Report on Sweetpotato value chain study: exploring opportunities to promote greater exploitation of the benefits of Sweetpotato in representative states of Nigeria

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May 2012

Executive Summary

This report is the output of a study undertaken as part of the Sweetpotato Action for Security and Health in Africa (SASHA) Project, which aims to improve *"food security and livelihoods of 150,000 poor households in Sub-Saharan Africa (SSA) by exploiting the untapped potential of sweetpotato"*. The study seeks to explore how Nigeria, which ranks third in global output of the crop, can exploit the benefits of sweetpotato in both its food and farming systems. Sweetpotato is not only a good source of carbohydrates, fibre and many micronutrients but also the orange-fleshed varieties are especially rich in beta-carotene, the precursor to vitamin A. Hence, increased consumption of the orange-fleshed sweetpotato can significantly reduce Vitamin A deficiency (VAD) and associated conditions such as blindness and premature death in children and pregnant women. Cultivation of this versatile crop requires fewer inputs and less labour than other staple crops but, in contrast with other low-input starchy staples such as cassava, it is a relatively higher value crop with a rather short gestation period and, therefore, can potentially offer poor households an effective means to optimise farm-based earnings. The study was specifically intended to generate evidence on the desirability and feasibility of investing in development of sweetpotato value chains for fresh root marketing and processed products in the major producing areas and markets.

A starting point in the study was a review of past and ongoing initiatives in the agriculture sector in Nigeria. This was undertaken to ensure that relevant lessons can be taken into account as stakeholders make decisions on short, medium and long term options to promote growth and development in the sweetpotato sub-sector. Among the lessons that emerged from this review is the need to ensure strong complementarity between supply-side and demand-side interventions, as weaknesses on one side appear to stymie progress and/or undermine sustainability. Furthermore, it was noted that commercial incentives tend to be more potent in attracting investment into various segments of agricultural value chains than merely demonstrating the technical feasibility of an enterprise. In addition, if policy interventions are to positively influence the incentive structure in the value chains then it is important to go beyond making particular investment opportunities more visible and/or motivating investors by means of the "legal stick" and to focus on addressing critical constraints that hamper remunerative and predictable transactions by various actors in the chain, especially those whose activities drive up demand within the chain.

As a crop with wide ecological adaptability, low input requirements and a relatively shorter gestation period than other root crops, production of sweetpotato has expanded to all the agro-ecological zones of Nigeria. Driven in part by investments in irrigation, there has been a significant growth in production outside of the sub-humid zone (comprising Kwara, Niger, Plateau and Benue) in the semi-arid zone (Kaduna, Kano and Bauchi). Sweetpotato has tremendous genetic diversity, ranging from very sugary to bland types, watery (low dry matter) to floury (high dry matter) textures, a wide array of flesh colours (white, cream, yellow, orange, purples) and diverse skin colours (reddish, brownish, yellowish, cream, purplish). Currently, the yellow-fleshed, bland varieties, with relatively high dry matter, are very popular among consumers and dominate production in the major surplus-producing regions. This diversity offers a wider range of potential marketing strategies.

The review of the economics of production and marketing of sweetpotato indicate that growth in the sub-sector can contribute significantly to reducing poverty in rural as well as urban areas. The estimated cost of production is not out of the reach of the rural poor, as may for instance be the case in the production of yam. This cost can be even lower if the cost of planting materials can be reduced (currently it constitutes close to 40 percent of the total cost of production of the crop). Relative to its main competitor in terms cost of production and adaptability to a range of soil and agro-climatic conditions – cassava – sweetpotato provides an opportunity for substantially higher gross margins per area cultivated and with considerably shorter gestation period which allows rural households to engage in other income-earning farm and non-farm rural economic activities – this was observed to be occurring in some sweetpotato-growing communities visited during this study.

Traders' margins appear tight, reflecting the competitive nature of the market. However, it is evident that access to capital does not constitute a major barrier to entry into the trade as new entrants often enter as micro-retailers and graduate into wholesalers by gradually building up their capital. The sub-sector is therefore attracting those entrants who do not have access to capital such as relatively young school leavers and university graduates and can offer an avenue for generating jobs with this target group in mind.

Sweetpotato can and is utilised in diverse forms in Nigeria as in other parts of the world. Currently, the bulk of the crop is marketed as fresh roots to households which eat it either boiled or fried. This market shows the greatest prospects for rapid growth in the short to medium term, in particular as it services a growing number of street-food vendors, who are selling fried sweetpotato slices targeting school children and urban workers. The biggest obstacle to growth in demand for fresh sweetpotato roots and fried sweetpotato slices appears to be erroneous perceptions about health risks associated with its sweetness. Hence, effective promotion of consumer awareness of the nutrition and health benefits associated with the crop is critical in stirring sustained growth in demand.

One of the top two value chains with good prospects for uptake of sweetpotato is the emerging sweetpotato crisps industry. Entrepreneurs who entered this infant industry have been constrained in their efforts to scale up by difficulties in complying with the registration requirements of the National Agency for Food and Drug Administration and Control (NAFDAC). This is mainly because they do not have factory premises which are compliant with the regulatory requirements, have failed to adopt good manufacturing practices to assure food-quality products, and product quality variability is quite common. The underlying constraint is lack of finance to invest in requisite facilities and equipment, a situation which can potentially be remedied if they have access to the public-funded Technology Incubation Centres (TIC).

The other chain with potential which is yet to be exploited is the marketing of sweetpotato fries by the fast food outlets and informal restaurants. Industry players consulted during the study expressed interest in marketing sweetpotato fries, which are growing in popularity in the United States, especially within the diabetic and weight-watching communities. However, investment in local processing units which will deliver frozen sweetpotato chips is seen as critical in encouraging uptake of this

opportunity by the fast food outlets. The informal restaurants do not require this to place sweetpotato fries on their menus. What they need is availability of affordable chip making machines which are suitable for chipping sweetpotato roots with high dry matter content.

Though trials by various institutions in the country have confirmed the technical feasibility of partial substitution of wheat flour with dried sweetpotato flour in the bakery and confectionary industries in Nigeria, the economics of producing the dried sweetpotato flour shows that it is currently not a financially feasible option, especially if mechanical drying technology is adopted to assure a food-grade quality flour product. A feasible option is to promote inclusion of sweetpotato puree[1], which has been successfully piloted in Mozambique. The economics of partial substitution of wheat flour with the sweetpotato puree is quite attractive (Table 8). However, larger-scale bakers and biscuits manufacturers appear unwilling to adopt this because of anticipated difficulties in logistics management. It appears more feasible with medium-scale bakeries, who can produce the puree on-site.

Utilisation of sweetpotato in producing glucose syrup is also discounted on similar grounds, and will be financially feasible only when the price of fresh sweetpotato roots is competitive with the price of fresh cassava roots – a situation we do not anticipate in the foreseeable future in Nigeria. The potential also exists for increased inclusion of traditionally-dried sweetpotato flour in the preparation of Amala – with dried yam or cassava flour – but dearth of information made it difficult to assess the growth potential and offers a possible new area of research and development.

To foster uptake and/or scaling up of the opportunities for value addition in the sweetpotato sub-sector, the following recommendations are made (and discussed in detail in Section 5):

- Since household demand for the fresh roots is currently being influenced by erroneous perceptions regarding possible adverse impact because of its “sweetness”, it is important to promote awareness of the nutrition and health benefits associated with the crop (Section 5.1). One “win-win” means to promote this awareness is to include sweetpotato on the menu for the School Feeding Programme, currently being implemented only in the Osun State and covering 129,318 pupils in nursery to Primary 2. If supported, and possibly replicated in other states, it is anticipated that the programme, by introducing pupils and students to sweetpotato-based meals, will encourage parents and families to also take more sweetpotato. Hence, the impact on aggregate demand for sweetpotato is expected to far exceed what is directly procured for feeding pupils and students. It is also anticipated that inclusion of sweetpotato will not only produce health and nutrition benefits for the pupils but also lower the cost of the programme as it may replace higher-cost carbohydrate sources such as yam.
- Consumer acceptance studies can be undertaken to generate interest, indicate the proportion of consumers who find the product acceptable and the results used to support promotion programs. Research elsewhere has shown the while consumers might initially purchase a product new to them based on advertising, it is the taste of the product that drives subsequent repeat purchases or growing.

[1] Boiled, mashed sweetpotato.

- Another proposal intended to promote public awareness of the benefits of the crop is to organize Annual Sweetpotato Festivals, similar to the traditional yam festivals. The festivals should be organized on rotational basis by leading sweetpotato states. Activities which will form part of the proposed festival include fairs or shows at which various sweetpotato products can be displayed and marketed, serving of sweetpotato-based meals by hotels and restaurants, especially those in the host states, and publication of information on health and nutrition benefits of the crop. It is further proposed that funding for the festival is raised from private sponsors as well as Government – especially from the Ministries of Agriculture and Health.
- Major challenges facing the small but growing sweetpotato crisps industry include difficulty in complying with the registration requirements of NAFDAC, lack of finance, low levels of adoption of good manufacturing practices, and poor packaging which sometimes causes deterioration in the quality of the product. It is proposed that these entrepreneurs should be granted priority access to facilities provided by the Technology Incubation Centres (TIC) in sweetpotato-producing states. The centres offer premises which are suitable for purposes of registration, provide required technical assistance in the form of training in good manufacturing practices and in product marketing as well as facilitate collaboration with researchers in product development and quality assurance.
- The potential exists to promote marketing of sweetpotato fries by the rapidly growing fast food outlets in Nigeria, which have a history of success in marketing traditional Nigerian dishes and the infrastructure for testing and marketing new products. However, it is important to attract investor who will supply frozen sweetpotato chips to the outlets. To encourage informal restaurants to market sweetpotato fries, it is crucial that appropriate and affordable chip making equipment which can be used in their kitchens are made available. The technology for chipping sweetpotato already exists in the US and Nigeria has proven capacity to fabricate local equipment for processing agricultural produce such as cassava. It should therefore be possible to fabricate the required equipment, in particular if there is collaboration between local research institutions and private fabricators.
- The sweetpotato distribution chain is highly competitive and, as a result of relatively low entry barriers, is generating employment for young school leavers, including university graduates. To enhance efficiency and reduce distribution costs, it is proposed that the multiplicity of levies that traders pay to different state authorities during transit is rationalized. Infrastructure in the markets also needs to be improved, including building temporary storage sheds in the markets. The traders and farmers will also require training to promote sorting and bagging of roots by size, making it possible to reduce transaction costs by promoting trade by description.
- To boost supply response that will sustain growth in the sweetpotato value chains identified in this study, it will be crucial to maintain and, indeed, increase investment in the development and effective distribution of high-yielding varieties which also meet consumer preferences. The smallholder farmers who dominate production of sweetpotato will also require support in addressing constraints such as lack of finance and difficulties in accessing land, especially in areas close to major roads linked to markets.

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1. Introduction

1.1 Background and objectives of study

This report is the output of a study undertaken as part of the Sweetpotato Action for Security and Health in Africa (SASHA) Project. SASHA is a 5-year project with the goal of improving *"food security and livelihoods of 150,000 poor households in Sub-Saharan Africa (SSA) by exploiting the untapped potential of sweetpotato"*. The project is part of a broader, multi-donor Sweetpotato for Profit and Health Initiative, which is expected to improve the lives of 10 million people in SSA in 10 years.

Promoting increased production and consumption of sweetpotato (*Ipomoea batatas*) has significant health and nutrition as well as poverty reduction implications. All varieties of sweetpotato are good sources of carbohydrates, fibre and many micronutrients and the orange-fleshed varieties are especially rich in beta-carotene, the precursor to vitamin A (Low et al. 2007). Hence, more widespread consumption of the orange-fleshed sweetpotato can significantly reduce Vitamin A deficiency (VAD), which threatens an estimated 43 million children under age 5 in SSA (Maziyan-Dixon et al. 2006; and Bovell-Benjamin 2010). It can also reduce the incidence of conditions which are associated with VAD such as blindness and premature death in children and pregnant women. As a source of calories and vitamin A, sweetpotato is relatively cheap. Low et al. (2005) estimated that only 125 grams of most orange-fleshed sweetpotato varieties, which in 2004 in Mozambique cost less than 1 cent (US), can supply the recommended daily allowance of vitamin A for children and non-lactating women. In Nigeria the cost of the same volume of sweetpotato ranges from 1.31 cents (US) or 2.09 Naira in rural surplus-producing areas to 4.06 cents (US) or 6.49 Naira in the urban areas[2]. Furthermore, sweetpotato provides more edible energy per hectare per day than rice or cassava; requires fewer inputs and less labour than other staple crops and tolerates marginal growing conditions, such as dry spells or poor soil (Njoku 2006). However, in contrast with other low-input starchy staples produced in Nigeria, such as cassava, it is a relatively higher value crop with a rather short gestation period. The crop, therefore, offers poor households an effective means to optimise farm-based earnings.

Nigeria is among the SSA countries which are yet to fully exploit the potential of sweetpotato. The country ranks as the third leading producer of sweetpotato in the world, after China (the run-away world leader) and Uganda. According to FAO statistics, in 2009 China produced over 75 million tonnes of fresh sweetpotato while Uganda's output was estimated at 2.766 million tonnes. Total production in Nigeria in 2009 is estimated at 2.746 million tonnes, having risen from the low level of 150,000 tonnes per annum in the 1960s (Akinpelu and Adenegan 2011) to a peak of 3.462 million tonnes in 2006 (FAOSTAT 2011). As subsequent discussions in this report demonstrate, Nigeria has considerable potential to increase sweetpotato production and utilisation and in a manner that will benefit the rural poor and women. What is required to achieve this is to outline a viable strategy for sustainable development of the sweetpotato value chains. It is for this purpose that the study was commissioned.

[2] The exchange rate at the time of the time of the study was N160 to US$1.00

1.2 Objectives of the study and methodology adopted

The study was specifically intended to gather and analyse evidence on the desirability and feasibility of investing in development of sweetpotato value chains for fresh root marketing and processed products in the major producing areas and markets. The report is to help guide stakeholders in determining options which make the most sense to invest in the short, medium, and longer term.

The methodology adopted in undertaking the study included a rapid market survey to identify the key market and product issues (economic, social, product, quality, regulatory etc.) influencing each value chain and their development. The surveys examined both constraints and opportunities. For the fresh produce market, the survey was also intended to identify the key characteristics of farmers commercializing and trading sweetpotato, with particular attention paid to gender roles in different parts of the value chain.

The study also included rapid market surveys of the existing sweetpotato processed products, focusing on opportunities for substitution in wheat flour products such as biscuits and bread (where sweetpotato could replace a percentage of wheat flour) and on convenient products and snack foods such as instant noodles, crisps and chips (French fries) as well as processed products typically made with cassava and higher value yam such as *Amala*. An assessment of the economic viability of use of sweetpotato as an ingredient in the identified products was undertaken. Any existing sweetpotato-based processed products were also captured, including estimating the size of market demand and calculating the cost of production.

Following the above rapid market surveys, four to five case study value chains for the fresh and processed products options were explored in greater detail in order to understand the relationship between the actors in the value chains, the margins, tradable qualities and potential future benefits, again paying specific attention to gender roles. Finally, based on the rapid assessments and value chain analysis, the top three potential interventions are ranked and the strengths and weaknesses of potential partners (research institutions, extension services, farmers, farmer associations/cooperatives, traders, agro-processors) and the potential degree of involvement of women described. Any relevant bottlenecks are identified. The rest of the report is structured as follows:

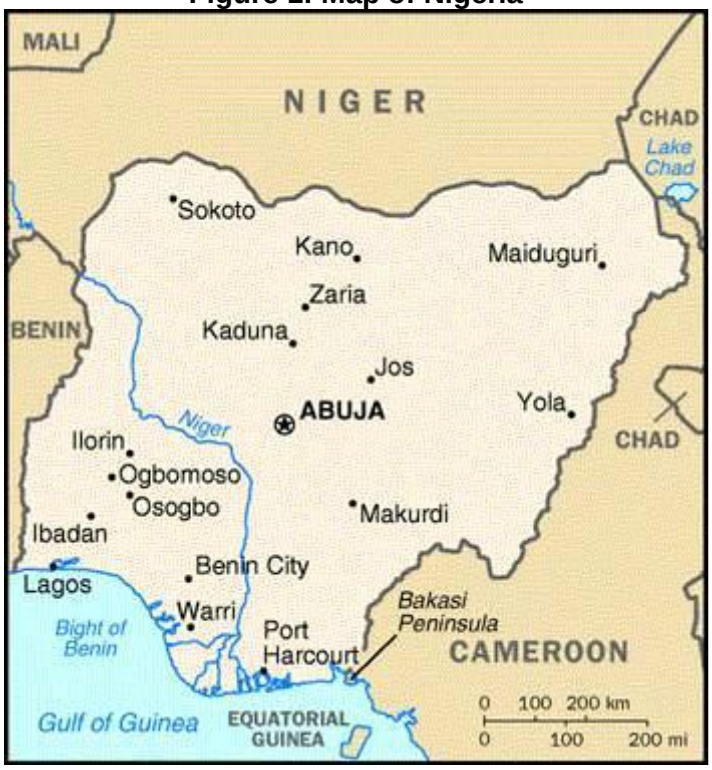
- In Chapter 2 we discuss Nigeria's agricultural economy, including a brief review of various programmes and projects in the sector in order to draw lessons which may be relevant in outlining strategies for growth in the sweetpotato sub-sector.
- In Chapter 3 we review sweetpotato production and utilization in Nigeria, including production costs and marketing margins.
- In Chapter 4 we assess opportunities for increasing demand for the crop, concluding with identifying top three sweetpotato value chains with the greatest prospects for growth in the short to medium term. We follow this up in Chapter 5 by assessing the strengths, weaknesses and constraints associated with key players in the identified chains and propose measures to enhance their role in the development of the sub-sector.

2. Nigeria's agricultural economy

2.1 Overview of the Nigerian economy

Nigeria is Africa's most populous nation, with an estimated population of close to 150 million in 2010 and an average annual population growth rate of just under 2 percent. About 48 percent of its population live in urban areas and the rate of urbanisation is estimated at 3.8 percent per annum. Nigeria, relative to most African countries, has a huge domestic market which can drive growth in agricultural and industrial production, including agro-based value addition.

Figure 1: Map of Nigeria



The country is well endowed with natural resources, including proven oil reserves of over 32 billion barrels. Nigeria exports over 2 million barrels of oil per day and has other mineral resources including tin, iron ore, coal, limestone, niobium, lead and zinc. Over 75 percent of the land area is suitable for agricultural production but less than 40 percent of its arable land is under cultivation. The country has diverse agro-ecological zones which are suitable for producing a wide range of annual and perennial crops including cash crops such as cocoa, oil palm and rubber, as well as food crops like maize, cassava, yams, cocoyam and sweetpotato. The climate becomes progressively drier towards the north, where the production of sorghum and millet is concentrated.

As shown in Table 1 below, Nigeria recorded an impressive average GDP growth rate of 6.7 percent between 2003 and 2009 compared with an average rate of 2.8 percent in the 1990s and 3.8 percent between 1999 and 2003. This growth is, however, below the 7.4 percent target required to achieve the country's Millennium Development Goals (MDGs). The growth recorded was also driven largely by the petroleum and agriculture sectors, while the manufacturing sector was reported to

have been in relative decline - capacity utilisation in the manufacturing sector was only 42.4 percent mainly due to unreliable energy (electricity) supply and consequent high cost[3].

Table 1: Nigeria Macroeconomic and other indicators (2009*)

Indicator	2009
Population	149.3 million
Real GDP Growth (average 2003 – 09)	6.7 percent
GDP (US $'bn)	212.08 billion
GDP Per Capita (US$)	1,089
Contribution of agriculture sector to GDP	41.7 percent
Agriculture sector growth	5.88 percent
Inflation (%)	12.5 percent
91-day Treasury Bills Rate	2.02 percent
Average Lending Rate	15.8 percent
Official Reserves (US$')	46.54 billion
Import Cover (months)	7.1
Exchange Rate to US$	150
External Debt (US$'bn)	9.69 billion
External Debt as % GDP	6.2
Sovereign Ratings (Fitch)	BB-
Sovereign Ratings (S&P)	B+

Source: Central Bank of Nigeria, National Bureau of Statistics and the Economist Intelligence Unit
*Otherwise stated against indicator.

Inflation in Nigeria averaged 11.6 percent between 2003 and 2009, when it hovered around 12.5 percent. Over the same period the domestic currency has also been relatively stable, with average annual depreciation estimated at 3.6 percent. Decline in public sector borrowing, partly the result of recent surges in oil prices which helped to improve the overall budgetary position of the federal government, contributed to relatively low real interest rates – about 3.3 percent in 2009 compared to 12.9 percent in Sub-Saharan Africa (SSA). The country has a diverse and relatively well-developed financial sector. By the end of 2009, the country had 24 universal banks, five discount houses, five development finance institutions, 900 microfinance institutions and 73 insurance companies. The network of bank branches stood at 5,134 at the end of 2008. Unlike most countries in SSA, the private sector share of total credit provided by the formal financial sector dwarfs credit granted to the public sector by far. However, the bulk of the credit – just over 75 percent – tends to be of short-term maturity, that is one year or below and only 1.4 percent of total credit to the private sector goes into the agriculture sector compared to 16.4 percent to financing for imports and domestic trade. For instance, inventory financing, usually involving stock monitoring or full-scale collateral management tends to be used mainly for importing and domestic distribution of petroleum products[4].

2.2 Under-investment stymies performance of Nigeria's agriculture sector

Agriculture remains important for the livelihoods of most Nigerians, especially the rural population. The sector accounts for over 40 percent of GDP and employs about 70 percent of the labour force. However, its performance has been affected by the

[3] Nigeria Agricultural Economy and Policy Report, 2009.
[4] Pers. Comm. with Country Manager of Audit, Control and Expertise (ACE).

rather dualistic nature of the economy – evidenced by weak links between the dominant oil sector, which accounts for 95 percent of total export earnings and almost 85 percent of government revenues, and the rest of the economy. Agriculture had been the dominant sector at independence in 1960, accounting for just under 65 percent of GDP. Between 1961 and 1970, agricultural exports accounted for an average of 62.2 percent of the total value of all exports in Nigeria, while sales tax and export duties on agricultural commodities accounted for an average of 27 percent of all duties collected by the Federal Government (Olayide, 1976; FAOSTAT data, 2009). The oil boom of the 1970s changed all that as the contribution of agriculture to GDP dropped steadily to 28.3 percent in 2002 before rising to 37.3 percent in 2006. In contrast, the contribution of the oil and gas sector to GDP rose from a low six percent in 1970 to over 45 percent by the mid-2000s.

This shift is attributable, in part, to the concentration of investment in the oil sector as well as neglect of the non-oil sectors, including in particular the agricultural sector. Heavy taxation of the sector to finance industrialisation and urban development, which was vigorously pursued between independence and 1985, sapped the growth potential of the rural sector. Furthermore, public investment in the sector remained low – less than 2 percent of total federal expenditure allotted to agriculture between 2001 to 2005 – and indeed lower than spending on other sectors such as education, health and water, and well below the 10 percent target set by African leaders in the 2003 Maputo agreement[5]. In analysing agricultural public spending in Nigeria, Mogues *et al.* (2008) observed that the spending was highly concentrated in a few areas, with three out of 179 programs accounting for more than 81 percent of federal capital spending, of which nearly three-quarters went to government purchase of agricultural inputs and agricultural outputs alone.

A consequence of the under-investment in Nigeria's agriculture is low and declining productivity across all the sub-sectors over the past four decades (Fulginiti, *et al*., 2004). As a result increase in agricultural production has been due to increase in area cultivated rather than from increasing yield (Phillip *et al.*, 2009). Other factors contributing to this situation include poor agricultural pricing policies, inadequate access to modern inputs such as fertilizer and tractors services, low access to agricultural credit, land tenure insecurity, land degradation, inadequate and unpredictable investment in agricultural research and inefficiencies in agricultural marketing systems.

As illustrated in Table 2 below, Nigeria, which was once a major exporter of agricultural commodities, turned into a net importer of food largely because the domestic food supply failed to meet the needs of the high and rapidly growing population. Except for starchy roots, sugar crops and spices, the country has become dependent on food imports. According to estimates by the International Trade Centre/UNCTAD/WTO, the country imports food and food products valued at over US$2 billion per year[6]. Wheat and rice imports account for 30 percent of the food imports, with the total value of imported rice representing 35 percent of domestic production. The food import bill therefore rose sharply, from about ₦57.7 million in 1970 to ₦3,474.5 million in 1990 and stood at ₦174,229.4 million in 2006

[5] Source: Mogues *et al.* (2008)
[6] Source: www.indexmundi.com/trade/imports/?country=ng&division=04

(CBN, 2006). This is despite being endowed with the agro-climate for producing sufficiently large volumes of some of these commodities for the domestic market and even for exports, especially into regional markets.

Table 2: Domestic Food Supply Profile in Nigeria

Commodity Group	Domestic supply (1000 tonnes)	Production (1000 tonnes)	% Produced	Net Import (1000 tonnes)	% Imported
Cereals	25,457.56	21,492.79	84.43	3,964.77	15.57
Starchy Roots	66,424.87	66,437.00	100.02	- 12.13	- 0.02
Sugar crops	738.88	739.00	100.02	- 0.12	- 0.02
Sugar & Sweeteners	1,377.20	53.60	3.89	1,138.82	82.69
Pulses	2,278.73	2,278.00	99.97	0.73	0.03
Oil crops	4,259.88	4,259.40	99.99	0.48	0.01
Vegetable Oils	2,099.56	1,929.07	91.88	170.50	8.12
Vegetables	8,452.53	8,285.00	98.02	167.53	1.98
Fruits – Excluding Wine	9,181.69	9,127.00	99.40	54.69	0.60
Spices	161.31	161.50	100.12	- 0.18	- 0.11
Alcoholic Beverages	9,894.89	9,863.71	99.68	31.18	0.32
Meat	1,046.94	1,041.96	99.52	4.98	0.48
Animal Fats	172.69	36.83	21.33	135.86	78.67
Eggs	460.31	460.00	99.93	0.31	0.07
Fish, Seafood	903.17	476.54	52.76	426.63	47.24
Specific cereals					
Wheat	2,297.52	71.00	3.09	2,226.52	96.91
Rice (Milled equivalent)	3,853.93	2,249.79	58.38	1,604.14	41.62
Barley	98.59	-	-	98.59	100.00
Maize	4,794.30	4,779.00	99.68	15.30	0.32
Millet	6,281.74	6,282.00	100.00	- 0.26	- 0.00
Sorghum	8,027.84	8,028.00	100.00	- 0.16	- 0.00
Cereals, Other	87.07	83.00	95.33	4.07	4.67

Source: Adapted from FAO (2009) and the Nigeria Food Balance Sheet as of 2003.

Table 3: Contribution of different crops to daily food consumption in Nigeria

Crop	Per capita consumption of food (grams /person/day)					
	1969-1971	1979-1981	1990-1992	1995-1997	2001-2003	Share of total consumption
Cassava & its products	233	211	330	364	318	0.21
Yams	210	78	182	218	208	0.13
Vegetables & other products	123	92	109	130	133	0.09
Sorghum & its products	137	98	109	131	120	0.08
Fruits (citrus & other fruits)	132	129	128	128	121	0.08
Millet & products	118	77	102	110	97	0.06
Rice & products (milled equivalent)	12	49	66	60	74	0.05
Maize & its products	43	19	98	87	57	0.04
Wheat & its products	17	47	16	24	50	0.03
Plantains	56	44	41	45	47	0.03
Sweet potatoes	6	3	4	26	40	0.03
Sugar & products (raw equivalent)	8	31	16	20	30	0.02
Pulses, other & products	25	15	24	26	26	0.02

Source: FAOSTAT (http://www.fao.org/faostat/foodsecurity/index.en.htm)

Dependence on imported food has created affordability problems for poor households, especially the rural poor. Table 3 shows that the bulk of food consumed by the average household consists of high carbohydrate sources such as cassava which are severely deficient in protein and other essential nutrients. Obayelu et al. (2009) report that in the past few years Nigeria has witnessed a general increase in the consumption of carbohydrates and reduction in the intake of protein sources, fruits and vegetables. As noted by Arulogun and Owolabi (2011), in urban areas, in particular, there has been a sharp rise in the consumption of high energy foods which also contain high levels of fat, salt and sugar. Especially among the young people in urban areas, patronage of convenience (ready-made) foods such as noodles and fast food outlets has exploded (Agwu et al. 2011). It is estimated that in 2007 over 12 million Nigerians consumed about 250 million cartons of noodles made from wheat flour, making the country the 13th largest consumer of instant noodles in the world[7]. Arulogun and Owolabi (*op. cit*.) stress potential health risks associated with this shift in urban food consumption patterns, but observe that many young people appear not to be fully aware of the risks, and therefore advocate educational campaigns to promote healthier eating habits.

The changing urban food consumption pattern is also increasing dependence on food imports as noted by Agwu et al. (*op. cit*.). This could accentuate food-related health problems for poor households as the global food price volatility translates into higher cost of food on the domestic market. Between 1985 and 2005, Sanusi et al. (2006) report a sharp rise in households which are food insecure. Further evidence of this is revealed in a report by the UNDP (2007), which states that in 2005 as much as 9% of the population were undernourished while 29 percent of children under the age of five years were underweight. Per capita protein intake in 2005 was estimated at 59g/person/day – well below the recommended daily intake of 70g/person (FAOSTAT data, 2009). Vitamin A Deficiency (VAD) is another nutrition-related public health problem in Nigeria. A study conducted by Maziya-Dixon *et al*. (2006) found a nationwide incidence of VAD of 29.5 percent among children below 5 years. In the dry savanna regions of the country the rate was as high as 31.3 percent while in the humid forest regions it was 29.1 percent. VAD is a leading cause of preventable visual impairment and blindness. It also increases the risk of severe illness and death from common childhood infections such as diarrheal diseases and measles.

2.3 Presidential initiatives to boost cocoa, rice and sorghum production

Most of the recent initiatives launched by the Federal Government and donors to promote increased production in the agriculture sector tend to focus on supply-side measures including distribution of subsidised inputs to farmers. The Presidential "seal" is often seen as important in mobilising stakeholders behind the programmes. One of the first of such initiatives is the Presidential Initiative on Cocoa, which was launched by the Obasanjo Administration in the late 1990s with the aim of reversing decline in Nigeria's cocoa industry. Until the 1970s, cocoa was a leading non-oil foreign exchange earner, but growth in output declined from a high of over 300,000 tonnes of cocoa beans per annum in the late 1960s to an extremely low 90,000 tons in 1999. To address the problem of declining yield due to aging trees, seedlings were

[7] Estimates by the World Instant Noodles Association (WINA) in 2007.

distributed free to the farmers – about 6 million cocoa seedlings were distributed to farmers to replant 5,450 hectares of farms with trees aged 30 years and above. The farmers were also sensitised on improved crop husbandry practices and received subsidised inputs. Output recovered and steadily rose to 340,000 tonnes by end of 2005, making the country the fourth largest cocoa producer in the world[8]. Under the Presidential Initiative on Rice Production, Processing and Export, "R-Boxes" containing improved rice seeds (NERICA 1 varieties), fertiliser, agro-chemicals, knapsack sprayers and extension messages were distributed to smallholder farmers. Similar support was provided to farmers cultivating oil palm and cassava.

The Government of Nigeria also continued to support and expand coverage of the Nigeria Agricultural Insurance Scheme, which was established in 1987 to make agricultural investments more secured and therefore encourage financial institutions to lend to the sector. The Scheme operates on the basis of premium subsidy – farmers pay 50 percent of the chargeable premium while the remaining 50 percent is shared between the Federal Government and the relevant State Governments in the proportions of 37.5 percent and 12.5 percent respectively. To further improve access to credit, Government in 2001, raised the capital base of the Agricultural Credit Guarantee Scheme Fund (ACGSF), which was established by in 1978, from ₦100 million to ₦3 billion (equivalent to US$26.08 million). The Fund guarantees credit facilities extended to farmers by banks by up to 75 percent of the amount in default net of any security realized. The Fund is managed by the Central Bank of Nigeria (CBN), which handles the day-to-day operations of the Scheme.

Olaitan (2006) reports that, between 1978 and 2004, credit valued at ₦7.603 billion (US$54.33 million) was advanced to borrowers engaged in agricultural production and agro-processing. Though producers supplying the domestic market could benefit, the prime target were those intending to export their produce or products. He reports further that, of the total loans granted, the reports indicate that 50.6 percent was advanced to small and medium-scale borrowers. An empirical assessment of the scheme by Efobi and Osabuohien (2011) showed that it failed to encourage increased lending to the agricultural sector – lending to the sector declined from 8.16 percent in 2001, when additional funding was provided, to 2.15 percent in 2007[9]. Furthermore, Efobi and Osabuohien (*ibid.*) concluded that the scheme did not impact significantly on agricultural output in Nigeria – either for domestic consumption or exports. They attributed this to infrastructure constraints and lack of processing capacity which hampered sustained increase in output.

The Federal Government of Nigeria also adopted interventionist measures aimed at increasing aggregate industrial demand for target agricultural produce, an example being policy measures to increase industrial utilisation of sorghum by breweries. To compel breweries to use sorghum, the Government in the 1980s imposed a temporary ban on the importation of malt barley for brewing beer. Though the ban was subsequently lifted, the successful adaptation by the breweries meant that they did not only continue to use sorghum malt for beer but also as a major ingredient in producing other alcoholic and non-alcoholic beverages[10].

[8] After Cote d'Ivoire, Ghana and Indonesia (FAOSTAT).
[9] Based on data published in the Central Bank of Nigeria Bulletin 2007.
[10] Source: INTSORMIL Report No. 17, January 15 2008.

2.4 The Presidential Initiative for Cassava (PIC)

An approach similar to the one adopted to promote production and utilisation of sorghum underpinned under the Presidential Initiative for Cassava (PIC). The aim of the PIC was to drive sustained growth in cassava yield and output through encouraging industrial utilisation of the cassava roots, for which Nigeria is by far the leading producer in the world. This involved requiring flour mills to include 10 percent high quality cassava flour (HQCF) in composite flour used for baking in the country. With total wheat flour production in the country estimated at over 2 million tonnes per annum, it was estimated that demand for HQCF will exceed 200,000 tonnes – which translates into demand for over 1 million tonnes of fresh cassava roots.

The requirement to include HQCF was, however, not backed by enforceable legislation but the millers appeared willing to participate when it was launched in 2006. At that time they offered to buy HQCF at N75,000 per tonne. Considering that the cost of production was estimated at N63,579 per tonne, the rate of return for processors was 17.9 percent. This proved sufficient commercial incentive to attract private investment into setting up private cassava processing plants equipped with flash dryers. Local fabricators supplied the flash dryers and by 2008 over 80 of the processing plants had been established – with total installed capacity of 100,000 tonnes of HQCF per annum. Availability of high-yielding planting materials through projects such as RTEP improved the supply and lowered the cost of fresh cassava roots.

Since 2008 the Cassava: Adding Value for Africa (C:AVA) Project, which is funded by the Bill and Melinda Gates Foundation, has been supporting stakeholders in two focal states – Ogun and Ondo – to sustain efforts to promote processing and marketing of HQCF. The support provided includes: organising farmers' groups and assisting them with improved planning materials as well as extension advice so as to assure access to fresh roots for processors; providing technical advice to the processors to improve the efficiency of the drying equipment; and fostering links with buyers of HQCF, including but not limited to the flour millers. Success has, however, been frustrated by a number of challenges:

i. Lack of enabling legislation implied that uptake by the millers could not be enforced if commercial incentives were not significantly attractive. As a result, with a change in government in 2007 the policy attention to the sector waned and with it uptake by the millers citing some of the issues outlined below.

ii. The huge mismatch between the policy-driven demand for HQCF and local supply capacity. Whereas the industry required over 200,000 tonnes of HQCF to comply with the policy target, total installed capacity in 2008 was only 50 percent of that requirement. Furthermore, actual output of HQCF was only about 10 percent of the total volume required, often leading to supply uncertainty. Consequently, the rate of inclusion varied within the industry – from zero to maximum of 5 percent.

iii. The problem of supply uncertainty was also attributable to the high levels of intra-seasonal price variability for the fresh cassava roots, with the informal fresh roots and gari markets being the key determinants of prices.

iv. The quality of HQCF supplied by the burgeoning processing industry tended to be variable. No robust quality certification systems had been instituted. Concerns about how this will impact on the quality of their products, therefore, discouraged commercial uptake of HQCF by the millers. Those willing to buy offered prices which were no higher than N65,000 per tonne. Table 4 below makes it evident that at that price the margins are severely tight and this discouraged further investment in HQCF production. Reducing the cost of production through efficiency gains was an option which could have improved margins. However, high energy costs resulting from unreliable power supply made this extremely difficult to achieve. Furthermore, farmers appeared unwilling to reduce the price of fresh roots as a result of farm productivity gains because of relatively easier access to higher prices in the informal marketing chains.

v. The Government of Nigeria is in the process of re-launching the Cassava initiative and it is anticipated that some of the lessons learnt will shape its new programme.

Table 4: Price and margins for high quality cassava flour in Nigeria

	Anticipated market (prevailing in 2006)	**Current market Situation**	**Cost reduction by 15%**
Selling price (N)	75,000	65,000	65,000
Total cost (N)	63,579	63,579	57,220
Gross margin (N)	11,421	1,421	7,780
Rate of return (%)	17.9	2.2%	13.6%

Source: Kleih et al. (2008)

2.5 Other agriculture sector initiatives and programmes

These are described below:

2.5.1: Fadama Developments Projects

The desire to realize the full potential of *Fadama* resources in Nigeria led to the design of the National *Fadama* Development Project, mainly funded by the World Bank, with counterpart funding by the Federal and benefiting state governments. *Fadama* is a Hausa word for low-lying flood plains; usually with easily accessible shallow groundwater. It is typically waterlogged during the rainy seasons but retains moisture during the dry season. It also refers to a seasonally flooded area used for farming during the dry season. Qureshi (1989) defines it as alluvial, lowland formed by erosional and depositional actions of the rivers and streams. They encompass land and water resources that could easily be developed for irrigation agriculture (World Bank, 1994). These areas are considered to be of high potential for economic development through appropriate investments in infrastructure, household assets, and technical assistance).

It is estimated that just over 681,000 hectares of land in Nigeria is classified as *Fadama* land – representing close to 30 percent of total irrigable land area in the country (FAO 2005). *Fadama* lands occur throughout the country but concentration – 74 percent can be found in the Southern zone, with the remainder in the Middle Belt Region (14 percent) and the Northern Region (12 percent)[11]. In many countries *Fadama* areas are key to vine conservation and dry season production of sweetpotato. However, sweetpotato was not among the target crops under the *Fadama* projects. The main target crops are cereals such rice, maize, sorghum and wheat; vegetables including onion, tomato, pepper, okra, egg plant, lettuce, hot chilly, cabbage and cucumber. Also promoted are watermelon and sugar cane.

Fadama-I Project was implemented during the 1993-99 period. *Fadama*-I focused mainly on crop production and largely neglected downstream activities such as processing, preservation, and marketing. The emphasis of *Fadama*-I was on provision of wash bores to crop farmers through simple credit arrangements aimed at boosting aggregate crop output (NFDO, 2005). It is reported that 55,000 pump sets were distributed to beneficiaries of the Programme, equipping them irrigate one hectare per pump (FAO 2005). Despite reported success, Kudi et al. (2008) and others criticise *Fadama*-I is for failing to attend to the issues below:

a. Although *Fadama*-I project helped producers increase output, it didn't focus on storage and preservation. As a result, much of the output was either not sold at all or sold at low prices due to over-supply. In addition, the design of *Fadama*-I did not allow for rural infrastructure to ensure the efficient transportation of farm output to markets (World Bank, 2003).

[11] Reported in the Summary of the Environmental and Social Impact Assessment Study of the Second National Fadama Development Project (NFDP II), Government of the Federal Republic of Nigeria, August 2003.

b. The project also did not involve and empower key stakeholders such as producer organizations, local government organizations, the private sector and civil society organizations in designing and implementing projects and in providing advisory services. It thus raised concern about project ownership and sustainability.

c. It did not institute mechanisms for conflict resolution in the *Fadama* project areas and failed to adequately consider the needs of other users of *Fadama* resources (such as livestock producers, fisher folks, pastoralists, hunters, etc) other than sedentary farmers. As a result, conflict sometimes broke out between the sedentary farmers and pastoralists who found their traditional routes to water and pasture blocked. These confrontations resulted in physical injury and destruction of properties.

d. The project gave little support to the establishment of rural non-farm enterprises. It narrowly focused on crop production neglecting opportunities of values addition through processing and other activities.

The drawbacks identified in the Fadama I were taken into account in the formulation of the Second National *Fadama* Development Project (NFDP-II). The main objective of NFDP-II was to ensure sustainable increase in the incomes of *Fadama* users through expansion of farm and non-farm activities. The project, which was be effective on May 27, 2004, was funded by the World Bank and the African Development Bank (AfDB) to the tune of US$ 100 million and US $ 30 million respectively. It covered eighteen states including the Federal Capital Territory (FCT). Out of the 18 participating states, twelve of these states were assisted by the World Bank. The states included Adamawa, Bauchi, Gombe, FCT, Imo, Kaduna, Kebbi, Lagos, Niger, Ogun, Oyo and Taraba (NFDO, 2007). The remaining states were Borno, Jigawa, Kastina, Kwara, Kogi and Plateau. The project was designed also to assist project-contracted facilitators and participating Local Government Areas to undertake project-related activities at the level of *Fadama* Community Associations (FCAs) and other beneficiary groups of *Fadama* User Groups (FUGs). *Fadama*-II was operated for six years (2004–2010) with a goal of contributing to poverty reduction in Nigeria. However, actual implementation did not begin until September 2005.

The basic strategy of the project was that of a Community Driven Development (CDD) approach with strong emphasis on stakeholder participation, especially at the community level. Facilitators supported under the project helped in organizing the *Fadama* Community Associations (FCAs) and guided them through an intensive process of group decision - making using a range of participating techniques, resulting in Local Development Plans (LDPs). In this manner, the project ensured that every activity funded by the project was conceived after informed discussion by the whole community, which resulted from consensus building and social inclusiveness (Ingawa *et al*, 2004). Under *Fadama* II, US$52.8 million was invested in rural infrastructure including over 750 tube wells/wash bores and 180 kilometres of feeder roads. In addition, 24 dykes and weirs were constructed to help control flooding. There was also investment in rural processing facilities and market structures to promote post-harvest value addition. Various evaluations report that the project had a positive and significant impact on farm productivity and output as well

as household income in the target communities (Kudi et al. 2008; Afolabi 2010; and Ater and Umeh 2011).

2.5.2: Root and Tuber Expansion Programme

The Root and Tuber Expansion Programme (RTEP) was designed in October 1995 and implemented between June 2001 and September 2009, reviewed in 2004/05 with 31st March, 2010 as the Programme Loan closing date. It was jointly financed by the Federal Government of Nigeria (18.9%), 26 participating states including the Federal Capital Territory (16.3%) and the International Fund for Agricultural Development (IFAD, 69.3%). It was managed by a unit under the Federal Department of Agriculture of the Federal Ministry of Agriculture and Water Resources (FMAWR) and based in Ijebu-Ife, in Ogun State.

The overall objective of RTEP was to increase income and enhance food security of root and tuber farmers and processors. Specifically, to increase the productivity and production as well as process and add value to cassava, yam, cocoyam, sweet potato and Irish potato[12]. RTEP outputs included support for the release of 12 cassava varieties, 13 varieties of yam, three varieties each of Irish potato and sweet potato; distribution to 18,750 farmers of 453, 543 bundles of improved cassava cuttings, 1,081,638 seed yam, 716,040 cocoyam corms and 711,422 sweetpotato vines; (RTEP Completion Report 2010). Under RTEP, the following varieties of sweetpotato were tested and distributed through the ADPs: TIS 2532.OP.1.13, TIS 8164 AND TIS 87/0087. The multiplication was undertaken on farms in four states: Kwara, Anambra, Ogun and Nassarawa.

Some of the lessons learnt are that the design of the programme was institutionally complex and cumbersome (involving seven implementing agencies at the central/federal levels, while the geo-political was too extensive and demanding (26 states, inclusive of Abuja). Therefore to allow for effective management and coordination of programme activities and to avoid spreading of resources too thin, the design of a similar intervention in future would need to (i) be less complex; (ii) limit the geo-political area of coverage. The focus on commodity value-chain and use of the Community-Driven Development approach "were and remain appropriate, correct and proper" (RTEP Completion Report 2010). There has been no post-project assessment to see if the varieties distributed have been retained by the farmers and there is no indication that such a study is anticipated in the near future.

2.5.3: National Special Programme for Food Security (NSPFS)

Implementation of the NSPFS started in November 2001 after an initial pilot in Kano in 1998. The project was financed by the Federal Government of Nigeria with a budget of US $45.2 million and complementary funding of US$22 million by the Government of China. It involved some 23,000-25,000 farm families per site in 109 projects sites across all the senatorial districts of the country. Under the project,

[12] Inside sources say that the activities of the original Cassava Multiplication Programme funded by IFAD and the Federal Government of Nigeria raised Nigeria to the number one position in cassava with a lot of surplus and creating the cyclic glut; such that there was a need to process and market the surplus.

2,800 farmers engaged in irrigation farming benefited from access to 1,360 hectares of irrigated land as well as investment in 296 tube wells and 77 wash bores with 603 units of irrigation pumps. Another 123,764 farmers producing under rain-fed conditions accessed inputs including 5,200 tonnes of fertilizer, over 25,000 litres of agro-chemicals, cassava planting materials (181,000 bundles), 1.3 million yam seeds and improved breeds of livestock. The project did not include distribution of sweetpotato vines – apparently because it was not considered one of the priority crops in Nigeria.

An assessment of the project carried out by the International Food Policy Research Institute – IFPRI in 2009 concluded that the performance of the project has been mixed. While some of the pilots were reported to be successful, others failed to meet set objectives. The IFPRI report further noted that lack of reliable information and data on the project made a rigorous evaluation difficult.

2.6 Lessons with implications for sweetpotato promotion strategy

From the foregoing discussions it is apparent that Nigeria has the potential to significantly boost agricultural production to simultaneously enhance food security and improve the livelihoods of smallholder farmers if strategies are adopted to encourage investment in the sector. As has been argued in this chapter, including currently marginalised sweetpotato in the list of priority crops can lead to significant health and nutrition benefits as all varieties are good sources of carbohydrates, fibre and many micronutrients. The orange-fleshed sweetpotato varieties are especially rich in beta-carotene, the precursor to vitamin A and therefore offer a relatively cheap means to address the problem of vitamin A deficiency (Low et al. 2007). Discussions in the next chapter will also demonstrate that development of the sweetpotato sub-sector can contribute to reduction of poverty in both rural and urban areas. For poor farmers it offers an opportunity to produce a relatively high value crop and for the urban poor, especially women, a chance to engage in processing activities with attractive returns but low entry barriers. Nonetheless, many challenges need to addressed if sub-sector development strategies are to be successful, including taking into account lessons from recent and ongoing interventions in the agriculture sector, which are briefly reviewed above. The lessons include the following:

- The need to ensure strong complementarity between supply-side and demand-side interventions, as weaknesses on one side or the other appears to stymie progress and/or undermine sustainability;

- Commercial incentives tend to be more potent in attracting investment into various segments of agricultural value chains than merely demonstrating the technical feasibility of an enterprise. However, careful consideration needs to be given to exit strategies to ensure sustainable benefits.

- If policy interventions are to positively influence the incentive structure in the value chains then it is important to go beyond making particular investment opportunities more visible and/or motivating investors by means of the “legal stick” and to focus on addressing critical constraints that hamper remunerative

and predictable transactions by various actors in the chain, especially those whose activities drive up demand within the chain. In addition, the actors in the value chain need to be brought together to ensure that trust is developed and information constructively shared.

- In the design and reporting of most agricultural interventions, there is little attention paid to the gender aspects of the interventions, including whether women or men were explicitly targeted, whether there was any attempt to ensure gender equity, and how women and men benefited from the various interventions. Creating gender awareness and building gender-sensitive interventions will need to target policy makers at the national and local levels.

- On many agricultural initiatives, there is inadequate monitoring and a dearth of information on final adoption and impact. Resources to do so need to be adequately built in from the beginning.

3. Sweetpotato production and marketing in Nigeria

3.1 Trends in sweetpotato production in Nigeria

Though Nigeria is the third largest producer of sweetpotato, the crop is considered the 9th most important staple food crop in the country based on the volume and monetary value (Table 5). Tewe et al. (2003) report that Nigeria produced just about 37,000 tonnes of sweetpotato in 1950s, mainly for consumption by the farm households. By 1961 output had reached over 143,000 tonnes and from then, according to FAO statistics, rose sharply to 2,460,000 tonnes by 2000. Since that steep rise, growth in output of sweetpotato appears to have stagnated as suggested by the data in Table 6. It should be noted, however, average on-farm yields reported by Tewe et al. (2003) as well as Njoku (2009) is more than two times the average reported in the official FAO statistics. It ranges from 7 tonnes per hectare to 8 tonnes per hectare[13].

Table 5: Output and value of major agricultural produce in Nigeria (2007)

Agricultural commodity	Output (metric tonnes)	Value (US$ million)	% of Total Value
Cassava	43,100,000	2,479.58	18.3
Yams	31,136,000	5,026.35	37.1
Sorghum	9,058,000	920.65	6.8
Millet	8,090,000	1,158.72	8.6
Maize	6,724,000	535.14	3.9
Groundnuts (in-shell)	2,991,000	1,778.08	13.1
Rice (paddy)	3,186,000	652.55	4.8
Cowpeas	2,800,000	196.12	1.4
Sweet potatoes	2,432,000	244.39	1.8
Palm oil	1,300,000	393.56	2.9
Palm kernels	1,275,000	166.62	1.2
Total		13,551.76	

Source: FAOSTAT

Table 6: Sweetpotato production in Nigeria (2000-09)

	Output (million tonne)	**Yield** (tonne/hectare)	**Area cultivated** (1000 hectares)
2000	2.468	2.998	832.0
2001	2.473	3.001	824.0
2002	2.631	3.000	877.0
2003	2.800	3.128	895.0
2004	2.996	3.141	954.0
2005	3.205	3.241	989.0
2006	3.462	3.391	1021.0
2007	2.432	2.15	1131.0
2008	3.318	3.000	1106.0
2009	2.747	2.871	956.8

FAOSTATS (2011).

[13] Improving the yield and output data through robust farm surveys, therefore, needs to be an important baseline for any sub-sector development strategy.

As a crop with wide ecological adaptability, low input requirements and a relatively shorter maturity period than other root crops, its production has expanded to all the agro-ecological zones of Nigeria – i.e. in all the states of Nigeria (Figure 2). Partly due to investment in irrigation facilities, the concentration of production has shifted somewhat from the sub-humid zone (comprising Kwara, Niger, Plateau and Benue) to the semi-arid zone where Kaduna, Kano and Bauchi are leading producing states.

Figure 2: Political States of Nigeria

State level data on sweetpotato proved difficult to obtain. 2006 figures from the National Food Reserve Agency indicate that sweetpotato production is heavily concentrated in the north, with over a third of production coming from the North-Central States, with Benue being the leading producing state.

Table 7: Percentage Sweetpotato Production in Nigeria by Region in 2006

Region	% of Total Sweetpotato Production in Nigeria in 2006
North-West	16
North-East	14
North-Central	38
South-West	6
South-East	14
South-South	12

Source: National Food Reserve (2006)

As is typical of the agriculture sector in Nigeria, sweetpotato production is dominated by smallholder farmers cultivating 1 hectare or less. Most of the farmers cultivate family (or inherited) land and very few rent or lease land for growing sweetpotato, though this is beginning to happen in communities where commercial production is becoming increasingly significant. Farmers typically rely on family labour but the use of hired labour is on the rise, as observed by Fawole (2007). In most communities, farmers intercrop sweetpotato with cassava, maize and sorghum. Commercial production appears to be concentrated in the semi-arid northern states, especially in Kano, Kaduna (particularly Zaria) and Bauchi, where irrigation makes year-round cultivation possible. Commercial production is also growing in significance in parts of Kwara State and Nassarawa State. Farmers in these communities tend to grow sweetpotato varieties which are bland (less-sweet) and floury (with high dry matter) for which there is rising demand, especially in the major urban markets.

3.2 Major sweetpotato varieties produced in Nigeria

Sweetpotato has tremendous genetic diversity, ranging from very sugary to bland types, watery (low dry matter) to floury (high dry matter) textures, a wide array of flesh colours (white, cream, yellow, orange, purples) and diverse skin colours (reddish, brownish, yellowish, cream, purplish). Specific varietal awareness is limited in Nigeria, but there are two commonly cultivated types of sweetpotato, these being red/purple skin-white fleshed sweet variety and yellow/cream skin & light yellow flesh variety. Three improved varieties have been officially released by the National Root Crop Research institute (NRCRI) and planted by farmers. These are: TIS 87/0087 (white-fleshed), TIS 8164 (cream-fleshed), and TIS 2532-OP-1-13 (white-fleshed). The extent of adoption of these varieties is not clear, but the other varieties, which may be unofficial products of the breeding program or landrace varieties, currently dominate production due to their preferred characteristics.

Consumer preferences are clearly influencing choice of varieties cultivated in the communities in which there is rising commercial production of sweetpotato. For instance, the yellow-fleshed, less-sweet varieties with relatively high dry matter are very popular among consumers. This is particularly so among “street-food” sellers who sell fried SP chips (freshly sliced). The yellow colouration, especially after frying, is reportedly attractive to young consumers, including school children. Adults reportedly prefer less sweet varieties because of apparent concerns about increased risk of diabetes from eating “sweet” foods. It is also reported that the high dry matter reduces oil consumption and makes sweetpotato “more filling”. However, research is required to determine the true impact on oil consumption.

The yellow-fleshed, bland varieties, therefore, currently dominate supply in major markets in the FCT and Lagos. Traders interviewed in Lagos indicated that the shift in the main supply base for sweetpotato from the southern Yoruba states to the north is partly due to production of the preferred varieties in the semi-arid northern states. It was evident during the study that some communities in the Kwara State which, historically were major surplus producers, are struggling to sustain production of the crop principally because they are producing sweeter white-fleshed varieties with lower dry matter. They include communities around Offa, for which sweetpotato is an important traditional food and cash crop. The sweeter varieties are reportedly

preferred in the northern communities where they are also used as sweeteners, including for the traditional *Kunnu*. This is confirmed by Tewe et al. (2003).

3.3 Sweetpotato production cost and margins

Data collected from farmers during this study were triangulated with previous estimates (NRCRI Annual report and Tewe et al. 2003) to estimate the cost of production of sweetpotato in Nigeria. It has to be acknowledged that the cost of production estimates in Table 7 represent average conditions and may not reflect evident differences in different communities. The cost of vines represents a rather high proportion of the total cost of production – about 38 percent[14]. Hence, households which have access to cheaper vines – in most cases because they have access to *Fadama* lands where they can grow their own vines for planting or for sale or have other means for conserving vines – can significantly reduce their cost of production.

The total cost of production of sweetpotato per hectare is estimated at N127,580 (equivalent to US$796.38). The cost per tonne depends on yields obtained by farmers. Njoku (2009) reports that although yields in farmers' fields remain low in most communities (ranging from 5 to 8 tonnes/hectare), it has been possible to achieve yields of more than 30 tonnes/hectare in some field trials. He notes further that yields can be increased if farmers adopt high-yielding varieties and better agronomic practices. In our estimates reported in Table 7, we assumed an average yield of 10 tonnes/hectare, which represented yields reported by farmers producing into the commercial chain – as in the Kwara state – which is lower than the average yield that NRCRI used in their estimates in 2005.

Table 8: Sweetpotato cost of production of 1 hectare in Nigeria (2011)*

	Cost (Naira)	Cost (US$)
Fixed costs:		
Land rent per hectare	8000	50.00
Depreciation of basic farm equipment	1280	8.00
Sub-total (fixed costs)	9280	58.00
Variable costs:		
Land clearing	15000	93.75
Ploughing/ridging	7800	48.75
Vines	49200	307.50
Fertiliser	11000	68.75
Planting labour	5600	35.00
Weeding	9500	59.38
Harvesting	16500	103.12
Packaging	3700	23.13
Sub-total (variable costs)	118,300	738.38
Total production cost	127,580	796.38

Source: Rapid market survey and data from NRCRI Annual Report (2005) and Tewe et a.l. (2003).
The survey data was collected through interviewing over 15 sweetpotato producers, some of whom were part of producer associations consulted (they are included in the list of stakeholders consulted during the study – Appendix 1).

[14] Fawole (2007) also estimates cost of planting materials (vines) as representing about 36 percent of total cost of producing sweetpotato.

Based on the average yield of 10 tonnes/hectare we estimate the cost of production per tonne of sweetpotato at N12,758 (equivalent to US$79.64). Farmgate prices in communities producing for the market in 2011 range from N2,100 to N2,500 (US$13.12 to 15.63) per bag with average weight of 125kg. This translates to price per tonne of sweetpotato ranging from N16,800 (US$105.00) to N20,000 (US$125.00). Hence, sweetpotato producers can obtain gross margins of between N4,042 (US$25.26) to N7,242 (US$45.26) per tonne; representing rates of return of 31.7 percent and 56.7 percent respectively. Farm households producing sweetpotato can therefore earn gross margins of between N40,420 and N72,420 (US$252.60 and US$452.60) per hectare per season.

Comparative cost of production per hectare for cassava is estimated at N70,950, which is about 55% lower than the cost of producing sweetpotato. Assuming yield per hectare of 15 tonnes, which is obtained by smallholder farmers cultivating high-yielding varieties and improved husbandry practices (compared to average national yield of 12 tonnes per hectare), the cost production of cassava is estimated at N4,730 (US$29.56) per tonne, which is 28.3 percent higher than average cost of production in Thailand (the leading exporter of cassava products. Farmgate prices range between N5,600 (US$35) during the peak of the harvest and N8,000 (US$50.00). Hence, gross margins per tonne range between 18.4 percent and 69.1 percent and farm households can obtain N13,050 (US$81.56) and N49,050 (US$306.56) per hectare per season. Households can therefore more than double or treble their earnings per hectare by switching from producing cassava to sweetpotato. Furthermore, sweetpotato has a much shorter gestation period of four (4 to 5 months) months compared to 12 to 18 months for cassava. Farm households therefore have the opportunity to increase household income by cultivating sweetpotato during the dry season – where they have access to Fadama land or irrigation – or engage in other farm and non-farm rural economic activities. For instance, in some of the communities in Kwara and Nassarawa States visited during this study, it was observed that some sweetpotato farmers engaged in relatively lucrative activities such as fattening livestock and raising poultry for the neighbouring urban markets. Others were involved in artisanal processing activities including producing Kunnu for consumers in the local communities as well as those in nearby urban areas.

The production of yam appears very lucrative with gross margins of between 45.3 percent and 74.4 percent – as reported by Izekor and Olumese (2010). However, the cost of production is more than double the cost of producing sweetpotato. A study by the NRCRI estimated the cost of production at over N470,000 (US$2,937.50) per hectare. This may be well beyond the means of rural poor households – the World Bank in its World Development Report (2010) estimates per capita income of almost 30 percent of the Nigerian population at less than US$1.25 per day or US$456.25 (N73,000) per year.

The above estimates of producer margins are consistent with perceptions of profitability among farmers interviewed. Market-oriented farmers in the communities studied, including relatively small-scale farmers, rank it lower only to yam in terms of profitability. In general, consumers of roots and tubers tend to rank sweetpotato lower than yam and cassava but higher than Irish potato and cocoyam in terms of availability and utilisation in Nigeria's traditional food systems (as observed in

Akoroda 2009). Rising demand for sweetpotato is in part attributed to its comparative affordability relative to yam – traders interviewed reported that demand for sweetpotato peaks in May-September when, according to official price data sweetpotato can be about 50 percent cheaper than yam[15].

3.4 Utilisation of sweetpotato in Nigeria

Food systems in Nigeria vary in the different regions, with 35 significant food crops, the most predominant of which are the roots and tubers (Akoroda 2009). Cassava roots and products, especially gari, constitute the dominant energy source in the country (Table 3), partly because it is affordable to most of the population, especially the poor. Sweetpotato has diverse uses ranging from consumption of fresh roots or leaves to processing into starch, flour, noodles, natural colorants, glucose syrup, candy, alcohol, citric acid, monosodium glutamate and animal feed (Lebot, 2009, Woolfe, 1992). However, its consumption in Nigeria is marginal relative to the other food crops though it is being increasingly recognised that all parts of the crop can be utilized as valuable foods as the plant contains a variety of nutrients.

Sweetpotato roots are rich in carbohydrates, many B vitamins, vitamins C and K, and the orange-fleshed varieties are extremely rich in provitamin A. Its leaves are rich in protein (4%) compared to other leafy vegetables and also have many micronutrients. Sweetpotato can produce more edible energy per day per unit area than wheat, rice or cassava (Lebot, 2009). In terms of nutritional content per 100 g of cooked food, sweet potato ranks third among the crops listed in food energy and fourth in protein, an advantage over cassava (Ewell and Mutura, 1991). It is the only starchy staple which contains appreciable amounts of β-carotene (orange-fleshed varieties only), ascorbic acid and amino acid lysine that is deficient in cereal based diets like rice (Bradbury and Singh, 1986). It also contains appreciable amounts of soluble fibre which helps in reducing cholesterol level, and anti-oxidant nutrients which can inhibit the development of coronary heart disease and cancer commonly found among the affluent (Kays & Kays, 1997; WHO, 1990). In a review by Bovell-Benjamin (2010), sweetpotato was reported to have anti-diabetic properties, that is, the capability to lower blood glucose level and improve glucose tolerance. White-skinned sweetpotato has anti-oxidative, radical scavenging and anti-mutagenic properties and have been associated with reducing liver injury and blood pressure lowering activity. The stem and leaves of sweetpotato contain potentially bioactive phytochemicals which have been shown to improve glucose tolerance in humans. It also has high amounts of polyphenolics, which are protective against diseases linked to oxidation such as cancer and cardiovascular disease (Bovell-Benjamin, 2010). Low et al. (2007) note that consumption of orange-fleshed sweet potato (OFSP) can contribute substantially to reducing vitamin A deficiency in Sub-Saharan Africa and can, therefore, be a lead crop in food-based strategies for controlling this condition.

During this current study, it was observed that awareness of these health and nutrition related benefits appear to be growing in some communities in Nigeria. For instance in Ilorin, in Kwara State, anecdotes from some respondents suggested that some health professionals in the state have been advising diabetic patients to take

[15] This is based on food price data obtained from 2001 to 2007 published by the Nigeria Bureau of Statistics.

more sweetpotato as part of their diet-control regime to manage their condition and even provide information on local sources of supply of the fresh roots. However, most respondents, including farmers, sweetpotato sellers and processors, were unaware of these benefits and often hold erroneous beliefs about sweetpotato precipitating diabetes because of its sweetness.

In Nigeria sweetpotato is consumed mainly boiled, fried fresh, and sometimes roasted. It is also cooked together with cowpea and other root and tubers to make yam pottage and other types of dishes. In the northern part of the country, it is used as a natural sweetener in some foods (Tewe, *et al*., 2003). In Nassarawa State, the roots are sometimes preserved by slicing, partial boiling and sun-drying to produce *kimbar*, which is then eaten when needed. Dried sweetpotato chips are used as an ingredient in producing *Kunnu-zaki*, a popular cereal-based beverage. Although *Kunnu-zaki* originated from Northern Nigeria, its consumption has spread to other parts of the country. Some people consume sweetpotato leaves in soups to control eye problems. In some parts of Kwara and Osun states, the roots are boiled with yam and pounded. It is also sliced, dried and milled into flour (*elubo*) and made into a traditional stiff paste (*amala*) (Fetuga, *et al*., 2010). Its potential utilisation as an industrial raw material for a wide range of products such as starch, glucose syrup, citric acid, mono-sodium glutamate and ethanol is yet to be fully exploited in Nigeria (Woolfe, 1992). In the next chapter we explore the feasibility of industrial uptake of the crop.

3.5 Marketing of sweetpotato in Nigeria

The bulk of the marketed crop from the northern states is sold into markets in the Federal Capital Territory (FCT) and in south-western markets such as Lagos and Ibadan. We estimate that about 54,000 tonnes of fresh sweetpotato roots from the northern states is supplied to markets in the FCT per year[16]. Over 70% of this is delivered into the main wholesale market at Madala[17] - to an open "depot" (with no form of shelter for the roots which are stored in bags). This is in contrast to the covered areas for maize. The main retail markets in the FCT, including Mararaba and Gosa markets, receive supplies from Madala involving traders who often move around these markets on "market days". These traders sell 1-2.5 tonnes of the fresh roots in the markets: 40% of that to micro-retailers 2-4 of whom will jointly buy one bag and retail; another 20% to people frying sweetpotato; and the remaining 40% they directly retail. Based on the rapid market survey, we estimate that Lagos is supplied with over 30,000 tonnes of fresh sweetpotato annually from the northern states, the bulk being sold through the main wholesale market ("Mile 12") with the rest being distributed through markets in Agege, Ajegunle and others. Estimates of volumes supplied were based on verbal reports by traders and, especially in the Lagos, there appeared to be a reluctance to provide information. We therefore acknowledge that the volumes may have been under-estimated and will require further in-depth surveys, including in the main surplus-producing northern states.

[16] This estimate is based on the number of truckloads of sweetpotato delivered to markets in the FCT area as reported by traders interviewed.

[17] On the average, over 20 truckloads (of 30-tonnes) being delivered on market days and the rest being delivered by 2-3 truckloads (of 30-tonnes) per day.

The traders in the Mile 12 market have an informal structure managed by *Dilali* who control trade. The *Dilali* maintain contacts with suppliers in the northern states and therefore control supplies into Lagos. They also maintain a system of registration of traders which limits the number of wholesale traders and access to the market by non-registered sellers. Supplies into Lagos from the "Yoruba"-communities such as Agbamu in the Kwara State as well as others in Osun are available during the main harvest season, beginning in August-September. During the 3-4 months season, these communities where sweetpotato is produced under rain-fed conditions supply about 5,000 tonnes in total into Lagos.

The third main consumer market for the fresh roots is reported to be in and around Port Harcourt. The supplies are mainly from Benue and Taraba States in the Middle Belt and South-Eastern states including Rivers State, Cross River State and Bayelsa State. Interestingly, the bulk of the marketed surplus of fresh sweetpotato produced in the Nassarawa is reportedly sold into the Port Harcourt markets. This is despite the fact that Nassarawa is closer to the FCT and the farmgate prices offered to producers in the state are similar to those offered to farmers in the north. Estimates of volumes delivered into these markets are currently unavailable.

A wide variety of sweetpotato is produced in Nigeria, ranging from very sugary to bland types, watery (low dry matter) to floury (high dry matter) textures, a wide array of flesh colours (white, cream, yellow, orange, purples) and diverse skin colors (reddish, brownish, yellowish, cream, purplish). Specific varietal awareness is limited, but the most preferred varieties are the yellow-fleshed, bland varieties with relatively high dry matter. This is particularly so among "street-food" sellers who sell fried sweetpotato chips (freshly sliced). The yellow colouration, especially after frying, is reportedly attractive to young consumers, including school children. Adults reportedly prefer bland varieties because of apparent concerns about increased risk of diabetes from eating "sweet" foods. It is also reported that the high dry matter reduces oil consumption and makes sweetpotato "more filling". These varieties therefore currently dominate supply in major markets in the FCT and Lagos, leading to dominance of the major producing communities.

3.5.1 Marketing costs and margins of sweetpotato in Nigeria

Farmgate prices of sweetpotato represent about 55% of retail prices in the major markets in and around Lagos and the FCT. Transport and handling costs account for 22% of the retail prices while levies collected by the states (of origin of the produce as well as those through it transits to the main markets) and local authorities (including those responsible for the markets) constitute 16% of the retail prices. Traders' margins represent only 7% of the prices paid by consumers buying from the retail markets, disaggregated as follows: average wholesalers' margin estimated at 2.2% and retail margins of 4.2%.

The rather tight wholesalers' margins imply that they have to maximise volumes traded to optimise their earnings. On the average they sell between 100 and 150 bags (12.5-18.75 tonnes) of sweetpotato per week, obtaining gross earnings of between N10,000 and N15,000 per week. The minimum wage in the public service in Nigeria at the time of the study was N7,500 per month. It is therefore not surprising

that educated young men are being attracted into the sweetpotato wholesale trade – including secondary school leavers and some university graduates.

The larger end of the retail trade in sweetpotato is dominated by men as is the case with the wholesale trade. The traders on the average sell about 10 bags (1.25 tonnes) of sweetpotato per day. The bulk (60%) of this is sold in bags to those who fry sweetpotato for sale as well as to other retailers. Their gross earnings per day is estimated at N9,300 per week, compared with average monthly earnings of about N5,000 for most semi-skilled workers in industry and services in Nigeria. The smaller-scale retailers sell up to 2 bags (0.25 tonnes) of fresh sweetpotato per day and their gross weekly income is about N2,000. This segment of the trade in fresh roots is dominated by women.

Transport costs on the main highways (e.g. Zaria-Lagos route) approximate N7.10 (US$0.05) per tonne/kilometre but from rural locations to markets in the major producing areas rises to an estimated N64 (US$0.40) per tonne/kilometre. The relatively higher transport costs in rural areas is due largely to the poor state of rural roads, which also reduces availability of cargo trucks – there were reports that many farmers transport their produce to the markets using motor bikes carrying a few bags of sweetpotato.

There is acute dearth of appropriate storage facilities in the farming communities. Most farmers store harvested produce in bags in cool, sometimes open places with shade provided by trees. Some adopt innovative methods to store unharvested roots in the soil[18]. Similarly, there are no storage facilities in the markets. “Depots” in the main wholesale markets are nothing more than open spaces allocated to sweetpotato sellers for holding stocks. The ground gets muddy when it rains, making it difficult for buyers to move around. Lack of storage facilities often leads to significant losses as roots rot away. At Mile 12 in Lagos, traders reported that losses due to rot could be as high as 5% of the produce delivered to the market.

Sorting and bagging roots by size does not occur very much in the trade. As a result, *trade-by-description* is difficult. This form of trading allows buyers to order by describing the volume and types of roots wanted, for example by phone, without having to personally supervise sorting and bagging. Traders will, at the minimum, save on the cost of travelling to the main buying centres – the cost involved may be as high as N10,000 per trip (for traders in the Lagos Mile 12 market travelling to Zaria and back). The reported case of a farmers’ group at Agbamu in Kwara State (Box 1 below), where the group undertakes collective marketing – bulking produce from members, sorting and packing according to size – allows the group to obtain a price premium of 10-15%.

The premium obtained by members of the association is also linked to the quality of the roots supplied by the group – reported to have smoother skin, relatively higher

[18] A major risk to storing in the ground is sweetpotato weevil attack. One commercial farmer reported engaging in the traditional practice of “hilling up”, i.e. building up the soil around the plant so there are no cracks and the weevils cannot penetrate. Another reported an innovative approach of cutting the vines of the mature plant, which helps “cure” the roots in the soil, then stomping on the ground near the plant base to prevent cracks for weevil entrance, followed by spraying an insecticide into the cut part of the vine to prevent weevil entry.

dry matter and more intense yellow colouration of the flesh compared with roots produced in the northern states. Of note in Nassarawa, was the fact that there is a market for small roots (<100 gms) which are used as a sweetener in the traditional drink *kunnu*. In East Africa, such small roots would be classified as unmarketable.

Box 1: Collective marketing of sorted sweetpotato fresh roots by Agbelere Youth Farmers' Association, Agbamu, Kwara State

The association has 125 members, including 40 women. Most of the members undertake sole cropping of sweetpotato on farms ranging in size from about 1.5 hectares (mainly for the women members) to 7.5 hectares. However, most members also cultivate other crops such as maize and cassava (often inter-cropped). The sweetpotato is seen by the members as a cash crop, though in the community it has cultural significance (it is usually part of the dowry paid by grooms).

Group services include facilitating access to extension services, and selling herbicides and pesticides to members. They have no collectively-owned or managed farms. Most farmers in the community do not apply fertiliser because of perceptions about fertilized roots produced not storing well but average yield is reported to be about 18 tonnes per hectare. A major function of the association is bulking produce from the members and marketing collectively to traders at the Lagos Mile 12 market. Through sorting and packing according to size they obtain premium price of between 10-15%. In addition by undertaking collective marketing, members of the association benefit from margins which will otherwise have accrued to middlemen. This additional income can be as high as 25% per bag of sweetpotato sold.

Source: interviews with members of the Association on 17th August 2011.

Official market information systems exist which involve collection and dissemination of price information for agricultural commodities including sweetpotato by National Project for Food Security and the state ADPs. However, there was no evidence that any market players, including farmers and traders rely on that information. Most of them access information on product prices from associates. There is also evidence that many traders use mobile phones to order produce from sellers with whom they have long-term trade relations. This is despite risks associated with lack of systems for sorting bagged roots as discussed above.

Very few traders reported having accessed formal credit, either as start-up or working capital. Despite this, lack of capital did not appear to be a major barrier to entry in the trade. New entrants often start by retailing small volumes and gradually building up capital and scaling up. Others also begin as agents on behalf of larger traders based, especially in the northern producing states. It is quite common for those traders as well as farmers to extend trade credit over periods of up to one week to wholesalers, who also extend similar facilities for 2-3 days to retailers. Personal ties can be important in accessing such facilities and may therefore create significant barriers to entry for new entrants lacking such ties.

3.6 Conclusions on production prospects

The discussions in this chapter have demonstrated that increased consumption of sweetpotato has the potential to significantly increase nutrition and health benefits among all income strata in the Nigerian society but in particular those on low incomes. There is anecdotal evidence indicating that increased awareness of the health benefits is beginning to attract relatively non-poor consumers but only if the price of sweetpotato roots and products remains affordable to poor consumers in both rural and urban areas. Demand varies seasonally, and is driven in part by the relative price between fresh yam and fresh sweetpotato.

The economics of the production and marketing of sweetpotato (discussed in Section 3.3) indicates that growth in the sub-sector can contribute significantly to reducing poverty in rural as well as urban areas. The estimated cost of production is not out of the reach of the rural poor, as for instance may be the case in the production of yam and can be even lower if the cost of planting materials can be reduced (currently it constitutes close to 40 percent of the total cost of production of the crop). Relative to its main competitor in terms cost of production and adaptability to a range of soil and agro-climatic conditions – cassava – it provides an opportunity for substantially higher gross margins per area cultivated and with a considerably shorter cropping cycle which allows rural households to engage in other income-earning farm and non-farm rural economic activities (as is reported in this study to be occurring in some sweetpotato-growing communities).

Traders' margins appear tight, reflecting the competitive nature of the market. However, it is evident that access to capital as a barrier to entry into the trade can be lowered if traders enter as micro-retailers and graduate into wholesalers by gradually building up their capital. The sub-sector is therefore attracting relatively young school leavers and university graduates and can offer an avenue for generating jobs with this target group in mind. As will be discussed in the next chapter, processors of all sizes can benefit from participating in the sweetpotato value chain.

It is, therefore, apparent that promoting sweetpotato production and consumption as part of Nigeria's agricultural development strategy can lead to multiple benefits beyond its contribution to overall sector growth. There are clear nutrition and health benefits as well as gains in terms of poverty reduction and employment generation which justify prioritisation of the crop.

4. Assessment of opportunities for increased utilisation of sweetpotato

From lessons learnt in promoting other roots and tubers in Nigeria, discussed in Chapter 2, it is evident that sustaining efforts to increase sweetpotato output needs to be driven by rising demand for the crop. In this chapter we review opportunities for increased uptake of the crop, first by assessing the growth potential in existing uses, including home consumption of the fresh sweetpotato roots, the growing market for "street-fried" sweetpotato slices, and the burgeoning sweetpotato crisps industry. We review other potential industrial end-uses of sweetpotato intermediate products such as the dried sweetpotato flour and puree in the bakery and confectionary industry. We also assess the feasibility of alternative options to promote uptake of the crop through the ongoing School Feeding Programme and as fries in the rapidly expanding fast food chains in Nigeria.

4.1 Household consumption of fresh sweetpotato roots in Nigeria

Based on the rapid market survey undertaken during the study, we estimate that close to 75% of the fresh sweetpotato produced is directly for home consumption. Households tend to consume the sweetpotato in the form of fried and boiled sweetpotato which is often eaten with porridge at breakfast or as a snack during lunch. It may also be taken as "pottage" – thick soup made with yam (or cocoyam) and with sweetpotato added (especially to yam). Dried sweetpotato flour is sometimes mixed with yam flour in preparing *Amala*. It is, however, more expensive than cassava flour which is often used in diluting yam flour in the preparation of Amala, not only on cost grounds but also to improve the texture, taste and colour of the *Amala*. This is occurring more in rural than urban households as the market for dried sweetpotato chips is very thin relative to the markets for dried yam and cassava chips.

The volume and form in which sweetpotato is consumed by households in Nigeria appears to be influenced by factors such as health, urbanization, convenience and availability of competing crops such as yam and cheaper substitutes such as cassava. Perceptions linking sweet foods to diabetes appear to have militated against consumption of sweetpotato. However, that seems to be changing. There is emerging anecdotal evidence suggesting growing awareness in communities in Kwara and Nassarawa States about the nutritional and health benefits from sweetpotato, including its potential as part of a healthy diet in managing diabetes. This appears to be driving up demand, though the scale is yet to be determined.

It is also apparent from anecdotes that demand from middle to high income households is especially likely to increase with the creation of awareness about positive nutrition and health benefits, especially linked to the introduction of orange-fleshed sweetpotato varieties as intended by the national program. These households currently access roots and tuber crops as well as vegetables through the major urban retail markets and "road-side markets" along the highways. The indications are that they will continue to rely on such markets rather than supermarkets for sweetpotato. As a result of urbanisation and increasing demand for convenience products, the indications are that ready-to-eat forms of sweetpotato will grow in popularity, especially in urban areas.

4.2 Street-fried sweetpotato has high growth prospects in Nigeria

Fried sweetpotato slices sold by street vendors appear to be experiencing rapid growth, especially in urban areas. We estimate that this chain takes up about 20% of the fresh sweetpotato roots sold in the major urban markets surveyed. The FCT and Lagos areas alone may be taking an estimated 18,000 tonnes of fresh sweetpotato per year for this purpose. Its popularity is reportedly rising because it is perceived by consumers as more filling and relatively cheaper than yam and Irish potato chips. The main target consumers are school children, who often take it as morning or mid-day snack and low-income workers for whom its low-cost and filling characteristics make if a good choice. Increased awareness of the nutrition and health benefits is likely to further strengthen growth in demand from this category of consumers. This is especially so because school children as good communication agents are likely to share positive messages with their parents, who will in turn, encourage them to spend their "pocket money" on the convenient and low-cost food product which can also be an important component of a healthy diet and lifestyle.

Vendors of fried sweetpotato slices, who are predominantly women, consider the enterprise as highly profitable. They can obtain gross margins of N2025 (US$12.56) per bag of fresh sweetpotato – representing an appreciable return on working capital of 23.9%. Entry barriers are relatively low as start-up capital requirements are minimal, as illustrated in the story of a street vendor in Box 2. In addition to encouraging patronage through generic promotion of the health and nutrition benefits of the crop, an issue that requires further research and training of vendors is how to minimise oil absorption during frying as cooking oil and fuel-wood are the main high-cost consumables used in frying sweetpotato.

Box 2: Marketing sweetpotato slices: the story of street vendor in the Federal Capital Territory, Nigeria

The vendor [any name?] was interviewed by the team at the Gosa Market, near Abuja (located off the busy airport road). She is a mother of two in her mid-30s and has been frying and selling sliced sweetpotatoes since 2008. She processes 4-5 bags (125 kg per bag) of fresh sweetpotato roots per week. She usually buys from the Gosa market and sells in the Gosa township, which is close to the market. According to her, it is possible to start the fried-sweetpotato business with total capital as low as N1,000 (less than US$10) for acquiring the basic equipment such as one knife for peeling and slicing, frying bowl and a scoop. An additional N500 (less than US$5.00) is required for buying the roots for frying. Growth can, however, be rapid if the location is suitable, i.e. accessible to the target consumers. In her case, within three years she grew from frying 1.0 kg of fresh sweetpotato roots per day to currently processing one bag (125 kg) of fresh sweetpotato roots per day. She reported that with capital accumulated marketing fried sweetpotato roots slices, she has opened a micro-retail shop selling mainly groceries and other "provisions" and also launched a traditional eatery where she sells traditional meals.

Source: interview with street food vendor in Gosa Market (26 August 2011).

4.3 Burgeoning sweetpotato crisps industry in Nigeria

Production and marketing of packaged sweetpotato crisps is gradually taking off in Nigeria. Four companies have been identified as marketing the product in Lagos and other parts of the country, including Ibadan. The companies are mainly micro to small-scale enterprises employing 2-3 people but a few have over 10 employees. One of the largest sweetpotato crisps companies, which employs over 10 people, got into its production largely as part of a diversification strategy since raw material supply for their original product – plantain chips – is seasonal.

Over the past two years, production of sweetpotato crisps at the factory has steadily grown from frying 2 bags (125 kg per bag) of fresh sweetpotato per week (i.e. 12 tonnes per year) to about 50 tonnes of fresh sweetpotato roots per month. The products are marketed in Lagos, Abeokuta, Ibadan, Abuja and Kano. A much smaller company – which utilises about two bags of fresh sweetpotato roots per week and is located in Ibadan – diversified into the product from baking cakes and other confectionaries. The producers of sweetpotato crisps who were interviewed in the course of the study indicated that market demand far outstrips supply and that gross margins can be very high, as illustrated in Box 3 below.

Box 3: Gross margins estimates for sweetpotato crisps in Nigeria

The gross margin estimates for the production of sweetpotato crisps is based on interviews with two processors in Ibadan and Lagos. The data provided shows that gross margins can exceed 100 percent, as detailed below:

Fresh sweetpotato roots (per tonne)	= N 52,000
Cooking oil (5 litres per tonne)	= N 35,000
Cooking gas (10 x 50kg bottles)	= N 55,000
Fuel for generator (0.5 x daily consumption)	= N 17,500
Sugar/salt	= N 8,000
Labour (per day: 8 unskilled & 4 semi-skilled)	= N 3,600
Packaging materials (per batch of 140 boxes)	= N 70,000
Distribution costs (per batch of 140 boxes)	= N 14,000
Total production cost (per tonne of fresh roots)	= N251,100 (US$1,569.00)
Estimated cost per kg of sweetpotato crisps	= N 717.43
Cost of 2.5 kg box	= N1,793.57
Ex-factory price per 2.5 kg box	= N3,800.00
Gross margin per 2.5 kg box	= N2,006.43 (US$23.75) – 112%.

The estimate is based on average yield (sweetpotato crisps per unit of fresh roots) of 35 percent reported by the processors. The gross margins therefore represent 112 percent of cost of production. It should be noted that the data provided is based on verbal responses during semi-structured interviews. The respondents appeared unwilling to provide records mainly because of regulatory issues discussed in this report.

Source: Study (August 2011).

The processors reported that they did not experience significant problems procuring fresh sweetpotato roots as there is year-round supply from the major northern states of Nigeria. The varieties predominantly used by the processors are the yellow-fleshed bland varieties with high dry matter. This may be because relatively large volumes of these varieties are produced in the northern states. The fact that they flavour with additional sugar indicates that sweeter varieties with high dry matter and low oil absorption will be better for the industry.

None of the processors had benefited from research outputs, for instance on the best types of varieties for crisping as well as processing methods that reduce oil absorption. Neither have they based their processing methods to minimise product quality problems, such as the crisps turning dark in colour, on research recommendations. Most of the processing methods they have adopted have evolved through trial and error. Research can, therefore, contribute to the development of the industry if it can address these issues and develop an effective communication system which makes it possible to share research recommendations with key stakeholders in the industry.

Despite the high margins reported above, rapid growth in the industry is constrained by a number of factors, among which are the following:

- Lack of capital for acquiring requisite fixed assets and in meeting working capital requirements. As is the case with most players in the sweetpotato value chains, access to formal credit is extremely limited. For instance, the Lagos-based processor interviewed during the study indicated that he had been frustrated in efforts to secure commercial finance to invest in capital equipment required to scale-up operations, increase efficiency and improve manufacturing practice at the factory. He estimated his financing requirement at about US$300,000. Collateral security requirements imposed by the banks as well as high interest rates and extremely short loan terms are among the factors which discouraged the entrepreneur from accessing bank credit.

  To illustrate, a bank loan equivalent to US$300,000 if repaid over a period of 5 years will require monthly repayment estimated at about US$16,525 (N2,644,000) – that is assuming interest rate of 22 percent[19] compounded and a grace period of six months for procurement and installation of the equipment. This amount represents about 20 percent of the gross monthly earnings from processing the equivalent of one tonne of fresh sweetpotato roots per day (based on the estimated gross margin per 2.5 kg box of sweetpotato crisps - see Box 3). If the duration of the loan is reduced to three years, the monthly repayment is estimated at US$19,233 (N3,077,280) or 23 percent of the gross monthly earnings – assuming the interest rate and gross margins per processed product remain the same. However, in Nigeria, bank loans, especially to small and micro enterprises, tend to have a duration of 12 months. The estimated monthly repayment if the loan is to be repaid over a 12-month-period is estimated at US$62,180 (N9,948,800), which is equivalent to 74.8 percent of the estimated gross earnings for producing sweetpotato

[19]According to data published by the Central Bank of Nigeria, bank lending rates in Nigeria in August/September 2011 ranged between 15% for “blue-chip” clients to 22.04% for other borrowers.

crisps – a very high level that is likely to increase the risk of loan default. For similar reasons, the much smaller-scale processor based in Ibadan was not even contemplating accessing formal finance for scaling up production of sweetpotato crisps.

- Difficulty in complying with regulatory requirements – in particular obtaining NAFDAC certification for marketed food products. NAFDAC certification requires suitable factory premises and processing equipment that makes it possible to comply with good manufacturing practice. However, the budding enterprises operate from residential premises that do not meet standards set by NAFDAC. They therefore operate without NAFDAC Licence, a situation which can pose potential health risks for consumers as the processors are unregulated. On the other hand, effective enforcement of NAFDAC regulations could stymie the development of this industry unless a large-scale food processing company takes up this opportunity or the smaller-scale processors in the market are supported to enable them comply with regulatory requirements. One means of assisting them to overcome this challenge could be through promoting access to Technology Innovation Centres discussed in Box 4 (Section 5.2).
- Quality variability is common and is attributable in part to types of packaging materials used as well as poor product storage by retailers. Better packaging appears to confer a competitive advantage to competing imported and local products. This observation is consistent with empirical evidence on product marketing summarized by DeBono et al. (2003). In addition, it is apparent that packaging material used for some imported and local products, particularly those which minimize direct exposure of the crisps to sunlight, can reduce the risk of product quality deterioration. These issues need to be highlighted when training in product marketing and quality assurance is provided to entrepreneurs in this industry – neither the crisps producers nor retailers interviewed during the study have benefited from such training.

4.4 Prospects for intermediate dried sweetpotato in traditional products

As discussed above, many rural households in the sweetpotato producing communities mix the flour from dried sweetpotato with yam flour in preparing *Amala* at the household level. The inclusion rate may be up to a ratio of 30:70 (sweetpotato to yam). In urban areas, the traditional “street-eateries” are reported to be similarly including sweetpotato flour in *Amala*. The prime consideration, however, appears to be to reduce the cost of production and therefore increase margins. For this reason, there appears to be reluctance to disclose inclusion of the sweetpotato flour, thus making it difficult to estimate volumes utilised. Consequently, the market for sweetpotato flour is rather thin. Supply of the flour is mainly from sun-dried small roots in rural households, which consume most of the flour produced – they acknowledge that selling the dried chips is at a loss relative to selling fresh roots. It should be noted, however, that these ‘smaller roots’ used in producing sun-dried chips, representing about 10% of the harvest, cannot be marketed as fresh roots (i.e. they constitute “rejects”). For this reason selling the sun-dried chips provides additional income or food for the household. Significant uptake of sweetpotato flour will be triggered if there is increased inclusion in preparation of *Amala*.

A traditional cottage industry which currently utilises sweetpotato is in producing *Kunnu* – a traditional non-alcoholic drink produced from sorghum to which sweetpotato is added (up to 30 percent) as a thickener and sweetener. Consumption is widespread in the central and northern states where for religious reasons consumption of alcoholic products is rather low. Consumption is also reported to be growing in the Southern states. The major challenge with commercial production and marketing of *Kunnu* is its rather short shelf-life – usually between 24 and 36 hours. Preliminary investigations undertaken during the study indicate that it may be technically and financially feasible to market such a product. The shelf-life of palm wine has successfully been prolonged in Nigeria through pasteurising and bottling the product. Scientists engaged in this process at the University of Agriculture, Abeokuta (UNAAB) indicate that it is technically feasible to adopt a similar process to prolong the shelf-life of *Kunnu* from 24-36 hours to several months. Further research on this is, however, required.

Parboiled and dried sweetpotato (*Kimbar*) is another dried product commonly used in rural areas, especially in the north. The product is often boiled and consumed with beans for household consumption. Growth in its utilisation will require promotion.

4.5 Inclusion of sweetpotato in bread and confectionary products

Rising wheat flour prices, a reflection of global price trends, as well as uncertainty in global supplies are encouraging bakers to consider various options to deliver competitively priced products. Among options currently adopted are reducing the size of products. There are indications that bakers will be willing to substitute wheat flour with sweetpotato. Research undertaken by the Women in Agriculture (WIA) Departments in Kwara and Nassarawa States as well as the NRCRI, among others, suggest that this is technically feasible.

Reports from China indicate substantial utilisation of sweetpotato in the production of noodles. The noodles industry in Nigeria has grown rather rapidly over the past 10 years with all the major flour mills currently in the market. Currently, the industry produces 100% wheat flour noodles for a rapidly growing market which industry experts estimate is nowhere near saturation. It utilises about 50,000 tonnes of wheat flour per year in producing noodles. If substitution with sweetpotato of up to 20% of this is achieved it will imply demand for 10,000 tonnes of sweetpotato flour (which translates into 40,000 tonnes of fresh sweetpotato roots).

One of the main challenges in exploiting these options is the cost of including sweetpotato as a flour product. Table 8 below clearly demonstrates that the option of including sweetpotato in the form of flour is not financially feasible. The cost of sweetpotato flour produced by means of mechanical drying is far higher than the sun-dried flour. However, it is preferred by bakers and other large-scale end-users because processors are better able to assure delivery of food-grade flour on a consistent basis. The flour can compete on cost basis only if fresh roots used in producing food-grade sun-dried flour is reduced by 9.9 percent of the average harvest season farmgate price. For mechanically-dried sweetpotato flour to compete at the same price as wheat flour, the price of the fresh roots has to fall by over 20 percent of the average harvest season farmgate price. We do not anticipate this occurring unless there is substantial over-production of the crop.

Table 9: Estimated cost of producing sweetpotato flour and puree in Nigeria

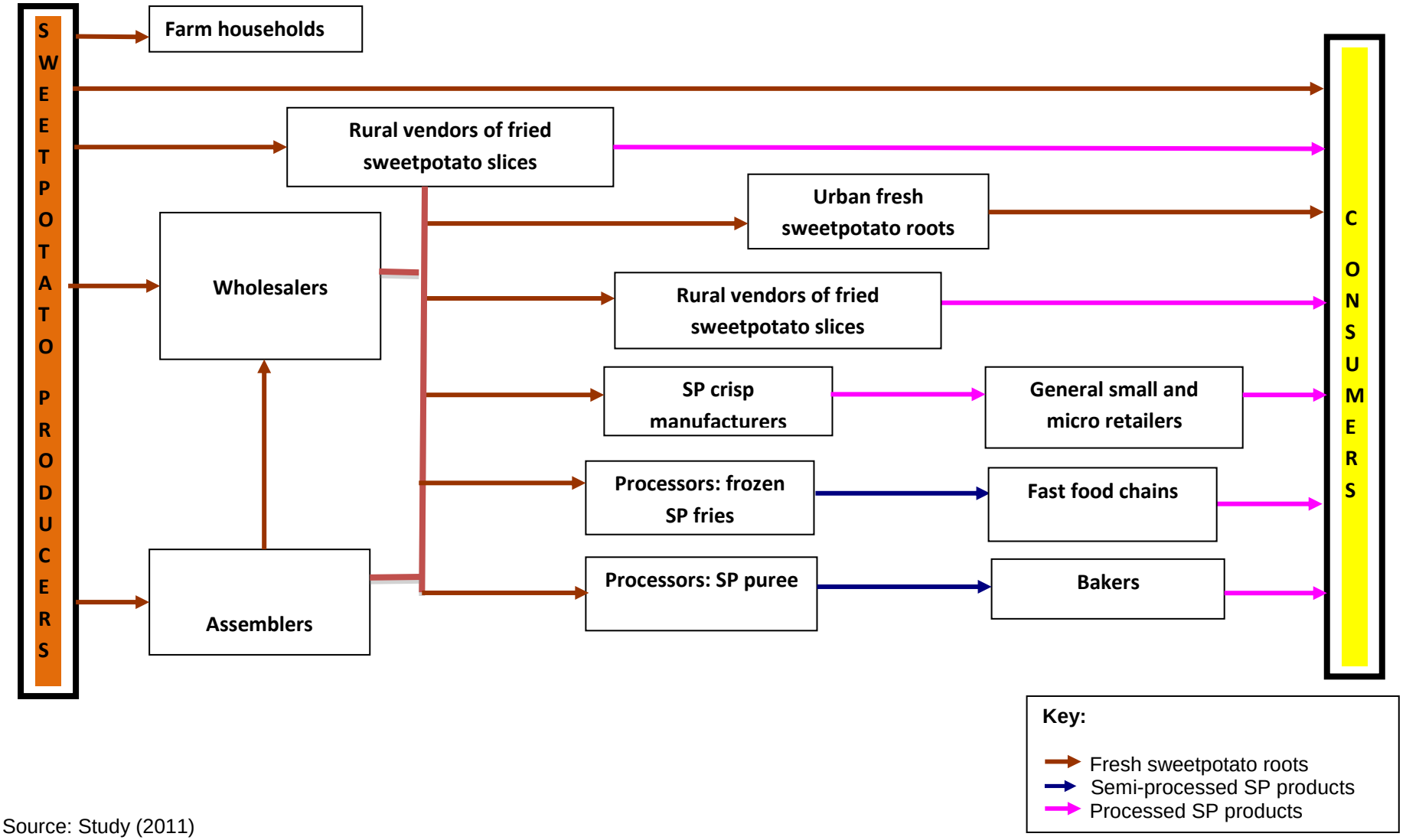
Costs in Naira (except where indicated)	Sun-dried sweetpotato flour	Mechanically-dried sweetpotato flour	Sweet Potato Puree
Cost of fresh roots per tonne	20,000	20,000	20,000
Transport cost to processing unit	1,625	1,625	3,200
Peeling/grating/de-watering	1,050	1,050	600.
Boiling and mashing	0.00	0	1200
Drying	300	2,370	0
Milling and sieving	500	500	0
Packaging	300	300	50
Fixed and other costs	600	600	600
Sub-total	24,375	26,445	24,075
Conversion rate	20%	20%	75%
Breakeven price per tonne	**121,875**	**132,225**	**32,100**
Wholesale price per tonne of wheat flour (Keffi)	112,000	112,000	112,000
Savings on inclusion of sweet-potato	(9,875)	(20,225)	79,900
Exchange rate: US$1.00 to Naira	160		
Farmgate price of fresh roots per tonne (Naira)	20,000		

*1Roots transported to or near bakery for processing as against processing into flour which should be occurring closer to source of fresh sweetpotato.

*2Cost reflects labour cost in peeling only as grating and de-watering is not required in the producing Puree.

Consumers in Mozambique found bread made with mashed OFSP acceptable (Low and van Jaarsveld, 2008; Tomlins et al., 2009). Table 8 further shows that the option of using mashed sweetpotato (puree) can lead to substantial cost savings as it costs less than 30 percent of the cost of the wheat flour it can replace. This option was discussed with some bakers and indications are that it may be attractive to small to medium-scale bakers if they can obtain regular supplies of puree from reputable processors who can guarantee consistent compliance with food quality standards. They may also be willing to produce the puree on-site if supply of roots is regular. It may be possible to pilot this in the Keffi area where an identified trader can supply fresh roots obtained from the northern states to about five medium-scale bakers in the community.

Figure 3: Sweetpotato value chains in Nigeria



Source: Study (2011)

The larger-scale bakers and biscuits manufacturers appear unwilling to substitute sweetpotato in the form of the puree, arguing that it will entail additional logistics management. The flour is preferred but cannot be justified on the grounds of cost. Similar considerations will appear to limit the scope for partial substitution of wheat flour in producing noodles. For instance, utilising the mashed puree in producing noodles could create demand for fresh sweetpotato roots of between 25,000 and 33,000 tonnes per annum depending on the yield (fresh roots to puree). However, the logistic challenges for the industry in using the puree need to be addressed and awareness about the opportunities created in the industry if uptake is to be encouraged.

4.6 Glucose syrup production: sweetpotato cannot compete with cassava

As a major source of starch and natural sugars, sweetpotato can potentially be used in producing glucose syrup in Nigeria. Demand for glucose syrup in Nigeria is estimated at over 120,000 tonnes per month. Domestic production is rather marginal, less than 5 percent. Currently, the main raw material used by the only glucose syrup factory in Nigeria is fresh cassava roots. As a result of supply uncertainties, the company explored the possibility of using sweetpotato. They discounted it because of extremely low starch content. The study team brought to the attention of the technical personnel at the factory that the standard procedure they adopted in measuring the starch content of cassava is unsuitable for sweetpotato and suggested an alternative procedure which offers a more accurate means of determining the starch content of sweetpotato.

It is evident, however, that unless the farmgate price of sweetpotato falls significantly, it cannot compete with cassava in producing glucose syrup. At the time of the study, the glucose sugar factory was offering N10,500 (US$65.63) per tonne of premium fresh cassava roots (i.e. roots with starch content of 20 percent and above). They paid N8,500 (US$32.69) per tonne of fresh cassava roots with starch content of between 15 and 18 percent and rejected roots with starch content below 10 percent. At these rates, the farmgate price of sweetpotato roots has to fall by over 45 percent in order to compete with cassava roots in the glucose syrup industry. Substantial increase in yield can potentially make this feasible but it if, as expected, increase in output of sweetpotato coincides with growth in market demand for the crop, then any fall in price will be far less steep. This is partly because sweetpotato is perceived as a higher value crop than cassava. For this reason, it is not anticipated that industrial use of sweetpotato in glucose syrup production will take off on a significant scale in Nigeria in the foreseeable future.

4.7 Prospects for promoting sweetpotato fries through fast food outlets

Based on the rapid growth in street frying of sweetpotato, the potential for inclusion of sweetpotato French fries on the menus of the fast growing fast-food outlets in Nigeria was explored. Currently, there are over 250 of such outlets run by the big four chains: Chicken Republic, Sweet Sensation, Mr Biggs and Tantalisers. Together

these chains consume between 15,000 and 20,000 tonnes of imported frozen Irish potato chips per annum[20].

Industry players consulted during the study expressed interest in marketing sweetpotato fries in Nigeria. Its introduction has already taken off in the United States. According to media reports, the inclusion of sweetpotato fries on the menus of restaurants started in the 1980s as an innovation in some of the trendiest restaurants in San Francisco and New York. However, it had "worked its way into the culinary mainstream" by 2010 and has been particularly popular "within the diabetic and weight-watching communities"[21]. Partly due to the popularity of sweetpotato fries, per consumption of sweetpotato in the US is reported to have grown by over 50 percent between 2000 and 2011[22].

Fast food outlets in Nigeria have demonstrated capability in successfully introducing traditional Nigerian dishes onto their menus. For instance, they have introduced rice/beans with chicken, which is served by almost all fast food outlets in the country. They also have the infrastructure for testing and marketing new products, including test kitchens and use of designated outlets to market-test consumer acceptance. However, it was stressed that collaboration with research institutions involved in development of sweetpotato products can potentially lower the cost and speed up the process of new product development. Challenges which need to be addressed in promoting this new product include attracting investors who will be in a position to distribute sweetpotato chips which are cut to standards determined by the industry on a regular basis. It is conceivable that such investment can be linked into the existing sweetpotato supply chain from the northern states into the major urban markets around Abuja and Lagos. The producer regions have demonstrated ability to adopt improved varieties with high demand in the target markets and should be able to adapt if specific varieties with shape and size suited to chipping are required. This potential needs to be further explored.

Another entry point for sweetpotato fries could be through its introduction and promotion in more informal restaurants in Nigeria. Whilst the fast food outlets prefer supply of frozen chips by industrial processors, it is apparent that the informal restaurants will opt for in-house chipping on a smaller scale. Hence, what needs to be developed is appropriate cutting machine for chip making. The machine should be suitable for chipping sweetpotato roots with high dry matter content.

4.8 Conclusions on prospects increased utilisation of sweetpotato

Sweetpotato is used in diverse forms in Nigeria and, as the discussions in this chapter have shown, the growth prospects for value chains centred around these uses differ. Currently, the fresh sweetpotato roots market has the greatest prospects for rapid growth in the short to medium term. The fresh roots are predominantly consumed by households, often boiled or fried. Another rapidly growing chain

[20] These estimated are based on information obtained through interviewing the Chief Executive of one of the fast food outlets and will require further research to validate.
[21] "Sweetpotato steps out from under marshmallows" by Kim Severson in The New York Times (24 November 2010). http://www.nytimes.com/2010/11/25/us/25sweet.html
[22] See (http://www.louisianaeconomicdevelopment.com/case-studies/conagra-foods-lamb-weston-inc.aspx).

centres around the sale of fried sweetpotato slices by street food vendors. Two relatively new value chains with good prospects for uptake of sweetpotato are the burgeoning sweetpotato crisps industry and inclusion of sweetpotato fries on the menus of the rapidly-growing fast food outlets as well as by informal restaurants in the country.

There is a long tradition of using dried sweetpotato flour in preparing *Amala* (with dried yam or cassava flour) as well as a "filler" in producing *Kunnu* (a traditional non-alcoholic beverage with a rather short shelf-life). Dearth of information made it difficult to assess the potential growth in demand for sweetpotato for these end-uses. A review of potential uptake of food-grade dried sweetpotato flour in the bakery and confectionary industries in Nigeria was undertaken as part of this study. This included examining the prospects for inclusion in producing noodles, the consumption of which is rising very fast in Nigeria. Evidence from trials by various research and agricultural development institutions in the country confirmed that partial substitution of wheat flour with dried sweetpotato flour in baking bread and for other confectionary products is possble. However, analysis of the economics of producing the dried sweetpotato flour reveals that it is currently not a financially feasible option, especially if mechanical drying technology is adopted to assure a food-grade quality flour product. The use of sweetpotato puree is economically feasible and the product was accepted by consumers in Mozambique. However, technical issues concerning storage and supply chain management need to be addressed if significant uptake is to be achieved. Utilisation of sweetpotato in producing glucose syrup is similarly discounted on the grounds that it will be financially feasible only when the price of fresh sweetpotato roots is competitive with the price of fresh cassava roots – a situation we do not anticipate in the foreseeable future in Nigeria.

Based on the foregoing, we recommend that a sustainable, demand-driven growth strategy for the sweetpotato sub-sector should focus on the following: household consumption of fresh sweetpotato roots, sale of fried sweetpotato slices by street vendors, supporting the development of the emerging sweetpotato crisps industry, and fostering exploitation of the growth potential in marketing sweetpotato fries by fast food chains and informal restaurants in Nigeria. In addition, substitution of wheat flour with sweetpotato puree in the bakery and confectionary industry can be explored. There appears to a strong economic case for doing this, especially if medium-scale bakers are targeted. In the next chapter we discuss key elements of such a strategy by assessing the strengths, weaknesses and constraints faced by players in these value chains.

5. Fostering growth and development in priority sweetpotato value chains: challenges and options to address them

In the preceding chapter we identified three sweetpotato value chains which should be prioritised in promoting sub-sector growth and development in Nigeria. The priority value chains proposed on the basis of growth prospects in the short-to-medium term are: fresh sweetpotato roots for household consumption, sale of fried sweetpotato slices by street vendors, the emerging sweetpotato crisps industry and marketing sweetpotato fries by fast food chains and informal restaurants. In this chapter we assess the strengths, weaknesses and constraints faced by key players in these value chains and discuss options to address the challenges and therefore unleash the potential. In the first three sub-sections we discuss chain-specific issues and follow these up with review of generic challenges such as constraints in the marketing and production of sweetpotato roots. The conclusions from these discussions are summarised in Section 5.6.

5.1 Boosting demand for fresh sweetpotato roots: consumer awareness is crucial

As noted in discussions in Section 3.1, the bulk of the sweetpotato crop produced in Nigeria is marketed directly in the form of fresh roots households who generally consume it in fried and boiled form sweetpotato. Street-food vendors have entered the chain, marketing fried sweetpotato slices in urban and rural areas targeting school children and urban workers. The street-food vendors selling fried sweetpotato slices are predominantly women and it is anticipated that this segment of the chain will grow rapidly with rising demand for the slices. For this reason, it is anticipated that growth in the market for street-fried sweetpotato would have positive impact on reducing poverty, especially among women in both rural and urban areas. Barriers to entry are rather low due to the minimal capital requirements, as stated in Section 4.2.

The major segment in the chain which will determine the rate of growth in sweetpotato uptake are the consumers[23]. Consumer demand for sweetpotato is currently influenced to a large degree by perceptions regarding the benefits sweetpotato – mainly erroneous perceptions about health risks associated with its sweetness. Hence, success in promoting consumer demand will be driven by increasing awareness of the nutrition and health benefits associated with the crop (Section 4.1). Consumer acceptance studies can be undertaken to generate interest and the results used to support promotion programmes. Research elsewhere has shown the while consumers might initially purchase a product new to them based on advertising, it is the taste of the product that drives subsequent repeat purchases. Other measures which can increase consumer awareness and demand, especially at household level, include the school feeding programme discussed below. In addition, public awareness campaigns including media promotions, can be organised and may be funded on a sustainable basis if they are organised around community activities such as annual sweetpotato festivals proposed during consultations with officials of Offa Polytechnic (Box 4).

[23] We discuss the other players in the chain – traders (especially wholesalers) and producers – who have generic roles in all the chains in Sections 5.4 and 5.5 respectively.

Box 4: Annual sweetpotato festival: potential launch-pad for generic promotion of the crop

The suggestion was made during a consultative meeting between the study team and staff of Offa Polytechnic in the Kwara State of Nigeria. It was suggested that the festival, which will be similar to Yam Festivals held in some parts of Nigeria can be hosted on rotational basis by communities which are significant surplus producers of sweetpotato. Activities which will form part of such include fairs or shows at which various sweetpotato products can be displayed and marketed. Hotels and restaurants, especially those in the host states, will be encouraged to serve various sweetpotato dishes. It was the view of proponents that Offa will be a good candidate to host the first festival as the crop is prominent in the traditions of the community and its contribution to the local economy is clearly recognised – the Chief's palace at Offa has a sculpture honouring the crop. Funding for the festival could be raised from private sponsors as well as Government – especially from the Ministries of Agriculture and Health. This is because the festivals will provide a means for marketing various products (therefore private sector players can benefit), as well as disseminating sweetpotato-related health and nutrition information which will benefit people in the host communities and the entire population of Nigeria. Furthermore, farmers will benefit from promotion of this cash crop in the surplus-producing communities. It was suggested that, if well-organised and patronised by high-profile personalities, it is possible that festival activities will receive free or relatively low-cost media publicity.

Source: consultations with staff of Offa Polytechnic, Offa, Kwara State Nigeria (17 August 2011).

5.1.1 Promotion via School Feeding Programme: a win-win strategy

School Feeding Programmes offer a great opportunity to promote uptake of sweetpotato in the country. It offers a quick, cost-effective and win-win (indeed *"killing two birds with one stone"*) means for promoting increased uptake of sweetpotato. There are the health and nutrition benefits for the school pupils, especially if the emphasis is on promoting consumption of the orange-fleshed varieties that are rich in pro-vitamin A. Being cheaper than some of the carbohydrate sources currently on the menu, such as yam, the inclusion of sweetpotato could reduce the cost of the programme, thereby making it more sustainable.

The School Feeding Programmes were launched 2006 in 14 states but have been sustained in only the Osun State, where it has survived change in the ruling party in the state. The annual budget of the programme, which currently covers 129,318 pupils in nursery to Primary 2, is over N300 million (i.e. about $2 million). It is co-financed by the State government (60%) and local governments (40%). The initial target of the state programme of covering up to JS 3 students was scaled down because of funding constraints. The Federal Government initially committed to funding of up to N88 million (about $570,000) per quarter but reportedly discontinued funding after the first quarter contribution was disbursed. Sahara International (an NGO) has recently committed to financing the budget for the Obokun Local Government, covering just under 4,000 pupils.

Currently, the main staples on the menu for the pupils are rice, maize and yam. Beans, fish, vegetables and eggs are also included. The programme managers are considering allowing schools in locations such as in Odo Otin Local Government, where sweetpotato is extensively grown, to include it instead of yam on the menu, principally because yam is more expensive in those communities. Cooks contracted by the programme managers are provided with the standard menu and paid N30 per day for a standard portion per pupil. This budget includes a margin for the cooks. They are provided with advance covering two weeks requirements. The rate is being reviewed in response to rising food prices and may be increased to N50-70 per pupil.

There is no centralised procurement as the cooks are expected to buy from markets in their communities. If inclusion of sweetpotato covers pupils in all the Local Governments in the state, then the total volume of fresh sweetpotato to be procured is estimated at 1,165 tonnes per academic year of 3 terms. This potential demand represents about 4.35 percent[24] of the total estimated marketed surplus in the state. It is anticipated that the impact on sweetpotato output in the state will be similar to that of the programme on egg producing poultry industry in the district – it is reported that the price per crate of eggs in the state rose by about 10% relative to prices in neighbouring states as a result of the demand from the programme, thereby triggering increased output (scale not determined).

Successful inclusion of sweetpotato in the School Feeding Programme will also facilitate similar inclusion in the menus of secondary level boarding schools and in the universities as well as other tertiary institutions. We estimate that about 2.3 million students will potentially be covered if this is done. Assuming that each student takes sweetpotato in one form or the other in a week, which will entail marginal change in food systems in such institutions, they will consume about 20,700 tonnes of sweetpotato in an academic year of 3 terms (assuming consumption of 250 grams per student per week). Furthermore, it is anticipated that by introducing pupils and students to sweetpotato-based meals, their parents and families will be encouraged to consume more sweetpotato-based meals. At the same time the cooks and caterers taking care of the needs of the pupils and students would have an opportunity to test market food products which they can market more widely. The impact on aggregate demand for sweetpotato as a result of this is expected to far exceed what is directly procured for feeding pupils and students. If pilots begin in states producing significant market surplus of sweetpotato, then procurement can be linked into existing marketing channels, thereby reducing supply constraints.

5.2 Scaling up sweetpotato crisps industry: a public-private partnership may be key to reducing adverse regulatory strictures

As noted in Section 4.3, most of the companies currently engaged in producing sweetpotato crisps are small to medium-scale enterprises. Their main strength arises from their ability to identify the opportunity offered by this emerging chain and the flexibility of their operations – being able to quickly switch to other products either

[24] Based on estimated area under cultivation of 6,680 hectares (Akoroda 2011 unpublished data) and average yield of 8 tonnes per hectare and assumption of not more than 50% of output being marketed by the farm household.

because of inadequate supply of raw materials or declining market demand. They have also developed reliable links with wholesalers of sweetpotato.

However, they face major challenges, including especially their limited capacity to comply with the registration requirements of NAFDAC due mainly to lack of appropriate premises and suitable equipment for scaling up. Furthermore, most of them have failed to adopt good manufacturing practices, which are meant to assure food-quality products. This is due to lack of awareness of such practices and/or limited resources to invest in the required systems. Indeed, most of them are unable to access formal credit for investment in fixed assets. Quality variability is common and is partly due to the use of cheap but inappropriate packaging materials and poor product storage. These challenges and consequent non-compliance with the NAFDAC regulatory framework, appear to be driving the industry underground[25]. The solution may include prioritising access by these enterprises to the public-funded Technology Incubation Centres (TIC) in sweetpotato-producing states (Box 5 below).

Box 5: Technology Incubation Centres (TIC) can nurture emerging sweetpotato crisps enterprises

The TICs are set up and funded by state governments and offer factory premises which are compliant with NAFDAC requirements. There is access to utilities such as water and electricity at the premises. The TICs assist the clients to register with NAFDAC and provide training in good manufacturing practices, virtually on one-to-one basis. The clients also receive advice on appropriate processing technology to adopt as well as advisory support in marketing their products. The TIC in Ogun State (located in Abeokuta the state capital), which was launched in 2007, was visited by the study team. Their facilities were being used by seven enterprises involved in a diverse range of processing activities, bottling *Palm wine,* fish processing and production of *Instant Pounded Yam*. According to the TIC officials, most of the beneficiaries are retired public servants (predominantly male), who are keen to enter into industrial processing. Access to the facilities is free, including use of the utilities. Though the use of the facilities is limited to a maximum period of five years per client, at the time of the visit many of them had exceeded that period but there appeared to be no effort to move them on and bring in new budding entrepreneurs.

Quite clearly, there are issues about the sustainability of the TIC model, mainly because access is currently free. However, access will enable, for instance, the emerging sweetpotato crisps processors to scale up while complying with regulatory requirements. They will also be better-placed to collaborate with researchers on issues such as the appropriate varieties of sweetpotato for crisping, product packaging and quality assurance in general. What needs to be done is to set a user-fee rate that enables the TIC to achieve financial sustainability while allowing the enterprises sufficient time to scale up their operations and be weaned off reliance on the facilities and services which are provide.

Source: interview with officials of Ogun State TIC, Abeokuta (5th September 2011).

[25] For instance, the entrepreneurs producing sweetpotato crisps appeared nervous about meeting the study team because they presumed that the team was part of a NAFDAC enforcement group.

5.3 Promoting sweetpotato fries: investment in producing an intermediate product is the main bottleneck

As noted in Section 4.7, the fast food outlets in Nigeria have the capacity to play an important role in the marketing of sweetpotato fries. They have a history of successfully introducing traditional Nigerian dishes onto the menus, and have the infrastructure for testing and marketing new products, including test kitchens and use of designated outlets to market-test consumer acceptance. Those consulted during the study also see a financially attractive opportunity in introducing this product. However, the existing potato fries market is structured around specialisation in the supply of imported frozen chips to the outlets.

Technology for chipping sweetpotato already exists in the US and Nigeria's proven capacity to fabricate local equipment for processing agricultural produce such as cassava suggest that there is potential to produce similar but cost-competitive versions for the local market. If appropriate chip making equipment can be fabricated for small and medium-scale informal restaurants then there is the potential for them to introduce sweetpotato fries on their menus. However, for the fast food chains it is important to attracting investors who will supply frozen sweetpotato chips on a regular basis. This may require collaboration with research institutions, for instance, in breeding for shapes and sizes of roots to facilitate chipping, an issue that has to be added to the agenda for ongoing breeding studies being undertaken to meet varietal preferences defined by consumers. A potential investor, who is already working with one of the fast food outlets and is from a sweetpotato-growing state, has expressed interest in going into the production of frozen sweetpotato chips. It is conceivable that those currently engaged in importing frozen potato chips for the outlets can also be encouraged to invest in new lines for frozen sweetpotato chips if they are made aware of the prospects. The high cost and unreliability of energy supply is likely to impede the development of the chain for frozen sweetpotato chips. For this reason, it is anticipated that in the short to medium term the option of importing frozen sweetpotato chips from the USA or Europe may be more appealing to entrepreneurs interested in this chain. The situation may improve with investment in the required infrastructure, especially in the energy sector, to improve Nigeria's comparative advantage in producing frozen chips. In the short-term, however, uptake of this option can be encouraged by working with smaller restaurants and food outlets to produce fries from fresh sweetpotato roots if suitable slicers are made more readily available.

5.4 Enhancing efficiency in marketing sweetpotato fresh roots

In Section 3.5 we noted that distribution margins in the sweetpotato trade are rather tight, an indication of the competitive nature of the trade. The wholesale trade, which is dominated by men, requires more working capital but this has not created a significant entry barrier as many young entrants start with little or no capital through retailing and graduate into larger wholesalers. Others also take advantage of family and other ties to secure trade credit which allows them to participate in the trade despite being capital constrained. The retail trade is dominated by women and also does not require much capital. The returns from wholesale, often obtained by means of high volumes rather than wide margins, are comparatively higher than incomes in

the public sector and therefore offer alternative employment to secondary school leavers and some university graduates, as is already occurring in the trade.

Most of the traders are well-informed about supply sources and well-linked with major surplus-producing areas. They are also quite knowledgeable about varietal preferences by consumers and have demonstrable capacity to pay for services as illustrated by the wide range of levies they pay in the markets and along the trade routes to different authorities.

The constraints the traders face include lack of suitable storage facilities in both the farming communities and the markets, often leading to losses as roots rot away. There is no sorting and bagging roots by size, implying the traders often have to engage in personal sampling before buying, thereby increasing the cost of transacting. Distribution margins are further widened as a result of the multiplicity of levies they pay to state authorities during transit as well as unauthorised payments at numerous road-blocks. Reducing these costs and improving infrastructure at the markets would, most likely, impact positively on margins to the benefit of the traders and consumers. This situation confronts players in most agricultural value chains in the country, especially the all perishable agricultural commodities, and therefore remedial interventions and investments to apply to the sector in general.

5.5 Boosting farmers output and productivity

Sweetpotato farmers have clearly shown that they can respond to market demand. On one hand, commercial production is evident in communities in the northern states as well as in states such as Kwara and Nassarawa. On the other hand, there is a growing trend to produce varieties preferred by consumers. Most of the farmers are smallholders and, therefore, boosting their output and productivity would require efforts to address the challenges they face, which are briefly discussed below:

5.5.1 Improved access to high-yielding varieties and extension services

As reported by Njoku (2009) average yields obtained by sweetpotato farmers is rather low (8 tonnes per hectare). This is despite the fact that yields 30 tonnes per hectare have been recorded in field trials under rain-fed conditions. The yields can be increased considerably if farmers adopt high-yielding varieties and improved agronomic practices. During farms visits undertaken in the course of this study, it was observed that some farmers lacked knowledge about such basic issues as minimum spacing, rouging out diseased material, and weevil management.

Research institutions engaged in sweetpotato breeding such as the NRCRI and the public agricultural extension agents appeared constrained in disseminating appropriate information. RTEP has played an acknowledged role in the distribution of improved planting materials but its success has been more in the cassava sub-sector than in sweetpotato which was not considered a priority crop. Access to quality planting material to varieties demanded by the market remains a critical constraint to improved production.

There appears to be an important role for NGOs and farmer-controlled organizations in promoting uptake of improved farm technology by sweetpotato farmers. For

instance, under the Cassava: Adding Value for Africa (CAVA) Project, local NGOs were directly contracted to supply improved planting materials to target farmers as well as offer extension advice and other services. It emerged, however, the NGOs often had variable capacity to deliver required services. For example in Ogun and Ondo States two NGOs were involved in the project: the Justice Development and Peace Commission (JDPC) and the Country Women Organisation of Nigeria (COWAN). While the JDPC proved effective in the formation and mobilization of farmer groups, the strength of COWAN was in promoting group-based microfinance. Utilising NGOs may prove crucial, especially as the study team observed the absence of strong farmers' organisations with firm roots in the farming communities. The two most visible organisations representing the sweetpotato sub-sector – POGMAN and POFAN – appeared to focus more on advocacy at the level of policymakers than in mobilising farmers and facilitating delivery of required services to them.

5.5.2 Access to Land

In Nigeria, following promulgation of the 1978 Land Use Act (FGN 1978), all land belongs to government. This Decree nationalized all land in the country and notionally handed over its administration to committees constituted at state and local government levels. According to Francis (2009), one justification given for the Decree was the rationalization of customary land tenure systems which were perceived as constituting a constraint to agricultural development. Despite the decree, land in rural areas is still loosely controlled by families and individuals, who sometimes sell the land or lease it for short or long term for agricultural purposes or for other investments. The variable land tenure systems remain a constraint in the development of large-scale farms and it is common to find large tracts of fallow lands in rural areas though some potential farmers are in dire need of land for farming.

According to Agricultural Development programme (ADP) officials, the average size of sweetpotato farms is less than one hectare but it has been observed this is steadily rising, partly in response to commercialisation of sweetpotato production. For instance, Usman Abdullahi a sweetpotato/maize farmer in the Ajarogi Tofa district in Lafia, Nassarawa State stated that he owns part of the land that he cultivates, but also rents additional land for which he pays N2,500 per hectare per year. The story is the same for Ibrahim Okpak, also a sweetpotato famer in Obi Local Government of Nassarawa who reported that although he inherited land, he still had difficulties obtaining additional land for cultivation of sweetpotato. In other areas of Nassarawa, however, such as Akruba, there seems to be no restrictions to securing farm land. The key for commercially oriented producers will be to secure land near roads linked to relevant markets.

5.5.3 Access to finance for production and processing

Top among the challenges faced by smallholder farmers is inadequate or limited access to finance, especially to credit facilities. Credit is usually supplied by three categories of financial institutions, these being:

(a) Formal financial intermediaries (FFIs) such as commercial banks, Microfinance banks, the Nigeria Agricultural and Cooperative Rural Development Bank

(NACRDB) and state government owned credit institutions. Though there are often complaints about high interest rates charged by the FFIs, the cost of borrowing from them tends to be relatively cheaper than those charged by other sources of credit. The major difficulties smallholder farmers have with this source of finance include complicated credit procedures and requirements which limit access severely. In particular, borrowers are required to maintain bank accounts for minimum periods of not less than six months but most of the rural poor cannot meet the minimum deposits required to open accounts at the FFIs. In addition, they insist on forms of security for loans which most smallholder farmers lack.

Government attempts to address these problems include establishing special schemes such as the Agricultural Credit Guarantee Scheme (ACGS) and the Agricultural Credit Support Scheme to ensure access to credit by farmers. Their impact, however, appears to be rather marginal. According to Akramov, (2009), only 18 percent of farm households have access to financial services, often through semi-formal financial institutions. According to Enhancing Financial Innovation and Access (EFInA), (2008), only 23 percent of the adult population in Nigeria has access to formal financial institutions and 24% to informal financial services while the rest are financially excluded.

During interviews with officials of a commercial bank in the Nassarawa State, it was revealed that farmers can access credit under the Commercial Agricultural Credit Scheme (CACS), Agricultural Credit Guarantee Scheme and Small Medium Industry Equity Investment Scheme (SMIEIS). The CACS is for large-scale farmers with a minimum asset base of over N50 million. This particular bank had no direct loans facility to farmers although it gave out consumer loans known as *no wahala loan* to civil servants who have their salaries paid into the bank. These loans which attract 17-22 percent per annum are repayable over 24 to 48 months.

High loan default among farmers is one of the reasons cited by bank officials as discouraging lending to the sector. The problem is particularly acute when farmers experience crop failure due to weather failure, especially when there is drought. Some banks have attempted to mitigate this problem by requiring that borrowers obtain crop insurance from the National Agricultural Insurance Corporation (NAIC) but the indications are that it is only large-scale or well-connected farmers who are able to secure the required insurance cover.

(b) Semi-formal financial institutions such as non-governmental organizations engaged in the delivery of financial services, microfinance institutions (MFIs) and credit unions which are registered cooperative societies. These institutions are relatively closer to the rural communities and the urban poor. The size of the facilities which they provide are also more appropriate to the needs of the rural people. However, increasing emphasis on financial sustainability of these institutions is impacting negatively on access by smallholder farmers as well as the cost of their financial products. For instance, most MFIs insist on weekly repayment of credit facilities, which is clearly unsuitable for farming purposes due to the lumpy nature of agricultural cash flows (concentrated in the harvest periods with little or no farm income flow prior to the harvest). Furthermore, the borrowers are required to participate in regular weekly meetings during which repayments

are made. Farmers may not have the time and inclination to be so engaged. The repayment structure is better suited to traders with regular incomes and one young sweetpotato wholesaler reported that he was able to graduate from a micro-retailer of the crop through facilities he obtained from a MFI. The cost of borrowing from MFIs is also significantly higher than interest rates charged by the FFIs, if annualized. Some charge between 3 to 5 percent per month, which translates to between 36 and 60 percent per annum.

(c) Informal financial institutions include moneylenders, who are often criticized for charging usurious interest rates. However, they are often the only source of finance in emergency situations in rural communities. The high interest rates they charge, which is often above 100 percent per annum, makes their form of finance unsuitable for agricultural production where the rate of return (as discussed in Chapter 3) is well below this cost of borrowing.

Farmers may also access finance through member-based Rotating Savings and Credit Associations (ROSCAs). Membership of ROSCAs in Nigeria is dominated by women, with over 65 percent of them being married (Yusuf et al. 2009) and reportedly using the system to protect their savings against claims by their husbands for immediate consumption (Anderson and Baland 2002). The main source of finance is member contributions and interest rates are set by the members. The restriction to internally-generated loanable funds limits the scale of borrowing by members. Most often, the very poor are excluded from such schemes.

Government, in response to access difficulties and the high cost of borrowing, sometimes institutes programmes such the *Fadama* grants which are to be disbursed by banks to targeted smallholder farmers who are registered with cooperative societies at the *Fadama* office. Some banks, including the Nigeria Agricultural Cooperative and Rural Development Bank (NACRDB) branch[26] in Nassarawa, also participated in disbursing a local credit scheme known as Badakoshi[27]. This scheme was designed to give 2,000 small-scale farmers interest free loans. However, reports suggest that the scheme was hijacked by the political class.

5.5.4 Labour Availability:

Presently, the unemployment rate in Nigeria stands at about 21 percent which translates to about 30 million people. Despite this, most of the unemployed and underemployed live in the urban areas as there is massive rural out-migration (Shittu, 2008). This situation does not only lead to a demographically unbalanced population of women, younger children and old people (Okali *et al.*, 2001; DFID, 2004), but also tends to simultaneously reduce availability of farm labour and increases its cost (Ogwumike and Aramolaran, 2000). Reliance on hired labour in Nigeria's agriculture ranges from 30 percent on rice farms to as high as 88 percent in the cultivation of other crops (Okuneye, 2000; Akinbode, 2010). Availability of labour

[26] Known at the time as Agricultural Bank
[27] *Badakoshi* means "to get satisfied food wise"

in rural areas can, therefore, impact significantly on farming activities including planting, weed control, timely harvesting and post-harvest management of crops.

The picture in some of the sweetpotato-growing areas visited the study is similar to the above. For instance, farmers in the Ajarogi Tofa district in Nassarawa State complained that though reliance on family labour can limit the scale of their farming, they were concerned about hiring labour because – as one of them put it – the "hired labourers are sometimes not careful'. In some farming communities, farmers form groups – known in the Obi Local Government Area and Akruba in Nassarawa as *Ayene*[28] – to provide labour to each other in turns. Partly in response to this situation, the use of herbicides by root and tuber farmers for weed control is growing in Nigeria.

5.6 Conclusions and recommendations on fostering growth and development in priority sweetpotato value chains

Assessment of the strengths, weaknesses and constraints faced by key players in priority sweetpotato value chains in this chapter is expected to highlight some of the issues and options that need to be considered in setting out strategies for growth and development of the sub-sector. In this sub-section we summarise the conclusions and recommendations, beginning with generic constraints and then the chain-specific issues.

Among the generic constraints facing all players in all the sweetpotato value chains is adequate supply of finance. Sweetpotato traders appear to be least affected by this constraint. They tend to utilise trust-based trade credit systems, often starting with micro-retailing and gradually scaling up. Smallholder farmers who dominate production of sweetpotato are generally unable to secure formal finance, including credit provided under various Government-funded schemes. An option which can improve supply of finance to this target group is to promote strong, well-organised community-level farmers' organisations where peer-monitoring can be effective in ensuring optimum repayment of production loans. A group such as the Agbelere Youth Farmers' Association, Agbamu, Kwara State (Box 1), which is well-organised and carries out collective marketing on behalf of its members, can be an effective vehicle for the delivery of group credit. Unfortunately, there is a dearth of such groups which have evolved spontaneously and the national level producer associations in the sub-sector appear not to be focusing on building strong primary associations.

Improving access to production finance will significantly boost supply to match rising demand as the value chains develop. Further efforts required to increase output and productivity include increasing investment in the development and effective distribution of high-yielding varieties which also meet consumer preferences. In addition, it is important to improve access to land, especially in areas where irrigation facilities make year-round production possible and access to roads linked to the major markets also enhance potential for commercial production.

[28] Ayene means "my brothers"

Though the sweetpotato distribution chain is highly competitive and its expansion will generate pro-poor benefits as it is providing employment for young school leavers, including university graduates, it is beset with problems which squeeze distribution margins. To reduce distribution costs, it is proposed that the multiplicity of levies that traders pay to state authorities during transit should be rationalized and reduced. Infrastructure in the markets also needs to be improved. For instance, simply providing sheds for temporary storage of produce in the markets could contribute to reducing losses – currently most of the fresh sweetpotato roots in the major markets are "stored" in the open and on bare grounds which get very muddy when it rains. This happens even in large wholesale markets in and around Lagos and Abuja. The traders and farmers will also benefit from training to promote sorting and bagging of roots by size, making it possible to reduce transaction costs by promoting trade by description.

Growth in household demand for fresh sweetpotato roots and for fried sweetpotato slices appears to be constrained by erroneous consumer perceptions about health risks associated with its sweetness. To counter this, it is important consumers are made aware of the nutrition and health benefits associated with the crop. Consumer acceptance studies can be undertaken to generate interest and the results used to support promotion programmes. It is specifically recommended that sweetpotato, especially the orange-fleshed varieties, is included in the school feeding programme. This will provide a "win-win" means of improving the health and nutrition status of the pupils benefiting from the programme and also help reduce the cost of the programme, especially where it replaces more expensive carbohydrate sources. It is further recommended that consideration is given to a suggestion that an annual sweetpotato festival is launched in communities which are significant surplus producers of the crop, including Offa in the Kwara State. The festivals can serve to highlight the economic importance of the crop to the communities as well as promote new sweetpotato-based products on the market and publicise the health and nutrition benefits associated with its consumption.

The emerging sweetpotato crisps industry has considerable growth prospect is struggling to exploit its potential in full because of difficulties in complying with NAFDAC registration requirements. This is mainly due to lack of capital to invest in appropriate factory premises and suitable processing equipment. The pioneering enterprises have also failed to adopt good manufacturing practices due principally to lack of awareness of such practices and/or limited resources to invest in the required systems. Partly because of these challenges, the infant sweetpotato crisps industry appears to be operating underground and is unable to benefit from research knowledge which can reduce problems of quality variability, which is quite common. An option which can potentially remedy this situation is to prioritise access by these enterprises to the public-funded Technology Incubation Centres (TIC) in the sweetpotato-producing states (Box 5). The TICs will offer the enterprises suitable factory premises with access to portable water and other utilities as well as support in registering with NAFDAC, training in good manufacturing practices and advisory support in marketing their products. To ensure sustainability, it is further recommended that rather than use the facilities for free, as is currently the practice, the beneficiaries pay user-fees set at levels that allow them sufficient time to scale up their operations and be weaned off.

Two sweetpotato value chains with potential which is yet-to-be exploited include a chain for marketing sweetpotato fries through fast food chains and informal restaurants. The fast food chains have expressed interest in the product and have the means to test and promote it. The missing link is attracting investors who will produce and supply frozen sweetpotato chips to them on a regular basis. This will require promotion of agronomic practices such as appropriate spacing to control size of roots which facilitate chipping. It is also important to encourage breeding for high yielding, adapted varieties, particularly of the OFSP types, which are most attractive from a health perspective. This is yet to be done to any considerable extent in Nigeria. Similarly, the development of high dry matter OFSP types which absorb less oil, remains a breeding challenge. For the smaller-scale informal restaurants, the major need is for appropriate and affordable chip making equipment to be available. The technology for chipping sweetpotato already exists in the US and Nigeria has proven capacity to fabricate local equipment for processing agricultural produce such as cassava. It should therefore be possible to develop appropriate cost-competitive versions for the local market, in particular if there is collaboration between local research institutions and private fabricators.

The other unexplored opportunity is to promote partial substitution of wheat with sweetpotato in the bakery and confectionary industry. Our assessment suggests that the use of dried sweetpotato flour is not cost-competitive. However, sweetpotato puree, can be used as has been successfully demonstrated in pilots in Mozambique. Larger-scale bakeries in Nigeria do not appear interested in this option because of the logistic challenges in producing and/or storing the puree on-site. Medium-scale bakeries with capacity to produce the puree on-site have shown interest and can take up the opportunity if they are linked to regular suppliers of the fresh roots and the product is adequately promoted.

From the foregoing discussions, it is evident that contrary to the perception that it is an *"orphan crop*[29]*"* in Nigeria, sweetpotato has the potential to contribute significantly to the attainment of pro-poor growth and development objectives in the agricultural sector in the country. The sweetpotato sub-sector offers high-potential opportunities for value addition which are open to players of different sizes. For instance, large-scale enterprises have a lead role to play in exploiting potential opportunities in marketing sweetpotato fries, especially if it is centred around the fast food chains. It is anticipated that medium-scale enterprises will eventually dominate the production of sweetpotato fries. Micro and small-scale enterprises are leading and will in the foreseeable future dominate the chain for fried sweetpotato slices, mainly because of the relatively low levels of equity required. The development of these chains will drive up demand for fresh sweetpotato roots to the benefit of producers and players in the marketing chain. However, to unleash this potential, it is important that the generic challenges as well as those specific to individual value chains need to be addressed. These challenges have been identified in this report, along with recommendations on how they can be addressed.

[29] Terminology used to describe marginal crops in Nigeria. This implies that it has not received research and policy attention to the extent merited. This is true. However, this orphan is showing great potential on its own. Our contention is that investment in this orphan will yield a superstar.

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Appendix 1: List of stakeholders consulted during study

FARMERS AND FARMERS' ORGANISATIONS		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Alhaji Saka Alade (leading over 20 members in a meeting on 17/08/11).	Agbelere Youth Farmers Association, Agbamu, Kwara State. Main contact: Afolabi Olaitan (Kwara ADP) +234(0)8032515532 olaitanafolabi24@yahoo.com	Chairman of the primary-level sweetpotato growers association.
Rasaki Osamotu	Agbelere Youth Farmers Association, Agbamu, Kwara State. Main contact: Afolabi Olaitan (Kwara ADP) +234(0)8032515532 olaitanafolabi24@yahoo.com	Treasurer of the primary-level sweetpotato growers association.
Abdul-Ganiyu Raji	Eloyoka Farmers Association, Eloyoka, Kwara State. +234(0)8075609310	Chairman of farmers' association.
Chief Dan Obiora Okafor	POFAN, Suite 38 Katsina Street, Garki II, Abuja +234 98733553 pofan2009@yahoo.com dannycoolassociates@yahoo.com www.pofan.org	National President of the potato growers' association.
Oyedwokpo Yemi	Igosu Poultry Farmers' Multipurpose Cooperative, via Offa. +234(0)8053166924	Chairman of cooperative with members in poultry and crop production (including sweetpotato).
Chief Bayo Ajabyi	Potato Growers and Marketers Association of Nigeria (POGMAN) +234(0)8035821796	Patron of potato growers association.
Chief Ajibade	Potato Growers and Marketers Association of Nigeria (POGMAN) +234(0)8030754775	National Chairman/President of potato growers association.
Yahuza Mohammed	Bukan Fadama, Agyara-Gudofa, Nasarawa State. +234(0)8069649106	Farmer (young)
Alhaji Musa Anya Ayala	Agada Sweetpotato Association, Agada, Obi, Nasarawa State. +234(0)7063339349	Farmer (old)
Belikiso Hassan	Akurba, near Lafia, Nasarawa State. +234(0)8068259681	Farmer/trader (middle-age woman) – contact number is for her son.
James Filibro	Maraba ("Orange") Market, Nasarawa State. +234(0)8054601170	Wholesaler and small-scale producer of sweetpotato
M. Olawoye	Osun State Mechanized Farmers Multipurpose Cooperative Union, Osogbo, Osun State. +234(0)8066767447	Chairman of farmers' cooperative
Bode Fapohunda	Osun State Mechanized Farmers Multipurpose Cooperative Union, Osogbo, Osun State. +234(0)8066451275	Business Advisor/Chartered Accountant

SWEETPOTATO TRADERS (WHOLESALERS/RETAILERS)		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Suleiman Shuri	Kasuwa Retail Market, Lafia, Nasarawa State. +234(0)8168935284	Retailer selling fresh sweetpotato roots and vegetables
Shuabu Alhassan	Kasuwa Retail Market, Lafia, Nasarawa State. +234(0)8035022359	Retailer selling fresh sweetpotato roots
James Filibro	Maraba ("Orange") Market, Nasarawa State.+234(0)8054601170	Wholesaler and small-scale producer of sweetpotato
Suraju Sanni	Madala Market, (near Abuja) Federal Capital Territory +234(0)81287211586	Sweetpotato wholesaler (young school leaver)
Issah Yusuf	Gosa Market, near Abuja. +234(0)8154006995	Male trader selling Irish potato and sweetpotato
Abdul Kabril and Gazala Isah	Maraba ("Orange") Market, Nasarawa State. +234(0)7030313201 and 234(0)8094570209 respectively.	Head wholesaler of sweetpotato and his apprentice.
Hajia Alausa	Bodija Market, Ibadan, Oyo State. +234(0)8038565384/8050378070	Trader selling sweetpotato.
Kehinde Momoh-Edo	Mile 12 Market, Lagos. +234(0)8033438448	Sweetpotato wholesaler.
Alhaji Inusah Yahaya	Mile 12 Market, Lagos. +234(0)8056441559/8066188933	General Secretary of Traders Union and sweetpotato wholesaler

FOOD PROCESSING COMPANIES (INCLUDING BAKERIES)		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Zira Sunday	Vawa Bakery, Maraba, Nasarawa State +234(0)8057757014	Proprietor of medium-scale bakery (brother of J. Filibro)
Temitope Abibu	United Bank of Africa PLC, Ibara, Abeokuta, Ogun State. +234(0)8058224443 temitope.abibu@ubagroup.com	Relations Manager
Ganesh Kherde	Niger Biscuits Co. Ltd., 35 Creek Road, Apapa, Lagos. +234(0)8075290603 ganesh.kherde@nigerbiscuits.com	Technical and Product Development Manager
Adeolu O. Okunubi	Reals Confectioneries Ltd., Abeokuta-Igboora Road, Abeokuta, Ogun State. +234(0)8034386900 realsconf@realsgroup.com	Head, Quality Control.
M.O. Azenabor	Mojo Industries, Jibowu Estate, Abule-Egba, Lagos. +234(0)8065908184	Processor: sweetpotato crisps,

		banana sticks and plantain chips (medium-scale).
Awonusi Adenike	Honeywell Superfine Foods Ltd., Ikeja, Lagos. +234(0)13453630/8023213829 Nike-awonusi@honeywell.com	Quality Assurance Manager at major flour mill and noodles manufacturer.
FOOD PROCESSING COMPANIES (INCLUDING BAKERIES)		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
F.G. Adeniji	Fumman Agricultural Products Ind. Ltd., Ibadan, Oyo State. +234(0)8023704888 gbola.adeniji@fummanagric.com	Production Manager
O.O. Efunwoye	Fumman Agricultural Products Ind. Ltd., Ibadan, Oyo State. +234(0)8054723221 bode.efunwoye@fummanagric.com	Quality Control Manager
Tunde Ogunrinde	Chicken Republic, Oregun, Lagos. +234(0)18136617283 tundeo@chicken-republic.com	CEO Chicken/Pizza Republic
Mrs. Bola Fadehon	TJ's Restaurant, located on Ibadan campus of the University of Ibadan, Ibadan, Oyo State. +234(0)8033234881 bolafadehon@hotmail.com	Has had successful trials with replacing carrots with OFSP I preparing rice meals. Keen to try other sweetpotato-based recipes.
Samuel Onobanjo	Olak Bakeries, Ibadan, Oyo State. +234(0)8062434806	General Supervisor of the medium-scale bakery.
Omojadesola Debo Afosi	Macro Bakeries, Ibadan, Oyo State. omojadesola@yahoo.co.uk	Small-scale baker and producer of sweetpotato crisps.
Adeguke Adekola and Simon Husseini	Ekha Agro Processing Ltd., Km 36 Lagos-Ibadan Expressway, Ibafo, Ogun State.	Production Engineer and Production Manager
Elijah Olukunle	UNAAB Consult Ltd., University of Agriculture (UNAAB), Abeokuta, Ogun State.	Procurement/Marketing Manager at the UNAAB pilot processing plant.
Mrs. Okoronkwo	UNAAB Consult Ltd., University of Agriculture (UNAAB), Abeokuta, Ogun State. +234(0)8038552847	Production Officer at the UNAAB pilot processing plant.
Rabui Zakari	Diamond Bakery, Lafia, Nasarawa State. +234(0)8036824963	Proprietor, small-scale bakery.

RESEARCH AND EDUCATION INSTITUTIONS INVOLVED IN WORK ON SWEETPOTATO		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Dr. Solomon Afuape	National Root Crops Research Institute (NRCRI), Umudike, PMB 7006, Umuahia, Abia State. http://www.nrcri.org Tel. 234 8037777445 solomonafuape@yahoo.com	Sweetpotato breeder.
Dr. Jude Njoku	National Root Crops Research Institute (NRCRI), Nyanya Sub-Station. Tel. +234 (80) 35479261 jcnjoku@yahoo.com; jude2k7@yahoo.com	Involved in sweetpotato multiplication
Prof. Malachy Akoroda (Professor of Agronomy)	Department of Agronomy, University of Ibadan, P.M.B. 20001, Ibadan, Oyo State. +234 (80) 35829286 ; m_akoroda@yahoo.com	Agronomist working on roots and tubers including sweetpotato

RESEARCH AND EDUCATION INSTITUTIONS INVOLVED IN WORK ON SWEETPOTATO		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Dr. Ijeoma Egeonu	Department of Agronomy, University of Ibadan, P.M.B. 20001, Ibadan, Oyo State. +234 (80) 38277325; eij_moi@yahoo.co.uk	Undertook PhD studies on sweetpotato
Dr.(Mrs.) Anjoli	Director, School of Applied Appliances and Technology, Federal Polytechnic, Offa Kwara State.	Undertaking studies on sweetpotato-based products like bread and confectionaries
Abraham Oyeyemi Idowu	Dept. of Food Technology, Federal Polytechnic, Offa Kwara State +233 (80) 53672008; Idowuoa56@yahoo.com	
G. B. Oyundele	Dept. of Food Technology, Federal Polytechnic, Offa Kwara State +233 (80) 56502357	
Prof. G. Olatunde	Osun State University, P.M.B. 4494, Osogbo, Osun State. dr_golat@yahoo.com	Dep. Vice Chancellor
Assoc. Prof. F. E. Babatunde	Osun State University, P.M.B. 4494, Osogbo, Osun State.	Agronomist/horticulturist

GOVERNMENT INSTITUTIONS AND PROGRAMMES RELEVANT TO SWEETPOTATO		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
Engineer Mike Eneh	Federal Department of Agriculture, Abuja. +234(0)8035975711 enehmcc1@yahoo.com	Director
John Ekundayo Babajide	Federal Department of Agriculture, Abuja. +234(0)8035918359 ekunjide@yahoo.com	Director
Dr. Julius T. Odeyemi	Federal Department of Agriculture, Abuja. +234(0)8036776685	Deputy Director
Dr. Oyebanji and Ms. B. Mordi-Onota	National Programme for Agriculture and Food Security, Abuja. +234(0)8035909268 +234(0)8033947191 benmoronoth@yahoo.com	Executive Director and Head of Nutrition and Health Programme
Sunday Atanda	Kwara Agricultural Development Project (ADP), Old Jebba Road, Ilorin, Kwara State. +234 (0)8073651069 kwadp@yahoo.com	Managing Director of Kwara ADP
Hajia Ahmed	Kwara Agricultural Development Project (ADP), Old Jebba Road, Ilorin, Kwara State.	Head, Women in Agriculture, Kwara ADP

GOVERNMENT INSTITUTIONS AND PROGRAMMES RELEVANT TO SWEETPOTATO		
NAME	**CONTACT DETAILS**	**OTHER INFORMATION**
N. Jarumi Dachor	Nasarawa Agricultural Development Programme (NADP), Lafia, Nasarawa State +234(0)7039056177; +234(0)7056373769	ADP Programme Manager. Others: Mrs. Zenya Alhassan (Director of Technical Services), Alhaji I. Giza (Director of Extension) Joshua Jonathan (Chief or Research).
Umari Gwana	Nasarawa Agro Export Processing and Development Centre, Ministry of Agriculture, Lafia, Nasarawa State. +234(0)8069213106 nagwana@yahoo.com	Government centre promoting agricultural exports from Nasarawa, including yam and sweetpotato.
Ibrahim Yahya	Ministry of Agriculture, Lafia, Nasarawa State.	Permanent Secretary at the Ministry.

	+234(0)8034948502	
R.B. Adeniyi	Osun State Agricultural Development Programme, Box 724, Iwo, Osun State. +234(0)8035696487 ossadep@yahoo.co.in	Programme Manager and Chief Executive
Deaconess Florence Olyinka	Home Grown School feeding for Osun State, Osogbo, Osun State +234 8033964804 bolayinka123@gmail.com	Operational Director for the school feeding programme.
Prof. I.I. Ihimodu	Agricultural and Rural Management Training Institute, Ilorin, Kwara State +234(0)31221183/223384 armti@ilorin.skannet.com.ng	Director/Chief Executive
A.K. Abiola	Raw Materials Research and Development Council, Abeokuta, Ogun State +234(0)8023601555 kayodeabiola@yahoo.com	State Coordinator
Lasisi Kamoru	Technology Incubation Centre, Federal Ministry of Science and Technology, PMB 2049 Sapon, Abeokuta. +234(0)8138430541 www.nbti.gov.ng	Senior Commercial Officer
Foluso Ohikhueme	Technology Incubation Centre, Federal Ministry of Science and Technology, PMB 2049 Sapon, Abeokuta. www.nbti.gov.ng	Higher Technical Officer
Mr. Innocent	Establishment and Inspectorate Directorate, National Agency for Food and Drug Administration and Control (NAFDAC), Lagos. +234(0)8136740405	Senior Inspector

GOVERNMENT INSTITUTIONS AND PROGRAMMES RELEVANT TO SWEETPOTATO		
CONTACT DETAILS	**OTHER INFORMATION**	
Alhaji Abdulfatai Adebiyi	Ministry of Education, Science and Technology, Ilorin, Kwara State. +234(0)8033832906 abdulfataiadebiyi@yahoo.com	Permanent Secretary at State Ministry of Education
V.O. Abioye	Ministry of Education, Science and Technology, Ilorin, Kwara State. +234(0)8028875954 mailsolly@yahoo.com.au	Director

APPENDIX 1: Scope of Activities for the Entire Project Period

1. Overall Goal:

To gather and analyze evidence concerning the feasibility and desirability of investing in development of sweetpotato value chains for fresh root marketing and processed products in sweetpotato producing areas of Osun and Kwara States and in the areas serving Abuja.

2. Overview

Although Nigeria produces an estimated 3.94 million MT of sweetpotato annually, its importance as a source of food and income has been neglected compared to other commodities. Understanding of the production and marketing systems for sweet potato are limited, if not non-existent in Nigeria. As in much of the rest of West Africa, sweetpotatoes are a component of the root-crop-based food systems that dominate in the forest and moist savanna regions of the region. Sweet potatoes are a relatively secondary component in these systems, being dominated by cassava and yams and where cocoyams are third most important. Prof Akoroda refers to sweet potatoes as an enclave crop, i.e. relatively specialized production areas with some connections to markets—the conditions that determine where such enclaves exist are not well defined. Thus, sweet potatoes are produced in most states in Nigeria, but production tends to be concentrated in the moist savanna region. Within each state, production tends to be concentrated in two or three LGA's and within any particular village a subset of farmers will produce the crop. There appear to be some areas where sweetpotatoes come into the subsistence food basket and cropping system during particular periods. Sweet potatoes fit into the cropping season as a short season crop—to a certain extent similar to green maize—breaking the hungry season in cassava and yam based systems. The crop has some market potential in local markets and there is some bulking for shipment to larger cities.

The root crop economy in Nigeria is very dynamic. The development of a national road network, large and growing urban areas distributed throughout the country, and demand for calorie sources that are price competitive and have a significant convenience quality have all provided conditions for rapid growth in demand for processed root crop products, especially gari. At the same time yams serve as a highly preferred root crop. Cocoyams and sweetpotatoes fill more niche markets at particular periods in the cropping year, coming into the markets during high price periods for yams and cassava. Sweetpotato, however, has agronomic characteristics (early maturity, disease resistance) and nutritional qualities, particularly of the orange-fleshed varieties that indicate a high potential for increased utilization and possibly even partial substitution of cassava and yam in the diet in the medium term.

Nigeria is a very large, complex country. While it is important to have a thorough overview of the diversified use of sweetpotato and its potential throughout the country, it would be impossible to thoroughly investigate the 7 major sweetpotato growing areas identified by Abu and Tewe (2008) given the resources available. Hence, we have decided to focus the majority of the effort in 3 areas chosen because of the existence of interested stakeholders in participating in sweetpotato value chain improvement. These areas are:

1. Osun State, focused on sweetpotato growing areas that align with the Home Grown School Feeding Program. The focus here will be on the use of orange-fleshed sweetpotato roots or processed products potentially linked to school feeding programs currently serving 130,000 students.
2. Kwara State, focused on areas serving the Offa city (population 2005: 114,000). This is an area where sweetpotato is particularly important in cultural traditions and product development has been researched by a food scientist at a local Polytechnic.
3. Nasserwa State and potentially other areas surrounding Abuja (population 2006: 776,000), the nation's capital. Abuja is a growing, dynamic city with a research sub-station that has been selecting sweetpotato varieties and the seat of the Potato Farmer's Association of Nigeria, which is keen to develop profitable processed product value chains linked to farmer cooperatives.

3. Terms of Reference

1. Review existing secondary information including national consumer budget surveys

The most up-to-date national consumer budget surveys and other relevant existing secondary information (including that from the C:AVA project in Nigeria) will be identified and the information on sweetpotato and competing products (both cereals and root crops) evaluated. It is anticipated that there will be significant gaps in these surveys, but this will enable the project team to identify data needs regarding locations of production and consumption and perceptions (if available) about the crop and its products.

2. Rapid market survey for fresh sweet potato

Rapid market surveys of fresh root value chains in the three target areas will be undertaken, including an assessment of marketing margins along the chains. The chains will be compared with fresh cassava and yam that are key potential substitutes. The purpose of the rapid market survey is to quickly identify the key market and product issues (economic, social, product, quality, regulatory etc) influencing each value chain and their development. These studies will specifically look at both constraints and opportunities.

3. Rapid market assessment of identified processed products

Rapid market surveys of the existing processed products will be undertaken in the 3 target areas, concurrent with the fresh root value chain assessment. The focus will be on wheat flour products such as biscuits and bread where sweetpotato could replace a percentage of wheat flour, convenient products and snack foods such as instant noodles, crisps and chips (French fries) as well as processed products typically made with cassava and yam such as amala. Price data on key ingredients will be gathered so that an assessment of the economic viability of use of sweetpotato as an ingredient can be made. Any existing sweetpotato-based processed products also will be captured, the extent of their market demand estimated and their cost of production calculated. As for fresh produce market assessment studies, the purpose of the rapid market survey is to quickly identify the key market and product issues (economic, social, product, quality, regulatory etc.) influencing each value chain and their development. The key characteristics of farmers commercializing and trading sweetpotato will be identified, with particular attention paid to gender roles in different parts of the value chain.

4. In-depth survey of identified existing fresh and processed products value chains based on rapid survey

Four or five case study value chains for the fresh and processed products options identified in activities 2 and 3 will be explored in greater detail in order to understand the relationship between the actors in the value chains, the margins, tradable qualities and potential future benefits, again paying specific attention to gender roles. Mapping techniques will be used to identify the actors in the identified value chains and the supporting institutional framework to identify the potential markets and potential products that the project will develop. These products are anticipated to include sweetpotato flour that can substitute for yam in amala (a fufu made from yam flour), snack foods like crisps, bakery products like biscuits and bread, and fresh roots linked to school feeding programs. While in general, the use of sweetpotato flour will be of more limited potential than boiled and mashed sweetpotato in processed products, among the flour products, amala has particular potential because yams are expensive and so substituting sweetpotato flour is thought to be cost effective. Also, amala is typically brown in color and so browning issues in sweetpotato flour may be desirable rather than a problem.

5. Recommendations on the way forward and assessment of strengths and weaknesses of potential partners

Based on the rapid assessments and value chain analysis, the top three potential interventions will be ranked and the strengths and weaknesses of potential partners (research institutions, extension services, farmers, farmer associations/cooperatives, traders, agro-processors) and the potential degree of involvement of women described. Any bottlenecks will be pinpointed. This feasibility study will help guide

stakeholders in which options make the most sense to invest in (if any) in the short, medium, and longer term.