

Challenges, opportunities, and strategy for cassava sub sector development in Nigeria

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Abstract. Nigeria has substantial economic potential in its agricultural sector. However, despite the importance of agriculture in terms of employment creation, its potential for contributing to economic growth is far from being fully exploited. The sector's importance fluctuates with any rise and fall in oil revenue and has remained stagnant over the past ten years. The contribution of the manufacturing sector to the GDP declined over the same period. Inappropriate macroeconomic and sector policies perpetuated by the 15 years of military rule and mismanagement have had a negative impact, not only on agriculture but also on the entire economy. Presently, Nigeria grows more cassava than any other country in the world. Production has been driven primarily by the demand for food for its nearly 130 million inhabitants while very little is used for feed and industry. Estimates indicate that 52% of cassava output is wasted due to inefficiencies in production and processing, 43% is consumed as food while five percent is used as livestock feed. The question remains whether the country could reduce the amount wasted by diversifying utilisation to bring down levels of unemployment and rural poverty and enhance economic growth. Using data from primary and secondary sources, the paper assesses the challenges and opportunities in the development of the cassava sub-sector in Nigeria. At the moment, the country does not seem to have a comparative advantage in cassava exports due to inefficiencies in domestic production. There is a need to encourage product diversification to take advantage of the huge domestic and

regional markets. The paper recommends a market-led strategy with an emphasis on agro-industrial development and the mobilization of resources through partnerships to improve domestic efficiency and subsequently tap into regional markets in West and Central Africa.

Introduction

Over the past ten years, the Nigerian agricultural sector has remained stagnant while the contribution of the manufacturing sector to the GDP had declined over the same period. Inappropriate macro-economic and sector policies perpetuated by the mismanagement of resources have had a negative impact not only on agriculture, but also on the entire economy. Consequently, per capita incomes have declined from approximately \$1200 in the 1980s to about \$290 in 2002 (World Bank 2003).

Meanwhile, Nigeria is the largest producer of cassava in the world. Its production is currently put at about 33.8 million metric tons a year (FAO 2003). The Central Bank of Nigeria (CBN, 2002) estimates are put at 37.9 million t/ha in 2002. Total area harvested of the crop in 2001 was 3.1 million hectares with an average yield of about 11 tons per hectare. Cassava is the most widely cultivated crop in the country and the crop plays a vital role in the food security of the rural economy because of its capacity to yield under marginal soil conditions and its tolerance of drought.

Presently, cassava is primarily produced for food especially in the form of *gari*, *lafun*

and *fufu* with little or no use in the formal agribusiness sector as an industrial raw material. Data from the Collaborative Study of Cassava in Africa (COSCA) showed that 80% of Nigerians in the rural areas eat a cassava meal at least once weekly. Per capita consumption of cassava of 88 kg/person/year between 1961 and 1965, increased to 120 kg/person/year between 1994 and 1998 (Nweke *et al.* 2002). Population growth and urbanisation are the principal factors driving the demand for cassava as food in Nigeria. In 2002, the annual population growth rate in Nigeria was 2.1% per annum. Urban population (as % of total population) in Nigeria has also grown from an average of 26 % in 1980 to 45% in 2001 (World Bank, 2003).

Urbanisation in particular presents a unique opportunity for producers to produce cassava for larger but sophisticated markets. In the near future, urban growth and development in Nigeria will place a dynamic challenge to product and process development in cassava for food, feed and industrial raw material as the demand for affordable and convenient foods increases. Agro-processing and value addition forms the platform for employment and wealth creation in the cassava sub-sector. Emphasising the transformation of cassava into various forms for food, feed, and industrial raw material has the potential to help Nigeria improve its food security situation, diversify its manufacturing base, generate income and employment and achieve a favourable balance of trade. Nweke *et al.* (2002) maintain that Nigeria is the most advanced of the African countries poised to diversify the use of cassava as a primary industrial raw material and livestock feed. Two key factors put Nigeria in this comparative advantage: one is the rapid adoption of improved cassava varieties and the second is the development of small scale processing technologies including the cassava grater. Currently, there is a proactive support from the government of Nigeria towards the development of the cassava sub sector. But the country needs to surmount certain obstacles within its domestic market in order

to commercialise its cassava sub sector. The objective of this paper is to identify the gaps, challenges and opportunities in the development of the cassava sub sector and provide strategies for transforming the sector into an important economic activity for the country.

Methodology

This paper is based on information obtained from secondary sources in very current literature.

Production inputs. The commercialisation of the cassava sub sector will require an active and responsive private sector agricultural inputs market. The private sector inputs market in Nigeria is undeveloped and existing private sector inputs markets rarely service the cassava farmer. This is because it is assumed that cassava is a hardy crop produced by very poor farmers and its vegetative propagation nature discourages investment in improved seed.

In general, soils of the tropics are fragile and relatively low in nutrients. Low soil fertility is one of the greatest biotic obstacles to increasing cassava output and improving land productivity. For example, to obtain root yield of over 30 t/ha, 164 kg of Nitrogen, 31 kg of Phosphorus, 200 kg of Potassium, 80 kg of Calcium, 31 kg of Magnesium are mined from the soil at harvest (Asher, 1980). Over the past 30 years soil fertility has been declining as fallow periods have become shorter due to pressure on arable land resulting from increasing population. Applying soil amendments such as inorganic and organic fertilizers can ameliorate the problem of low soil fertility. Chemical fertilizers are by far the most important purchased variable input especially in terms of their yield impact on improved seeds and in terms of the volume and gross value of their consumption compared to other inputs.

Unfortunately, economic forces especially transportation costs, logistical defects, and delivery failures, keep fertilizer out of the

hands of many farmers (Idachaba, 2000). Fertiliser consumption in Nigeria is very low compared to other major cassava producing countries (Figure 1) because it is import dependent and domestic production has dropped. For instance in 2001, total fertilizer consumption in Nigeria was only 13% and 3% of the amount consumed in Thailand and Brazil respectively. Nweke *et al.* (1999) notes that the use of fertiliser in cassava production is much lower than in any of the other major food crops in Nigeria. Further development of the cassava sub sector in Nigeria will have to contend with the intractable problem of fertiliser supply distortions.

Pests and diseases. Various diseases and insect pests plague cassava and result in huge economic losses. These include the cassava mosaic disease (CMD), cassava bacterial blight (CBB), cassava mealybug, green spider mite (GSM), and the large grain borer, which attacks dry chips of cassava in storage. Others are termites, anthracnose, root rot, rodents, and stem girdlers. Cassava mealybug and GSM have been largely controlled through Africa-wide biological control efforts of IITA and its partners. White ants (termites) destroy planted setts before they sprout. Some areas appear to be very

prone to this problem. Various chemical control measures are recommended, but the need for safe use and high costs restricts their use among many small farmers who practice mixed cropping. Root yield losses due to cassava mosaic disease are as high as 70% on susceptible genotypes in Nigeria.

An emerging threat to cassava production in Nigeria is the incidence of the cassava mosaic disease (CMD). Recently, mixed infections of ACMV and EACMV, the two viruses that gave rise to the EACMV-Ug, have been reported in Cameroon, Nigeria, Ghana and Togo (Fondong, *et al.*, 1998; Fondong *et al.*, 2000; Offei *et al.*, 1999; Ogbe, *et al.*, 1999; Ogbe 2001; Ogbe *et al.*, 2003). The occurrence of ACMV, EACMV and their variants, in mixed infections in Nigeria, in addition to the possible spread of the virulent Ugandan variant EACMV-Ug to Nigeria pose a serious threat to the food security situation of the world's largest cassava producing nation.

Without pre-emptive measures to contain the virulent form of the cassava mosaic disease the estimated loss to the cassava industry in Nigeria would amount to ₦36 billion (US\$300 million) at 2001 production levels (Ezedinma, 2002). The collapse of the cassava industry would also lead to loss of jobs in the rural areas, loss of the processing

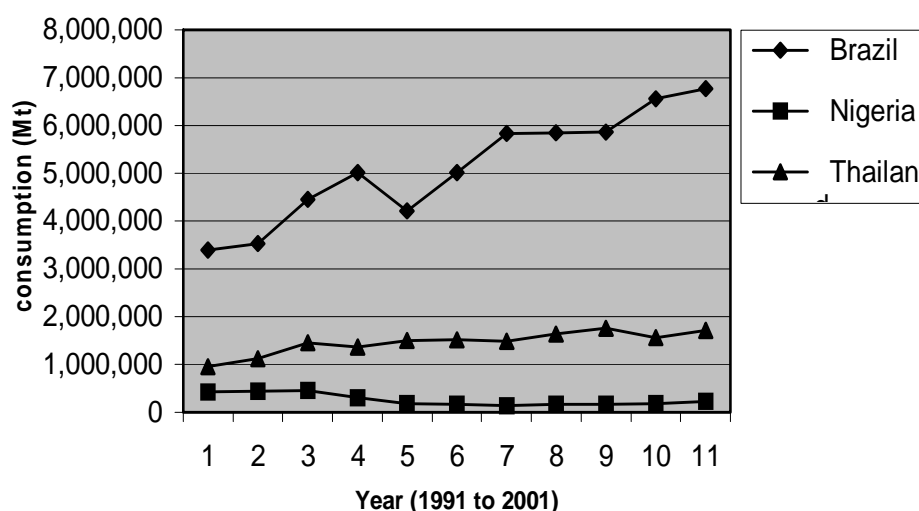


Figure 1: Total fertiliser consumption in major cassava producing countries.

and machine fabrication industry, and decimation of urban and rural food security. This may eventually lead to food scarcity, loss of confidence in government, and pressure on government to import food.

Agronomic challenges. Among the crops widely cultivated in Nigeria, research efforts have made the greatest impact on cassava. Production has increased substantially in the

country over the last twenty years principally owing to an increase in the area cultivated and improvements in production efficiency through the introduction of high yielding, disease and pest resistant cultivars (Figure 2). Cassava is produced mostly in the south and central zones of Nigeria (Figure 3). The collaborative study of cassava in Africa (COSCA) show that farmers in Nigeria obtain an average yield of 14.65t/ha without

Figure 2: Cassava production and area trend in Nigeria.

Figure 3: Comparison of domestic and world market prices for cassava chips, cassava starch and maize.

fertilizers. Fresh tuber yield (t/ha) range from 1.25t/ha to 67.2t/ha in Nigeria (Nweke *et al.*, 1999). While the average yield estimate by the FAO (2003) is 11t/ha, evidence from the COSCA in the early 90s show that farmers in Nigeria can attain equivalent yield levels as their counterparts in Thailand (16.4t/ha) and Brazil (13.7t/ha). This is because over the years, the international and national agricultural research centers have developed high yielding cassava varieties purposely for low input production. Manyong *et al.* (2000) have shown that by 1998 the use of such improved cassava varieties had increased the gross economic benefits per hectare by 142 US dollars in Nigeria.

However, the use of improved cassava varieties is not widespread in Nigeria (Nweke *et al.*, 1999; Ezedinma, 1989; Akoroda *et al.*, 1989). Shortage of planting materials is also compounded by farmers' inability to preserve planting materials. The lack of well-organized planting material multiplication and distribution system in Nigeria is also a major constraint. Hence breeding for high yield may not be the major challenge to cassava development but the multiplication, distribution and adoption of existing high yield varieties.

Challenges to agro-processing. In fresh form, cassava roots are bulky and perishable. Processing reduces the bulkiness and extends the shelf life and therefore reduces the transportation cost, as well as adding value to the product. The fact that cassava roots have to be processed before marketing may seem to make it less tradable than grains. But the vast majority of cassava roots are processed at the village level by a variety of small-scale methods into many different products that cater for local preferences. Small-scale processing machines namely graters, mills and press are available in the cassava producing zones of Nigeria (Nweke 1994; Ezedinma and Oti, 2001).

Available processing technologies especially graters and mills has reduced the use of manual labour in Nigeria by 50%

(Nweke *et al.*, 1999). The use of labour saving grating technology and improved cassava varieties has also improved income in rural areas. But the availability of the mechanised grater and improved cassava varieties has shifted the cassava labour bottleneck to harvesting, peeling and drying. The challenge therefore is to develop and transfer mechanised technologies that will improve cassava harvesting, peeling and drying operations in order to save labour and improve quality and standards. Consequently the likely enhancement in cassava production will occur only through "integrated and complementary" improvements in both cultivation methods and processing techniques.

Among other principal constraints to cassava processing are the absence of efficient dryers and pelletisers. Perhaps the greatest constraint to cassava processing is drying which takes up to 4 days to complete with solar energy with apparent loss in quality. Drying is a key process because in Nigeria the major cassava producing zones are also the relatively higher rainfall zones with longer rainfall months. Solar radiation is relatively low, justifying the need to use dryers extensively for cassava commercialisation.

Evidence (Omosaiye *et al.*, 2002) indicates that dryers (including flash dryers) using kerosene, diesel, charcoal and electricity are available, but their economic advantages have not been widely demonstrated in the country. Observations indicate that they are expensive because of inefficiencies in the use of energy. The development and promotion of efficient pelletising machines for making pellets either for poultry, ruminants, fish and for export is an engineering challenge as more Nigerians are becoming increasingly aware of production of pellets for animal feeds.

Market development and cassava commercialisation. Cassava has long been used as a famine reserve and food security crop produced mainly through smallholder subsistence farming systems. Low input use, rudimentary technology, large post-harvest

losses and limited processing characterize these farmers. Small-scale cassava producers (cultivating <2 ha) constitute about (95%), while those with more than 5 ha constitute about 5%. Production is not oriented towards commercialisation but instead farmers produce and process cassava as a subsistence crop. There is no scale advantage in subsistence cassava production using manual methods. Hence while it is true that Nigeria is the largest cassava producing country in the world, agro-industries may not be able to obtain adequate and reliable cassava supplies due to the dominance of subsistence production systems. Incentives are required to stimulate the commercialisation of the cassava sub sector. Such incentives include subsidy on fertiliser and agro chemicals and the introduction of tariffs on substitute imports such as cornstarch and ethanol to enable local industrial development in the sub-sector. The development of the cassava sub-sector also requires a complete re-orientation of farmers to think commercial. Commercialisation implies increase in the number of farmers who can produce cassava commercially with improved inputs and production practices at the farm level to meet the volume and quality requirements of emerging agro-industries in Nigeria. This is the major challenge in the industrialisation of cassava.

In Nigeria, production costs for cassava at the farm level are high relative to those in other countries. Average production cost/ton is as high as \$92.40 in the prevailing traditional production systems (Ezedinma, 2000). This contrasts with \$15.63/t in Indonesia, \$17.75/t in Thailand, \$22.51/t in India, and \$26.03/t in China (Howeler, 2000). It is the high cost of production that has placed Nigeria at a comparative disadvantage in the cassava export market (Figure 3). Reducing farm level production costs for cassava is therefore a major challenge in the development of the cassava sub-sector in Nigeria. An opportunity may lie in encouraging the cultivation of medium sized farms (10ha) using partly mechanised and partly manual labour. Since the soils, especially in the humid zones, are

fragile, the use of small (less than 20hp) tractors for land preparation, planting and harvesting may help mitigate rapid soil degradation. But in a semi mechanised production system labour for harvesting will still account for about 45% of the total cost of production (Olabashola, 2003) due to the absence of mechanised harvesters in Nigeria. The critical issue is that the subsequent introduction of yield-increasing technologies must be complemented with labour-saving mechanical technologies for cassava production and harvesting in order to drive down the price of cassava to consumers, feed millers, and industrial users.

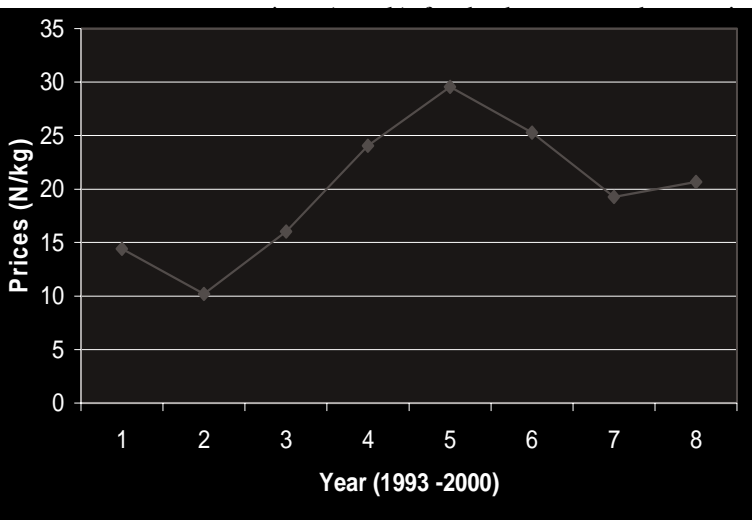
Another market related challenge is the fact that cassava production in Nigeria exhibits cyclical gluts due mainly to the inability of markets to absorb supplies. As a result when cassava is scarce the price goes up and farmers are encouraged to plant; production goes up and the price comes down prompting farmers to plant less until the price goes up again in a cycle of approximately two to three years (Figure 4). Such factors cause price instability over the years, which significantly increase the income risk to producers. The cyclical price movements for cassava justify the need to stabilize cassava prices through market expansion into other forms and uses.

Challenges to product and process development. In Nigeria, it is possible to broadly distinguish two markets, i.e. the traditional food-oriented market and the new emerging market for industrially processed cassava. The vast majority of the cassava grown in Nigeria is processed and sold through traditional market channels, which are fairly well known. Much less is known about the market structure for industrial cassava. Cassava *gari* has gained importance as a key food in urban households because it is convenient and easy to cook. Income elasticity estimates based on household food consumption and expenditure surveys (Kormawa, *et al.*, 2003; Nweke *et al.*, 1992) show that urban demand among households

Figure 4: Average annual market prices (N/kg) for gari in Nigeria, 1993 to 2000.

particularly in its main consumed form, as *gari* is positive. These results suggest that efforts to expand the domestic market for cassava should focus on the development of convenient foods including snacks from cassava. The challenge is to develop

from traditional foods to industrial uses, there is need to explore these opportunities to diversify cassava markets. The key to the successful commercialisation of the cassava sub sector lies in the development of a distribution system that links commercially



linked producers to urban consumers (process development) to enable a consistent supply of good quality products (product development) at a competitive price. Unfortunately, supply networks have yet to respond to the cassava transformation process (Ezedinma *et al.*, 2002) especially for supply of secondary cassava products. The primary source of raw material for agro-industries. Associated with these are problems of unreliable supply, uneven quality of products, low producer prices, and costly marketing structures, which affects its use for industrial transformation. Other than these constraints, cassava has great potential once its unique characteristics are capitalized on

processed into several secondary products of industrial market value. These products include chips, pellets, flour, ethanol, and starch, which are vital raw materials in the livestock, feed, alcohol/ethanol, textile, confectionery, wood, food and soft drinks industries. They are also tradable in the international market. With changing focus

as raw material for different end uses and product markets. Increasing the range and quality of consumer acceptable cassava-based products, its entry into the animal feed industry, and other industrial applications would raise the demand for cassava, provide the necessary incentive to improve production, expand trade and income

generating capacity of cassava producers and processors.

In a recent survey, Knipscheer *et al.* (2003) assessed the domestic opportunities for the industrial cassava market in Nigeria (Table 1). A potential market for cassava is in the livestock feed industry. However, the use of cassava for livestock feed in Nigeria is not competitive at the moment. According to the FAO (2003) only about 5% of the total cassava produced is used as feed indicating that the industry is under-developed. The current demand for cereals namely maize, a major carbohydrate source in the livestock industry is put at 1.2 million metric tons a year in Nigeria (Table 1). It is unlikely that cassava will completely replace maize as the basic energy source in livestock feed. This is because while cassava tubers are cheaper than maize the additional processing to chips and pellets for the livestock industry are prohibitive due to high processing costs. Cassava in its processed form as chips and pellets is not currently cheaper than the price of maize (www.rusep.org, 2003). This is because peeling and drying account for a greater proportion of the cost of processing due to the use of manual labour and solar energy.

The industry with the most potential for providing a rapid market for cassava is the ethanol industry. Until recently Nigeria imports all its ethanol since it stopped production in 2001 after cheap world market imports and a difficult domestic feed stock situation had undermined the viability of local production (www.ethanolmarketplace.com,

2003). Yield of alcohol per ton is much higher from cassava (150 litres/t of fresh root) than from sugar cane (48 litres/t) - a raw material source that had been used without much success in Nigeria (Bamikole and Bokanga, 1998). A distillery using cassava to produce alcohol can operate year round because cassava is available year round. The total market volume required in Nigeria is estimated at about 20,900t annually and 90% is used by the liquor industry alone. Substituting 80 million litres of imports with local cassava would require 500,000t of dried cassava roots (or 2 million tons of fresh roots) valued at (2003 prices) roughly 62 million dollars. Interest in investments in the Nigerian ethanol industry is growing but emphasis on small-scale cassava based production units using cassava, as raw material will generate equity and growth in the industry.

The use of cassava starch as an industrial raw material in Nigeria is low and the market structures are also under developed. In the early 1990s only about 700t of cassava starch was produced per annum because Nigerian cassava starch is considered to be of low quality by industries and none is exported (Nweke *et al.*, 2002). Maize starch rather than cassava was preferred especially by the textile and confectionery industries. The current demand based on imports of maize starch that can be replaced completely with cassava starch in 2002 is 67,100t (Table 1). The poor economic climate during the military era led to the near collapse of the textile industry in Nigeria and so reduced the potential market

Table 1: Potential domestic demand for industrial cassava in Nigeria, 2002.

Sector	Domestic Demand MT/year	Substitution (%)	Equivalent in fresh cassava roots (MT)
Animal feed	1.2 million (cereals)	20	1.0 million
Starch	67,100 (corn starch)	100	0.35 million
Flour	1.18 million (wheat)	20	1.0 million
Ethanol	20,900 (imports)	100	2.0 million
Total			4.5 million

Source: Knipscheer *et al.*, 2003.

for cassava starch. The positive steps taken by subsequent leadership to revamp the textile industry will provide an incentive to develop the starch industry.

Other potential markets are with respect to modified starch, which have several uses. The soft drinks industry imports all its syrup concentrate because cassava starch derivatives (hydrolysates e.g. glucose, sucrose, fructose, maltose, and syrup) are not currently developed in Nigeria. The estimated annual use of starch hydrolysates in the pharmaceutical industry is 1523t but 80% of the raw materials used by the pharmaceutical industry in Nigeria is imported because for now it is easier, less risky and much less complicated to import than to manufacture locally (RMRDC, 1997). Again in the 1990s, 58,000t of adhesives, a major derivative of starch (dextrin) were used in the wood, cable, paper and printing, packaging and footwear industries in Nigeria. Unfortunately, all these were imported either as adhesives or as dextrin. Developing the starch industry for use as adhesives for these industries would put 60,000t of cassava into use for this industry alone in Nigeria (Nweke *et al.*, 2002).

Opportunities in the regional market. At the moment, Nigeria is not a major cassava exporting country even though there is a large opportunity within the African region especially for cassava starch. Several countries in Africa import cassava starch totalling about 2.494 million tons in 2001 (Table 2). To gain access to these markets, the country needs to comply with international standards and negotiate trade terms with these African countries. Presently, Nigeria has no comparative advantage in the export of cassava chips and pellets to the EU because of stiff competition from Thailand (which dominates the export market at the moment), under developed inefficient marketing structures and the favourable domestic prices for maize (Ezedinma *et al.*, 2002; Nweke *et al.*, 2002).

The agribusiness environment and policy.

Investing in agribusiness enterprises in Nigeria is a big challenge arising from several factors within the domestic economy. For instance, available data from the Central Bank of Nigeria indicate that from an average of 75% in the 1970's the manufacturing capacity

Table 2: Cassava Starch imports in Africa.

Country	1999		2000		2001	
	Quantity (MT)	Value (1000\$)	Quantity (MT)	Value (1000\$)	Quantity (MT)	Value (1000\$)
Botswana	2	1	10	0	23	10
Burkina Faso	10		10		10	
Gabon	18	6	18	6	18	6
Kenya	132	38	160	53	160	53
Madagascar	4	3	0	0	75	29
Mauritania	204	54	295	72	400	77
Rwanda	52	49	52	49	0	0
Senegal	203	77	138	47	89	30
South Africa	1094	222	2777	388	2165	344
Swaziland	161	61	231	105	4	4
Zimbabwe	6	11	8	11	3	3
Total	1886	527	3690	731	2949	558

Source: FAOSTAT, 2003.

utilisation deteriorated to 50%, 40%, and 38% in 1983, 1987, and 1992, respectively. Throughout the 1990's capacity utilisation in the manufacturing sector fluctuated between 29% and 42% with an average of 35%. The low capacity utilisation in Nigeria's manufacturing sub-sector is attributed to a large variety of domestic factors. These factors include infrastructure deficiencies, high cost of inputs because of domestic currency depreciation, unstable and unpredictable government fiscal policy prescriptions, depleted production capacities of installed equipment because of poor maintenance and servicing cultures and inadequate support by government (Marchet *et al.*, 1999; Adeyemo and Bankole, 2003). On the issue of inadequate government support for production boosting incentives, Nweke (2003) recently notes that the absence of intellectual property rights protection to support private sector activities is a major challenge to cassava transformation in Nigeria.

Until recently, government had rarely intervened directly in the development of the cassava sub-sector. In 2002, the government of Nigeria committed itself to the development of cassava as a major export-earning commodity. In the coming year government intends to commit a lot more funds to the agricultural sector with specific allocations to cassava development. But there is still a need to set out new policy to guide the development of the sub sector. In the next section we discuss the strategy and policy requirements for the cassava sub sector in Nigeria.

Strategy for cassava sub sector development in Nigeria

Commodity chain approach. The best strategy in cassava development is to follow a market led approach within the cassava commodity chain. The commodity chain includes the inputs market, production at the farm level, agro-industrial processing, distribution and marketing, and consumption. Improvements in each chain (within the cassava commodity

chain) are urgently needed. The market led approach should target development where the private sector has made investments especially in the food, feed, and agro-industrial use. To gain efficiency in inputs and output markets and improve the supply chain, there is a need to encourage commercial farm and processing systems using a nucleus farm and cluster model (Knipscheer *et al.*, 2003). Developing commercial farming systems will not remove the subsistence production systems that have already gained efficiency in the traditional food sector. Commercial farm and processing also means the use of improved and purchased inputs and machinery.

Private-public sector strategy. The absence of a commercial approach to cassava production and marketing in Nigeria justifies a synchronized approach involving several partners in the development of the sector. A long-term cassava industrial and market development strategy that involves public-private partnerships is essential. The private sector will have to focus on investing in market development and procuring needed machinery, while the public sector provides the needed policy environment and physical infrastructure. The various actors in the partnership (i.e. farmers, processors, industrialists/investors) should remain in their own expertise. To strengthen the present weak link between industrial processors and producers of cassava products the sector will also require initial activities in capacity building especially producer and processor groups support and development, quality and standards in product development, transfer of production and processing technologies, and development of clusters to supply identified markets.

Focus on the domestic market and regional markets. To gain economies of scale in the industrialisation of the cassava sub-sector Nigeria has to focus on its domestic market. A comparison between the prices of Nigerian and Thailand cassava products clearly

indicates that – in the short run — Nigerian industrial cassava products cannot compete on the world market. However, Nigeria has a large domestic market. The domestic demand for animal feed, starch, crude alcohol and confectionary products are all increasing. By following a policy of import substitution, the Nigerian government can further stimulate the demand for homegrown cassava, while at the same time save foreign exchange. The development of the domestic market will help to improve industry, national and international standards, quality and global phytosanitary requirements leading to a gradual approach to export oriented production. In the short-run efforts to penetrate the world market to gain foreign exchange should focus on identifying niche or dedicated markets. Such markets could be explored within the African sub-regions and Europe.

Conclusion

In conclusion, we recommend new and additional roles for research and development institutions and for government and public sector institutions.

Research and Development. For sustainability, the cassava commercialisation effort must be supported by adequate research and development activities. Research and development institutions should focus on two critical issues that need to be addressed simultaneously. One is that the cost of cassava production and processing needs to be reduced to become more efficient. The second is that improved varieties need to be multiplied and distributed adequately.

Research and support activities should include the introduction of labor saving devices and appropriate processing technologies (planters, harvesters, dryers, peelers, pelletizers, etc.) and the development of high yielding and disease-free planting materials, plant health and resource-use management strategies, and postharvest technologies.

Machinery for cassava planting, dryers, peelers and pelletizers has been developed elsewhere. Initially, there would be need to import these, copy and mass-produce them and at the same time build domestic capacity to produce, maintain and repair them. Import incentives on the side of government would be required to achieve this.

Research and development agencies should play a market support role by targeting efforts in areas where the private sector is prepared to make significant investments. They should also support market linkages and supply chain organization. Supply chain organization includes the following: farmer organization and training, support and development of processor groups, build capacity in quality and standards in product development and in the transfer of production and processing technologies, and develop clusters to supply identified input and output markets.

Government and public sector institutions.

Develop a comprehensive policy for the use of cassava as a raw material in the food, feed, and agro industry on a commodity basis (e.g. starch, dextrin, ethanol, etc) to guide cassava development in Nigeria. In addition government should stabilise the investment climate with consistent policy incentives and security. Public and private sector research on product development and vertical/horizontal integration of industries should be supported with adequate intellectual property rights on the part of government. Government and its agencies should also support technology transfer and import substitution and strive to improve infrastructure especially electricity supply, railway transport, and water supply. At the moment great strides have been made in the area of information and communication technology.

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