acreage, yields, root production per year, demand,

markets, use of inputs, access to loans, income, and household information. A data-base of this information will be developed for the country to help plan dissemination and value-chain development activities for the current initiative.

Creation of mega clusters will be driven by State Governments, as represented by ADPs, and cassava farmer associations with technical backstopping from Cassava + and USAID Markets. Once the clusters have been developed, farmers groups will initially be trained in cassava production practices, for example adequate fertilization, effective erosion control, crop rotation, best time of planting, plant density, selection of healthy planting material, timely weeding, integrated pest management, etc etc by a visit to a commercial scale demonstration trial to be located in each SPCZ. Following, a few improved production packages of: 3-4 best bet improved variety, fertilizer rates - based upon soil testing - weed control, crop rotation, and cultural practices, will be selected in a participatory fashion with farmers for their specific location. The cluster of farmers will also be supported to access inputs and tractors, via the growth enhancement support program of FMNAR, and credit for purchase of inputs. During the season, an extension agent will be sent to inspect the crop and provide advice as needed. Based upon projection of acreage, we envisage 4,000 clusters of farmers will be set up every year, and at one extension agent for 50 farmer groups, we envisage 80 extension agents across SPCZs.

6.4 Increased Cassava Processing

6.4.1 Building Supply chains

The cassava transformation team will designate as SCPZ areas where there are existing large processors and SMEs in HQCF, starch, sweetener, dried chips, and high quality garri. This will help buy-down risk, through the support of processors with basic amenities like reliable power and water, reduction of excessive taxation, elimination of police toll gates, etc etc . In the first instance, the cassava team will assist in building a network of growers around processors and helping to facilitate fair pricing mechanisms, both spot and future prices, via pricing surveys to help the processor and farmers quickly arrive at a fair price. The team will work with processors and third-parties to communicate pricing and pickup dates via SMS.

6.4.2 Quality control

A key activity of processing under the cassava transformation is quality audit of existing SMEs working on HQCF, starch, and dried chips, and the development of a Tracking System for HQCF purchased by end users. Furthermore, it is very important that associations of SMEs self-regulate the quality of HQCF produced by their members. This will require setting up laboratory facilities that can be funded by DFIs, for example the Dutch Foreign Development Agency (DGIS). In addition, the cassava team will aggressively pursue experienced international and

local investors via Joint Ventures and partnerships to pursue opportunities in the starch, sweetener, and HCQF value-added chains in SCPZ with high levels of commercial production. Investment and technical know-how is required to create an industrial demand for cassava. Discussions are different stages with Cargill, SabMiller, and Unilever on setting up Sweetener plants in Nigeria.

6.5 Product promotion (Existing and new products)

There are new products that can be developed from cassava that can further extend import substitution and create additional demand; this includes cassava bread, noodles and spaghetti from composite flour, cassava-based dispersants (oil drilling fluids), and animal feed formulations based on cassava as supplier of carbohydrates.

Cassava bread is made with 100% cassava starch and it is commonly consumed in Brazil and Colombia as a national food. It is made by fermenting cassava starch (non-fermented versions can also be made), sun-drying it, and then adding other baking ingredients and baking it in the oven. Sun drying the flower causes a photochemical reaction that polymerizes starch into a network of polymers which traps gas and makes the bread to rise like wheat bread; a project to develop cassava bread will be negotiated with CIRAD via the French embassy in Nigeria.

6.6 Input requirement (Seed, Fertilizer, Agro-chemicals, etc)

6.6.1 Commercial Seed Systems

The value chain for cassava planting materials is complex and not well-developed; farmers are not interested in multiplying cassava stems as a stand-alone business. However, as value-added chains become better organized, there will be a need for farmers to harvest and sell cassava during the dry seasons and will require stems at the start of the rains. The price of cassava is higher during the dry season. But, donor financed projects have often given away stems for free, destroying whatever business opportunities exist for sale of stems to farmers. There is a need to develop incentives for multiplication and distribution of stems commercially. The approach in the cassava transformation is to build capacity of progressive farmers to multiply stems and develop a reputable supply chain to farmers via agro-dealers that will address timely access and quality of planting materials. Quality control systems and feedback loops will be put in place to ensure stem quality goes up in clusters in a timely fashion. To further strengthen the seed value-added chain, DFIs and State governors will be encouraged to use a voucher system to disseminate stems rather than hand them out for free. The vouchers are given to the agro-dealer or stem producer who redeem them for cash.

Setting up this kind of seed system is very important for the cassava subsector. It it build up a crop of seed entrepreneurs. Each stem producer will manage between 5-50 ha and will be certified for quality and seed health based upon their complying with phytosanitary protocols for cassava fields. This activity will requires working with NPQS, NASC, IITA, NRCRI to develop these protocols and help these seed farms to learn and implement. These farms subsequently become source of stem procurement by farmers and will help mitigate disease pressure. The activity will involve diagnostic surveys to document disease levels especially the key ones like CMD, CBB, CAD, CM, CGM and the possibility of new threats entering like CBSD. We will institute the stem value-added chain, at least two major certified supplier of seeds in each SCPZ, immediately the projects begins and ensure it is large enough to produce sufficient stems for clusters of farmers that it serves.

6.6.2 Breeder and Foundation seeds

A critical interface between breeding programs and the seed distribution system occurs at the provision of promising selections to farmers for on-farm adaptation trials and subsequent distribution of breeder seed (BS) or foundation seed (FS) of released cultivars for distribution to farmers. Some logistic and operational policy issues are required to support this system for rapid success and impact. The research institutes (IITA and NRCRI) will work with RTEP ADPs, NGOs, CBOs, to select farmer organizations, medium scale, or large scale farms receive BS or FS seeds for further multiplication. The selected partners will be represented in each SCPZ to allow for quick production and distribution of foundation seeds. Given the need for success and for wider diffusion of the good varieties, a scheme to allow for full cost-recovery by commercial distributor of seeds will be pursued while ensuring the seed supplier also makes a profit. The research institute jointly with RTEP will monitor performance of new cultivars and provide feedback information to breeders required to develop more, better suited cultivars

6.6.3 Access to fertilizer and herbicide

The Agricultural Transformation Agenda, calls for a stimulation of a thriving private sector fertilizer and agro input procurement and distribution industry, with minimal involvement of government, and ensuring that farmers secure the credit to purchase inputs - the Growth Enhancement Support (GES). The cassava transformation will align itself very closely to this program and participate in the private sector-led voucher program of GES to ensure fertilizer and inputs reaches farmers in the clusters widely and in a timely fashion. A functional Agro-dealer networks is key to this. For clusters of commercial farmers, an effective network of agro-dealers cannot be overemphasized. Working with the agro-dealers association of Nigeria, a survey of agro-dealers in the intervention areas will be conducted. The survey will enable the cassava transformation team to determine the strength of the agro-dealer, provide necessary training and

link them to credit, and to establish linkages between input suppliers, agro-dealers and clusters of smallholder farmers.

6.6. Cassava Variety trials

6.6.1 Adaptive Variety trials

The Presidential Cassava Initiative in 2003 evaluated 40 new genotypes with three check varieties [TMS 30572, TMS 4(2)1425, and TMS 82/00058] in multi-location field trials. The 40 genotypes were the results of a decade of genetic enhancement work at IITA in Ibadan, Nigeria. The check varieties were among the 17 improved genotypes earlier released. A fast-track farmer participatory selection approach was devised to meet the need for new varieties under that initiative and also to abide by the variety release laws of Nigeria. The approach entailed invitation of all the executing agencies involved in variety release (Ministry of Agriculture and Rural Development, ADPs, NSS, NRCRI, farmers) to participate from the onset in a combined series of field trials.

The mandatory on-farm trials (OFTs), demonstrational trials (DEMOs), and multilocational trials (MLTs), instead of being carried out in relay, were executed concurrently for 2 years. In OFTs, DEMOs and MLTs, 40 new clones were used along with three known checks (TMS 30572, TMS 4(2)1425, TMS 82/00058). These new clones, with the potential to replace the current nationally released lines, were 91/02324, 92/0057, 92/0067, 92/0325, 92/0326, 92B/00061, 92B/00068, 94/0026, 94/0039, 94/0561, 95/0166, 95/0289, 95/0379, 96/0523, 96/0603, 96/1089A, 96/1565, 96/1569, 96/1632, 96/1642, 97/0162, 97/0211, 97/2205, 97/3200, 97/4763, 97/4769, 97/4779, 98/0002, 98/0505, 98/0510, 98/0581, 98/2101, 98/2226, 99/2123, 99/3073, 99/6012, M98/0028, M98/0040, M98/0068, and TME 419.

Criteria for the choice of these 40 genotypes were as follows:

- CMD resistance/tolerance (score of <1.04 on severity scale 1–5).
- Multiple pest resistance/tolerance (score of <1.04 on severity scale 1–5; root rot, <5% incidence).
- High and stable yields (<11 t/ha baseline from farmers' fields, choice genotypes must have yields >20 t/ha)
- High dry matter content (>24% baseline, aim >30%).
- General feedback on acceptability from Uniform Yield Trials conducted by IITA.

For the OFTs and DEMOs, the decision on where to locate the trial sites was taken by each State team of ADP workers. The OFTs and DEMOs were spread throughout the three senatorial districts in each State to get a State-wide spread. This was to enable State-level generalizations to

be made based on the data retrieved from the trials. A total of 33 genotypes were formally released from those trials but there are a lot more genotypes not released because of adaptation to specific environment and lack of insufficient resources multiply varieties for onward release to ADPs and farmers.

However, these varieties were not tested under best management practices of fertilizer, based on soil testing, herbicides, and planting dates. The cassava transformation initiative will:

1. Work with RTEP and the ADPs to conduct farmer participatory trials of 3-4 varieties and a suite of improved production practices for each cluster location in the SCPZ based on existing field trial information and produce foundation seed of the recommended cassava varieties using existing capacity.
2. Identify best bet genotypes for different agro-ecologies under improved production practices.
3. Identify the defect in these varieties with respect to the needs of the specific locations and particular value-added chain and provide feedback to the breeder.

6.6.2 Variety improvement

Improved crop varieties remain the engine of agriculture. Successful value-added chains of cassava in Thailand and Brazil take advantage of the increased productivity, and profits for actors along the chain, that improved varieties of cassava brings. Under the cassava transformation emphasis will be placed on the development of new varieties that respond well to inputs, the use of biotechnology approaches to accelerate breeding, expanding the genetic base with novel traits, and capacity building of a new generation of cassava breeders.

6.6.2.1 Identification of cassava varieties that respond to increased use of inputs especially fertilizer:

Cassava breeding in Nigeria test materials across agro-ecologies under zero input conditions typical of how farmers have always grown cassava. But the emphasis is now to grow cassava under best production practices; there is a need to improve cassava for these conditions. In the first instance, 60 advanced breeding lines in the IITA and NRCRI breeding programs will be tested across the cassava belt of Nigeria under optimum production conditions. This activity is expected to result in the identification of genetically improved cultivars that respond to fertilizer best suited in each agro-ecological zone. In addition, an emphasis will be placed traits important to the value-added chains, especially high starch yields.

To ensure quick adoption by farmers and processors, lines already at an advanced stage in the breeding pipeline will be evaluated for performance and quality traits in collaboration with farmers and processors involved in the five value-added chains to determine those that best meet commercial quality requirements. It is important that farmers include seed producers in the respective SCPZ clusters. They can contribute to quick dissemination of new selected materials.

6.6.2.2 Promote the integration of biotechnology interventions for the improvement of cassava VAC.

In the last two decades, advances in biotechnology, especially in molecular markers and double haploid technology, increase the speed of making genetic gain for commercial traits critical to the development of value added chain products for cassava. Double haploids (DH) reduce to 1-2 generations the time required to generate inbred lines for cassava for production of hybrids. The use of inbred lines to exploit heterosis is a very well known phenomenon in crop breeding and impact of success is huge. In addition to DHs, well defined heterotic groups and evaluation of in- breds for combining ability are other requirements. In addition, DH helps to identify valuable recessive traits, including the waxy starch trait, and novel plant architecture and facilitate their transfer into cassava genepools. While a gestation period of two years is required to develop the DH technology for Nigerian cassava varieties, and another 2-3 years for testing the inbreds for combining ability and performance, the impact DH and resulting from hybrids will be high.

6.6.2.3 To genetically enrich source populations for strategic target traits critical to the cassava VAC

Progress in cassava breeding relies upon genetic variation. In the past few years, there has been a concerted effort to build and expand the genetic base of cassava through the collection and introduction of landraces and improved exotic materials for different attributes, especially those with novel traits needed to enhance the commercial value of cassava. Through the Generation Challenge Programme (GCP), NRCRI has introduced over 500 genotypes for different traits including improved nutritional quality (protein, beta carotene) delayed Post harvest Physiological Deterioration (PPD), dry matter content, disease and pest resistance, drought tolerance and early bulking.

Similarly IITA have a broad collection of germplasm assembled in the last 35-40 years including wild relatives and unadapted germplasm. Segregating populations created through pre-breeding are available. In addition, mutated populations in collaboration with IAEA, have also been developed and are being screened. These materials and germplasm provide a new base for improving source populations for several economic traits to strengthen the value chain. The source population will be improved through recurrent selection to generate elite gene pools which are expected to result in combination of several favorable alleles of valuable traits for

better adaptation, durable and sustainable productivity. About 100 genotypes with good characteristics will be used in this exercise and for genetic improvement.

6.6.2.4 To improve plant breeding capacity (PBC) to meet market response and demand elasticity of cassava VAC (Capacity building for second generation of cassava breeders)

The success of green revolution and development of value added chains is dependent on having well trained breeders. The ideal breeding team should be led by a senior breeder, having an advanced degree in plant and many years of experience, supported by junior breeders that he mentors. This model ensures continuity of breeding programmes for sustainability and continued production of improved materials. Program continuity is very important since development of new cultivars is a long-term endeavor and the program should avoid disruption if it is to be successful. We propose the building of human capacity through training of 3-4 young breeders at the Ph.D. level and10-15 at the M.Sc level. We also seek an improvement of infrastructure for breeding at National Institute. A detailed description of this request is in the action plan document for variety improvement.

6.7 Engagement with Private Sector: Market and Marketing institutions

Implementation of the value-added chain activities will be driven by the private sector with support from the public sector. A Cassava Market and Trade Development Corporation (CMTDC) will be established as the primary vehicle for implementation of value-added chain activities. Primary activities of CMTDC are market development, including advocacy with potential users of cassava-based products and policy makers, to ensure reliable demand. The corporation will also be charged with establishment of quality standards for the various cassava products.

Learning from Big Players-Thailand, Brazil, is vital if we are the get the formation of CMTDC right. If there is a single word to describe the reason behind the yield increase and strong demand for cassava in the Thai cassava industry it is the Thai Tapioca Development Institute and the Thai Tapioca Trade Associations (TTTA). These two institutions build market and extensions services around farmers. TTDI was established in 1992 as an independent non-profit organization with an initial endowment Fund of 600 million Baht (US$16 million) from the Ministry of Commerce and the Royal Thai Government. The Thai Tapioca Development Foundation was formed with a mission to:

1. To promote cost-saving production efficiency through replacing traditional varieties with new, improved varieties, and improving production methods and technologies.

2. To promote greater uses of tapioca through research.
3. To develop markets for tapioca products within the country and abroad.
4. To create public awareness on tapioca through providing information and knowledge on tapioca products.
5. To develop human resources needed in the tapioca industry.

The objectives of TTDI are:

1. To promote research and development on tapioca varietal improvements, production technologies, mechanized harvesting and other tapioca products.
2. To undertake studies on production restructuring and provide policy recommendations relating to the government, the private sector and the farmers.
3. To undertake studies on import duties and other trade barriers imposed on tapioca exports

TTDI established a 300 hectares Tapioca Development Institute at Huay Bong, Korat in 1993 to expand the production of new high yield varieties for distribution to farmers, and to conduct research and experiment activities in various aspects of production efficiency as well as to train farmers in new cultivation techniques. From 1993 to 2000, more than 30,000 farmers had been trained and 60 million stems of new varieties were distributed free of charge to farmers.

The commercial agriculture program of the World Bank is funding an expert group study of experienced agricultural entrepreneurs, one from the starch and dried chips industries from China and Thailand, and one Thai government official expert, on implementation of the minimum guaranteed price for dried cassava chips. The goal of the expert study group is to advice the government on setting up the Cassava Market and Trade Development Corporation (CMTDC) and development of strong supply chains in the starch and flour value-added chains in Nigeria, and setting up a minimum guaranteed price mechanism. The expert group will visit existing starch and flour factories, production and dried chips processing/marketing locations in Nigeria over a period of two weeks. An, additional week will be spent writing a report and making recommendations on technical, policy, and capacity building interventions to improve supply chain management.

6.8 Engagement with public sector: State and Local Government, and civil society

State and Local governments are critical to the successful implementation of the cassava action as they own and fund the extension service and are closest to farmers. The cassava transformation will jointly develop investment framework with States by incentivizing states to co- invest with the federal government in the development of the cassava value-added chain. Partnership will be operated under four key principles:

1. Subsidiarity: Working from the State level up

2. Partnership: Working with states, private sector and civil society.
3. Investment: Utilize investment methodology and framework.
4. Accountability: There will be full transparency and accountability within the system.

Method of engagement will be twofold: first the Honorable Minister of State will present a well articulated roadmap of the agenda to the Agricultural Council and at the governors' forum to gain their consent. Once the governors buy-in, the local governments will follow with ease. The second approach is State by State sensitization, on a geo-political regional basis, to demonstrate the seriousness of the Federal Government and to firm up states' commitment to the programme. The interested governors will be invited to express their commitment to the Hon. Minister of Agriculture and Rural Development in the form of commitment to invest in rural infrastructure and extension services.

Another group of stake-holders that will need to be engaged are NGOs, CBOs, and other civil society groups who have capability to take model interventions to scale. Specific area of intervention expected from each stakeholder will be spelt out; for example the development of rural roads, which is paramount for the success of the agenda will be the responsibility of the state governments. The responsibility of providing water and energy should be assigned to relevant agencies. Expected derivable and benefits for each stakeholder will also be clearly stated.

6.9 Research and Extension requirement.

Extension or farmer education is required to facilitate the dissemination of improved production and small scale processing technologies to thousands of farmer group. Facilitation requires investments in skills training and productive infrastructure. The cassava transformation team will put in place a mechanism to train, support, and supervise State ADP extension agents who will be the primary vehicle for getting information out to farmers. Two extension agents, one in production and one in processing, will be attached to each cluster of farmers and processors. Training sessions, by geo-political zones will be held for the extension agents by subject matter specialist on the cassava transformation team or consultants engaged for that purpose. To ensure quality control, subject matter specialist will pay a visit to the extension agents in the field at least once during the course of the year. To ensure commitments, the project will provide incentives to the two extension agents attached to the farm and processor clusters.

6.10 Policies and Advocacy requirement (land, input, product, insurance and fiscal)

Taking examples from countries that have successfully developed their cassava sector, Thailand and Brazil, enabling legislative acts, fiscal, financial and agricultural policy interventions targeted at creation of market demand are needed to build the cassava sector. Other incentives

include recognizing outstanding performance by farmers and the creation of awards. A list of the needed policies are described below

Enabling Legislative Acts for Market Development

i) 10% Cassava Flour substitution for bread wheat flour
ii) Blending 10% ethanol with petrol.

Fiscal Policies

i) Zero tariffs (custom, excise and value added) for import of agricultural equipment and agro-processing equipment
ii) Create incentives for investment, both foreign and domestic, in large scale processing facilities, including but not limited to tax holidays for investors putting processing plants in staple crop processing zones
iii) Increase levy on any commodities that Nigeria can produce (starch, sugar and wheat)
iv) Tax reduction for the flour millers that adhere to the 10% cassava flour inclusion policy.
v) Current policy on import levy of 5% for brown rice and 30% for polished milled rice, and 5% on raw sugar and 10% on starches should be increased and revenue used to support domestic production
vi) Tax reduction for the companies using cassava starch as composite/substitute for the imported flour; e.g. cassava instead of corn starch, users of cassava glucose syrup as substitute of another product, e.t.c. (Nestle, Cadbury, Indomie Noodles, pharmaceuticals……..)
vii) Supportive incentives for investors establishing blending plants for ethanol
viii) Guaranteed minimum pricing for Cassava producers.
ix) Elimination of the import tarrif in China for exporters of cassava chips.

Financial Service Policies

i) Incentives for access of farmers to weather index insurance to adapt to climate change
ii) Removal of the current monopoly on agricultural insurance by the National Agricultural Insurance Company and liberalize to allow private sector insurance companies Industrial Policies

Agricultural Policies

i) Create institutions to support the agricultural transformation agenda
ii) Marketing Corporations, to replace marketing boards
iii) Transform the Agricultural Research Council (ARCN) to a National Agricultural Transformation Agency like EMPRAPA that transformed Brazilian agriculture
iv) Guaranteed minimum price for food crops
v) Revise the Land Use Act to enable easier access to land for investors in agriculture
vi) Rapid expansion in irrigation facilities and revamping of existing ones
vii) Incentives to engage young commercial farmers for farming as a business

Cross cutting Incentives for motivation

i) Recognition, Awards and Prices for high performing farmers, Processors, Input dealers and Marketers, in the all agricultural enterprises, especially the target commodities.
ii) Recognition and Award for best performing State Governors in Agriculture.

6.11 New Investment required to support the entire value chain

Total amount of investment to support the cassava transformation plan is N4.751B. The funds will be expended as follows:

1. Study of expert group from Thailand and China to set up the Cassava Market and Trade Development Corporation (CMTDC) – N12.87M (funding already obtained from the Commercial Agriculture Program of the World Bank)
2. Survey of the cassava production and processing sector towards formation of clusters – N7.5M Source of funding is the Crop department of FMANR
3. Quality control and audit of the small scale flour processing industry – N3M
4. Establishment of the clusters and Supply chain management activities –N120M. Source of funding is the Crop department of FMANR and ATIC
5. Feasibility studies on a minimum price guarantee and dried chip export to China – N7.5M. Source of funding is the ATIC of FMANR
6. Testing and dissemination of new cassava varieties that respond to inputs – N160M Source of funding is the Crop department of FMANR
7. Dissemination of new small dried chip scale processing technology– N3.3B. Source of funding is the Processing department of FMANR
8. Development of new products N8.5M. Source of funding includes CIRAD, FIIRO, and FMANR
9. Breeding new varieties – N160M (Varied source of current and new funding – GCP, AGRA, Danforth Center, Gates Foundation, etc)

Detailed budgets are under preparation and will be made available soon.

6.12 Job creation strategy and figures

Based upon a potential demand of 250,000 ton/year in the High Quality Cassava Flour (HQCF), for 10% replacement in bread flour, and for use in bouillon, noodles, and the adhesive industry (dextrins); a demand for native and modified starches that exceeds 230,000 tons/year in the food, paint, and pharmaceutical industries, another million tons of fresh roots; an annual demand of 150,000 tons exists for high fructose syrup, as part replacement for imported sugar, and 40,000

tons/year for glucose (40,000ton/year); a potential demand of 900,000 tons per annum for dried chips, with 300,000 tons going to the regional food market, an estimated 80,000 tons/year to the local a potential 400million liter per year market of and 455,000 tons/ per year, for hig quality garri, a total additional production of 12.7 million tons of fresh roots from 510,337 ha of land is needed. Assuming one direct job per hectare on-farm and one direct job off-farm, this is a total of creating over 1.04 million jobs.

In addition, income attributable to farmers based upon this demand is estimated at 12.5ton per farm family, assuming one farm family cultivates an average of 0.5ha in the farm clusters. At price of US$40 per ton, this is an increased income of US$450 per family or a total addition of 62billion of added income to the economy.

6.13 Major assumption and risk elements.

Risk elements associated with the program can be divided into three: technical, financial, and political. Successful implementation of the programs makes assumptions that these risks will be adequately taken care of; below are a list of these assumptions; they are also described in greater detail by value-added chain in the program log frame.

Technical

1. Coordinated production and supply capacity to processing plants resolved by formation of clusters of farmers and producers
2. Access to inputs by farmers through implementation of the Growth Enhanced Support (GES) Program
3. Fair pricing of fresh roots
4. Availability of efficient and affordable peelers and dryers

Financial

1. Adequate Funding to the cassava transformation program
2. Sincerity of financial institutions under NIRSAL to provide credit to both processors and end-users

Political

1. Consistency in policy & appropriate legislation.
2. Improved power, road and market infrastructure
3. Cooperation by all stakeholders
4. Availability and consistent pricing of diesel

6.14 Monitoring and evaluation

Monitoring and evaluation (M&E) plans will be drawn up and implemented for all activities of the project and tools for the project. An M&E plan will be completed during the first two months of project activity. The monitoring system will build on existing tools used in similar large-scale projects, including on-farm monitoring tools, site surveys, and assessment of quantitative indicators. A simple but adequate reporting format will be developed by which the intervention efforts will be monitored on a quarterly basis. The report will help to determine the impact of current strategies on poverty alleviation or a need for modification.

Implementing partners will be trained in monitoring tools and reporting requirements and will be responsible for data collection and reporting on achievements against targets. A database will be developed to compile information received from partners at the state ADP levels. Information will be analyzed at all project levels – partner, territory, country and project. To achieve near real-time reporting, a web-based system will be used, with partners uploading data directly.

However the program will encourage leading research institutes to participate in its monitoring and evaluation process as well as employ social scientists who will monitor and evaluate its work.

7 EXPECTED IMPACT

1. Strong value added chains of starch, HQCF, sweeteners, dried chips, high quality garri, and fuel ethanol in Nigeria.
2. A doubling of average cassava productivity from 12 to 25 ton/ha in target clusters by 2014.
3. Generation of one million jobs in the rural areas of Nigeria over the next four years of the program.
4. An increase in income of 1.8 million participating farm families by US$450 every year.
5. Strong market institutions establish for long term sustainability of the cassava sub-sector.

8 DATA MANGEMENT

Large amounts of data will be collected in the process of implementing the cassava transformation program. They include: information on production, processing, and markets from the cassava; market information; inventory of agro dealers; data from the adaptive variety trials and the various breeding initiative etc etc. A data base capable of handling these diverse sources of information and that is searchable will be set up. It will be web-based so that the information is accessible from different parts of the country. The data base will be built in cooperation with USDA's National Agricultural Statistics program, NASS, and PCU.

9 LOG FRAME

10.1 Logical Frame Work of HQCF Value Chain

Expected output	Intervention Logic	Objectively verifiable indicators of achievement	Assumptions
1. A minimum capacity of 120,000 tons /annum HQCF from larger and SMEs 2. Sustainable HQCF supply chain 3. Efficient processing machines 4. Train 100 SMEs owners, 1000 wet cake processors 5. Established sustainable call log systems on HQCF Value Chain Actors in Nigeria 6. Generated direct and indirect employment of about additional 1 million people	Strengthening Market Demands for HQCF through in centified inclusion policy Identification and promotion of alternative markets for HQCF Capacity building of SME owners, wet cake suppliers, and operators on quality management, price negotiation skills, business management, good manufacturing and hygienic practices Process audit; retrofitting, south south trainings on efficient peelers, pressers and dryers. Facilitation of the establishment of targeted downstream processing outfits in an integrated nature following Brazilian model. Organization of Investment Platform, Open Day, Cassava Show drawing experiences from Latin America, and Asia	1.a) Bill on HQCF Passed into Law b) Flour Millers buying HQCF from recognised HQCF processors and marketers c) HQCF available in major supermarkets and open markets for domestic consumption d). No of reopening of closed down SMEs and other processing outfits e). No of Developed Training Manuals, flyers on new cassava products, & investment profiles as well as available reports on status of the implementation of Cassava Agenda f) No of peaks on HQCF from CT websites at the producer association and project office levels. g)No of fabricators fabricating efficient and environmentally friendly processing machines h) No of Processors with NAFDAC Registration numbers and other corporate Certificates	• Consistency in policy & appropriate legislation. • Adequate Funding • Cooperation by all stakeholders • Attracting pricing of HQCF by the end users • Sincerity of financial institutions, processors and end users in business transactions • Improved power, road and market infrastructure • Availability of efficient and affordable peelers and dryers • Production capacity limitation resolved • Availability and consistent pricing of diesel

	continents	I). At least 100,000 Nigerians employed in HQCF Value Chain J.) Volumes of cassava roots procured by processors	

10.2 Logical Frame Work of Starch and Sweetener Value Chain

Expected output	Intervention Logic	Objectively verifiable indicators of achievement	Assumptions
1. Study on building effective supply chains around existing starch and sweetener processing plants completed by expert Chinese and Thai expert 2. Farm clusters around existing starch mills and glucose processing plants established for timely supply of fresh roots 3. Feasibility studies for the establishment of additional starch and sweetener plants conducted 4. Two additional large starch plants and one additional large sweetener plant established 5. Capacity of SME that	South-south cooperation to learn from the cassava sub-sectors in Thailand and China on building strong supply chains Increase the capacity of local starch mills to meet the market Demands for starch and sweeteners in Nigeria Make the business case for the establishment of additional sweetener and starch plants to replace imports Identification and promotion of alternative products from cassava starch to increase demand for cassava starch Capacity building of SME	1. Visit to Nigeria of a group of Chinese and Thai cassava value-chains experts 2. Report on improving supply chains in the cassava processing sector 3. Feasibility studies for the establishment of additional starch and sweetener plants 4. Two additional large starch plants and one additional large sweetener plant 5. Improved, with respect to recovery and quality, of starch production of SMEs 6. Product development of cassava bread in Nigeria 7. Increased use of cassava starch by Nigerian food and pharmaceutical industries	• Policies on incentives for import substitution for producers and users of cassava-based starch and sweeteners in place • Funding in place for the cassava transformation agenda • Cooperation by owners of starch mills and sweetener plants • Access to credit from banks under NIRSAL • Improved power, road and market infrastructure

produce starch in the South South built up by upgrading their process machines for better starch recovery. 6. Research and development on the use of cassava starch for bread 7. Advocacy for the use of cassava starch in food and pharmaceutical industries in Nigeria	owners, on quality management, business management, good manufacturing and hygienic practices Process audit; retrofitting, south south trainings on efficient peelers, pressers and dryers. Organization of Investment Platform, Open Day, Cassava Show showing the benefit of cassava starch		

10.3 Logical Frame Work of Dried Chips Value Chain

Hierarchy of Objectives	**Objectively Verifiable Indicators**	**Means of Verifying**	**Risk or Assumptions**
<u>Goal</u> 150,000 jobs created and 20,000 youths employed --million Naira (--Dollars) generated.	No. of jobs created; No. of youths employed Amount generated in naira and dollars	Monitoring of farm and factory sites.	Incentives for engaging youth are in place.
<u>Outcome</u> 2.2 million tons of cassava roots produced. 600,000 tons of chips produced and	Tons of cassava roots produced. Tons of chips produced	Farm records. Production records.	Cassava chips prices are favorable. Cassava chips market profitable and sustainable.

marketed			
Outputs 73,300 Ha of cassava farms established 200 Processing factories established.	No. hectares of cassava farms established. No. of cassava chip factories established &functional.	Monitoring of project sites	Weather is favorable. Farm operations are carried out on time. Factory buildings are completed to time; Equipment and machinery are delivered as scheduled.
Inputs Feasibility study on the export of dried chips to China 73, 300 accessible land in clusters of 120ha in 617 locations; *Production inputs* 617 Tractors and complete equipment and spares; 3.7 million bdls of improved cassava cuttings; 22,000 tons of NPK fertilizers; 366,500 lt of premextra; 6,170 youths (10 youths/location); 65 sets of technical	Feasibility study on export of cassava to China Hectares of accessible land available; No. of tractors and complete equipment available; Sets of technical support staff available; Sets of peeling & chipping equipment on ground.	Report of a feasibility study Physical monitoring of facilities, equipment and infrastructure	States/LGAs rehabilitate rural roads and farmlands are secured from communal crisis; Funds are available in the required amounts and on time. Improved planting materials are available in quantities required; Inputs and machinery are available for procurement.

support staff (extension, agronomists and engineers); 200 processing factories; 200 nos peeling and chipping machines;			

10.4 Logical Frame Work of Garri Value Chain

OBJECTIVES	ACTION	IMPLEMENTORS	INDICATORS
I) Improve cassava production as a means of improving the supply chain.	1) Screening and distribution of high yielding and disease-tolerant varieties	1) Partnership among farmers, service providers ADPs, IITA and RTEP	1) Private sector participants have access to planting materials with specific characteristics
II) Improvement of the existing processing plants	1) Participative and comprehensive review and upgrading of the existing garri processing plants in Nigeria 2) Establishment of NGDA. 3) Training of involved processing groups (re. hygiene, environmental issues, packaging, quality, energy use and the like) 4) Participative monitoring of Stake holders' satisfaction. Monitoring as the basis of an ongoing learning	1) Partnership among processing groups, NGDA projects, AMEFAN 2) Processing groups, NGOs (service providers) 3) NGDA, processing groups, specialized NGOs and service providers 4) Specialized NGO 5) NGDA cassava projects	1) NGDA recruits a service provider in quarter one 2) First prototype is constructed in quarter 4, second in quarter 8, third in 3) Reports in quarter 4, 8 and 12 4) Quarterly monitoring reports of stakeholders' satisfaction. 5) Feedback and learning system is

	and exchange process 5) NGDA projects copy improved processing concepts		operational Successful concept has been copied from year 3 onwards
III) Standardize and upgrade garri processing equipments	1) Preparation of a national strategy Document to standardize equipment. Organization of regional planning and exchange event 2) Identification of best performing processing equipment (the objective being not to prepare a comprehensive list of all manufacturers, but to identify good models of graters, presses, stoves, etc.) 3. Organize national learning events for equipment manufacturers on standardization issues. 4)National forum to discuss progress and promote standardization of processing equipment.	1) Partnership: NGDA,SON, IITA NAFDAC, AMEFAN and other important equipment manufacturers 2) Partnership: AMEFAN NGDA, IITA, NCAM and other important equipment manufacturers. 3) IITA/ NGDA/ BOA, BOI , to provide funding . 4) NGDA facilitates the setting up of the forum for a highly specialized public and. private sector entrepreneurs. 5) AMEFAN, NCAM, CaGRI, and IITA.	1a) Partnership established, through a memorandum of understanding signed after 6 months 1b) national planning and exchange event organized in year 1 1c) Operational national strategy document available before the end of year 1 2a) Partnership established, through a memorandum of understanding signed before the end of year 1 2b) Prototype plants promote “best performing equipment 3a) At least 1 national learning event is organized in all the

	5) Establishment of 774 processing centres in all the local government areas in the first phase.		regions every year 4) The national learning event monitors and updates the standardization strategy
V) Give access to financial products and services	1) Explore the financial instruments available within each country to capitalize the poor (learn from micro-lease and other instruments). Focus on market conformed instruments to be used after a matching grant phase 2) Organize national learning event on innovative financial products for small scale and medium-size garri enterprises (combine with design of improved processing plants)	1. NGDA facilitates the creation of national working groups of private sector operators (garri processors) 2) NGDA functions as secretariat and animator of the working group	1) Inventory of existing innovative instruments and case studies in the region available by the end of quarter 6 2a)National learning event is organized 2b) IITA garri projects promote these innovative instruments 2c) Both small-scale processing groups and medium garri enterprises
V) Establish commodity chains for high-quality cassava products	1) Develop partnerships with processors and domestic supermarkets. Establish a working group that sets up a commodity chain to bring high quality garri (HQG)	1. NGDA facilitates the creation of national working groups of private sector operators (garri processors) 2) NGDA functions as	1) National working group is created and designs national action plans for value chain development in year 1. 2a) Every six months the action plan is

	products to supermarkets through the design of a national action plan. 2) Quarterly follow-up meetings to monitor progress and update the action plan.	secretariat and animator of the working group	updated 2b) High-Quality Garri (HQG) products are available in supermarkets
VI) Introduce retail packaging material at a large-scale in Nigeria	1) NGDA, PDMB with the assistance of an economist (business experienced) prepares a detailed report of its approach and results (who, how, how expensive, which type of packaging material) 2) Assessment of feasibility to copy the Most effective garri production centre in the country. 3) Action plans are prepared and the example copied. 4) Monitor implementation, register lessons learnt and update action plan	1) NGDA, PDMB -. 2 NGDA., IITA. 3) NDGA, IIITA, NCRRI, processing groups and involved SME. 4) NGDA processing groups and involved SME, IITA, NCRRI, RTEP, country projects.	1) Partnership between NGDA and all garri processors in Nigeria. 2) Assessment of feasibility to copy experience is available before the end of quarter 3. 3a) National action plans are available. in quarter 4 3b) National action plans are implemented in year 2 4) Monitoring and feedback mechanism Operational.
VII) Updated garri data through the national garri Information Network”	1) NGDA to coordinate the development of a National garri Information Network”. This should	1) NGDA to coordinate Inputs from other stakeholders. PDMB receives inputs from all	1) Up-to-date Natiional Garri Information Network is operational and

	provide information on model, garri processing equipment, and contacts for equipment manufacturers and technical and business service providers to the garri industry 2) National exchange and learning events with specialized stakeholders are Organized.	stakeholders in the commodity chain to effectively share and disseminate knowledge 2) NGDA facilitates organization of N meetings and events	private sector stakeholders have access 2) Proceedings of meetings
VIII) Policy dialogue and advocacy	1) Stakeholders identify issues, establish advocacy agenda	1) FGN, FMARD, HCo A CaGRI, and other relevant NGOs.	1) Advocacy agenda exists at the end of year 1 2) Stakeholders organize advocacy and communication events

10.5 Logical Frame Work of enabling technologies

Expected output	**Intervention logic**	**Objectively verifiable indicators of achievement**	**Assumptions**
1. Improved productivity output through identification of highly adapted varieties for the cassava VAC	Develop seedling nursery in each agro-ecological zone in Nigeria Field screening for appropriate traits in the breeding scheme	About 200 top genotypes elected for different traits identified for the value-added chain	That good flowering will be achieved and good germination Funding a logistic facilities
2. Genotypes with high levels of resistance to diseases and pest as well as good agronomic	Test released varieties for suitability for commercial quality standards for identified value	At least two genotypes most suited to each of the value chain products identified	Existing released varieties possess desired attributes

performance for mechanization to reduce production cost, targeted for value chain and specially suited to industrial requirements developed to maximize profit, and enhance competitiveness of cassava with other substitute crops.	chains		
3. New generation of high-yielding varieties with at least 35-40t/ha on-farm developed and for release for short, medium and long term impacts leading to 100% increase in production (i.e. doubled production).	Assess current existing lines for temporal yield stability in the 28 states Lines at advanced stages at NRCRI and IITA selected for wide scale testing in the UYT, NCRP and on –farm targeted specifically for the six value added chains Testing in the UYT in agro-ecological based manner and subsequently at later stages in the 28 states Release of varieties on the short term using materials existing at advanced stages in the breeding pipeline	About 15 top lines with good potential for value –added chain products selected for national testing Five to ten best clones are recommended for release with higher production capacity of about 35-40 t/ha on farmers field developed and recommended for release	Funding for wide extensive testing

	Release of materials just initiated or at early stages in the breeding programmes of NRCRI for the medium term and long term		
4. Foundation seed generated to support 100% increase in number of farmers with access to new varieties and improved diffusion and adoption	Released varieties need to be multiplied to facilitate access by famers and stakeholders to improved elite varieties to boost productivity for the value-added chain	At least ten outgrowers and large farms are engaged per state to produce foundation seed. The number of farmers with access to improved lines increased by 100%.	Planting materials are adequately available early enough to outgrowers for the multiplication Funding and logistics
5. Integration of biotechnology intervention to modernize breeding for the development of novel genetic stocks to increase rapidly genetic gain and superior varieties.	Self pollinations in search of useful recessive traits. Basic understanding of inbreeding depression and heterosis in cassava Self-pollination of elite germplasm with know desirable characteristics	Identification of high-value traits that can increase the value of cassava roots by up to 30%.	Funding and flowering
6. Genetic improvement of source populations for efficient breeding and quick delivery of superior varieties for sustained supply chain for the long term goals	Improving of source population via recurrent selection using elite materials with attributes for value added to pyramid and increase frequency of favorable alleles for traits relevant to the value-added chain products	About 100-150 lines selected for their genetic potential for breeding purposes developed to pyramid favourable genes for value-added chain products.	Funding

7. A comprehensive database on best adapted varieties, performance , and agronomic practices for decision making process of farms and related agribusiness created to support bi-directional information flow between producer and end-users created	Database of production for improved and released varieties and elite genotypes from breeding activities and on-farm studies	Country wide data base on best agronomy practices, production of each adapted variety per state for the different ecologies created.	Funding
8. Improvement of plant breeding capacity achieved through training of plant breeders and Research assistants as well as the development of infrastructures required for modern breeding leading to productivity outputs of the breeding team.	Formal Training of breeders and assistants in plant breeding in partnerships with AGRA, WACCI, IARC. Workshops on phenotyping for value-added chain products Training on breeding decision tools Building infrastructures for field activities Provision of screenhouse facilities and storage (cold store for seeds) Procurement of Lab equipment for molecular breeding and processing and quality assessment	Public breeding capacity improved for the development of adapted and well suited varieties through acquisition of facilities critical to the phenotyping of key traits relevant to the value added chain. Lab equipment, screenhouses etc. installed	Funding

10 TIME-LINE

11.1 Time-line of HQCF Value-added Chain

Activities	2011				2012								Budget (N)
	S	O	N	D	J	F	M	A	M	J	J	A	
Facilitate FMAN buying of HQCF i.e. 700t DADTCO & 600t TFI													450,000
Validate and map all existing cassava processing factories in each agro-ecological zones of Nigeria													4,500,000
Conduct Production Audit/Quality Management of those factories													3,500,000
Strengthen Wet Cake Producers to Supply SMEs													8,750,000
Cluster Commercial Farmer Groups from existing Growers Association round each Processing outfits (Large Scale and SMEs) to ensure consistent root supply via mechanized farming													6,650,000
Facilitate Access to Credits for Farm inputs i.e. Fertilizer...													500,000
Involve the CMTC in designing effective supply chain management and pricing													750,000

mechanisms to ensure corporation between SMEs & Farmer Clusters													
Development of Tracking System (volumes of HQCF purchased by end users vs volumes delivered by the processors)													2,000,000
Establishment of Quality Monitoring System													3,000,000
Organise Trainings on Good Manufacturing practices in HQCF production in the six Geo-political Zones													8,500,000
Commission Industrial application of HQCF in pasta, Cassava Bread, cassalina etc.													8,500,000
Total													47,100,000
Funds for the Retrofitting of equipments of Existing 100 SMEs													100,000,000
Grand Total													147,100,000

11.2 Time-line of Starch and Sweetener Value Chain

Activities	**2011**				**2012**								**Budget (N)**
	S	O	N	D	J	F	M	A	M	J	J	A	
Study by Chinese and Thai experts on building effective supply chains around existing													12,876,000

starch and sweetener processing plants													
Survey for the establishment of Farm clusters around existing starch mills and glucose processing plants and the organization of farmer groups													7,500,000
Feasibility studies for the establishment of additional starch and sweetener plants													15,000,000
Facilitation of the establishment of two additional large starch plants and one additional large sweetener plant established													6,550,000
Capacity of SME that produce starch in the South South built up by upgrading their process machines for better starch recovery.													8,650,000
Research and development on the use of cassava starch for bread													9,700,000
Advocacy for the use of cassava starch in food and pharmaceutical industries in Nigeria													2,750,000
Development of Tracking System (volumes of starch purchased by end users vs volumes delivered by the													2,000,000

processors)													
Establishment of Quality Monitoring System													3,000,000
Total													68,026,000
Counterpart Funds for the Retrofitting of equipments of Existing 100 SMEs													50,000,000
Grand Total													118,026,000

11.3 Time-line Work of Dried Chips Value Chain

Step	Activity	Expected Output	2011				2012								Budget
			S	O	N	D	J	F	M	A	M	J	J	A	
1.	Conduct a comprehensive survey on cassava chips processing, marketing and utilization to identify markets for cassava chips (feed mills, alcohol factories etc.); Determine the present capacity of chip processors to know the gap in chip production; Take inventory of chipping equipment available in the country and Determine the capacity of local fabricators to produce the required equipment	Volume of market established; Dimension of intervention in chip processing established; Present capacity for chip production established; Gap of machinery requirement established.													₦15,800,000

2	Feasibility study on the export of cassava chips to China														₦7,500,000
3.	Policy on use of cassava chips as substitute for maize in animal feeds	Policy on cassava chips in place													₦1,000,000
4.	Woo interested investors to cassava chip enterprise	Production of adequate quantity of chips assured													₦5000,000
5.	Establish sustainable linkage between chip producers and end-users	Market-oriented chip production establish													₦3,5000,000
6.	Sensitization of states and LGAs; communities; and financial institutions for credit facilities and other support services	Awareness of opportunities in cassava chip production & export created and accepted													₦5,000,000
7.	Selection of production and processing sites	617 locations with at least 120ha selected													₦8,500,000
8.	Enlisting interested youths and technical officers (Advert & Publicity)	6170 interested youths and 195 technical officers identified for participation													₦4,600,000
9.	Contracting cassava planting materials growers	2600ha of cassava farms contracted													₦2,340,000
10.	Procurement of 22,000 tons of fertilizer,	Inputs delivered at													₦916,250,000 (Herbicide)

	366,500 liters of herbicides	various production sites for timely operations													
11.	Provisions of 617 tractors and complete equipment by State and LGAs	Tractors & Equipment are available for timely farm operations													₦2,500,000
12.	Design and Construction of 200 Processing Factories in equip with necessary facilities	Construction of factories conform with international standards													N3,200,000,000
13.	Procurement & delivery of peeling & chipping equipments	Equipment delivered on time													
14.	Monitoring and Evaluation	Ensure chips production plan is on course													₦18,500,000
															₦4,190,490,000

11.4 Time-line of Garri Chain

Activities	**2011**				**2012**								**Budget (N)**
	S	O	N	D	J	F	M	A	M	J	J	A	

FMANRD Facilitate buying of HQG for strategic storage 500tons from e.g Friday farms and shambach farms													300,000
Validate and map all existing GARRI processing factories in each agro-ecological zones of Nigeria													3,500,000
Conduct Production Audit/Quality Management of those GARRI factories													3,000,000
Encourage on-farm Wet Cake Producers to Supply SME Garri factory													6,5000,000
Cluster Commercial Farmer Groups from existing Growers Association round each Processing outfits (Large Scale and SMEs) to ensure consistent root supply via mechanized farming													6,500,000
Facilitate Access to Credits for Farm inputs i.e. Cuttings, tractor hiring Fertilizer...etc													7,500,000
Involve the CaGRI in designing effective supply chain management and pricing mechanisms to ensure corporation between SMEs & Farmer Clusters													750,000
Development base-line Tracking													1,500,000

System for production of HQG													
Establishment of Quality Monitoring System													3,000,000
Organise Trainings on Good Manufacturing practices in HQG production in the six Geo-political Zones													8,500,000
Developing New products from HQG like Garri flakes, Popo Garri etc													5,500,000
Total													46,050,000
Establishment of Model Garri processing factory in six zones of the country													60,000,000
Grand Total													106,050,000

11.5 Time-line of Enabling Technologies

Objectives	Activities	Year 1				Year 2				Year 3				Year 4				Budget
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
1 To deploy efficient breeding strategies with maximum investment returns for the cassava value-added chain (VAC)	1. Develop seedling nursery in each agro-ecological zone in Nigeria																	4,000,000
	2. Field screening for appropriate traits in the breeding scheme																	9,000,000
2. To identify the best cultivated improved varieties with maximum	1. Test released varieties for suitability for commercial quality																	2,500,000

market potential in the cassava value-added chain (VAC)	standards for identified value chains																	
3. To release new generation of highly adapted and bumper yielding varieties for the sustained long term growth of cassava VAC	1. Assess current existing lines for temporal yield stability in the 28 states																	11,000,000
	2. Lines at advanced stages at NRCRI and IITA selected for wide scale testing in the UYT, NCRP and on –farm targeted specifically for the six value added chains																	12,000,000
	3. Testing in the UYT in agro-ecological based manner and subsequently at later stages in the 28 states																	12,000,000
	4. Release of varieties on the short term using materials existing at advanced stages																	4,000,000

	in the breeding pipeline																	
	5. Release of materials just initiated or at early stages in the breeding programmes of NRCRI for the medium term and long term																	2,000,000
4. To facilitate access and rapid adoption of improved varieties for stable supply chain	1. Multiplication of released to facilitate access by famers and stakeholders to improved elite varieties to boost productivity for the value-added chain																	12,000,000
5. To promote the integration of biotechnology interventions for the improvement of cassava VAC products	Self pollinations in search of useful recessive traits.																	2,000,000
	Basic understanding of inbreeding depression and heterosis in cassava																	3,000,000
	Self-pollination of elite germplasm with know desirable																	1,500,000

	characteristics																	
6. To genetically enrich source populations for strategic target traits critical to the cassava VAC	1. Improving of source population via recurrent selection using elite materials with attributes for value added to pyramid and increase frequency of favorable alleles for traits relevant to the value-added chain products																	2,350,000
7. To generate and develop country-wide productivity database for informed decision making in the cassava VAC .	1. Database of production for improved and released varieties and elite genotypes from breeding activities and on-farm studies																	15,000,000
8. To improve plant breeding capacity (PBC) to meet market response and demand elasticity of cassava VAC	1. Formal Training of breeders and assistants in plant breeding in partnerships with AGRA, WACCI, IARC.																	14,000,000
	2. Workshops on phenotyping for value-added chain products																	4,500,000

	3. Training on breeding decision tools																	2,000,000
	4. Equipment for field activities																	13,000,000
	5. Provision of screenhouse facilities and storage (cold store for seeds)																	24,000,000
	6. Procurement of Lab equipment for molecular breeding and processing and quality assessment																	40,000,000
																		189,850

11 BUDGET

N4,751, 516 (Under Review)