THE GLOBAL CASSAVA DEVELOPMENT STRATEGY

A cassava industrial revolution in Nigeria

The potential for a new industrial crop

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PREFACE

In Africa, cassava is gradually being transformed from a famine-reserve commodity and rural food staple to a cash crop for urban consumption. For the cassava transformation to advance to the next stage of livestock feed and industrial raw material, labour-saving production, harvesting and processing technologies are needed to reduce costs, improve productivity and make cassava more competitive. Yet the transformation will not continue unless new uses and new markets are identified to absorb the increase in production.

Nigeria is the world's largest cassava producer; its cassava transformation is the most advanced in Africa. However, the scope for increasing the use of cassava in Nigeria's industries is, to a large extent, determined by the development of an efficient and well-integrated production and marketing system, to assure a steady supply of cassava products of stable, high quality standards and appropriate price, and of specific properties required by domestic industries and export markets. Thus, public and private investments in research and development required to develop cassava products for industrial uses, if well targeted, could offer good returns and prospects for the future of cassava in Nigeria.

The belief that a growing demand for cassava will spur rural industrial development and contribute to the economic development of producing, processing and trading communities and well-being of numerous disadvantaged people in the world, has prompted the development of the Global Cassava Development Strategy. The Strategy was endorsed at the International Validation Forum jointly organized by the Food and Agriculture Organization of the United Nations (FAO) and the International Fund for Agriculture Development (IFAD) held in Rome, Italy in April 2000. It suggests that industry analysis in cassava-producing countries should be undertaken to indicate current status, strengths, weaknesses and issues for attention and action needed to resolve pressing constraints and take advantage of markets and business opportunities as well as to encompass finding of committed national champions.

The study on "*A Cassava Industrial Revolution in Nigeria*" coordinated by the International Institute of Tropical Agriculture (IITA) is in line with the Global Cassava Strategy. It was prepared as a contribution to the joint effort by IITA and the Federal Government of Nigeria to enhance the Nigerian Cassava Industry. This has been followed-up with similar support from many of the petroleum and crude oil producing companies operating in Nigeria to ensure that this effort is achieved.

As part of the study, a nationwide cassava industry analysis was commissioned to dTp Studies Inc. of Canada to determine the actual and potential size of the market for cassava and cassava based products in Nigeria and to assess what is required in terms of economic, social and physical investments to develop an efficient cassava industrial sector. The study team comprising of agricultural economists from dTp Studies Inc., a local post harvest specialist and an agronomist began work in November 2003 with an extensive search for available data on the Nigerian cassava industry. This involved visits by the study team to all state agricultural development programmes (ADPs), federal offices and key industrial informants. Duplication was minimized by not visiting those industries already visited by previous consultants; instead information from their reports was used.

This report together with the resulting *Statistical Handbook* forms a pool of information from which private sector investor information can be drawn. It is obvious that in its current form, the information contained in this report may be too detailed to interest large, medium and small scale investors. Condensed reports and pamphlets for industrial application should be gleamed from this report to suit specific end user interests.

It is hoped that the available information will contribute to supporting the potential of cassava to being an engine of industrial revolution in Nigeria and so contribute to the development of action plans for the

industry, including the who, what, why and how, plus the question “Whose money should be used to guide investment and research decisions in the cassava subsector?”

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AGIP Oil Company LTD, Rivers
Consultancy Unit, University of Agriculture, Abeokuta
National Association of Small Medium Enterprise in Nigeria
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Real Foods, Asejire, Oyo State
The Nigerian Cassava Growers Association
Agricultural Projects and Extension Services, Shell, Rivers

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Eric A. Kueneman
Chief
Crop and Grassland Service
FAO Plant Production and Protection Division

EXPLANATORY NOTE

Statistics

The statistical information in this study has been prepared from figures and information available to:
- FAO Statistical Database (FAOSTAT) and Web pages
- Federal Office of Statistics, Nigeria
- Agricultural development programmes (ADPs)
- IITA's Rural Sector Enhancement Programme (RUSEP)
- Central Bank of Nigeria (CBN)
- FMANR
- State Agro-Processing and Market Expansion Groups (SAMEG)
- Projects Coordinating Unit (PCU)
- Ministry of Health and Nutrition of Nigeria - National Consumption Survey
- Root and Tuber Expansion Program (RTEP) baseline survey
- Nigeria's cassava industry: statistical handbook
- World Bank web site
- United States Trade Representative Office web page
- Supply-Chain Council Web page
- International Food Policy Research Institute (IFPRI)
- Federal Ministry of Agriculture and Natural Resources Nigeria (FMANRN)
- Corporate Affairs Commission (CAMA) Web page

Symbols

The following symbols are used in this publication:
$ = US dollars
N = Naira
N per Ha = Naira per hectare
mt = metric tonnes
mmt = million metric tonnes
Yld = Yield
km = kilometre
N per km = Naira per kilometre

Units

Unless otherwise indicated, the metric system is used in this publication.

Exchange rates

During the study period the local currency Naira was 138.75 to US$ 1.00.

ACRONYMS AND ABBREVIATIONS

ADP	Agricultural development program
AGIP	Agip Oil Company LTD
ARCEDEM	African Regional Center for Engineering Designs and Manufacturing
CAMA	Corportate Affairs Commission
CBN	Central Bank of Nigeria
DFID	Department of International Development – United Kingdom
EU	European Union
FAOSTAT	FAO Statistical Database
FIIRO	Federal Institute of Industrial Research, Osodi
FMANR	Federal Ministry of Agriculture and Natural Resources Nigeria
IDEAA	Initiative for Development and Equity on African Agriculture
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
LGA	Local Government Authority
NEPAD	New Partnership for Africa's Development
NNPC	Nigerian National Petroleum Corporation
NRI	Natural Resources Institute
PCU	Projects Coordinating Unit
PRODA	Product Development Agency
RTEP	Root and Tuber Expansion Program
RUSEP	Rural Sector Enhancement Programme
SAMEG	State Agro-Processing and Market Expansion Groups
SCOR	Supply Chain Operations Reference
UNAAB	University of Agriculture Abeokuta - Nigeria
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

The objective of this report is to provide comprehensive information that will guide investment decisions in the Nigerian cassava subsector. Specifically the study team was mandated to develop a report that covered four topic areas; cassava production, processing and utilization, prices and margins and development clusters. Each topic is discussed in terms of the current status, future targets, new initiatives and a suggested way forward.

It was the intention of this study to draw heavily on data collected and collated by the industry and State and Federal Governments. In travelling across the country it was soon realized that much of the data desired for this study of cassava did not exist. If it did exist, in many cases, it was not in a user friendly format that could be quickly or easily analysed. These realities led the team to develop the first *Nigerian Cassava Industry Statistical Handbook*.

The Handbook contains over 100 pages of state and national level data in tabular form relevant to the Nigerian cassava industry. The sections provide data on production, processing, utilization, prices, enterprise budgets, transportation, domestic economic indicators and international cassava data. The data is intended to provide a baseline for monitoring changes in the industry and a guide for investments and research. Although some tables are incomplete, sections and table headings are provided, as a guide for future industrial data collection.

The Handbook should be used as a companion when reading this report. Data summarized in this report can be examined in detailed tabular form in the Handbook. It is hoped that as the use and availability of the handbook become widespread, industrial stakeholders, policy-makers and national researchers will be able to undertake their own or similar analysis and interpretation of the data when and as needed. This report together with the Statistical Handbook forms a pool of information from which private sector investor information can be drawn.

The second analytical contribution of this study was the development of Nigerian regional cassava production models. Regional production models have traditionally been used to assess the potential responses of farmers to changes in policy, technology and market conditions. In this study, linear programming was selected as an appropriate technique to use. Ideally, these models are based on enterprise budgets which provide an indication of quantity and cost of production inputs and timing of these activities.

The 40 plus crop enterprise budgets collected from six states, published in the *2000*/*2001 Advisors Handbook,* formed the core data for these models. The constraints to the model were regional land availability and producer food consumption requirements. The regional models are annual models that maximize gross margins (revenue minus input and labour expenditures) subject to minimal farmer consumption and limited by available land. A feature of the models is the assumption that the traditional harvesting of cassava continues into the second year. The implication being for an annual model, enterprises containing cassava require 2 ha of land rather than 1 ha of land, as do all other enterprises.

The regional models were used to compare four scenarios against a base scenario. The base scenario is designed to represent current regional conditions of land use, food consumption and agricultural production. Land constraints are used to ensure that the base results are similar to calculated regional averages. The four scenarios are based around the permutations of two changes. One change results in cassava being harvested in one year as opposed to two years. The second is the adoption of high yielding varieties. The results of these models assisted the analysis of future production, processing and utilization targets and initiatives in the report.

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1 INTRODUCTION

In the early years of Nigeria's independence, agriculture accounted for nearly 60 percent of Gross Domestic Product (GDP) and 80 percent of export earnings (Shaib, Aliyu, and Bakshi, 1997). Today agriculture accounts for a third of GDP and less than one percent of export earnings, oil accounting for the rest[1].

Although room exists for Nigeria to prosper, the country continues to face a number of challenges. Policies to date have yet to diversify the productive base away from the continued reliance on a single industry, petroleum. There continues to be underutilization of industrial capacity, high unemployment and political anxiety.

A desirable outcome for the Nigerian populous and current government is a strong diversified economy able to generate employment and sustain incomes for its citizens. Increasing the productivity of agriculture, increasing the utilization of industrial capacity, diversifying export earnings and providing gainful employment for its population are all desirable targets.

To achieve this, President Olusegun Obasanjo's newly elected government, in 1999, pledged to support the agricultural sector and announced the need for immediate action in five agricultural subsectors: cassava, rice, vegetable oils, livestock and tree crops. The cassava initiative alone seeks to generate US$5 billion in export revenue by 2007. Since its launch in July 2002, great excitement has been generated, creating new hopes and even greater expectations.

To compliment this Initiative, IITA together with the Nigerian National Petroleum Corporation (NNPC) recently signed a four year action plan providing local communities with cassava mosaic disease resistant planting materials and production and marketing support. These improved cultivars also produce more cassava per plant. Their distribution to farmers could lead to a substantial increase in production (IITA, 2003). The question is can the utilization of cassava grow sufficiently to mirror farmer's enhanced ability to produce cassava?

[1] Oil represents 99.6 percent of total exports, valued at 1 979 337 million N or US$17 418 million in 2001. There are 12 pages of exports classified by commodity and country in the 2001 Nigeria Foreign Trade Summary compared to 564 pages of imports (Federal Office of Statistics, 2001).

1.1 STUDY OBJECTIVES

The primary objective of this study was to determine the actual and potential size of the market for cassava and cassava based products in Nigeria and what is required in terms of economic, social and physical investments to develop an efficient cassava industrial sector. The specific objectives and activities directing this study are provided in Appendix A.

The intended audience for the report was to include large, medium and small-scale private sector investors, farmers and processors. It was also intended to guide donor and development bank investments and government policy.

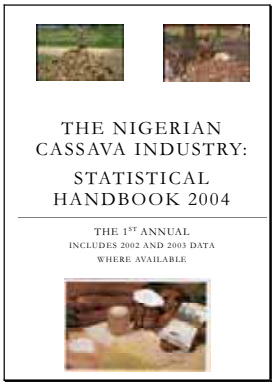
The study team comprised two agricultural economists, a local post harvest specialist and an agronomist. Work began in November 2003 with an extensive search for available data on the Nigerian cassava industry. This involved visits by team members to all state agricultural development programmes (ADPs), federal offices, and key industrial informants. Duplication was minimized by not visiting those informants and industries already visited by previous consultants. Instead information from their reports was used in this report.

The task for this single report is enormous. It is obvious that in its current form, the information contained in this report may be too detailed to interest large, medium and small-scale investors, donors, governments and development banks. Condensed reports or pamphlets for industrial application should be gleamed from this report to suit specific end user interests. The data intensive nature of this study lead to a companion document being assembled, entitled "The Nigerian Cassava Industry: Statistical Handbook".

1.2 THE CASSAVA STATISTICAL HANDBOOK

This study draws heavily from previously presented material on simulating the cassava industry in Nigeria. It was also the intention of this study to draw heavily on data collected and collated by the industry and State and Federal

Governments. In travelling across the country it was soon realized that much of the data desired for this study of cassava had not been collected nor collated and was not readily available in a form that could be quickly or easily analysed. It was for this reason that *The Nigerian Cassava Industry: Statistical Handbook 2004* was born.



This handbook, a first of its kind for cassava, contains over 100 pages of data in tabular form relevant to the Nigerian cassava industry. The sections provide data on production, processing, utilization, prices, enterprise budgets, transportation, domestic economic indicators and international cassava data. The data is intended to provide a baseline for monitoring changes in the industry and a guide for investments and research. Although some tables are incomplete, sections and table headings are provided, as a guide for future industrial data collection.

The Handbook is intended to provide the Nigerian Cassava Industry and those interested in learning about the industry with a basic understanding of its scope, organization and magnitude. It is hoped that this Handbook will be updated on an annual basis and widely distributed in both hard and soft formats. Hard copies are to be made available to all levels of government, institutions, industries, associations and interested individuals. Soft copies are to be made available on request to those with available technology.

Although many have suggested that such a Handbook can be easily and cheaply maintained in CD or web site form many people in Nigeria do not have access to such technology and even those that do, do not have a steady supply of electricity for it to be available when and as needed. Paper copies are still very important in Nigeria. Especially so, when one considers the fact that less than one percent of the population accesses the Internet or has personal computers (World Bank, 2004).

The Handbook should be used as a companion when reading this report. Data summarized in this report can be examined in detailed tabular form in the Handbook. It is hoped that as the use and availability of the handbook become widespread, industrial stakeholders, policy makers and national researchers will be able to undertake their own or similar analysis and interpretation of the data when and as needed. This report together with the Statistical Handbook forms a pool of information from which private sector investor information can be drawn.

Another innovation brought about by this study was the development of regional production models that can be used to simulate the outcome of alternative production scenarios.

1.3 Regional Production Models

Regional production models have traditionally been used to assess the potential responses of farmers to changes in policy, technology and market conditions. Depending on the objectives of the analyses and the availability of data, the scope of such models has ranged from that of individual farms to aggregate models representing the entire agricultural industry.

For this study linear programming was selected as an appropriate technique to develop regional production models. Linear programming is a technique that maximizes or minimizes an objective function subject to a set of constraints. In the case of regional modelling the objective function normally consists of maximizing profit or output from farming activities, or minimizing costs of production or use of inputs. The constraints generally refer to the availability of land and labour and the need to meet some minimum marketing, or consumption standard.

These models are typically based on enterprise budgets. Ideally the budgets provide an indication of quantity and cost of production inputs, as well as the timing of these activities. These budgets also provide information on the output and value of production activities. The budgets may also

provide information on the linkages between different production activities, such as the amount of produce that is processed into another commodity (e.g. cassava roots to *gari*).

Initial data collection activities led to the belief that each Agricultural Development Programme (ADP) had enterprise budgets for the primary cropping patterns in its state. It was thus planned to develop farm models for each state. Unfortunately, the visit to 16 ADPs proved otherwise. Only three of the 16 visited ADPs were able to provide enterprise budgets that were representative of the commonly practiced intercropped activities of the state. Two additional states provided an enterprise budget on mono-crop activities, but it was felt that these could not be used to develop representative farm models. It was suggested by various ADPs that the desired enterprise budgets be available at the Project Coordinating Unit (PCU) in Abuja. Unfortunately it was not possible in the two-day visit to the PCU in Abuja to collect the desired data.

Copies of the 2000/2001 Advisors Handbook (Projects Coordinating Unit, 2002) which contained a compilation of over 40 crop enterprise budgets collected from 6 states. From the point of view of farm modelling the data lacked information on the quantity of inputs (labour and purchased inputs) and location of the states used to develop the budgets. Appendix B details how the data was adjusted to account for this missing detail. With this adjustment, these data represented the best and most comprehensive source of cost of production data we were able to find and formed the starting point for developing regional farm models.

The constraints to the model were regional land availability and producer food consumption requirements. The regional models are annual models that maximize gross margins (revenue minus input and labour expenditures) subject to minimal farmer consumption and limited by available land.

The regional models were used to compare four scenarios against a base scenario. The base scenario is designed to represent current regional conditions of land use, food consumption and agricultural production. Land constraints are used to insure that the base results are similar to calculated regional averages.

A feature of the model is that it was assumed that the traditional harvesting of cassava continues into the second year. The implication for the annual model is that enterprises containing cassava require 2 ha of land rather than 1 ha of land, as do all other enterprises. The four scenarios are based around two changes. One change results in cassava being harvested in one year as opposed to two years. The second is the adoption of high yielding varieties.

Scenario A assumes yields increase to 15 tonne/ha but harvesting continues into second year. Scenario B assumes that cassava is harvested within a single year but yields don't improve. Scenario C assumes yield increases to 15 tonne/ha and cassava is harvested in one year. Scenario D assumes yield increases to 20 tonne/ha and cassava is harvested in one year.

	Labelled	Use High Yielding Varieties	Harvest within a single year
Base Scenario	Base	No	No
Scenario A	Yld 2ha	15 tonne/ha	No
Scenario B	1ha	No	Yes
Scenario C	Yld 15	15 tonne/ha	Yes
Scenario D	Yld 20	20 tonne/ha	Yes

The results obtained from these scenarios on production, area and quantities marketed are illustrated and discussed throughout the report.

1.4 THE REVOLUTION

The cassava revolution in Nigeria is at its infancy. This report hopes to describe it in the context of its current status; new initiatives; future targets; and future directions. The report organizes the discussion within six sections: Introduction, Production, Utilization and Processing, Prices and Margins, Development Clusters, and The Ultimate Way Forward. Each section, except for the last, contains the four subsections: Current Status, Future Targets, New Initiatives, and The Way Forward.

2 CASSAVA PRODUCTION

2.1 CURRENT STATUS

Nigerian cassava production is by far the largest in the world; a third more than production in Brazil and almost double the production of Indonesia and Thailand. Cassava production in other African countries, the Democratic Republic of the Congo, Ghana, Madagascar, Mozambique, Tanzania and Uganda appears small in comparison to Nigeria's substantial output.

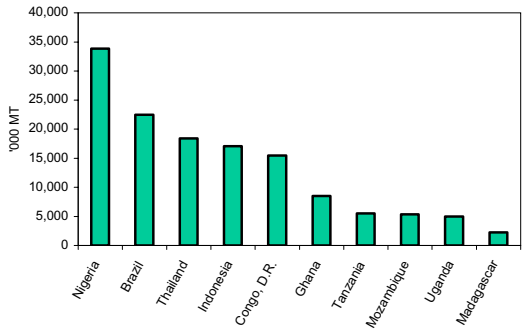


Figure 2-1 Leading World Producers of Cassava

Three sets of estimates exist for Nigerian cassava Production from 1996 to 2002.

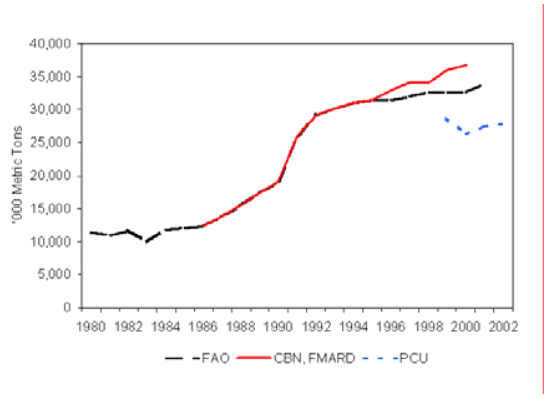


Figure 2-2 Cassava Production 1980-2002

The Food and Agriculture Organization of the United Nations (FAO) in Rome (FAO, 2004a) estimated 2002 cassava production in Nigeria to be approximately 34 million tonnes. The trend for cassava production reported by the Central Bank of Nigeria mirrored the FAO data until 1996 and thereafter rises to the highest estimate of production at 37 million tonnes in 2000 (FMANR, 1997; Central Bank of Nigeria). The third series provided by the PCU (PCU, 2003) had the most conservative estimate of production at 28 million tonnes in 2002. PCU data collates state level data provided by the ADP offices in each state. Comparing the output of various crops in Nigeria, cassava production ranks first, followed by yam production at 27 million tonnes in 2002, sorghum at 7 million tonnes, millet at 6 million tonnes and rice at 5 million tonnes (FAO, 2004a).

Expansion of cassava production has been relatively steady since 1980 with an additional push between the years 1988 to 1992 owing to the release of improved IITA varieties.

By zone, the North Central zone produced over 7 million tonnes of cassava a year (1999 to 2002). South South produces over 6 million tonnes a year while the South West and South East produce just less than 6 million tonnes a year. The North West and North East are small by comparison at 2 and 0.14 million tonnes respectively (Table 2-1).

Table 2-1 Cassava Production by Zone 2000-2002 (tonnes)

Region	2000	2001	2002
South West	4 993 380	5 663 614	5 883 805
South South	6 268 114	6 533 944	6 321 674
South East	5 384 130	5 542 412	5 846 310
North West	2 435 211	2 395 543	2 340 000
North Central	7 116 920	7 243 970	7 405 640
North East	165 344	141 533	140 620
Total	26 363 099	27 521 016	27 938 049

(PCU, 2003)

On a per capita basis, North Central is the highest producing state at .72 tonnes/per person in 2002, followed by South East (.56), South South (.47), South West (.34), North West (.10) and North East (.01). National per capita production of cassava is .32 tonne/per person.

Benue and Kogi state in the North Central Zone are the largest producers of cassava (IITA, 2004).

Map 2-1 Crop Production by State 2002

Cross River, Akwa Ibom, Rivers and Delta dominate state cassava production in the South South. Ogun, Ondo and Oyo dominate in the South West and Enugu and Imo dominate production in the South East. Kaduna alone in the North West is comparable in output to many of the states in the southern regions at almost 2 million tonnes a year with very little currently produced, in the North East. The Handbook lists each state's production and area.

2.2 FUTURE TARGETS

These are exciting times for cassava enthusiasts in Nigeria and indeed across Africa. African Heads of State and Government agreed at the African Union Summit held in July 2003, to make agriculture a top priority and to raise budget allocations for agriculture to a minimum of 10 percent of total public spending within five years.

At two recent conferences held in South Africa organized by NEPAD[2] jointly by IDEAA[3] and IFPRI in August and November of 2003 it was strongly recommended that cassava be promoted as a poverty fighter across Africa facilitated by a continental or Pan-Africa Cassava Initiative. This initiative would be based on a transformation strategy that emphasizes markets, collective action, the private sector, research and extension.

[2] New Partnership for Africa's Development

[3] Initiative for Development and Equity on African Agriculture

Much is being invested and much is being expected. Given the hopes and aspirations of many Nigerians, ignited by the Nigerian President's Initiative for cassava and now KNEEPAD many futuristic scenarios for cassava production are being debated. Three are illustrated in the following figure.

The first production target stems from the President's Initiative itself. In order to actualize the President's Initiative of US$5 billion a year by 2007, it was determined that 150 million tonnes of cassava would be needed by the end of 2006 (Subcommittee, 2002).

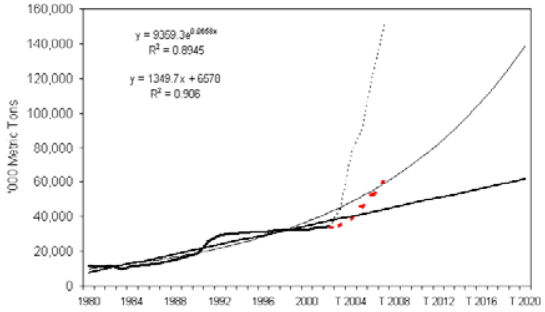


Figure 2-3 Production Scenarios for Cassava to 2020

Production being a function of area and yield, this target requires an expansion of 2 million ha of land (from 3 to 5 million ha) and an average yield of 30 tonnes per ha.

Research institutes, such as IFPRI and FAO suggest a more conservative production target for cassava. Extrapolating from estimates for cassava production in Africa (Scott, Rosegrant, and Ringler, 2000) and (FAO, 2004b), Nigeria's production is targeted at 40 million tonnes by 2005 and 60 million tonnes by 2020 (IITA, 2002). This target relates well to the mapping of a simple linear time trend on historical production levels in Figure 2-3.

An alternative 'middle of the road' production target generated by mapping an exponential time trend to historical production levels suggests an intermediate production target for 2007 of 60 million tonnes (a doubling from early 1990

production levels) to be followed by 150 million tonnes in the year 2020.

Adopting the 'middle road' scenario of 60 million tonnes by 2007 the implications on area are illustrated in Figure 2-4. Applying a simple linear time trend to national cassava area illustrates an increase of 1 million ha or 4 million ha by the year 2007.

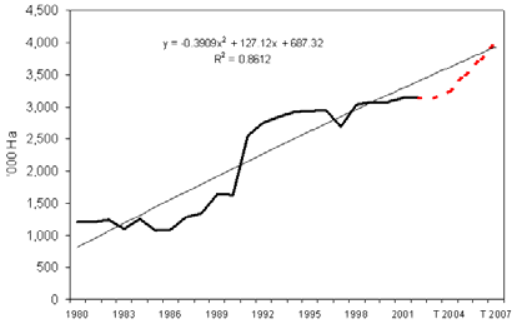


Figure 2-4 Cassava Area 1980 to Targeted 2007

Given these two targets in production and area, a significant increase in national yields is required. Sixty million tonnes on 4 million ha would require an average yield of 15 tonnes per ha. Current yields have been stagnant at just over 10 tonnes per ha since the early 1990s. To advance the suggested exponential production growth target of 60 million tonnes, an enormous intervention effort is required to propel cassava yields from their current trend (Figure 2-5).

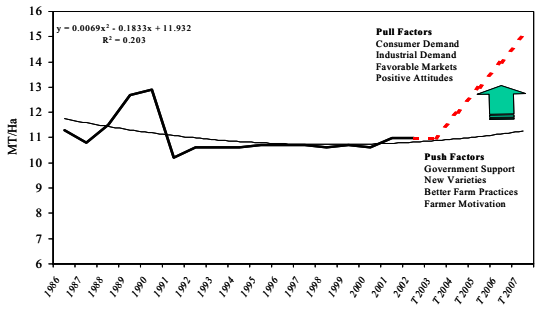


Figure 2-5 Cassava Yields 1980 to Targeted 2007

Increasing yields to 15 tonnes per ha is a significant challenge for the subsector. Push factors such as government support, new varieties, better farming practices and farmer motivation are typically cited as a means to increasing yields. Pull factors such as consumer demand, industrial demand, favourable markets, and positive attitudes are not commonly mentioned. It is maintained that both the 'push' and the 'pull' are needed if the industry is to move forward.

Comparing this yield target to international levels, it is observed that Nigeria is not that far from yields obtained in other countries.

Yields in Brazil and Indonesia are not much above that of Nigeria and are relatively flat. Yields in Thailand have only recently taken off since 1995. To supply low priced cassava starch, Thai producers are increasing their efficiencies in production. The target of 15 tonnes per ha places Nigeria on the same linear growth path as Thailand.

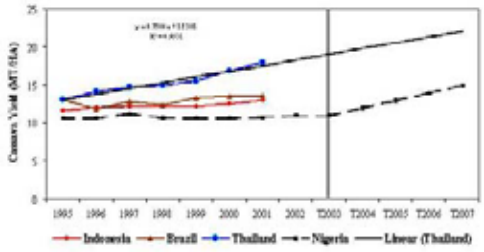


Figure 2-6 Comparison with International Yields

2.3 NEW INITIATIVES

A number of new initiates are currently being implemented to increase yields and area to achieve increased cassava production in Nigeria.

One innovative initiative to achieve greater cassava production is being undertaken by the Cassava Growers Association. It is acquiring large parcels of land in each Local Government Authority (LGA). Each parcel is intended to provide 1 000 ha of continuous land, suitable for commercial cassava cultivation. In addition to current production levels, farmers' groups (or clusters) would be organized in such a way that, using mechanized equipment, high yielding varieties and improving farming practices, yields of 30 tonnes per ha could be achieved in this new

area[4]. There are 547 LGAs said to be participating in this programme. If each LGA plants 1 000 ha of high yielding cassava this would increase production by 16.5 million tonnes achieving more than half of the targeted increase of 26 million tonnes by 2007.

Members of the Cassava Growers Association are currently practicing cluster farming. Presently there are about 500 groups carrying out cluster farming with each group having about 30 ha under cultivation. Members are divided into groups with land side by side. As a group they can hire a tractor to plough, spray with herbicide to reduce weeding and gain in efficiency. Unfortunately, the success of these clusters was jeopardized because inappropriate tractors were made available[5].

Another initiative is the encouragement of plant population to the recommended 10 000 stands per ha. If plants per ha are currently 7 to 8 thousand stands per ha an increase to 10 000 stands per ha would increase yields to approximately 13 tonnes per ha or 9 million tonnes.

The regional production models also indicate the benefits of improving production practices, as illustrated in Figure 2-7. The first observation is the close relationship of the base production to actual production levels. One has to realize that these results are based on a rudimentary styled model of a complex real world.

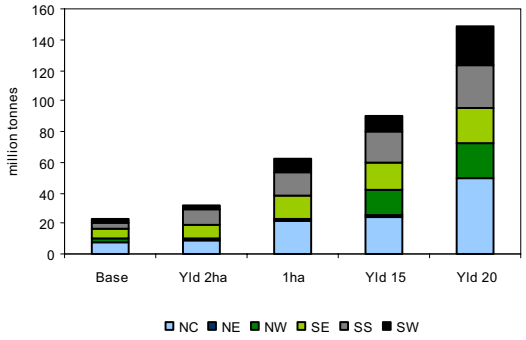


Figure 2-7 Cassava Production for Alternative Scenarios

Nevertheless, the results of the model are intuitively correct. The adoption of improved agronomic practices (1 ha) has a more pronounced effect on cassava production, than improving yields to 15 tonnes/ha without the associated changes in production practices (Yld 2 ha).

Many claim that improving cassava production practices can result in increased cassava production. In terms of the regional production model the effect of completing cassava production in one year essentially doubles the yield of cassava which doubles current production. The target of 60 million metric tonnes by 2007 would appear quite feasible under this scenario.

Increasing yields to 15 tonnes/ha and harvesting cassava within one year (Yld 15) has an even greater impact than agronomic improvement alone because it combines the positive impact of improved agronomic changes with the use of improved cassava varieties. The increase of yield to 20 tonnes/ha (Yld 20) boosts the expected output of cassava even further. In fact, the outcome is consistent with the target of 150 million tonnes by 2020.

The expansion of land devoted to cassava requires some explanation. As noted in the description of the models, total land available is a major constraint. Increases in cassava land are made possible by a decrease in the land devoted to some of the competing crops. This reduction of land does not lessen the amount of food produced for home consumption. What is reduced is the amount of competing crop that is marketed.

[4] Commercial or large scale cassava production implies continuous land of 400 ha and more. It implies the use of a planter and the use of a harvester. Brazil and Thailand are currently being examined as possible examples for future Nigerian production methods. The harvesters that are being examined require straight parallel rows. Prior to harvesting the cassava stems are cut leaving a stub for gripping and extracting the roots (Angar, 2004).

[5] Farmers cannot afford a tractor costing N4.5 million and the Federal Government of Nigeria tractors have no implements. Furthermore, the Federal Government of Nigeria gave one tractor to local governments but farmers had been promised tractors from the Federal Government of Nigeria on a hire to purchase basis

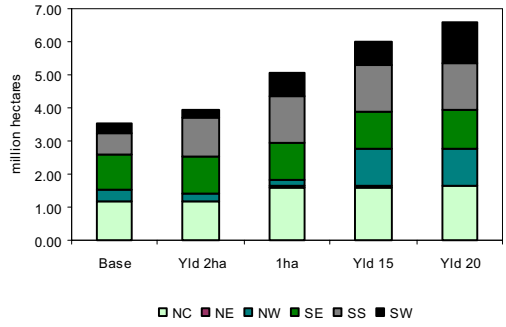


Figure 2-8 Cassava Area for Alternative Scenarios

The estimate of labour required for the different scenarios underestimates the potential positive impact of perusing any of the scenarios. Firstly the model only provides estimates of the cost of major labour operations.

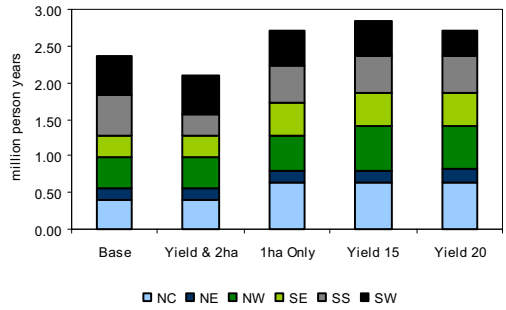


Figure 2-9 Total Labour for Alternative Scenarios

Labour requirements were calculated by dividing labour costs by an estimate of labour wage rates. Secondly the model does not provide any estimates of the amount of labour opportunities that would be generated by post-harvest activities.

The amount of land devoted to cassava and the amount of agricultural labour differs between scenarios although the changes were not as dramatic as the production changes.

2.4 THE WAY FORWARD

In the same way that the Cassava Growers Association has been provided with 1 000 ha of continuous land per LGA, there is a need for authorities to assist corporate bodies and cooperatives in acquiring similar large parcels of agricultural land for agro-industrial development. Industrial users of cassava may initially wish to produce and process cassava themselves through own sourcing or outsourcing. Either way, continuous parcels of land will have to be organized to provide efficient and continuous supplies of raw material. The setting up of such land parcels for industrial use will require the blessing, if nothing else, from local authorities.

In discussing 'the way forward' it is wise to be mindful of the past. In the early years of Structural Adjustment, Nigerian agricultural trade policy set out to achieve many of the objectives being discussed here; promotion of agricultural exports and reduction of agricultural raw material imports. During that time four strategies were utilized: trade liberalization, export promotion, backward integration and privatization. In the early years these initiatives gave rise to significant improvements in non-oil exports, with cocoa leading the way. Unfortunately this growth was not sustained. The reasons cited: poor quality of exported product failing to attract good international prices, inefficient large scale farms established by the private sector resulting in large capital losses and problems in sourcing supply because out growers failed to honour contractual agreements with industries (Shaib, Aliyu, and Bakshi, 1997).

In protect from these past mistakes an alternative mindset must be obtained by those producers involved in the industry. More will be discussed on this in the final section of this report the *Ultimate Way Forward*.

It is sufficient to mention here that various requirements are needed to initiate changes in agronomic practices, yields and land utilization.

Commissioning a national farm and agro-industry survey would greatly assist future modelling exercises. Accurate and reliable data would also assist in setting up benchmarks for developing the cassava subsector.

3 PROCESSING AND UTILIZATION

3.1 CURRENT STATUS

Cassava is a very versatile commodity with numerous uses and by products. Each component of the plant can be valuable to its cultivator. The leaves may be consumed as a vegetable, or cooked as a soup ingredient or dried and fed to livestock as a protein feed supplement. The stem is used for plant propagation and grafting. The roots are typically processed for human and industrial consumption. The Handbook lists the numerous uses of cassava in human consumption and industrial use.

In Nigeria, the consumption pattern varies according to ecological zones (Table 3-1). Gari, a roasted granule is the dominant product and is widely accepted in both rural and urban areas. It can be consumed without any additives or it can be consumed with a variety of additives such as sugar, groundnut, fish, meat and stew.

Table 3-1 Consumption Pattern by Zone and Cassava Product

Zone[6]	Order of importance
South West	*Gari, Lafun, Fufu/Akpu*
South South	*Gari, Akpu*
South East	*Gari, Fufu/Akpu*
North Central	*Gari, Fufu/Akpu,* Starch
North East	*Fufu/Akpu, Gari, Abacha*

Fufu and *Akpu*, a fermented wet paste from cassava is also widely consumed throughout the country especially in the southern zones. Most processors however complain that the wet paste and ready to eat forms of *fufu,* that are currently sold, have a very short shelf life.

Estimates of industrial cassava use suggest that approximately 16 percent of cassava root production was utilized as an industrial raw material in 2001 in Nigeria. Ten percent was used as chips in animal feed, 5 percent was processed into a syrup concentrate for soft drinks and less than one percent was processed into high quality cassava flour used in biscuits and confectionary, dextrin pre-gelled starch for adhesives, starch and hydrolysates for pharmaceuticals, and seasonings (Kormawa and Akoroda, 2003).

This estimate leaves 84 percent or 28.9 million tonnes of production for food consumption, a portion of this of course being lost in post harvest and waste.

Comparable time series data describing cassava processing and utilization at the national, regional and state level is virtually non-existent. Fortunately it was possible to obtain a preliminary analysis of the first national consumption survey of Nigeria since the early 1980s[7] (Ministry of Health and Nutrition of Nigeria, 2004).

Table 3-2 illustrates daily cassava consumption per capita by geographic region. Surprisingly, urban and rural consumption are not dissimilar, confirming the fact that cassava is truly a national food with an urban market presence. Cassava appears to be a 'food of choice' even in the face of alternative food options in urban areas.

Table 3-2 Daily Consumption of Cassava per capita

	Grams per Person per Day
National	226.93
Dry Savannah Zone	131.16
Moist Savannah	192.37
Humid Forest Zone	284.42
Rural	239.74
Medium	220.53
Urban	213.76

(Ministry of Health and Nutrition of Nigeria, 2004)

Assuming per capita urban consumption is 213.76 gm of cassava per day, the rural micro, small and medium food processors is supplying 4 million metric tonnes of processed cassava product a year. This is equivalent to 6.6 million tonnes in cassava root. This estimate of cassava utilization is low given earlier estimates that work backwards

[6] Data were unavailable for the North West

[7] The Cassava Handbook contains information on daily consumption by grams and frequency of cassava consumed per week by the states surveyed.

from production. Clearly, this suggests that a more in-depth study is required on the production of cassava product *vis-à-vis* its consumption by the populace.

The informed impression in most 'cassava circles' suggests that the demand for traditional foods in a convenience form is increasing in Nigeria. Cassava consumption is finding a new place in the diets of both rural dwellers and up and coming urban elites. Cassava is no longer only grown by the poor. It is a Nigerian food staple with industrial potential.

In terms of frequency of cassava consumption in a surveyed state, it is encouraging to processors and producers of cassava alike to find high levels of consumption as reported in Table 3-3. There can be little doubt that cassava is a staple food, when over 30 percent of the respondents in seven of the 12 surveyed states respond that they consume cassava more than four times a week.

Table 3-3 Frequency of Cassava Consumption

	Percent of respondents that consumed cassava in a week		
State	1-2 times	3-4 times	> 4 times
Osun	29%	36%	33%
Akwa Ibom	29%	36%	33%
Bayelsa	21%	15%	51%
Edo	21%	25%	53%
Imo	24%	21%	43%
Kaduna	77%	18%	4%
Kano	57%	37%	4%
Kebbi	84%	15%	0%
Kwara	27%	38%	35%
Nassarawa	57%	28%	13%
Borno	65%	28%	4%
Taraba	37%	25%	33%

Cassava processing operations in Nigeria can be described at 5 levels of capacity. The common terms used to describe these capacity levels are household (or cottage), micro, small, medium and large.

Household level processing typically does not employ any outside labour. The household consumes virtually all of the processed products and sells a small amount to raise income for additional household needs. At present, most Nigerian processors fall within this category.

At the micro processing capacity the employment of one or two units of labour may take place while processing a variety of cassava products. This enterprise typically uses batch processing. Batch processing may take four hours per day and this would be sufficient for the owner/operator. Nigeria has a few cassava processors in this category of operation.

The small and medium processing operations typically employ three to ten workers and are very sparse at present. Large scale cassava processing is virtually non-existent in Nigeria. Large-scale operations are defined as enterprises employing 10-30 or more labourers. Large-scale operations would also have the capacity for large tonnage processing with wider marketing opportunities. Table 3-4 illustrates commonly quoted capacities for various products and scales of operation.

Table 3-4 Daily Processing Capacity by Scale of Operation and Product

Processing	Cottage to Small Scale	Small to Medium Scale	Medium to Large Scale
Chips	1 tonne/day		
Ethanol	50 litres/day	1 000 litres/day	2 000 litres/day
Malt Drink		100 litres/day	500 litres/day
Feeds	1 tonne/day	2 tonne/day	
Flour	1 tonne/day		
Gari	1 tonne/day		
Hard Pellet			120 tonne/day
Starch	1 tonne/day		

It is safe to say that medium to large scale cassava processing equipment and fabricators of this equipment are few and far between in Nigeria. Gari is the only product that is currently able to push the industry from a traditional to a semi-mechanized process. In a RTEP survey (RTEP, 2001), participants in 25 states were asked about their use and availability of processing techniques such as graters, pressers and fryers. The resulted indicated a level of awareness and use of these primitive semi-mechanized equipment in every state surveyed (IITA, 2004).

The need for innovative cassava processing technologies is enormous. Traditional cassava processing has a number of undesirable attributes. It is time consuming, provides low yields and lacks storage capacities. Many unattractively describe it as drudgery.

In a typical village, *fufu* processors cultivate cassava in family lots to process *fufu* for weekly market days[8]. Time is spent peeling roots, washing, soaking, wet sieving and copiously adding water before pressing. *Fufu* processing requires no less than 14 steps. On sale day, time would be spent grating and bagging.

Women typically carry out 70 percent of the work; planting, weeding, harvesting, transporting cassava, peeling, soaking, bagging and selling. The men carry out approximately 30 percent of the work; land preparation, harvesting, transporting and grating. The only mechanization might be the use of a mobile grater.

At the end of the week a basin of *fufu* would sell for between N300 and N350 depending on market conditions. One bag or six basins of *fufu* might sell for N2 100. Processors using hired labour indicated that 15-20 basins could be produced each week for market compared to ten basins without labour[9].

While seeking processing capacities and costs, the survey team found village level processors in Nigeria unable to describe their input to output capacities for their activities in quantifiable measures. Most respondents quoted the use of a basin, tin cup, plastic bucket, bags, mobile truck, head pans, etc. Attempts to standardize the weight of each proved abortive.

The lack of standardized weights and measures make assessing the efficiency of the marketing systems extremely difficult. Assessing the extent to which differences in product quality affect the prices received by processors was extremely difficult if not impossible. The lack of standard weights and measures for cassava products in the marketplace means one must rely on laboratory and industrial standards and conversions that do not accurately reflect the real world and the vast number of cassava processors in Nigeria.

Assessing labour costs was another major setback in this study. When asked about the cost of a person-day for each processing unit, the responses were not assertive. Attempts to calculate processor and trader margins were ineffectual during the interviews. The tremendous role that women play in cassava production, processing and marketing was confirmed during field visits and must be taken into consideration in the design of any labour saving technologies and trainings.

Turning now to large scale assembly in quick succession, it has already been mentioned that very few plants are in operation today. This was not the case even two years ago. In the late 1990s medium to large processing facilities were operating, many as starch manufacturers. However, many of these industries closed down because they were working at low and seasonal capacities.

Peak Products Nigeria Limited is an example of a company that was able to adjust under adverse circumstances and thus remain in operation. Its story is worth describing here in some detail.

Peak Products Nigeria Limited began cassava processing in 1998 with the sun drying of cassava flour. The flour was sold to bakeries and confectionaries through Ogun State Agricultural Development Programme (Agro Processing Unit). However, some processors began contaminated fermented cassava flour with unfermented cassava and by 1999-2000 the flour bakeries and confectionaries stopped asking for and using cassava flour. This forced Peak to shift to the production of sun dried cassava starch.

[8] Alternatively, local truckload of cassava root might be purchased. A truckload of cassava costs N4 000 providing three bags (or 18 basins) of finished fufu.

[9] Labour costs are typically N200 per person-day plus N200 to feed, for a six-hour day (from 0600-0700 hours to 1200-1300 hours).

With growing demand for cassava starch[10], Peak upgraded from sun drying to the use of a mechanical dryer. Using a flash dryer, production capacity achieved 3-5 tonnes per day, 72 000 tonnes per year with a daily input of 25-30 tonnes of wet starch.

Flash drying however requires a wet milling component. Faced with environmental problems, the company was forced to stop wet milling and instead obtained wet cake from rural women. At present Peak is currently under utilized in its production of cassava starch because it has diversified production into the fabrication of flash dryers.

Existing buyers of Peak's flash dryers are predominantly chemical companies from the Sango-Lagos Axis and a few beverages and food industries. Prospective buyers include Nigerian Distilleries in Ota who want 150 tonnes of cassava flour per day for ethanol production. DeUnited Nig Ltd., is looking to produce 60 000 tonne of cassava flour per month for noodles (Ndomie Noodles). Oil companies are interested in producing cassava starch for drilling muds[11]. Textile industries, although not currently using local cassava starch negotiations are currently underway between the Government, cassava processors and the textile industry. Finally, paper mills such as Iwopin Paper Mill in Ogun State and Okui Ibokwe Paper Mill in Akwa Ibom State may also patronize cassava starch in the near future[12].

Although no one can know the likelihood that these prospective buyers will actually purchase, their efforts to search out information on cassava processing fabrication offers hope. Their slowness to invest however may be a symptom of uncertainty regarding future government policy directions, uncertainty in being able to produce competitively and uncertainty in their ability to source cassava roots. As illustrated in the Peak example, cassava processing is vulnerable to many conditions – market vagaries, trade policy, product substitution, and adverse environmental impacts, to name a few.

The ability (or inability) to source a reliable stream of good quality cassava roots is also a real concern for cassava processors. Problems relating to sourcing cassava roots are a serious deterrent for industrialists as described in the following example of the Mosaconi Cassava Factory in Kogi.

The Mosaconi Cassava factory was a large operation that utilized raw cassava from farmers for the production of packaged *gari* and laundry starch for local markets. It began operations in 1993 but closed in 1999.

Before the establishment of the factory, the community used cheap cassava for the production of local staple foods like *lafun* and *gari*. When the company began, it patronized all cassava growers in the state and bought most of the cassava from their farms. This resulted in a scarcity of cassava and a higher selling price for smaller local processors.

As local cassava prices rose, public complaint by the local people surfaced that the presence of the factory was increasing the price of *lafun*. This resulted in host of problems such as pilfering, administration fraud, and use of poor land, lack of adequate accurate information and vandalism of factory equipment. The factory suffered as a result and faced a shortage of cassava for its operation.

Since the factory had no farm of its own, it tried to solicit cassava growers to supply cassava into the factory through radio and television jingles. This only encouraged cassava growers to truncate the maturity of planted cassava, selling cassava of less than eight months old. After many

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[10] Cassava starch easily substitutes for imported corn starch and import bans on maize currently make cassava starch attractive. Once importation resumes however cassava starch will not be marketable at current prices. Cassava starch is currently N80 000 per tonne at factory price and N120 000-N 125 000 per tonne at market price.

As recently as two years ago, to reduce prices it was common for starch plants to mix cassava flour with cassava starch to break even. Fortunately the starch met most client requirements and plants remained in business. Since then prices of cassava have fallen and this has allowed the production of 100 percent cassava starch again.

[11] ADP Rivers State should have more information on the level of expected demand.

[12] Provided there is adequate legislation and enforcement

unsuccessful attempts at troubleshooting, the owner was forced to close down the company.

Clearly if cassava processing is to mature in Nigeria these types of deterrents must be resolved.

3.2 FUTURE TARGETS

A number of estimates exist as to future demands for cassava-based products. The President's Initiative provides the following estimates.

Table 3-5 Cassava Demand Estimates by President's Initiative by 2007 (tonnes)

	Domestic	Export	Total
Food	5 700 000	1 825 000	7 525 000
Starch	1 770 000	3 200 000	4 970 000
Livestock	15 622 000	75 621 248	91 243 248
Ethanol	900 000	2 700 000	3 600 000
Total	23 992 000	83 346 248	107 338 248

A recent consultant's report (Knipscheer, 2003) provides a more conservative estimate of potential domestic demand for cassava.

Table 3-6 A Conservative Estimate of Demand (tonnes)

Sector	Current Alternative Product Use	Substitution (%)	Equivalent in fresh cassava roots (tonnes)
Food	1 180 000	20	1 000 000
Starch	67 100	100	350 000
Livestock	1 200 000	20	1 000 000
Ethanol	20 900	100	2 000 000
Total			4 500 000

For this study, these estimates have been merged with some additional assumptions to generate the following estimates of potential near term demand for cassava.

Table 3-7 Middle of the Road' Estimate of Potential Demand for Cassava (tonnes)

Sector	Potential Market
Food for Urban Market	14 157 438
Food for Rural Market	4 378 788
Food for Export	1 825 000
Food as Flour	1 170 055
Livestock	675 000
Starch	335 000
Ethanol	139 347
Total	22 680 628

The demand estimate in this study, different from the previous estimates, suggests that the human food market provides the greatest growth opportunity for cassava. The previous estimates suggested livestock and ethanol as the largest immediate markets. The explanation of human demand in this study's estimate is the more than 4 percent annual growth rate in urban population in Nigeria. This means that in a five-year period nearly 13 million people are expected to move to urban areas.

It has been shown that these people continue to desire and eat cassava products. The difference between the urban dweller and the rural dweller is the tendency to develop preferences for foods that are convenient, well preserved and well packaged. These changes in preferences point to additional value addition to cassava products sold in urban areas.

Markets for modified and new products are likely to develop. The estimates of potential growth of Nigerian urban and rural demand are based on population growth numbers and the maintenance of average per capita consumption rates. As is seen from Map 3-1 urban population is concentrated along Nigeria's expressways. This relative concentration and access to better transportation should be beneficial to promoting the consumption of cassava and cassava products.

Map 3-1 Urban Centres and Express Roads in Nigeria

The estimate for exported food is based on estimates of the number of Nigerian and West Africans outside of Nigeria who remain potential consumers of cassava products. Our estimate adopts the President's Initiative estimates.

The potential demand for animal feed, starch and ethanol originates from the previous consultant's report outlined in Table 3-6. The animal feed estimate is derived from estimates of the size of Nigeria's broiler and layer industries multiplied by the amount of animal feed they required. It is further assumed that only 60 percent of the industry uses mixed feeds and those cassava products (primarily chips and pellets) could replace 20 percent of this market. The potential for cassava flour as a replacement of wheat flour is based on a 20 percent substitution for imported wheat flour.

The estimate of fresh cassava requirements for this animal feed in Table 3-7 are less than those in Table 3-6 because it was assumed that chips would be produced from unpeeled cassava. The impact of this assumption is that one tonne of chips can be produced from 2.5 tonnes of roots rather than the 1:4 ratio that is commonly practiced in Nigeria.

The starch and ethanol demand figures are based on the assumption of replacing imports of these products. The fresh cassava equivalent for ethanol in Table 3-7 is less than the estimate in Table 3-6 owing to the assumption that 150 litres of ethanol can be produced from one tonne of cassava rather than the 100 litres assumed in Table 3-6. The difference in conversion rates can be explained by different technologies and scale of production[13].

It is difficult to assess the ability of industry to process the above-mentioned amounts of cassava because these industries have been reported at running substantially below their designed capacity[14]. Due to this low level of production it is difficult to determine the timeframe required to return these industries to full capacity. This inability to absorb cassava production in a timely fashion could have damaging effects on future industrial cassava supplies.

3.3 New Initiatives

Although few, there are a number of new initiatives relating to cassava processing and utilization.

First there is an initiative by IITA to increase consumer awareness with cassava recipe booklets on non-traditional ways to eat and cook with cassava. The publication is currently being modified and will be published as a manual by IITA. Information and recipes gathered from various training of processors at IITA, RTEP and ADPs are included. There remain some local snacks that need to be upgraded and included in the recipe manual.

In addition to a recipe book for household consumption, a second booklet or pamphlet is required for commercial restaurateurs. Training would also sharpen food and beverage operators' understanding of cassava's place in their businesses[15].

[13] It is assumed that there was a typographical error and that in Table 3-6 the demand for ethanol should read 0.2 million.

[14] The textile milling industry in 1983 was reported to have 55 mills with only 18 operational. Similarly liberalization of the textile industry in 1994 led to the closure of about 135 companies out of 175. The feed milling industry is also said to be producing at about 15 percent capacity.

[15] Is there any possibility for micro finance and surveillance of graduates from such training in the nearest future?

Secondly, a project sponsored by the Department of International Development (DFID) – United Kingdom and now the European Union (EU) with NRI and the University of Agriculture Abeokuta (UNAAB) on the commercialization of traditional processed products from cassava, such as *wet fufu and dried fufu* has proven to be a successful initiative in South West Nigeria. This initiative has the potential to offer new opportunities to rural households – either through the sale of fresh roots or through processing and marketing. Several options exist for the commercialization of *fufu*, including the production of a shelf-stable product.

At the rural level, processors have demonstrated their ability to adopt low-tech, low cost improvements to processing such as the construction and use of water tanks and "double fermentation". A processing technology has also been developed for village level production of dried *fufu* flour using a simple drier that can operate in areas with or without electricity.

The fabrication of user-friendly equipment for cassava processing in Nigeria is also witnessing renewed interest. Since 1970, the Federal Institute of Industrial Research Osodi, FIIRO, has provided a processing plant for the mechanization of cassava *gari*. National, regional and private fabricating centres have also demonstrated new processing equipment such as mobile graters, modified fryers, dryers and millers. Data on the adoption rate of this equipment, however, remains scarce.

As part of the IITA Cassava Mosaic Disease (CMD) project, an initiative has been put forward for the collection of needed data on processing technologies and equipment. Benchmarks are needed to measure the progress of the cassava industry in the years to come. It is known that small-scale operators using low level technologies do process, but their needs, capacity or the intended benefit from moving to higher levels of technology are not known. This IITA CMD project survey will hopefully answer these questions and develop targets for future research and development in cassava processing and utilization. For example, technologies targeted to peeling may have implications on breeding of new cassava varieties.

An important initiative was started in September of 2003 when a meeting of manufactures of textiles and producers of cassava starch was organized. These types of dialogues are necessary and strongly recommended. The position put forward by the textile manufacturers was that corn starch is better than cassava starch and since Nigeria does not produce corn starch it should be allowed to import it. The key constraints identified by the textile representatives were the high moisture content of cassava starch above 13 percent, poor packaging, irregular supplies, high prices compared to imported corn starch, and unacceptable pH levels and values. The response from the cassava starch manufacturers was to suspect micro to small scale starch plants for the low standards and low starch purity levels. It was further explained, that the problems caused by low quality standards could be easily solved by patronage of medium to large starch plants. This response by the starch manufacturers is less than satisfactory and seems more like an attempt to shift blame and obtain new business. Instead an enquiry should have been suggested to determine where the textile firms were purchasing their cassava starch and what measures can be put in place to guarantee the desired product and delivery regardless of whether the supplier was a small, medium or large cassava starch manufacturer.

Other processing research initiatives currently underway include developing a thin-skinned cassava that would remain unpeeled, dried and used in poultry animal feeds. By leaving the thin skin on it increases the conversion rate but also increases the fibre content of the feed[16]. Use of a yellow cassava in poultry feed is also being investigated as a positive contributor to making yolks more yellow and higher in nutrition.

Finally although the new Federal Food Reserve Scheme has earmarked the collection of *gari* from various zones, implementation to date has been poor.

[16] In addition to this research, livestock feeding practices should also be investigated to see if placing the water in containers above the birds would lessen the caking of the cassava flour around the bird's beaks.

3.4 THE WAY FORWARD

State Agroprocessing and Market Expansion Groups (SAMEG) such as in Imo State have successfully demonstrated what can be achieved in state ADPs (Imo State Agricultural Development Programme (ADP), 2003). They have shown leadership and determination in the area of processing and utilization by providing a link between processing and marketing activities. As a way forward, this type of initiative should be encouraged at all ADPs as an example of supporting the cassava industry in their state.

Imo State's ADP SAMEG, began by surveying. Their yearly survey includes the identification of agroprocessors and industrial end users, agroprocessing equipment fabricators, participatory technology development, and an inventory of existing products by processor.

In their most recent survey, thirty-seven *gari* and *fufu* processing groups were identified and documented. Cassava starch and flour were found as processed by products of the *gari* produced by rural women in their villages. SAMEG also identified 21 groups that were ready to go into partnership with any end users as a processor, marketer or producer. Their stated constraints however were poor quality of processing equipment, high cost and drudgery of operation.

As an outcome from their work, stakeholder trainings and capacity building on group dynamics, record keeping, savings mobilization, participatory extension and monitoring and evaluation are being sought. A root and tuber fair is also forthcoming.

This model is the hope and inspiration for the Cassava Industry in Nigeria. Worthy of greatest praise is the fact that the Imo State SAMEG has demonstrated the implementation of its stated objectives. The stated objectives include the provision of day-to-day leadership in processing and marketing activities; linkages with industrial end users; promotion of the concept of collection centres to improve marketing, finance and capital; and acquisition of equipment through partnership arrangements with industrial end users. Although the ultimate outcome of these efforts on production, incomes and employment in the state are not documented, these activities represent the way forward.

A number of industries and private individuals are showing interest in utilizing new equipment for cassava processing. After the stakeholder workshops organized by IITA in 2001, linkages were formed between local fabricators of equipment and processors. To date, however there are no champions of cassava processing equipment to support these new equipment users and variability in the standards of fabricated equipment and installation remains. To achieve maximum utilization and output, expert opinion (or a consortium) is needed to oversee fabricators and advise new buyers of the proper use and maintenance of equipment.

Small-scale local processing facilities should be strongly considered for the rural areas. Small diesel, petrol, or electric generators should power these facilities with capacities ranging from 3-6 hp. Unfortunately, the scarcity of fuel and the frequent breakdown of these machines increase costs.

Farm processing and cottage type processing that include storage and packaging facilities should also be promoted. The typical requirements of a cassava processing facilities include chipping machines (manual and motorized), a drying platform and tray dryers, packaging devices, graters, a press (screw and hydraulic type), a dryer, a grinder/milling (hammer/plate mills), a starch collection vat and sift (mechanical and manual). The concept of mobile processing facilities should also be promoted amongst processors.

Even if time saving technologies are invented, improved processing equipment has not been introduced to village level processors. This fact has serious implications on the ability of village level processing to advance to the provision of bulk supplies, timely delivery and provision of safe consumable products.

In closing, on the utilization side, a number of relatively drastic measures is commonly proposed and implemented to increase cassava utilization such as import bans and laws which force industries to use a specific level of cassava in their production. These may help to spur cassava

industries but they should be used carefully. Strict bans (such as those on poultry or textiles) may hinder regional trade and reciprocal bans may be placed on Nigeria when they wish to export their cassava-based products.

An alternative to the introduction of laws forcing domestic industries to use cassava, a memorandum of understanding could be sought between all stakeholders of the Nigerian cassava supply chain. For example, the Government could commit to relieving market imperfections and improving public goods (such as transportation, communications, electricity, policy). The private sector might commit itself to working with cassava as an industrial input improving upon it so that it can effectively compete with alternative input sources. Non-governmental organizations might commit themselves to supporting the efforts of both government and the private sector. Finally, a commitment is needed from everyone to support and defer to a 'cassava ombudsman' who can act on complaints of poor quality of produce, corruption and extortion that raise costs of production unnecessarily.

Lastly, an industrial commodity organization could be formed that would raise consumer and industrial awareness of cassava's attributes and use, and ensure a minimum level of quality of product and investment in the production and future of the industry. More on this will be discussed in the final section of this report *The Ultimate Way Forward.*

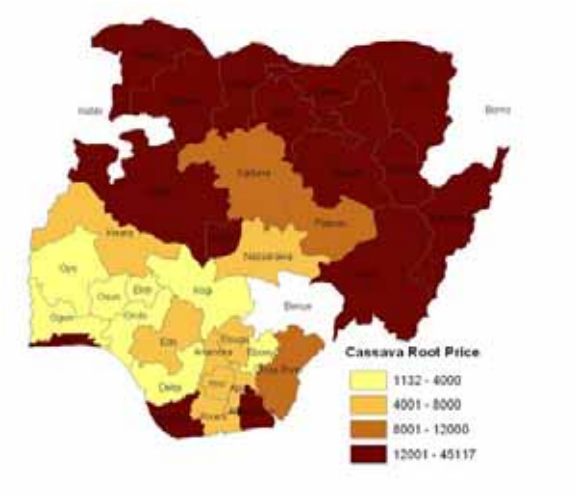
4 PRICES AND MARGINS

4.1 CURRENT STATUS

The Cassava Handbook contains numerous tables of historical annual, monthly and state level price series for cassava roots sold in rural and urban areas as well as the overall state average. Prices for *gari*, chips, flour and starch and competing maize and yam prices are also provided.

For this report, an overall impression on the level and patterns of price movements for these goods is provided. Detailed examination of prices can be seen from the Handbook. All state level price data were collected by the Project Coordinating Unit of the Federal Ministry of Agricultural and ADPs in the country.

An overview of cassava root prices is illustrated in the map below[17].



Map 4-1 Cassava Tuber Prices by State (N/tonne)

Generally cassava root prices are lowest in the southern regions of the country. The exceptions are Bayelsa, Akwa Ibom and Lagos which have high root prices. The highest cassava root prices are in the North East and North West.

Historical price trends of maize, sorghum, yams, millet, cassava and *gari* are illustrated in Figure 4-1. Cassava prices are lowest in this series while *gari* and yams are the highest. All except cassava and yams experienced a severe decline in prices from 1998 to 2000. *Gari* prices rebounded exceeding that of yams in 2001.

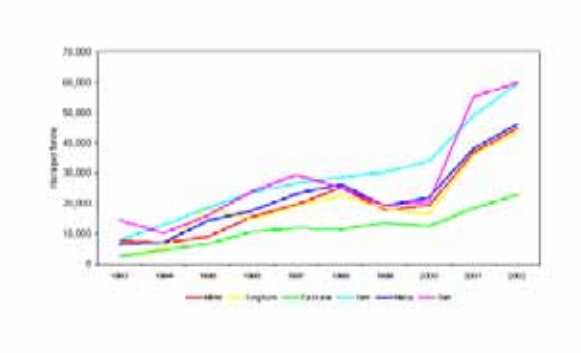


Figure 4-1 Historical Price Series

Monthly prices are illustrated in Figure 4-2 from 1993 to 2003[18] for cassava, *gari* and maize. Cassava again is the lowest price in this series while processed *gari* exceeds the price of maize except for a period in mid 1998 and again in mid 2000. Other than the occasional month prior to 2001, *gari* prices closely track maize prices. Beginning in 2001 *gari* prices jumped steeply as did maize but the reason for the magnitude of the increase is unknown to the authors. An import ban on maize was lifted in 2000 but import duties continue to make imports expensive. Cassava prices rose in mid 2002 exceeding the maize price in only one month. By early 2003 cassava and *gari* prices had fallen while maize prices remained high and relatively steady throughout.

[17] The price data set did not have prices for cassava root for Benue, Borno and Kebbi.

[18] Monthly price data for 1997 and 1999 are missing however.

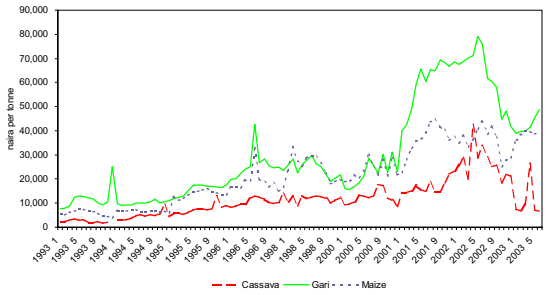


Figure 4-2 Monthly Prices

Regional *gari* prices deflated by the US dollar for this same period from 1993 to the end of 2002 are illustrated in Figure 4-3. The impression is that prices move in unison around the country. Other than some individual months where isolated peaks and dips appear, regional prices fall within a relatively narrow band. Prices in the South East have been relatively higher of late, while prices in the North Central are shown to be dropping.

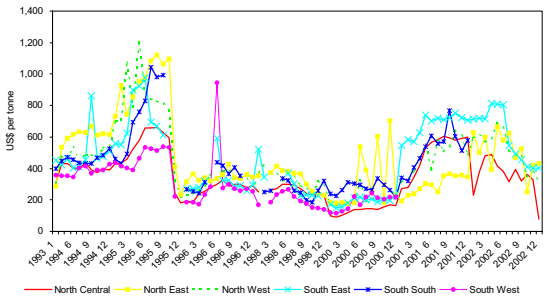


Figure 4-3 Monthly Gari Prices by Zone

Figure 4-4 provides a slightly different approach to examining regional prices. In this figure *gari* prices for each region are averaged for each month over the time period 1993 to 2002.

The lack of seasonality in *gari* pricing, other than a few outliers, confirms the conclusion that the relatively consistent supply of cassava roots provides a fairly predictable price throughout the year and a relatively narrow *gari* price band across the country.

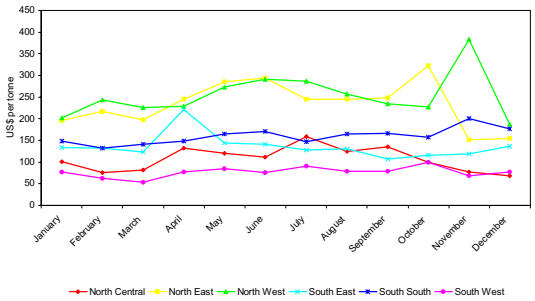
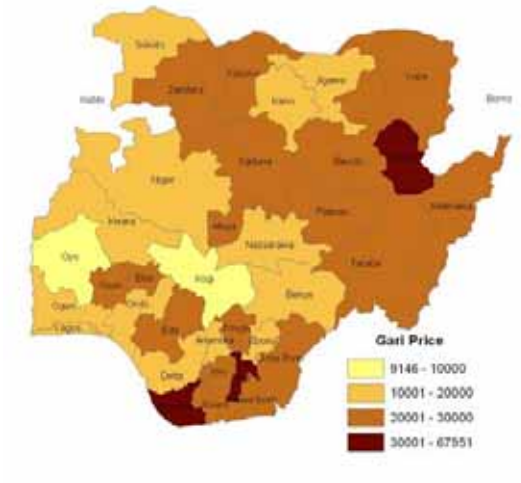


Figure 4-4 Average Monthly Gari Prices

Cassava has a unique characteristic in that it can be continuously harvested and marketed throughout the year. This provides a consistent supply of product, available for immediate processing at a fairly predictable price throughout the year. This could be cassava's greatest attribute[19], relative to competing commodities like maize.

As illustrated in the following map, *gari* prices[20] below N20 000 are primarily found in the South West and North Central. Gari prices are highest in the South South, North East and North West.



Map 4-2: Gari prices by State (N/tonne)

Data on the cost of cassava production and processing was not readily available. Costs of production that were available were often

[19] The fact that it is not is indicative of problems unrelated to this one delightful attribute.

[20] Gari prices were not available for Borno and Kebbi.

restrictive in coverage. The best source of data found was in annual farm management surveys[21] carried out by the Projects Coordinating Unit (PCU). The following data on costs is summarized for the most part from the 2000 wet season farm management survey (Projects Coordinating Unit, 2002) generated through direct contact with farmers in Bauchi and Jigawa in the North East, Nasarawa in North Central, Katsina and Kebbi in the North West and Akwa-Ibom States in the South South.

In the six surveyed states of the *2000 wet season farm management survey,* the annual average rental cost of one ha of land for farming ranged from N656 in Jigawa to N2 088 in Akwa-Ibom. The outright purchase of land for agricultural development, although rare[22], ranged from N11 084 in Katsina to N36 929 Akwa-Ibom. The cost of land clearing is as follows:

Table 4-1 Cost of Clearing Land in 2000 (N per Ha)

Clearing of	North	Central	South
Old Farmland	300	500	1 000
Fallow for 3-5 seasons	1 000	2 000	4 000
Virgin Forestland	3 000	5 000	10 000

It was reported that one ha of land from land preparation to harvesting costs approximately N62 000 to maintain. Human labour per man-day is N400 plus meals. The cost of a woman-day is N300 plus meal.

Production of one tonne of cassava costs N2500. The market price should be between N7 000 to N10 000 a tonne[23]. One tonne of cassava costs N2 500 to transport.

The average price of cassava planting material is N100 per bundle. The average quantity of fertilizer bought by the small scale farmer was six 50 kg bags (five used and one for future use). On average, farmers applied three bags of fertilizer on a hectare of land and supplemented with farm yard manure where available. Pest and disease if present were controlled with karate chemical. The cost of fertilizer is N1 300 from government sources or N2 600 on the open market.

The average farm gate cassava price was reported as N8 000 per tonne. The average cost of a storage structure is N1 500 to store ten bags Rumbu or N20 500 to store 50 bags in a mud wall structure.

If the average farm household size is ten, the cost of feeding the household per year was estimated in 2000 at N72 196. The cost of household maintenance (clothing, etc) was N 47 298. Estimated annual cash income for members was N67 666.

These are just some estimated production costs for cassava. Interviews throughout the study provided other indicators of prices and costs. However, little can be reported since the information was not collected in a standardized or systematic manner. A national agricultural survey would be better able to capture true costs of production and processing for cassava and competing products. One factor in determining the costs of production *vis-à-vis* international standards is reflected in the following statement by the US report of Nigerian trade barriers.

> *As Africa's most populous nation with an estimated 120 million people, Nigeria potentially offers investors a low-cost labour pool, abundant natural resources, and the largest domestic market in sub-Saharan Africa. However, Nigeria's poorly maintained infrastructure and difficult bureaucracy contribute to a very challenging investment climate. Due to Nigeria's inadequate services in power supply, telecommunications and other services, investors must compensate with additional measures. The "premium" or additional costs to investors of maintaining such measures is generally estimated to be about 25 percent above the total standard cost of production p.327 (United States Trade Representative, 2001).*

Understanding the true costs of production and processing is essential to pricing and investment.

[21] Farm Management Survey and Advisory Services (FAMAS)

[22] Ownership is typically transferred by inheritance. Under the Land Use Act of 1978 land is owned by the Government with cultivated land under tenure by individuals and households (Department of Agriculture 2000).

[23] Conversation with the National Cassava Growers Association, 13 November 2003.

Such calculations are used on a daily if not hourly basis to determine the appropriate mix of inputs for commercial operators.

It has been said that the price of cassava must represent 80 percent of the price of maize for it to be competitive. Other benchmark prices may also exist but using this one, Figure 4-5 illustrates those states where cassava is competitive and those where it is not.

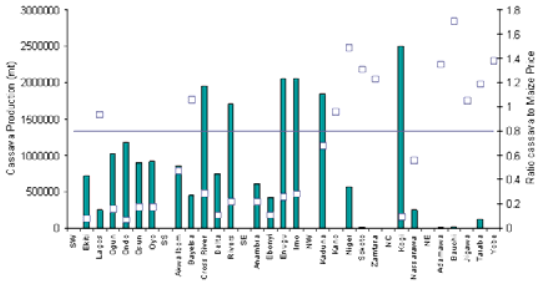


Figure 4-5 Cassava-Maize Price Ratio and Cassava Production

The dots in this figure represent the cassava price ratio to maize. The horizontal line represents the 80 percent benchmark. Those states whose dot is above the line are said to be uncompetitive at the time of review (using 2000 prices) and those states whose dot is below the line are said to be competitive. Coupled with the level of cassava production in each state (the bars) one can quickly see those states that have an advantage in cassava production, processing and utilization. Cross river, Rivers, Enugu, Imo, Kogi and Kaduna all appear to be strong contenders barring other considerations such as resources in land, labour, water, etc.

4.2 FUTURE TARGETS

There are two future price and margin targets for Nigeria to strive for. The first is a short-term target that lowers domestic costs of production and final prices to remain competitive against internal competition. The second, a long-term target, that lowers the costs of production and final prices to attain international competitiveness.

In the case of the first target, it is the impression that cassava has only been used by industry when maize or wheat prices were high. Potential users of cassava do not generally talk of using cassava because the price is low. There is a need to achieve lower cassava prices so that cassava is used because its price is competitive.

In most instances the competitive price for cassava is the price of imported replaceable commodities. The primary candidates for replacement are maize, wheat flour, ethanol and starch. It is assumed that cassava chips or pellets could be competitive with maize and it is also assumed that cassava chips would be produced in the Thai manner with a 1 to 2.5 ratio of chips to roots. The conversion factor in this table also includes the aforementioned 80 percent factor (3.125=2.5/.80). Cassava flour is assumed to be the prime commodity to compete with imported wheat and wheat flour in the bakery, confectionary and flour milling industries. Fresh cassava is assumed to be the primary input for the production of ethanol. Finally, cassava starch could compete with imported starches.

The following table indicates the range of these prices (high and low) and converts them to a naira value (the last column of the table). This value provides an indication of the target price (roots plus processing) that would make cassava and cassava products competitive.

For example, it would appear that cassava chips or pellets could be competitive with maize if the cost of cassava roots and processing was in the range of N6 550 to N12 254. Obviously when maize prices are low the cost of roots and processing has to be at the lower price range.

For cassava to be competitive in the ethanol and starch industries, the cost of cassava roots and processing should be in the range of N11 213 and N18 860.

When attempting to identify the relative importance of these target prices it should be recalled that the cost of processing cassava differs greatly between the industries. Ethanol processing is probably the highest cost industry followed by starch – at least the production of high quality modified starch.

Table 4-2 Calculated Cassava Root and Processing Price

Replace crop commodity US$/tonne or litre	Import Price US$	Conversion	Root Price US$	Roots and Processing Price Naira
Maize (l)	178	3.125	56.96	6 550
Maize (h)	333	3.125	106.56	12 254
Wheat Flour	250	5	50.00	5 750
Wheat Flour	415	5	83.00	9 545
Ethanol	0.65	150	97.50	11 213
Ethanol	0.7	150	105.00	12 075
Starch	540	5	108.00	12 420
Starch	820	5	164.00	18 860

Source: Maize and wheat import prices (FAO various years). Ethanol and starch (Subcommittee, 2002).

A discussion of the second price and margin target requires a move outside of Nigeria. While Nigeria dominates in the production of cassava, Thailand, dominates as the major exporter of cassava products. In 2002, Thai exports of dried cassava, cassava starch and tapioca totalled US$3.6 billion. This represents 81 percent of total cassava export values in 2002 (US$4.5 billion).

As the world's largest exporter of cassava chips, pellets, cassava starch and flour, all other existing and potential exporters must accept the Thai price as its world price or 'price to beat'.

Table 4-3 Thai Exports Value and Quantity 2002

2002 Thailand	Cassava Dried	Cassava Starch	Cassava Tapioca	Cassava Equivalent
Tonnes	2 904 153	767 420	22 612	11 621 252
'000 US$	191 227	135 020	5 520	346 783
Unit Price	US$65.84	US$175.94	US$244.11	US$29.84

The export unit prices in Table 4-3 indicate that competitively priced cassava ranges from US$65.84 per tonne for dried cassava to US$244.11 per tonne for cassava tapioca. More specific price targets can be found from the Thai Tapioca Trade Association web site, prices are up-dated twice a month. Super high grade Tapioca flour/starch is priced at US$175-185 per tonne. Tapioca Hard Pellets Shipment shipped to the European Union on 3 December 2003 were priced at US$82-83 per tonne and Tapioca Chips shipped to China on 4 January 2004 were priced at US$74-75 per tonne. It should also be noted that the quantity of dried cassava exports were up 30 percent in 2003.

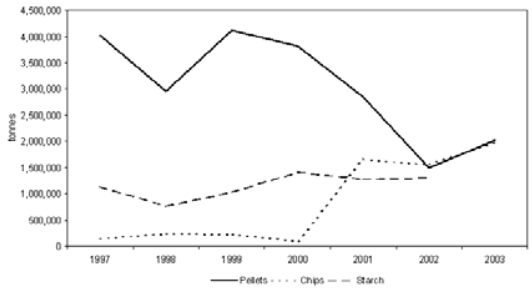


Figure 4-6 Volume Thai Exports

An examination of recent historical trends in Thai trade illustrates some interesting changes. The quantity of exported Thai pellets has declined since 1999. In contrast Thai chip exports have risen such that chip/pellet trade has almost balanced out. Thai starch exports have shown slow yet steady increases over this same timeframe.

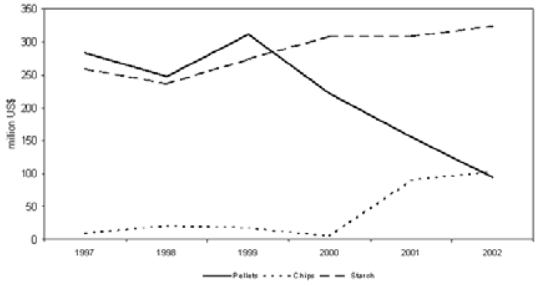


Figure 4-7 Value Thai Exports

Looking now at the value of Thai exports, it is not surprising that chips and pellet values have followed quantity levels. Relatively new to the scene, starch export values have achieved very high added values.

Price ratios in Thailand currently range between 2.09 to 2.43 for chips to root and 5.39 to 6.50 for starch to roots, as of 15 January 2004. On top of these narrow margins, Thailand's pelleting capacity is vast.

Thailand currently has 200 pellet factories with a total capacity of 10 million tonnes a year. At present the EU quota is 5 million tonnes a year, which means Thailand, is working at 50 percent capacity equivalent to three to four months a year and is quite ready to increase supply in response to international demand.

4.3 NEW INITIATIVES

Returning to the Nigerian domestic market for food and industrial goods and the farm modelling exercise, one of the most interesting results provided by the regional production models is the estimates of the amount of cassava that could be marketed as a result of the adoption of improved production practices and improved varieties. These results are highlighted in the following chart and figures.

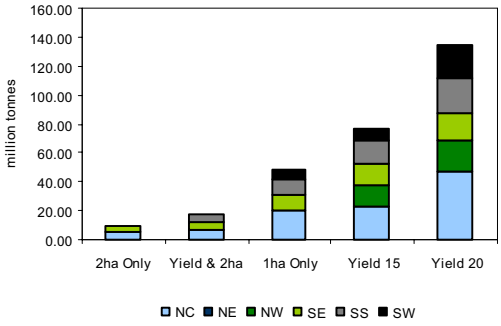
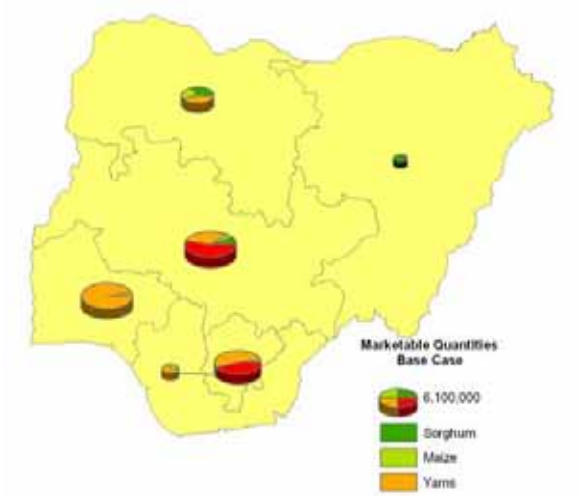


Figure 4-8 Marketable Cassava by Alternative Scenarios

The model suggests that improvements in agronomic practices coupled with the use of improved yields can lead to large increases in the amount of cassava that could be marketed. This is consistent with often-repeated statements that the adoption of mosaic resistant cassava varieties could lead to large increases in cassava production.

The increase in marketable cassava changes the relative importance of other marketable crops as illustrated in Maps 4-3 and 4-4.

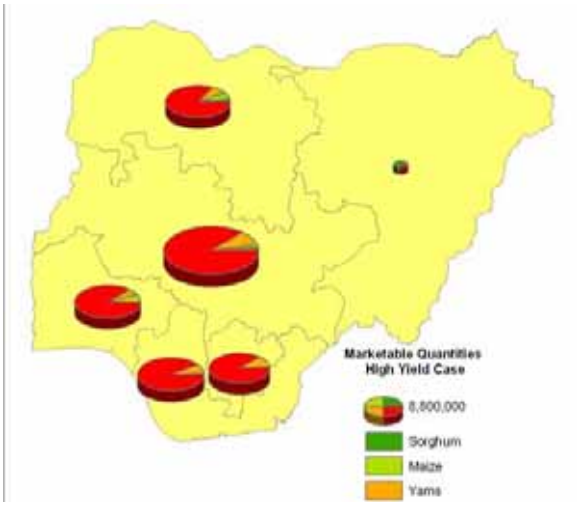
Map 4-3 is the base scenario of the model. It illustrates that the South East and North Central are the primary sources of marketable cassava. The South West is identified as the primary source of marketed yams and the North West as the primary source of sorghum and maize.



Map 4-3 Primary Marketed Crops Base Scenario

The source and amount marketed changes for the scenario of improved agronomic practices and yields of 20 tonnes/ha is illustrated in Map 4-4.

All regions except the North East are identified as potential marketers of cassava. The North Central is identified as the region with the greatest marketing potential while the North West, South East, South South and South West have nearly equal potential.



Map 4-4 Primary Marketed Crops in 20 tonnes/ha Scenario

The substantial increase of marketable cassava does not necessarily imply a decrease in the marketing of other commodities.

As illustrated in Table 4-4, results of the model suggest that in many cases increased availability of marketable cassava is accompanied by increased availability of marketable quantities of competing crops.

Table 4-4 Marketing Impact of Scenario where Yield Increase to 20 tonnes/ha

Region	Crops	Amount Marketed
North Central	Cassava	Increased
	Maize	Increased
	Millet	Increased
	Sorghum	Decreased
	Yams	Increased
North East	Cassava	Increased
	Maize	Increased
	Millet	Increased
	Sorghum	Increased
	Yams	Increased
North West	Cassava	Increased
	Maize	Increased
	Millet	Decreased
	Sorghum	Decreased
	Yams	Unchanged
South East	Cassava	Increased
	Cocoyam	Increased
	Maize	Decreased
	Sorghum	Decreased
	Yams	Decreased
South South	Cassava	Increased
	Cocoyam	Decreased
	Maize	Increased
	Sorghum	Decreased
	Yams	Increased
South West	Cassava	Increased
	Cocoyam	Unchanged
	Maize	Increased
	Sorghum	Decreased
	Yams	Decreased

In general, the model suggests that the adoption of improved production practices and improved cassava varieties can lead to substantial increases in the production of cassava and the availability of marketable cassava. This appears possible while meeting existing food consumption requirements and within the limits of available land. It also appears that these changes do not require large negative changes in the production and marketing of other crops. The model also suggests that the proposed improvements could increase employment opportunities.

It must however be remembered that this is only the output of a model. A model that operates at a rather aggregate level and a model that is based on restricted information. Notwithstanding these

caveats, it can be suggested that the results are consistent with the conclusions of other assessments of the potential benefits that could be derived from adopting improved cassava production practices and improved cassava varieties (Implementation by IITA, 2003), (RTEP, 1995).

4.4 THE WAY FORWARD

The Farm Management Survey provides an invaluable opportunity to quantify the health of the agricultural industry in Nigeria and the overall effectiveness of national agricultural programmes and policies. It also provides advisory information for extension agents. Typically, agents are encouraged to use these guides to identify weaknesses and strengths of like-farms, identifying areas of over or underutilization of resources.

These data can also support marginal pricing analysis to determine true costs of production and appropriate returns to production and investment.

An essential requirement for the development of an industrial cassava industry in Nigeria is the need for industrial cassava to be marketed at competitive prices. The problem for the private sector, as illustrated in the case of the missing cassava, is that if there is not a sufficient supply of cassava to sustain both industrial and existing food demands, cassava supplies will drift to the market offering the highest price. Cassava intended (and possibly even contracted) for use in the industrial sector will find its way into the food sector. To illustrate this point the need for a 'purple cassava' has been identified.

The need for a 'purple cassava' implies the need for two separate cassava markets in Nigeria; cassava produced and processed for the food market and cassava produced and processed for the industrial market.

The 'purple cassava' solution implies the need for an easily and identifiable mechanism to prevent industrial cassava from entering the food market. Whether breeding can create a cassava variety in Nigeria that is undesirable for human consumption, yet desirable for industrial use, is something that has yet to be seen.

As a means of achieving price and margin targets, it is strongly suggested that improvements must be made at every stage of the cassava industry's supply chain. Established and proven models exist for describing, assessing, measuring and improving supply chains. One state-of-the-art model is called the Supply Chain Operations Reference (SCOR) Model (Supply-Chain Council, 2004). The model provides a framework that links business process, metrics, best practices and technology features into a unified structure to support communication among supply chain partners. The objective of SCOR is to improve the effectiveness of supply chain management and related supply chain improvement activities.

Figure 4-9 provides an overview of a SCOR roadmap to improve supply chain operations. Firstly, competition is analysed, a supply chain is configured, and performance levels, practices and systems are aligned and implemented. Feedback is linked back through the model and specific metrics are used to measure progress at each stage of the chain. The SCOR roadmap provides a convenient way to bring together supply chain members with a common purpose to improve the supply chain. The SCOR approach can be developed with the support of outside agents who assist the supply chain members as they tackle the different SCOR levels. Although single firms most often use this analysis, application to an entire subsector would be groundbreaking if accomplished.

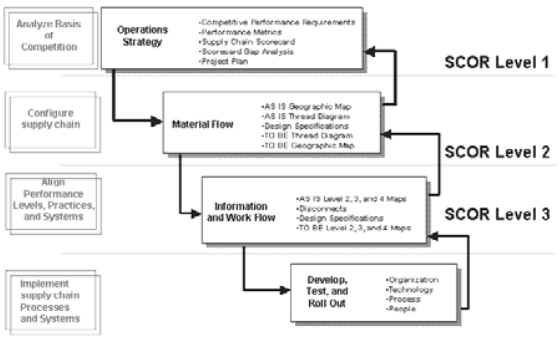


Figure 4-9 A Roadmap for Supply Chain Development

5 DEVELOPMENT CLUSTERS

5.1 CURRENT STATUS

One of the more noticeable and highly expressed prerequisites in developing an efficient Cassava Industry in Nigeria was the need for better roads and cheaper transportation.

Throughout the study, access to markets and transport were found related to the quantity that producers sold. In the RTEP survey, respondents located on the road or within 5 km of the market were more likely to indicate that they sold more than 50 percent of home consumption compared with those located more than 5 km away from the market.

Table 5-1 Marketed Produce and Distances to Markets

State	Distance to Market	Percent Sold 0-50 percent	Percent Sold 50-100 percent
Akwa Ibom	road and <5km	30.16	**38.62**
	5-10km	10.87	13.92
	>10km	6.49	8.31
Kaduna	road and <5km	16.81	**55.17**
	>10km	6.53	21.44
Lagos	road and <5km	9.93	**44.00**
	5-10km	1.36	6.04
	>10km	2.09	9.27
Nassarawa	road and <5km	12.70	**68.70**
	5-10km	2.15	11.65
	>10km	0.75	4.05
Ogun	road and <5km	4.68	**70.20**
	5-10km	1.26	18.90
	>10km	0.06	0.90
Oyo	road and <5km	6.46	**71.33**
	5-10km	0.81	8.98
	>10km	0.60	6.63
Plateau	road and <5km	17.37	**52.30**
	5-10km	3.77	11.35
	>10km	2.70	8.14

Marketing produce in Nigeria is complicated by many hidden factors related to supplying produce to markets. For example, the only available transport is by truck and highway. Rail service is virtually non-existent in Nigeria. Reliance on highway transportation means roads are heavily travelled and are in need of regular maintenance and upgrading. Unfortunately good quality roads are few and maintenance irregular.

Breakdowns, accidents, congestion and road closures all represent a substantial cost for Nigerians and the economy. Transportation expenses represent a high percentage of the final product price. While travelling the study team interviewed three traders travelling from Ikom in Calabar. Their 9 11 lorry was faulty and they were offloading 50 kg bags of *gari* while the *gari* trader was looking for a vehicle to carry them to Uyo. Their full 9 11 Lorry load of *gari* was priced by the trader at N30 000 which must build in the costs and likelihood that such a breakdown would occur.

Another example of extraordinary costs to marketing is the time it takes to hire a vehicle and roadblocks. Traders on the New Haven Express reported that it took them from 1630 hours on Friday 12 December 2003 until 0930 hours the following day (the time of the interview) waiting and negotiating with transporters on the cost per bag for transport. The Enugu traders reported that transporters were insisting on N70 or N100 per bag of *gari* while they were negotiating for N50 per bag of *gari.* Transporters will typically charge N10 000-N20 000 for 200 bags of *gari* (a full 9 11 lorry) depending on road conditions and frequency of security checks (road blocks) that demand money from drivers. An example of the number of roadblocks, demanding money from drivers, is listed in Table 5-2. Breakdowns, time to negotiate with transporters and roadblocks all add to the cost of food in Nigeria.

Table 5-2 Road Blocks for a Selection of Routes

Route	Road conditions
Ibadan-Abeokuta	7-10 Road blocks
Ibadan-Iseyin	6-8 Road blocks
Ibadan-Niger	Worst route many road blocks
Ibadan-Ogbomosho	30 Road blocks
Ibadan-Ogbomoso	8-10 Road blocks
Ibadan-Oyo	0-15 Road blocks
Ibadan-Oyo	Very difficult for some tribes to pass
Ibadan-Saki	7-10 Road blocks
Ibadan-Sokoto	Bad roads, numerous road blocks
Ojoo-Iwo	6 Road blocks
Ojoo-Mokola	7 Road blocks

Figure 5-1 illustrates the cassava price variability from rural to urban areas by state. These price differences can be used as a proxy for transaction costs (which include transportation) between rural

and urban markets. Costs appear highest in the Northern States.

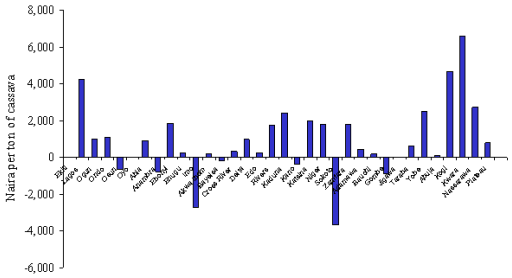


Figure 5-1 Transaction Costs Between Rural and Urban Centres

Typically one would expect the price of cassava to be lower in the rural areas of state production than in the urban areas of state consumption. Negative values mean the opposite has occurred, the price in the rural areas was found to be higher than the price in urban areas. This can happen if traders upon entering the urban market find themselves unable to sell their produce and therefore must accept a price less than they could have received in their rural location or else return home with the produce. This can also happen if the urban area is able to attract a broad range of sellers (especially from outside the state) then the price reflects lower costs of production than that found in the State's rural areas.

Another way to examine transportation costs is to ask transporters their prices and experiences. Table 5-3 lists the unit price per kilometre and tonne by route and type of vehicle. Although restricted to points starting from Ibadan, a range of destination points are provided. The unit costs are surprisingly consistent, ranging from N3 per km per tonne for a distance of 165 km to N8 per km per tonne for the Owerri-Lagos route.

Table 5-3 Transportation Routes and Unit Costs

Route	km	tonne	Cost per km and tonne	Type of Vehicle
Ibadan-Abeokuta	77	14	3.25	3-Seater Bus
Ibadan-Abeokuta	77	18	3.25	Mazda Bus
Ibadan-Abuja	645	30	5.68	Trailer
Ibadan-Bauchi	1 070	30	4.98	Trailer
Ibadan-Ilorin	162	14	2.47	3-Seater Bus
Ibadan-Ilorin	162	18	2.47	Mazda Bus
Ibadan-Iseyin	75	18	3.33	Mazda Bus
Ibadan-Iseyin	75	14	3.33	3-Seater Bus
Ibadan-Jos	928	30	4.49	Trailer
Ibadan-Kaduna	756	30	4.41	Trailer
Ibadan-Kano	1 005	30	4.64	Trailer
Ibadan-Kano	1 005	30	3.98	Trailer
Ibadan-Katsina	1 065	30	4.07	Trailer
Ibadan-Lagos	141	30	3.55	9 11 Lorry
Ibadan-Maiduguri	1 532	30	3.70	Trailer
Ibadan-Ogbomoso	100	14	3.00	3-Seater Bus
Ibadan-Ogbomoso	100	18	3.00	Mazda Bus
Ibadan-Oyo	42	18	3.57	Mazda Bus
Ibadan-Oyo	42	14	3.57	3-Seater Bus
Ibadan-Saki	165	14	2.73	3-Seater Bus
Ibadan-Saki	165	18	2.73	Mazda Bus
Ibadan-Sokoto	890	30	4.49	Trailer
Ibadan-Yola	1 545	30	3.67	Trailer
Ibadan-Zaria	827	30	4.43	Trailer
Owerri-Lagos	574	15	8.13	9 11 Lorry
Owerri-Lagos	574	15	6.97	9 11 Lorry

In an attempt to identify the location of industrial users of cassava the Corporate Affairs Commission, which registers business names and handles the incorporation of companies, was a logical first step. Its list of businesses, if available, would have provided an unbiased list and location of numerous businesses across Nigeria. Unfortunately this information was unobtainable. Even though it has a web site (Corporate Affairs Commission, 2004) that suggests that a downloadable CD is available repeated attempts to contact the head office in Abuja by telephone, fax and e-mail were fruitless.

A second option was to request a directory of members from known industrial associations. This option however had the potential to be biased in favour of those associations that are more established and better organized, at least in terms of listing their members and locations.

The method finally used was to list all potential users of industrial cassava from the National

Telephone Directory Yellow Pages Section. It was believed that such a listing of industries would represent an unbiased cross-section of like industries, at least in terms of their desire to be listed in the Yellow Pages telephone directory. Whether they still exist or not as an industry in Nigeria was irrelevant to the purpose of getting a general idea of preferred locations for industrial cassava production and processing.

The categories used to collect the yellow pages listings included all possible industries, namely, Baby Food and Products Manufacturers, Bakers and Confectioners, Biscuit Manufacturers, Canned Food Manufacturers, Confectionery Raw Material Suppliers, Supermarkets and Department Stores, Explosives, Farmers, Fish Farmers, Flour Mills, Food Contractors and Foodstuffs Suppliers, Food Processing Companies, Foods and Beverage Producers, Gari Processing Industries, Grinding Mills, Hotels, Restaurants, Livestock Feed Manufacturers, Mud Products, Newspaper Manufacturers, Packaging Industries, Paper Bags Manufacturers, Paper Mills, Converters and Distributors, Poultry Farms, Poultry Feeds (Feed Mills), Shipping Companies and Agents, Snack Stores and Suppliers, Starch Mills, Textile Manufacturers, Timber Industries, Trade Organizations, Trade Promotion and Transporters.

Of the 2 356 firms found, some were obviously more interesting than others. For example, poultry farms and feed mills are meaningful because of the extent to which they could utilize cassava in their feeds. Food processing industries such as bakeries and flourmills are also interesting because of the potential to substitute cassava for wheat flour. The concentration of supermarkets and transportation faculties was also interesting in terms of access to urban markets.

The Cassava Handbook contains numerous maps similar to the two shown here for textiles and bakeries. Of note, is the level of concentration along the main expressways running North South from Kano to Lagos and East West from Aba to Lagos.

This type of data is valuable to the selection of future processing locations and production sites.

Map 5-1 Location of Textile Firms

Map 5-2 Location of Bakeries

5.2 FUTURE TARGETS

Data from the Handbook provides information on the number of small, medium, large or international size plants that would be required to process the additional demand that was described earlier in the processing and utilization section.

It is clear that the number of small and cottage scale industries necessary to meet potential demand is very large (Table 5-4). The implication being that the realization of this size of potential market opportunities will need to be coupled with the development of larger scale processing facilities.

Table 5-4 Number of Plants Required to Meet Estimated Demand

	Scale of Operation			
Market	Small	Medium	Large	World
Food for urban	96 969	-	-	-
Food for rural	29 992	-	-	-
Food for export	12 500	-	-	-
Food as flour	12 823	-	-	-
Livestock chips	4 623	2 312	-	-
Livestock pellets	-	-	39	12
Starch	4 589	-	-	92
Ethanol	1 145	57	29	2

For the supply-chain to develop and survive there is a need to get the members of the supply chain to work together to assure that production, collection, delivery and processing activities are scheduled to work together. If key components of supply are ahead or behind schedule it is quite possible that the supply chain will fail.

The number of small and medium processing plants is great and will likely be scattered across the country. The estimate for large and world scale processing plants is more manageable to fathom and it is for these plants that the following selection criteria was formulated.

5.3 New Initiatives

Suggesting the best production locations or best locations to set up a plant is a difficult task and the answer will change depending on the objectives and situations facing the person, persons or institution desiring to know the *best location*. A number of conditions are necessary for selecting production and/or processing areas. The main one being proximity to the user.

Owing to data limitations, recommendations on the best site must be primarily limited to state recommendations. An approach is suggested which can be modified and adapted to different levels of aggregation.

It is suggested that the selection of best cassava production sites are not necessarily the best sites for production. However, owing to the bulkiness of cassava and the need, at times, to process freshly harvested cassava, the distance between production and processing sites may become a critical decision factor.

The selection approach demonstrated is based on selected data contained in the Handbook. The selected data are considered to be indicators of the suitability of each state as a cassava production or processing site. Individuals can select their preferred indicators.

For this study the following Table contains the indicators and the measures that were considered positive for production and processing sites.

Table 5-5 Site Selection Variables and Related Indicators

Production	Positive Indicator	Processing	Positive Indicator
Population Density	Low, MLow	Cassava Root Price	<8 000 N
Village Density	Low	*Gari* Price	<20 000 N
Express Roads	Yes	Ratio Maize Cassava Prices	Low
Cassava Yields	>12 tonnes/ha	Express Roads	Yes
Cassava Root Price	<8 000 N	Feed Poultry Industries	Yes
Ratio Maize Cassava Prices	<.8	Flour Bakeries Industries	Yes
		Starch Textile Industries	Yes

It is suggested that states with low population and village density are states that may have greater opportunities for cassava production expansion and perhaps larger contiguous blocks of land.

In earlier analysis of the baseline data collected by RTEP those farmers that were on the road or within 5 km of the road sold more produce than those farmers farther away. This argument was extended here to suggest that states with an express road have a better chance of marketing cassava than those states without an express road. Obviously more detailed information on the closeness of production areas to good roads would be a useful addition to the selection process.

Production and price variables were also considered in the selection process. It is suggested that states with higher than average yields (greater than 12 tonnes/ha) were better locations for increasing cassava production. Low absolute root prices (less than N8 000) and root prices below the 80 percent maize threshold price were also interpreted as indicators of competitively priced cassava and good producing states.

The selection of potential processing industrial sites follows the process associated with the selection of potential production sites. It is argued that the prices of cassava roots, *gari* and ratio of cassava to maize prices are all relevant. Low priced cassava roots are an obvious benefit to processing industries. Low *gari* prices (less than N20 000) are also beneficial. If the price of *gari* is high there could be a tendency to divert cassava roots from new industries to the *gari* market. Similarly, a low cassava to maize price ratio again is taken as an indicator that cassava is competitively priced.

The availability of expressways is taken as being beneficial to new industries, both in terms of their sourcing of raw material and their ability to move their products to markets.

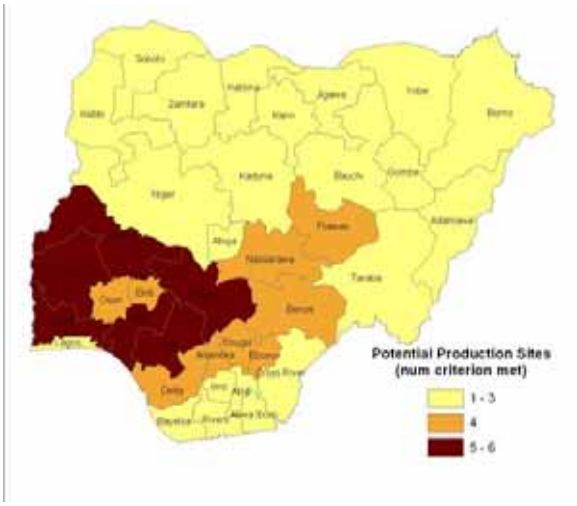
Finally the existence of industries that are potential cassava users (animal feed, flour and starch) was taken as a positive indicator.

The number of positive indicators was counted and used as a gauge of the suitability of the state for expanded cassava and industrial processing of cassava. The following Table 5-6 lists the results of the selection process.

Table 5-6 Results of Site Selection Criteria

Zone	State	High Production Potential	High Processing Potential
NC	Kogi	√	√
NC	Kwara	√	√
SS	Edo	√	√
SW	Ogun	√	√
SW	Ondo	√	√
SW	Oyo	√	√
NC	Benue	-	√
NC	Nassarawa	-	√
NW	Kano	-	√
NW	Niger	-	√
SE	Abia	-	√
SE	Anambra	-	√
SE	Enugu	-	√
SS	Delta	-	√
SS	Rivers	-	√
SW	Lagos	-	√
NC	Abuja	-	-
NC	Plateau	-	-
NE	Adamawa	-	-
NE	Bauchi	-	-
NE	Borno	-	-
NE	Gombe	-	-
NE	Jigawa	-	-
NE	Lake Chad	-	-
NE	Taraba	-	-
NE	Yobe	-	-
NW	Kaduna	-	-
NW	Katsina	-	-
NW	Kebbi	-	-
NW	Sokoto	-	-
NW	Zamfara	-	-
SE	Ebonyi	-	-
SE	Imo	-	-
SS	Akwa Ibom	-	-
SS	Bayelsa	-	-
SS	Cross River	-	-
SW	Ekiti	-	-
SW	Osun	-	

Six states are identified as exhibiting potential for expanded production (Map 5-3). Sixteen states were identified as exhibiting potential for processing cassava on a large scale (Map 5-4).



Map 5-3 States Identified for Expanded Cassava Production

The six states identified for production were also identified as potential processing sites. The selected states cover the zones North Central, South South and South West.

Map 5-4 States Identified for Expanded Industrial Cassava Processing

The results of the preceding analysis need to be assessed in light of data limitations and the fact that a different set of variables or cut-off levels would greatly alter the results.

Nevertheless it is hoped that the approach may be useful to those trying to identify the best cassava growing areas or best cassava processing areas.

The addition of intra-state data can assist with the selection of production or processing data. The following Map 5-5 illustrates the LGAs that ADP staff members identified as their best cassava LGAs.

Map 5-5 LGAs identified by ADP Staff as Best for Cassava Development

What is interesting to note is that the best LGAs in Kogi, Enugu and Benue almost constitute one large area that is rated as being very good for cassava production.

5.4 The Way Forward

The Nigerian Cassava Growers of Ogun State identified the need to reduce the distance required to move product to processing centres and markets. They suggested less than a 70 km radius or maximum of 200 km radius[24]. The supply of public goods such as electricity, portable water and a good road system was also frequently identified as necessary improvements in Nigeria by those interviewed.

Four ways to reduce transportation costs caused by road blocks include the elimination of such blockages, the legalization and regulation of blockages, the preferred (free) passage of transport carrying cassava, cassava processed

[24] Personal interview 11 November, 2003

and cassava using products (with complaints to a cassava ombudsman or private police force) and a government refund of the charges imposed by such blockages.

Much is required to lower cassava production, processing and marketing costs in Nigeria. Perhaps a first step would be to provide a structure and organization to the industry. The Handbook is a beginning; an association and application of supply chain management would also help.

6 THE ULTIMATE WAY FORWARD

The task to be faced now is to how to develop successful long-term relationships between members of the cassava supply chain (farmers to agribusiness entrepreneurs) to address and resolve the problems faced by everyone from ineffectual markets, low levels of technology use, and inadequate policy and regulatory systems.

There is no shortage of recommendations. The team while undertaking this study identified no less than 300 recommendations[25]. Each one was suggested as a means for addressing a genuine problem or concern. Rather than listing them here (although it is strongly recommended that one should review them for future consideration) it was preferred to suggest a process or way forward to building a legitimate and respected cassava industry in Nigeria that may activate its own solutions.

To date cassava remains, in the eyes of most Nigerians, a food security or self-sufficiency crop. Although their consumption of cassava in the form of processed *gari* and *fufu* suggests otherwise, the perception remains strong. It is not thought of as an agrifood industry capable of moving the Nigerian economy forward. It is not thought of as able to provide a marketable convenience food to a growing urban market nor as an export-earning provider. It is not known by the general population that it is capable of providing high quality flour, starch, animal feed and ethanol energy. These are just some of the knowledge gaps, attitudes and mind-sets that must change and if changed, will stimulate cassava's role and importance in Nigeria's agricultural economy and overall development.

6.1 THE OBJECTIVE

This will entail support from champions outside and inside the industry. In the early years of change this will most likely be initiated through small-scale processing chains and vertical integration in selected industries. To get there cassava partners must start to think bigger.

Thinking bigger in this context means partners must begin thinking beyond one's own enterprise; thinking beyond their operations; thinking backwards by forming strong and trusted linkages with one's suppliers of raw material and thinking forwards by forming strong and trusted linkages with one's customers.

Thinking bigger is not about thinking of bigger profit margins or bigger outputs and capacities. Thinking bigger is first thinking about ensuring that contracts are fulfilled and high levels of quality and service are maintained throughout the supply chain all the way to final consumer satisfaction.

Final and intermediate consumer satisfaction will ensure the success of the cassava industry. Small firm level successes will eventually lead to bigger successes and ultimately the success of a larger industry.

6.2 BENEFICIARIES

The anticipated beneficiaries of a successful cassava supply chain are the producers, processors, traders, transporters and consumers of cassava today and in the future. Cassava, presently and accurately is described as an orphaned commodity without institutional, organizational and policy support. The number of intended beneficiaries can be thought of as the sand in an hourglass: a large number of smallholder producers feeding into a narrow opening of traders, processors and final product distributors, opening again to a large number of low-income consumers of the final product.

6.3 THE PROCESS

The process for change must be demand driven. In this analysis untapped value added product opportunities for cassava were identified in urban convenience foods such as ready to eat or serve *gari* and *fufu,* breads and snacks to name just a few. Cassava crop expansion was identified as willing and able. The constraints that prevent production from meeting its demand potential are vast, as evident from interviews with industrialists, producer groups, state extension officers, previous reports (NAPA, etc) and the list of recommendations. Yet, given these vast constraints there remains hope and optimism that these constraints can be overcome if the industry is able to find a way to work together for its

[25] The list is available upon request.

greater good, set for itself well defined indicators of progress and a mechanism to monitor, detect and solve subsequent foreseen and unforeseen problems.

The process begins with the identification of a group of interested enthusiasts that will act as catalysts, and hopefully champions, for the Nigerian Cassava Industry. This means catalysts and champions not only for the industry itself but catalysts and champions representing each link in that chain from production to processing to final consumption.

These catalysts and champions, if serious, would be willing to put their time and energies into organizing events and activities that will give input and ideas to the development of the industry. Legitimate activities of such a group would be to identify the constraints limiting the exploitation of opportunities, ways of overcoming the constraints and modalities for proceeding.

When agreement is reached, action can proceed. In simple terms this means a concerted effort to overcoming identified market imperfections with the anticipated outcome that the supply chain is improved, or minimally begins to exist.

An on-going programme of data collection is a prerequisite for this process to succeed. Without reliable data generating an accurate knowledge base, simulating new ideas and future directions, and providing planning and performance evaluation advice, little can be reasonably expected. Data and evaluations provide a guide for improving, modifying and introducing new activities.

Capacity building is also a prerequisite for this process to succeed. The skills and attributes required for this process include data base management, organizational behaviour, problem solving, negotiation and facilitation, benevolent leadership and unrelenting patience.

6.4 Outcomes and Activities

The overriding goal of this process is to contribute to the development and maintenance of a well functioning market for Nigerian cassava and cassava products. To do this, a series of outcomes and activities are suggested to remove barriers to progress.

As each barrier is removed, it is anticipated that new efficiencies are gained, economic incentives are identified, opportunities for product development and product utilization are realized and industrial growth occurs.

It is already known from interviews throughout the country and industrial reports that linkages between suppliers and users of cassava products are weak and damaged; that in the industrial market, cassava supplies are uncompetitive at current prices and unstable at competitive prices; and that traditional markets of processed foods such as *gari* and *fufu* are by and large untapped to date. These facts illustrate both promise and room for improvement. However, barriers such as mistrust, impatience and inaction coupled with exceptional costs, market imbalances, hidden information, barriers to new entrants and unequal quality of products, inhibit growth potential.

Outcome 1: Industrial Cooperation and Trust

Presently players and potential players in the cassava marketplace are guarded and distrustful of each other. Many have strong and legitimate complaints as discussed in the previous sections of this report. Producers and processors distrust traders and middlepersons, traders and middlepersons distrust transporters and end users.

Therefore, before filling a room with market stakeholders expecting them to immediately work together to identify and solve problems within the supply chain, an environment of trust, confidence and cooperation must be established. An event, a reason, a purpose must be invented that will draw them together devoid of adversarial agendas.

A positive environment that encourages changing attitudes needs to be created. Trust, honesty, cooperation, problem solving and building lasting relationships (if not friendships) are requirements. From this changed position, each subsequent activity of the industry stakeholders is more likely to succeed.

One event under which such an environment might be immediately created is the planning and

organization of a National Cassava Fair. Different than the International Cassava Trade Show (currently underway for 2004), but possibly linked to the timing and excitement of that show, this fair would be targeted to domestic producers, processors, consumers and potential users of cassava nationally. The objective of the fair is to engage industrial stakeholders in a tangible activity that is positive, exciting, different and hopefully fun.

The long-term outcome of such an event includes:

- stronger networks and improved linkages throughout the marketing chain;
- greater trust and understanding of the interdependency among industry participants;
- excellence within all aspects of the cassava industry;
- pride in the accomplishments achieved by the industry;
- heightened profile of the importance of and potential within the cassava industry;
- improved consumer and retailer attitudes toward cassava and cassava based products;
- Measurable outcomes in terms of attendance, consumer awareness and ownership.

Outcome 2: Ownership and Leadership

The second outcome required for the Nigerian Cassava Industry is a sense of ownership and leadership. The cassava industry throughout Nigeria has long been neglected as a valued and respected contributor to modern agriculture. Yet cassava production is greater than the 'more respected' and 'more organized' commodities in Nigeria. For the cassava industry to mature in Nigeria it too must organize itself in such a way that it can provide leadership to initiate, propel and activate desirable and needed changes. Without ownership, change is meaningless. Without leadership, change will not happen.

One mechanism used to provide ownership and leadership to stakeholders of an industry is to form an association. In today's society of political lobbying and global competition the formation of industry commodity associations, is almost mandatory. In North America is it common to see an association formed to represent even the smallest agricultural niche market let alone an industry the size of cassava in Nigeria. The specific objectives of a Nigerian cassava industry association could be to:

- foster cooperation among industry participants along the supply chain from suppliers of raw material to the final end users;
- lobby state and federal governments for improvement in transportation, infrastructure, data collection and conducive policy;
- promote the attributes of cassava and encourage greater utilization;
- encourage excellence and use of high quality raw material and final product development;
- educate the public, policy-makers, investors, and members in the production and marketing of cassava and cassava products by updating and distributing the Cassava Statistical Handbook;
- exchange information on local, national and regional demands, supplies and prices;
- disseminate timely market information, of interest to all industry participants;
- Assist in the provision of crosscutting services such as insurance, transportation, storage.

Providing a more organized, more efficient and more relevant cassava industry encourages ownership and leadership. An improved cassava industry could significantly advance the commercialization of smallholder agricultural production, the economic welfare of members within the cassava supply chain, their rural communities and urban consumers.

It is strongly recommended that the association seek the active membership or at least the observing representation of publicly respected consumers. Membership might include representatives from the teachers or nurses unions. Representation by either would provide reassurance to the general public that their concerns and opinions were being heard, especially if awareness campaigns were initiated by the industry. It would also provide an all important dialogue between producers, processors and consumers of cassava and cassava products. A two way educational process is necessary if industrial and consumer biases are to change.

For those public goods that cannot be provided through industrial organization or associations, such as improved transportation, highways, communications and security, the newly formed cassava associations can begin lobbying respective governments of the importance of such needed and justifiable services.

Outcome 3: Quality of Product and Profit

Once the industry has been able to achieve a sense of cooperation and trust, ownership and leadership, members should feel empowered to make the necessary changes that ensure the production of quality products and profit.

Without trust, without honesty, without self-regulating quality assurance, without meeting commitments, advances cannot be made in the commercialization of cassava in Nigeria. Without these things, purchases sight unseen cannot be made; contracts guaranteeing supply and price cannot be trusted; and product users cannot predict the outcome of their efforts. These traits (trust, honesty, quality and commitment) form the basis (or back bone) of all successful market economies. Without them Nigeria's entry into a global marketplace will not happen and if it does it will not be sustained.

Although these traits originate from one's own individual character, an industry can encourage and reward these traits in numerous ways. Firstly, by setting an example and a standard by which to follow. For example, leaders of the Cassava Industry Association can exemplify transparency at all costs. Meaning that their personal accounts (records and bookkeeping) and that of the association are open to public scrutiny and inquiry, their participation in illegal activities is strictly prohibited and that checks and balances of power within the association are assured.

Only when the association and its leadership itself are shown to be honest, trustworthy, and dependable and committed stewards for the industry can it assist and encourage its membership to maintain a quality of product that is profitable.

Homogeneous and substitutable cassava products according to quality and grade improve price determination and marketing conditions. Transaction costs are lowered as contracts can now be articulated and enforced. Products can be handled in greater volume and travel greater distances if grades and standards convey accurate information about the product. This helps to determine prices and helps to define contracts of delivery. This leads to lower transaction costs, the ability to bulk product keeping prices and transportation costs low, improved efficiency of markets, more transparency, and the identification of market niches. The ability to provide a standard and uniform product will provide those sellers with a premium price because such changes provide savings further along the supply chain.

In addition to the premium prices that will be received by those that meet their quality and timely commitments to buyers, industrial rewards may also be awarded in terms of peer respect and esteem. 'Awards of excellence' as defined and described throughout the industrial supply chain can be bestowed upon 'the best of the best' in the industry.

Quality encouraging projects can also be initiated by the industry for children and youth within and outside the school system. This will ensure a

continuous supply of high quality, highly educated and motivated cassava producers and industrialists for the future. Members of the Teachers and Nurses Union could help to facilitate such educational programmes and rewards. Large industrial users of cassava may also see the advantages to their companies to be seen funding and promoting such programmes in Nigeria.

Membership within such a highly regarded Cassava Industrial Association may also exact a cost in terms of maintaining and sustaining the minimum standard of product quality. For the betterment of the industry the Association may choose to insist and enforce a minimum level of product quality on its members to complement generic advertising campaigns. When running an expensive advertising campaign, quality and delivery of product is all important. If the quality is not as advertised or not on the shelf as promised, the costly advertising has been for nothing. A generic advertising campaign requires sufficient supplies of the advertising quality of product to meet anticipated demand. This is particularly difficult with a highly perishable commodity such as cassava in the food market. That said if the product is available and meets its advertised quality the returns to a generic advertising campaign is very rewarding.

Outcome 4: Information and Planning

The final outcome suggested from this study is that of information and planning. Information is the basis of successful planning. Planning forms the basis of successful outcomes. Thus a full circle turn has been made. All the above-mentioned outcomes must be based on informed decision-making and planning. Planning implies organization. It implies thinking ahead of what is needed to be done now to be prepared for the future. This is what research provides. To many industrialists, research has little meaning yet they themselves undertake research (or information seeking) every day when they plan and make their decisions about future activities.

As an industry, a minimum amount of respect and attention must be given to the results and suggestions from applied research in production, processing, distribution mechanisms, market research and product development. Competitive funding in support of excellence and innovation within the cassava industry should be given priority. The purpose of such funds is to target the advancement of small, medium and large scale agricultural activities in cassava production, marketing and product and human resource development. The outcome of these funds is to:

- increase the sale of locally grown or processed cassava products;
- develop and commercialize innovative cassava technologies;
- develop new uses for cassava;
- contribute to the long-term economic health of cassava growing communities;
- create partnerships within the cassava subsector and across sectors;
- lead to the long-term competitiveness of the cassava industry;
- Enhance international and/or cross-border trade.

The anticipated use of these funds is to support and encourage market participants and stakeholders to address and resolve both anticipated and unanticipated problems as they arise.

Conclusion

The overriding objective of this study and these outcomes is to encourage an environment where industry agents initiate and activate the market corrections within their power. Each outcome and activity is suggested in the spirit of providing positive support to a deserving cassava industry. By rewarding innovation, efficiency and excellence in the New Nigerian Cassava Industry, it is strongly believed that both the human spirit and domestic economy will be advanced.

Sustainability demands a participatory process, transparency, relevancy and cost recovery. It is suggested that each activity follows its own path

starting with small modest objectives and budgets, growing only as cost recovering resources allow. Sustainability also demands ownership of change. It means participating fully and being rewarded for that participation. It means taking ownership of the problems and difficulties arising from change. Changing attitudes, consumer perception, and business practices are not easy and require patience and time and initiation from within.

REFERENCES

1. Angar, Boma, 2004. *Large Scale Cassava Production*. Unpublished handout.

2. Central Bank of Nigeria.

3. Corporate Affairs Commission. "CAMA." Web page, [accessed 15 January 2004]. Available at www.cac.gov.ng.

4. Department of Agriculture, Federal Ministry of Agriculture and Natural Resources Nigeria. 2000. *Cassava Development in Nigeria: A Country Case Study Towards a Global Strategy for Cassava Development*. Rome, Italy: FAO.

5. FAO. 2004a. *Online Statistical Database*. Rome, Italy: Food and Agriculture Organization of the United Nations, Web Site www.fao.org.

6. FAO. "Trends in Cassava Production." Web page, [accessed 2004b].

7. FAO. Various years. *FAO Trade Statistics*. Rome, Italy: FAO.

8. Federal Office of Statistics. 2001. *Nigerian Foreign Trade Summary, January - December 2001*. Abuja, Nigeria: Federal Office of Statistics.

9. FMANR, Department of Planning, Research and Statistics. 1997. Nigerian Agricultural Statistics.

10. IITA. 2002. Competitiveness workshop. *Opportunities for Cassava in Nigeria.* Bokanga, IITA-Ibadan.

11. IITA. 2004. Nigerian's Cassava Industry: Statistical Handbook.

12. Imo State Agricultural Development Programme (ADP). 2003. *Report on the State Agro-Processing and Market Expansion Group (SAMEG)*.

13. Implementation by IITA. 2003. *Assessment of Nigeria's Agricultural Policy*, USAID - Nigeria.

14. Knipscheer, Henk. 2003. *Opportunities in the Industrial Cassava Market in Nigeria*, IITA, Ibadan.

15. Kormawa, P. & Akoroda, M.O. 2003. *Cassava Supply Chain Arrangements for Industrial Utilization in Nigeria*. Ibadan: IITA.

16. Nigerian Ministry of Health and Nutrition. 2004. *National Consumption Survey*.

17. PCU. 2002. *Field Situation Assessment of 2001 Wet Season Agricultural Production in Nigeria*.

18. PCU. 2003. *Crop Area Yield Survey*. Abuja, Nigeria: Federal Ministry of Agriculture and Rural Development: Project Coordinating Unit.

19. Projects Coordinating Unit. 2002. *Advisory Handbook 2000/2001*. Abuja, Nigeria: Federal Ministry of Agriculture and Rural Development.

20. RTEP. 1995. *Roots and Tubers Expansion Programme: Formulation Report (Vol. 2)*, 91/95 IFAD-NIR 64. IFAD, Rome.

21. RTEP. 2001. Baseline Survey.

22. Scott, G.J., Rosegrant, M.W. & Ringler, C. 2000. *Roots and tubers for the 21st Century: Trends, projections, and policy for developing countries*. Washington, D.C.: IFPRI.

23. Shaib, Bukar, Adamu Aliyu, & Bakshi, J.S. 1997. *Nigeria National Agricultural Research Strategy Plan: 1996-2010*. Ibadan, Nigeria: Intec Printers Limited.

24. Subcommittee. 2002. *Report of the President's Committee on Cassava Production and Export*.

25. Supply-Chain Council. Web page [accessed 2004]. Available at www.supply-chain.org.

26. United States Trade Representative, Office of 2001. "National Trade Estimate Report on Foreign Trade Barriers: Nigeria." Web page.

27. World Bank. 2004. *ICT at a Glance Tables*. Washington, D.C.: World Bank web site.

APPENDIX A

Cassava Market Opportunity and sub Sector Analysis

IITA, Ibadan

Nigeria is the largest producer of cassava in the world. Its production is currently put at about 34 million metric tonnes a year (FAO, 2002). Total area harvested of the crop in 2001 was 3.125 million ha with an average yield of 10.83 tonnes per ha. Presently, cassava is primarily produced for food especially in the form of *gari*, *lafun* and *fufu* with little or no use in the agribusiness sector as an industrial raw material. But the crop can be processed into several secondary products of industrial market value. These products include chips, pellets, flour, adhesives, alcohol, 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.

In 2002, the President of Nigeria announced an initiative to use cassava as a foreign revenue earner of five billion naira annually three years hence. To achieve this, there is need to develop the domestic market, diversify the use of cassava in industries, curtail the threat of the virulent form of the cassava mosaic virus and entrench national policies that will leverage cassava development in the country (Cassava Competitiveness workshop, 2002). Unfortunately, no supply chain structures exist for the commercialisation of secondary cassava products as primary source of raw materials for agro industries (Ezedinma et al, 2002). At the farm level, production costs for cassava are high relative to other countries. Production is not oriented towards commercialisation but instead farmers produce and process cassava as a subsistence crop (Dixon, 2002). The current status and potential demand for cassava and its secondary products as industrial raw material in Nigeria is neither unknown nor documented. To guide the commercialisation of cassava such documents are important. The absence of a commercial approach to cassava production and marketing in Nigeria justifies a synchronised approach involving several partners in the development of the sector. It has become imperative to provide data that will inform investment on the industrial development of the cassava sub sector. The development of the sector will also require initial activities in capacity building, product development, fabrication and transfer of processing technologies to target beneficiaries and development of clusters to supply identified markets.

Processing Problems and Issues

Cassava tubers consist of 60 to 70 percent water and have a shelf life of 2 to 3 days. Once harvested, the tubers have to be processed or consumed immediately otherwise the tubers begin to deteriorate. Transportation of fresh tubers from farm to processing sites therefore becomes critical for quality and cost reasons; such that transportation is a major cost component in cassava processing. The need for processing arises to stabilise the crop for storage purposes and price stability guaranteeing higher prices for farmers. However, the cost of acquiring simple processing machines is prohibitive for the small farmer and in the more humid cassava producing areas, the use of dryers is critical. There is also a need to ascertain accurately the effect of processing costs on the final price of the cassava products. This will also influence investment decisions especially for emerging agro industries. Unfortunately, credit on capital investments even for small processing plants is difficult to obtain due to risks and past experiences of banks with poor business ethics of clients.

Against this background, the challenge for cassava industrialisation lies with the reduction in the cost of production and transformation to enable the supply of cheaper processed products of desired quality and standards to markets including potential agro industries. This involves the identification of market opportunities, the organisation and training of clients, including farmers, processors, and traders to

respond to the demands of existing and potential market opportunities to enhance effective farm agribusiness linkages and agricultural trade.

Objectives

The general objective of this survey is to provide comprehensive information that will guide investment decisions in the cassava sub sector. The specific objectives are grouped under several headings namely: production, processing and equipments, transportation and cluster development, products and products development, market competitiveness and export.

The specific objectives are as follows

1. Identify the technical, institutional, socio-economic and policy opportunities and constraints for promoting the cassava sub sector

2. Assess the domestic market opportunity for cassava products (chips pellets, flour, starch, ethanol and so on) in Nigeria and suggest how this potential could be realised

3. Evaluate the economics of cassava production and processing costs structures (and profitability) of value adding cassava enterprises and suggest reduction strategy

4. Determine optimal locations of processing plants based on identical markets for various cassava products with markets

5. Provide information on marketing cost structure from rural to urban areas for cassava and its products and determine the break-even distance and volume for cassava transportation

6. Make recommendations on how to make cassava and cassava products competitive within the domestic and export markets

Activities

The analysis will follow a vertical agribusiness perspective in which we assume that the cassava sub sector is segmented into four categories were cassava is produced at the farm level by farmers, processed into chips, flour and pellets by processors, and used by agro industries to produce other products like ethanol, dextrin/adhesives, native and modified starch, etc for the other industrial (e.g. textiles, paper, wood, etc) and consumer (food and beverage) markets.

Production

1. Provide information on the production cost for cassava per ha in the cassava producing states in Nigeria

2. Ascertain the cassava varieties available and their actual and potential yield

Processing and Equipments

3. Evaluate the economics of existing cassava processing equipments and new equipment such as flash dryers, solar dryers, centrifuge, washing machine, peeling machine etc.

4. Ascertain the current status of processing technology, and local maintenance capacity in Nigeria

5. Ascertain and evaluate the conversion ratios for different cassava products

Transportation and Cluster Development

6. Provide information on transportation costs from rural to urban areas for cassava tubers, *gari*, etc on kilometre per tonne basis for 30 km, 60 km and 90 km radius

7. Describe the supply chain requirements and identify preliminary logistic framework for cluster development in the SE, SW, and middle belt of Nigeria

Products and Products Market

8. Provide information on price trends for cassava and cassava-based products relative to other dry grain products like maize, sorghum, and rice

9. Determine the availability and existing use of secondary cassava products and the key agribusiness firms as well as their supply chain structure (e.g. farmer groups, processor groups, etc)

10. Identify and assess the status of existing and potential industries (e.g. food, animal feed, textile, paper, plywood, glue, pharmaceuticals, starch, alcohol and so on) that use or can potentially use cassava products

11. Ascertain the market share and size of use of cassava as raw material in these identified industries in Nigeria

12. Identify existing and potential volumes, prices, quality standards, and delivery schedules for cassava based products used by the various industries in Nigeria

Competitiveness and Export

13. Using Private cost ratio, domestic resource costs, nominal protection coefficient for output and profitability coefficient ascertain the degree of cassava competitiveness in Nigeria

14. Provide information on export quality requirements, delivery schedule, shipping costs and requirements, international prices for cassava based products, and niche markets for Nigerian cassava (e.g. composite pellets, etc)

Other information

15. Provide any other information and recommendations that will guide investment decisions in the cassava sub sector

Methodology of the market investment Survey

The market and sub sector study will be carried out through a review of existing documents and surveys. A sub sector is a vertical slice in the commodity chain from input supply to consumption showing all the stages and key players in the chain. In the cassava chain the study will focus on cassava producers, processors and traders as well as banks, input dealers and extension institutions. The study will cover all the major sectors where the cassava and cassava products are (potentially) utilised. These include the food, feed and industrial sectors.

Data will be collected in three stages: first wherever available, published data would be used to establish the structure, conduct and performance of cassava sub-sector. Secondly, a rapid appraisal survey will be conducted using focussed group interviews and key informants to obtain information on trading patterns, transportation facilities, processing costs and marketing systems. The third stage of the study will focus on the captains of industry that use or are potential users of cassava. This industrial survey will among

other things focus on the size and volume of different cassava commodities required in the domestic market.

The study will require extensive travels to institutions, industries, and various States of the federation especially the south-south and south east zones of Nigeria. Visits will be made to the Projects Coordinating Unit, of the Federal Ministry of Agriculture and Rural Development located at Abuja, the National Root Crops Research Institute, Umudike, the State Agricultural Development Projects, reputable cassava fabrication centres such as IITA, ARCEDEM, PRODA, Adis Engineering Lagos, Nova Technologies, the Export Processing Zone Calabar, and Chambers of Commerce and so on. Apart from Abuja, various agribusiness firms located in the major industrial areas of Nigeria and particularly the south-south and south east zones the will be visited. These include industries located in Lagos, Ibadan, Kaduna, Kano, Port Harcourt, Onitsha, Nnewi. Aba, Calabar, and so on.

Information to be collected will include production and price data for cassava tuber, cassava based products (*gari*, chips, flour, starch, etc), and grains such as maize, sorghum, soybean, and rice; availability and cost of cassava processing technology, maintenance capacity, and location of reputable fabricators and large scale processing industries in Nigeria; availability of improved cassava varieties, yield per ha, and suitability for different cassava based products; supply chain requirements, structure for commercialisation and development, market size, segments by product and prices, export limitations, opportunities and incentives, tariffs and barriers and so on.

Team Composition

This study will require a team of three (3) persons (Agricultural economist, Agronomist and post-harvest specialist). An agricultural economist will lead the team and will also collate and document a draft report for the study.

Team Composition

The duration of the survey will be two months while another month will be required to write up a draft of the sub sector survey.

Expected Output

Information on the production cost for cassava per ha in the cassava producing states in Nigeria provided

Information on available cassava varieties and their actual and potential yield provided

The economics of existing cassava processing equipments and new equipment such as flash dryers, solar dryers, centrifuge, washing machine, peeling machine etc evaluated

Information on the current status of processing technology, and local maintenance capacity in Nigeria provided

The conversion ratios for different cassava products evaluated

Information on transportation costs from rural to urban areas for cassava tubers, *gari*, etc on kilometre per tonne basis for 30 km, 60 km and 90 km radius provided

The supply chain requirements and preliminary logistic framework for cluster development in the SE, SW, and middle belt of Nigeria identified

Information on price trends for cassava and cassava-based products relative to other dry grain products like maize, sorghum, and rice provided

Information on the availability and current use of secondary cassava products and the key agribusiness firms as well as their supply chain structure (e.g. farmer groups, processor groups, etc) provided

Information on existing and potential volumes, prices, quality standards, and delivery schedules for cassava-based products used by various industries in Nigeria provided

Information on the degree of cassava competitiveness in Nigeria using private cost ratio, domestic resource costs, nominal protection coefficient for output and profitability coefficient provided

Information on exports quality requirements, delivery schedule, international prices for cassava-based products, and niche markets for Nigerian cassava (e.g. composite pellets, etc) provided

Selection of the most lucrative investments for detailed analysis based on the initial evaluation

Any other information and recommendations that will guide investment decisions in the cassava sub sector provided such as identification of target communities (producers), processors, middlemen, fabricators, and other key stakeholders, using criteria set in the project focus (market access, supporting services, high probability of success, etc).

APPENDIX B

Data Adjustments for Model Development

Model development began with the identification of enterprise budgets that were consistent with those found in each of the regions (PCU, 2002), Table 2). For example sorghum/millet/cowpea enterprise budgets were included in the North West and North East regional models, but not in the models of the North Central, South East, South South and South West.

The resulting regional enterprise budgets had to be adjusted to reflect regional differences. For example, enterprise budget labour costs were adjusted by an index of regional labour costs. We calculated these latter indices. Data on published labour rates for different agricultural activities for each state (PCU, 2002), Table 22) were averaged for each region and then expressed as an index of the calculated national average labour cost.

Enterprise budget crop yields and selling price were replaced by the calculated regional crop yields and selling prices. Regional crop yields were calculated from data obtained while visiting PCU. Regional prices were calculated from data provided by IITA's Rural Sector Enhancement Programme (RUSEP). The above-mentioned formed the core technical and objective coefficients for the regional models.

Regional land constraints were determined as the average of land normally devoted to the crops in the regional models. The regional land constraint was calculated from the data used to calculate regional crop yields. Regional producer food consumption was calculated from multiplying estimates of the percentage of farm production consumed on the farm (RTEP, 1995) by the regional estimate of regional production.

This publication presents an analysis of the actual and potential size of the market for cassava and cassava-based products in Nigeria and reviews what is required in terms of economic, social and physical investments to develop an efficient cassava industrial sector. It aims at guiding investment decisions for donors, banks and policy-makers in the Nigerian cassava subsector.

The outcome of the study works on encouraging an environment whereby the industry agents initiate and activate the market corrections within their power. They are not a set of static rules; on the contrary, they encourage ownership of the problems and difficulties arising from change as well as modifications in order to address local needs and circumstances in a participatory process involving different partners in the new Nigerian cassava industry. The study will interest a wide range of readers including cassava producers, policy-makers, donors and banks, scientists and technicians, non-governmental organizations and the private sector.