

Cassava postharvest needs assessment survey in Nigeria: Synthesis report



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**L. Sanni, C. Ezedinma, R. Okechukwu, J. Lemchi,
F. Ogbe, M. Akoroda, E. Okoro, B. Maziya-Dixon,
P. Ilona, and A. Dixon**

**International Institute of Tropical Agriculture,
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Ibadan, Nigeria
Telephone: (234 2) 2412626
Fax: (234 2) 2412221
Email: iita@cgiar.org
Web: www.iita.org

To Headquarters from outside Nigeria:
C/o Lambourn (UK) Ltd, Carolyn House
26 Dingwall Road, Croydon CR9 3EE, UK

Within Nigeria:
PMB 5320, Oyo Road
Ibadan, Oyo State

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Contents

Preface	v
Acknowledgements.....	vii
Other contributors.....	ix
Acronyms and abbreviations.....	x
Executive summary	xi
Background and concepts	xi
Research approach	xi
Main findings	xii
Political and institutional support	xiii
Market/industrial demand and access.....	xiii
Profitability of selected cassava products	xiv
Observations, conclusion, and recommendations.....	xiv
Background and concepts.....	1
Cassava production and utilization in Nigeria.....	1
The preemptive management of cassava mosaic disease.....	2
Postharvest handling of cassava roots and cassava products	3
Research approach.....	4
Introduction	4
Project objectives	4
Project results/outputs	5
Main findings.....	7
Export market	16
Political and institutional support	27
Market/industrial demand and access.....	29
Observations, conclusions, and recommendations.....	32
Observations.....	32
Conclusion	33
Recommendations	33
References	34

Tables

1. Communities and products selected for SME in each state.....	8
2. Baseline availability of local fabricators and knowledge of potential sources of equipment in prioritized communities.	11
3. Production costs of selected cassava products and costs of land in prioritized communities.	13
4. Community response to constraints in cassava processing.	18
4. Community response to constraints in cassava processing contd.....	19
5. Cassava processing plant ownership preferences in prioritized communities.	21
6. State of key infrastructure in selected communities.	23
7. Availability (number interviewed) of institutional support in the operational states.	28
8. Profitability indices for selected cassava products in the prioritized communities.	31

Figures

1. Map of Nigeria showing operational states of the project.	5
2. Proportion of communities choosing different cassava products for SME...	9
3. Availability of equipment fabricators in the communities selected for siting cassava processing plants.	12
4. Community's knowledge of where to source for the required equipment for selected products.	12
5. Gender differences in wage rates in selected communities.	15
6. Market chain for cassava products in the surveyed communities.....	15
7. Frequency of mention of key constraints to cassava processing in the operational states.	17
8. Dominant cassava processing plant ownership preferences in the prioritized communities.	20
9. State of roads in prioritized communities.	24
10. Electricity supply in prioritized communities.	24
11. Available water supply in prioritized communities.....	25
12. Frequency of mention of communication facilities in prioritized communities.	26
13. Availability of storage structures in prioritized communities.	26

Preface

Cassava and cassava products are important to the majority of Nigerians who eat the products at least once a day. A threat to the crop is a threat to food security in many Nigerian households and a potential cause of great suffering. The Federal Government, in a bid to forestall the repeat of the experience of the 1980s with the cassava mealybug, initiated the Cassava Mosaic Disease (CMD) Prevention Project. The Federal Government of Nigeria supports the project, as well as the 12 state governments of the south-south and southeast zones including Ondo State, the Niger Delta Development Commission (NDDC), the Nigerian National Petroleum Corporation (NNPC), and its joint venture partners. The project seeks to address the critical threat of an outbreak of CMD in Nigeria, increase yield, and diversify the market. The project started in the fiscal year 2003 as an integrated cassava development project operational in the 11 states of the south-south and southeast zones, and Ondo State in the southwest zone of Nigeria.

The overall objective of the project is to create a firewall from the eastern flanks of the country that would break the westward movement of the disease through the development and deployment of high yielding and disease-resistant varieties. The CMD Project is expected to increase cassava productivity and precipitate surpluses that must be mopped up through appropriate processing and marketing interventions. It therefore became necessary to carry out a needs assessment survey that would lead to the setting up of processing and marketing formations in the country. This report summarizes the findings of that exercise as a step in attaining the overall goal of the postharvest component of the preemptive management of CMD in Nigeria.

Acknowledgements

The International Institute of Tropical Agriculture (IITA) gratefully acknowledges the Federal Government of Nigeria, the 11 state governments of the south-south and southeast zones, the Ondo State Government, the Niger Delta Development Commission (NDDC), and the Nigerian National Petroleum Corporation (NNPC) and its joint venture partners. Special thanks also go to the Program Managers of the ADPs in the operational states of the project and their staff, participants in the RRA activities that formed the core of this report, as well as several others who provided the basic data, which formed the raw materials of the report.

IITA also appreciates the Principal Investigator, Dr Lateef Sanni, and his team both here at IITA and at NRCRI, FUTO, UI, Dela Foods, UNN, AIDU, and the respective states whose boundless energy has ensured the successful completion of this work. We also thank Dr K. Adebayo of the University of Agriculture Abeokuta (UNAAB) who worked tirelessly to edit the states' reports and put together the synthesis report of the project.

Hartmann
Director General
International Institute of Tropical Agriculture
April 2005

Other contributors

Prof. E.N.T. Akobundu, Department of Food Science and Technology, Michael Okpara University of Agriculture, Umudike

Prof. B.F.D. Oko, Department of Crop Science, University of Calabar, Calabar

Prof. O.O. Tewe, Department of Animal Science, University of Ibadan, Ibadan

Dr N.J. Enwere, Department of Food Science and Technology, University of Nigeria, Nsukka

Dr R. Ehigiamusoe, MD/CEO, Dela Foods, Benin City

Dr G.N. Asomugha, National Root Crops Research Institute, Umudike

Dr E. Oti, National Root Crops Research Institute, Umudike

Dr U.J. Ukpabi, National Root Crops Research Institute, Umudike

Dr C.I. Iwuoha, Department of Food Science and Technology, Federal University of Technology, Owerri

Dr C.C. Eze, Department of Economics, Federal University of Technology, Owerri

Mr S. Ibana, Department of Agricultural Economics, University of Ibadan, Ibadan

Mrs E.G. Kumokou, Bayelsa State ADP

Mr B. Echemi, Cross River State ADP

Engr I. Azogu, AIDU, Sheda, Abuja

Mr B. Odoemena

Mr R. Asenime, Delta State ADP

Engr H.I.P. Oduh, Postharvest Specialist, Abia State ADP, Umuahia

Mr B.O.E. Agwu, Akwa Ibom State ADP, Uyo

Mr B.C. Eko, Akwa Ibom State ADP, Uyo

Mr A.I. Nwankwo, Ebonyi State ADP, Abakaliki

Mr A.S.O. Oyakhilome, Edo State ADP, Benin City

Engr I.B. Abdulkarem, Edo State ADP, Benin City

Engr R. Edosio, Imo State ADP, Owerri

Mr C.O. Ajagu, Enugu State ADP, Enugu

Mr Madu, Enugu State ADP, Enugu

Mrs J. Arogundade, Ondo State ADP, Akure

Mr O. Adeniyi, Ondo State ADP, Akure

Mr K. Ivanhoe, Rivers State ADP, Port Harcourt

Acronyms and abbreviations

ADP	Agricultural Development Program
B/C	benefit/cost ratio
CBN	Central Bank of Nigeria
CMD	Cassava Mosaic Disease
CMP	Cassava Multiplication Project
FAO	Food and Agriculture Organization
GSM	global system of mobile communication
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
LGA	local government area
MJ	mega joules
NACRDB	Nigerian Agricultural, Cooperative, and Rural Development Bank
NAFDAC	National Agency for Food and Drug Administration and Control
NAOC	Nigerian Agip Oil Company
NDDC	Niger Delta Development Commission
NEPA	National Electric Power Authority
NGO	nongovernmental organization
NRCRI	National Root Crops Research Institute
RRA	rapid rural appraisal
RTEP	Root and Tuber Expansion Program
SME	small and medium-scale enterprises
SON	Standards Organization of Nigeria
SPDC	Shell Petroleum Development Company
UBA	United Bank for Africa

Executive summary

Background and concepts

Cassava plays an important role in Nigeria's food security. The majority of Nigerians eat cassava products at least once a day. However, the unit operations in cassava processing are labor-intensive and time consuming. There is a pressing need, therefore, to mechanize cassava processing bearing in mind that the absence of appropriate machines and efficient dryers constitutes major constraints to full mechanization of cassava processing. Recently, it was discovered that the Ugandan strain of the cassava mosaic disease was moving westwards and had entered Nigeria through Cameroon causing destruction and frustration in its wake. The Federal Government in a bid to forestall the repeat of the experience of the 1980s with the cassava mealybug, initiated the Cassava Mosaic Disease (CMD) Prevention Project. The overall objective of the project is to create a firewall from the eastern flanks of the country that would break the westward movement of the disease through the development and deployment of high yielding and disease-resistant varieties. The CMD Project is expected to increase cassava productivity and precipitate surpluses that must be mopped up through appropriate processing and marketing interventions. It therefore became necessary to carry out a needs assessment survey that would lead to setting up of processing and marketing formations in the country.

Research approach

A team of three/four multidisciplinary scientists carried out a needs assessment survey in the 12 operational states. The survey was carried out in nine communities from the three senatorial zones of the states (Abia, Akwa Ibom, Anambra, Bayelsa, Cross River, Delta, Ebonyi, Edo, Enugu, Imo, Ondo, and Rivers states). The team relied on existing information at the state ADP headquarters to pick the three local government areas, which occupy the position of the highest concentration of cassava production in their respective senatorial zones. A purposive rapid rural appraisal (RRA) was used to generate information at the community, institutional, and market levels for the needs assessment. Major stakeholders (farmers groups, community leaders, cooperative societies, processors, NGOs, financial institutions, fabricators) in cassava production, processing, and end-users were visited and interviewed and information captured using a set of checklists designed by IITA. The CMD team employed a monitoring strategy which included unscheduled visits to survey sites, occasional telephone calls (using GSM), and validation visits to already surveyed communities. The output of the survey report will be presented to various stakeholders in each state before final establishment of processing centers in the selected communities.

Main findings

Community level needs assessment

The most popular cassava product selected by these communities for the small and medium-scale enterprise (SME) projects in their locality was *gari*—chosen by almost three-quarters of the prioritized communities. Cassava flour was selected by 14% of the prioritized communities. This is made up of all the communities in Imo State (Ntu, Etekuru, and Agbodu) and two communities in Edo State (Igueben and Ebese-Ivbiaro). Two of the prioritized communities in this survey selected starch (Ogueka in Edo State and Okpara Waterside in Delta State). Other cassava products mentioned by other communities included in the survey were cassava chips and pellets targeted to the requirement of the animal feed industry. This also has potential for human consumption and *fufu*, which is presently gaining national acceptance in the Nigeria food market.

Only two communities (Ikot Udo Abia in Akwa Ibom State and Ekuku-Agbor in Delta State) have resident equipment fabricators with potentials for providing required maintenance for equipment to be used in the proposed cassava processing plants.

All the communities hoped to source for fresh cassava roots from their community all year round. Some communities, however, indicated that apart from their community, cassava supply to the plant could also come from cooperative groups within the community and neighboring communities. The production costs of selected cassava products in the prioritized communities vary widely. For instance, *gari* is more costly to process in Anambra, Bayelsa, Delta, Enugu, and Rivers states where production costs vary between ₦26.67/kg (Imiringi in Bayelsa State) and ₦71.21/kg (Ndikelionwu in Anambra State). In communities where other products of cassava (ethanol, flour, and starch) were selected for SME, attempts have been made to establish the production costs of these products. When compared to other communities, the production cost of cassava flour in Imo State (₦105.11/kg–₦125.62/kg) was far higher than in Edo State (₦42/kg).

This survey shows that most of the communities studied have major four or five-day markets where they sold their cassava roots and cassava products in their localities. Members of the community and nearby communities who purchased cassava roots processed it for their own use or for sale. Where the prioritized community was located along major interstate highways (e.g., Ipele in Ondo State and Ekuku-Agbor in Delta State), appropriate sites on these highways have transformed to major market locations for cassava products. The implication of these findings is that establishing clear market outlets for cassava products were as important as securing the transformation of fresh cassava roots to these products.

The major constraints to cassava processing were equipment-related problems, finance, low profit levels, bad access roads and transportation difficulties, insufficient supply of cassava roots, and high costs of production. Other constraints to cassava processing mentioned by the communities are drudgery of cassava processing, high costs of processing, and low demand for cassava products.

In some communities, individual investors were willing to finance the project. Women and processor groups were also willing to own a cassava processing plant. It was clearly stated

in a few communities that there were no functional registered associations, cooperatives, NGOs, investor groups, or individuals willing to finance processing of cassava products. However, all the communities prioritized were willing to make land available as well as support the acquisition of cassava processing machines and source for the processing plant through loans.

In one community (Tungbo in Bayelsa State), electricity supply is by generating plants. In another (Ndikelionwu in Anambra State), water is sold by commercial tankers. In most of the prioritized communities, storage facilities for cassava roots and products were not available. There is a need for appropriate storage facilities for the different cassava products. As such, each processing plant should be constructed with an in-built store capacity for handling fresh cassava roots for short periods and for keeping stocks of cassava products for longer periods.

All the cassava processors in the prioritized communities claimed to be aware of the environmental hazards associated with cassava processing. They frequently mentioned effluent liquid, cassava peels, and the offensive odor associated with cassava processing units. In some communities, cassava processing units are mandatorily located outside residential areas.

Political and institutional support

Political goodwill is the first indicator of political support for a development project. To a great extent, this project already enjoys government patronage especially in the provision of basic infrastructural facilities. However, Cross River and Imo states' infrastructural facilities need to be improved. On the other hand, Anambra, Delta, and Edo states have good roads, boreholes, electricity, adequate means of transport, communication, and storage which signifies a solid foundation for the establishment of profitable business ventures.

The main institutions surveyed were financial institutions/banks, equipment fabricators, training institutions, NGOs, cooperative societies, and cassava processing industries. Few of the prioritized communities have resident local fabricators. There are cooperative societies in many of the prioritized communities.

Market/industrial demand and access

Two marketing arrangements were obtained for cassava products in the operational states—direct purchase of the products from the producers by distant wholesalers/middlemen and direct purchase of the products by retailers/middlemen, usually indigenous market association members. During the periods of scarcity, the distant wholesalers usually have an understanding with the rural assemblers to mop up the product for distant evacuation. Industrial demand for cassava-based products in the operational states was still low and did not contribute significantly to high cassava production in these states. Some starch producers withheld market information, which hindered cassava product development efforts.

Profitability of selected cassava products

Gari processing was not profitable due to input-output relationships, technology, and infrastructural environment in Abia, Anambra, Bayelsa, and Cross River states. In contrast, *gari* processing in Akwa Ibom, Ebonyi, and Ondo states was profitable. In these communities, the levels of infrastructural facilities available were satisfactory and production costs moderate.

Cassava flour processing was profitable in Edo State, but not in Imo. The prioritized communities in Edo State have the best combination of infrastructure. Both land and production costs were cheaper in the prioritized communities in Edo when compared to Imo. All these reinforce the argument, as in the case of *gari* processing, that profitability of cassava processing was directly related to the processing environment provided by government and other development institutions in the community.

Observations, conclusion, and recommendations

The absence of appropriate market links and outlets for the products emanating from this project could lead to disenchantment from the participating communities and affect the sustainability of the proposed processing plants. Furthermore, industrial demand for cassava-based products in the operational states was still low and did not contribute significantly to high cassava production in the states. Some industrial processors of starch and cassava chips switched over to *gari* processing enterprise where a market was easily available locally.

Declining prices stemming from bumper cassava harvest anticipated in the Preemptive Management of Cassava Mosaic Disease (CMD) would lead to less than proportionate increases in consumption of cassava products and corresponding declines in revenues for producers. In this respect, a viable option that would protect cassava farmers and processors was desirable. Such a policy would contribute to more than proportionate increases in the consumption of cassava products through increased diversity of available cassava products, opening up of new market opportunities, and creating a buffer system where the cassava processor can hold stock and influence supply in prompt response to market forces.

Cassava postharvest needs assessment survey in Nigeria: Synthesis report

Background and concepts

Cassava production and utilization in Nigeria

Nigeria, with an estimated annual cassava production of 34.5 tonnes (FAO 2002), cropped in about 3.1 million hectares, is presently the world's largest producer of the crop. Amongst the 36 states in the country, the wetter 17 southern states account for about two-thirds of the nation's annual harvest of cassava roots. The estimated daily per capita consumption of cassava in Nigeria contributes about one megajoule (MJ) to the diet (Sanni et al. 2004). Countrywide, over 85% of the total cassava production is processed into *gari*, chips, flour, fermented paste, starch, and *abacha* (Ugwu 1996); largely by farm gate food processors (Nweke et al. 1999). However, most of the cassava produced in the country is consumed as food. The potentials of some of its dry intermediate products as raw materials for the livestock, alcohol, sugar/confectionary, pharmaceutical, and paper and textile industries in and outside Nigeria have not been fully explored.

Furthermore, cassava plays an important role in Nigeria's food security since the majority of Nigerians eat cassava products at least once a day. However, the prospects for expanding domestic demand for food uses in this region are limited necessitating the development of new products (Sanni 2002). Since the unit operations in cassava processing are labor-intensive and time consuming, there is a pressing need to mechanize cassava processing bearing in mind that the absence of cassava peeling machines and efficient dryers constitutes major constraints to full mechanization of cassava processing. The factors, which mitigate against market development for cassava and its processed products include high processing and transport costs, the absence of strong farmer/processor organizations and information system, restricted access to credit, and other processing inputs. In addition, there is scarcely any substantial investment in intermediate products such as cassava chips and flour; and the dearth of agroprocessing industries does not augur well for market development. Inefficiency of the input supply market and inadequate development in institutional capacity and human capital formation are major factors inhibiting the growth of agribusiness enterprises in Nigeria. The necessity for the existence of socioeconomic and political institutions to support and sustain agribusiness outfits (small-, medium-, and large-scale) in the country cannot be overemphasized.

Limited diversification of the use of cassava as an industrial raw material, poor processing and storage infrastructure, the absence of a competitive market for cassava, and weak access to market are, to a large extent, responsible for the slow development of the cassava

processing industry in Nigeria. Increased application of cassava in the food, livestock feed, textile, pharmaceutical, and other industries such as the alcohol industry calls for private-public sector partnership. The private sector should invest in market development and processing machinery while the public sector should provide the needed policy environment and physical infrastructure as well as strengthen the link between cassava producers and processors. These linkages are weak due to underdeveloped structures for commercialization, poor market access, unreliable supply of cassava roots, quality variability of the processed products, low producer prices, and costly market structures such as processing costs (Sanni et al. 1999; Dipeolu et al. 2002; Adebayo et al. 2004).

Presently, some of the dry processed food products from cassava (such as *gari* and *fufu* flour) have been exported to USA and Europe (Dipeolu et al. 2001). Ugwu and Ukpabi (2002) showed that diversification of cassava products through processing could help in sustaining the increasing cassava production in the country. This is, however, after taking care of the challenges posed by other factors such as pests and diseases, government policies, market constraints, products' quality standards, and mechanization of the unit operations in the crop's processing.

The preemptive management of cassava mosaic disease

The first major outbreak of a cassava disease was in the 1980s when the cassava mealybug devastated entire cassava fields and caused distortions that threatened the food security of the country. The intervention of the Federal Government and the International Fund for Agricultural Development (IFAD) was the setting up of the Cassava Multiplication Project (CMP). The project emphasized the development of high yielding and disease-resistant cassava varieties for distribution to farmers. The project was so successful that by 1994, Nigeria's cassava production rose to 36 million tonnes and in the process, became the world's leading producer of cassava. Unfortunately, the emphasis on high production of cassava was not matched by a corresponding attention to processing and marketing issues. This precipitated a cyclical glut/scarcity situation that has plagued the country for the past 10 years, thereby creating untold hardship and pains to cassava farmers.

Recently, researchers discovered that the Ugandan strain of the cassava mosaic disease was moving westwards and had entered Nigeria through Cameroon causing destruction and frustration. The Federal Government in a bid to forestall the repeat of the experience of the 1980s with the cassava mealybug initiated the Cassava Mosaic Disease Prevention Project (CMD). The overall objective of the project is to create a firewall from the eastern flanks of the country that would break the westward movement of the disease through the development and deployment of high yielding and disease-resistant varieties. The CMD project is expected to increase cassava productivity and precipitate surpluses that must be mopped up through appropriate processing and marketing interventions. It therefore became necessary to carry out a needs assessment survey that would lead to the setting up of processing and marketing formations in the country.

The role of IITA in the production of new cassava varieties and the initiation of the postharvest program that would process high standard products is in congruence with the

Federal Government policy on cassava production and processing. This is through the Presidential Initiative on Cassava, which forms a greater part of the perspective plan for root and tuber development in the country. A large proportion of the crops produced in Nigeria are at risk of loss through spoilage due to inadequate processing and preservation. To overcome this, farmers sell their marketable surpluses within a few weeks of harvest at giveaway prices. Then only few months later, food prices increase rapidly and some of these farmers are unable to purchase them, thus reducing their food security and nutritional status.

Postharvest handling of cassava roots and cassava products

For foods that are low in moisture content such as grains, legumes, nuts, and spices, they could be preserved by simply sun-drying to reduce the moisture to safe levels for storage, especially during the dry season or harmattan. For crops such as roots, tubers, fruits, and vegetables with high moisture content, dry season sun-drying yields products which may be fairly acceptable, but sun-drying during the rainy season, especially in the humid tropics of southern Nigeria, becomes almost impossible without the aid of artificial dryers. For crops such as cassava, which is high in moisture and deteriorates soon after harvest, there is need for rapid processing into stable products before spoilage sets in. However, drying alone adds little value to the base raw material, thus limiting income generated for producers and their workforce. In order to overcome the postharvest losses of cassava, there is need to use appropriate postharvest technologies to process cassava to more stable products with higher values added and high demand inside and outside the producing areas. Postharvest activity is of great significance because it makes food more available by avoiding losses, providing better food and nutrition to the people, and increasing exports and foreign exchange earnings. It also provides the right type of raw materials for food and agroprocessing industries, generates employment opportunities, ensures food security, increases income, and reduces poverty due to greater financial returns to the farmer and others involved in production and marketing. It also stimulates more production and ensures a consistent supply of raw materials to industries.

On-farm or household food processing and preservation generally use low-cost equipment, which may have other uses in the home and result in products that may vary widely in quality. Family members are more likely to accept large variations in product quality than consumers who buy the product. On the other hand, commercial food and agroprocessing, manufacturing, and preservation must be carried out under controlled conditions to ensure standard product quality that meets the needs of various consumers. Therefore before establishing a commercial food processing plant using a particular raw material, needs assessment should be done to determine the requirements for the success of the business. Needs assessment should elicit information on the types, sources, storage stability and consistency of supply of raw materials, nature of finished products and storage requirements, level and scale of production, financial capability of the owners and avenues for sourcing more funds, institutional support, type and source of equipment, maintenance and repair facilities including after sales service, expected markets and customers, and micro and macropolicy environments under which the plant will operate.

Research approach

Introduction

The Federal Government of Nigeria, the 11 state governments of the south-south and southeast zones, the Ondo State Government, the Niger Delta Development Commission (NDDC), the Nigerian National Petroleum Corporation (NNPC), and its joint venture partners endorsed an action plan in October 2002 to address the critical threat of an outbreak of the virulent form of CMD in Nigeria. Funding was committed for a four-year project entitled "Preemptive Management of CMD in Nigeria". The project started in the fiscal year 2003 as an integrated cassava development project operational in the 11 states of the south-south and southeast zones, and Ondo State in the southwest zone of Nigeria.

This project responds to an urgent and increasing need of resource-poor farmers, processors, and consumers to increase and sustain cassava-based agricultural production, food systems, commercialization and trade, thereby spurring rural and agroindustrial development in Nigeria.

The goal of this project is to contribute to the sustainable increase in food availability, reduce rural poverty and unemployment, and enhance the agroindustrial and socioeconomic growth in Nigeria.

Through preempting an imminent CMD-associated production crisis, the project aims to promote sustainable and competitive cassava production, improve value-added postharvest technologies, marketing, and agroenterprise development, and commercialize agroindustrial development and trade in collaboration with a wide range of stakeholders (public/private), thereby ensuring food availability, increased economic opportunities, and reduction of poverty in the rural areas.

Project objectives

The objectives of the project are to:

- Mitigate the impact of cassava mosaic disease and prevent its spread throughout Nigeria and West Africa.
- Increase cassava productivity through deployment of high yielding, multiple pest and disease-resistant cultivars, and proven sustainable crop and soil management technologies.
- Promote the adoption of improved and profitable postharvest and processing technologies as well as new product development.
- Improve the value of cassava through increased private sector investment in production, processing, storage, and marketing.
- Increase incomes and improve livelihoods in rural areas through the development of effective and active market information acquisition and dissemination systems, and increased commercialization of cassava.
- Strengthen human and institutional capacity to produce, process, and market cassava efficiently.

Project results/outputs

In implementing this project, the following results/outputs are expected:

- Sustainable and competitive cassava production technologies generated, disseminated, and adopted.
- Promote demand-driven cassava postharvest technologies generated and integrated with competitive production and IPM technologies.
- Promote viable private sector agribusinesses, develop diversified cassava markets, and enhance access to credit institutions.
- Enhance human and institutional capacity to promote private sector investment in the cassava industry.
- Strengthen cassava stakeholders' network and monitor and evaluate the coordination and impact of project activities.

Operational locations

- South-south zone: Rivers, Cross River, Akwa Ibom, Edo, Delta, and Bayelsa states including Ondo State (IITA Onne, Rivers State as zonal hub).
- Southeast zone: Abia, Anambra, Enugu, Imo, and Ebonyi states (NRCRI, Umudike, Abia State as zonal hub (Fig. 1)).



Figure 1. Map of Nigeria showing operational states of the project.

Basis for needs assessment survey

A needs assessment survey was designed to identify processing and marketing needs/opportunities that would promote postharvest technologies (processing and storage) to reduce crop losses, and drudgery; and improve the quality of marketable cassava products for defined markets (domestic and export) and trade.

To achieve this, a meeting was held to resolve major criteria to conduct a needs assessment in major cassava producing LGAs within the CMD states. Those who attended were postharvest specialists from Abia, Akwa Ibom, Anambra, Bayelsa, Cross River; Delta, Ebonyi, Edo, Enugu, Imo, Ondo, and Rivers states and selected scientists from selected universities and research institutes.

Survey design and tools

A team of three/four multidisciplinary scientists carried out a needs assessment survey in the 12 states. The purpose of the study was to select potential communities with the objective of setting up viable small- and medium-scale cassava processing plants.

The survey was carried out in nine communities from the three senatorial zones of the states (Abia, Akwa Ibom, Anambra, Bayelsa, Cross River, Delta, Ebonyi, Edo, Enugu, Imo, Ondo, Rivers states). The team relied on existing information at the state ADP headquarters to pick the three local government areas, which had the highest concentration of cassava production in their respective senatorial zones.

A purposive rapid rural appraisal (RRA) was used to generate information at the community, institutional, and market levels for the needs assessment. Major stakeholders (farmers groups, community leaders, cooperative societies, processors, NGOs, financial institutions, and fabricators) in cassava production, processing, and end-users were visited and interviewed. A set of checklists designed by IITA was used to capture information.

The CMD team employed a monitoring strategy, which included unscheduled visits to survey sites, occasional telephone calls using GSM, and validation visits to already surveyed communities.

The output of the survey report was also presented to various stakeholders in each state before final establishment of processing centers in the selected communities.

Main findings

Community level needs assessment

Communities and cassava products prioritized for SME. The communities and cassava products prioritized in each senatorial zone of the project operational states are presented in Table 1.

Almost 75% of the prioritized communities selected *gari* as the most popular cassava product for the SME projects in their locality (Fig. 2). *Gari* is the most popular processed and consumed cassava product in Nigeria. Considerable advancements have been made at cottage level in the processing of cassava roots into *gari* in the country. This is due mainly to the simple nature of the microprocessing units, level of technology and know-how available, low maintenance costs, and high level of durability of associated equipment.

Cassava flour is produced for direct consumption or as an intermediate product and basic raw material for the confectionery industry. Cassava flour was selected by 14% of the prioritized communities (Fig. 2). This is made up of three communities in Imo State (Ntu, Etekuru, and Agbodu) and two communities in Edo State (Igueben and Ebese-Iybiaro). Cassava flour has great potential in industrial utilization. A substantial proportion constitutes the raw material in making bread, biscuit, cookies, and pastries currently available in the country. The task of obtaining flour from cassava involves grating peeled cassava roots, dewatering the mash, drying the mash, milling the dried mash, and sieving to get the desired quality.

Two types of starch are obtainable from cassava. One is the food grade starch and the other is industrial starch. Starch derived from cassava tubers has a variety of uses. It competes favorably with starch obtained from potatoes, maize, and wheat. The largest consumer of starch is the conversion industry, which produces sweeteners (glucose, syrup, maltose, and dextrose). These sweeteners compete with and substitute sucrose derived from cane and beet sugars. These materials are used in industries to make canned fruit, confectionery, baked goods, ice cream, beverages, alcohol etc. Other uses of starch are as thickeners or fillers in products such as custard, soup, baby food, ice cream, and pharmaceuticals. Also starch is used as a binder in sausages, processed meat, as well as in paper, textile, dextrin, and adhesive industries. This product was selected by two of the prioritized communities in this survey (Ogueka in Edo State and Okpara Waterside in Delta State as shown in Table 1).

Ethanol used in preparing methylated spirit, is an industrial raw material for several products and fuel for vehicles especially in Brazil. It can be prepared from cassava starch through several processes involving gelatinization, hydrolysis, fermentation, and distillation. These technologies are not currently in use at cottage level in Nigeria. The people of Oboro community in Abia State have selected it as their preferred cassava product for SME (Table 1).

Other cassava products mentioned by other communities included in the survey were cassava chips and pellets used in the animal feed industry with potentials for human consumption. *Fufu* is presently gaining national acceptance in the Nigerian food market. The

Table 1. Communities and products selected for SME in each state.

State	Senatorial zone	LGA	Prioritized community	Selected product
Abia	Abia North	Bende	Uzuakoli	Project to decide
	Abia Central	Ikwuano	Oboro	Ethanol
	Abia South	Ukwa West	Ogwe	Gari
Akwa Ibom	Uyo	Etinan/Nsit Ubium	Ikot Udo Abia	Gari
	Ikot Ekpene	Ini	Itu Mbonuso	Gari
	Eket	Okobo	Odobo	Gari
Anambra	Anambra North	Oyi	Umunya	Gari
	Anambra Central	Awka North	Mgbakwu	Gari
	Anambra South	Orumba North	Ndikelionwu	Gari
Bayelsa	Yenagoa	Kolokuma-Opokuma	Odi	Gari
	Sagbama	Sagbama	Tungbo	Gari
	Brass	Ogbia	Imiringi	Gari
Cross River	Cross River South	Odukpani	Ikot Nyong	Gari
	Cross River Central	Obubra	Ochon Town	Gari
	Cross River North	Yala	Okpudu <i>Okpoma</i>	Gari
Ebonyi	Ebonyi Central	Ikwo	Ekpaomaka	Gari
	Ebonyi North	Ohaukwu	<i>Okposhi-Eheku</i>	Gari
	Ebonyi South	Ivo	Ishiagu	Gari
Edo	Edo South	Uhunmwode	Ogucka	Starch
	Edo Central	Esan West	Igueben	Cassava flour
	Edo North	Owan East	Ebese-Ivbiaro	Cassava flour
Enugu	Enugu North	Nsukka	Okpuje	Gari
	Enugu West	Oji River	Akwu Achi	Gari
	Enugu East	Isi-Uzor	Ehamufu	Gari
Delta	Delta North	Ika South	Ekuku-Agbor	Gari
	Delta Central	Ethiope East	Okpara Waterside	Starch
	Delta South	Patani	Patani	Gari
Imo	Owerri	Ngor Okpala	Ntu	Cassava flour
	Orlu	Ohaji/Egbema	Etekwuru	Cassava flour
	Okigwe	Okigwe	Agbobu	Cassava flour
Ondo	Ondo North	Akure North	Iju	Gari
	Ondo Central	Ipele	Ipele	Gari
	Ondo South	Irele	Ode- Irele	Gari
Rivers	South East Rivers	Khana	Wiiyaakara	Gari
	Central Rivers	Etche	Umuebulu	Gari
	Southwest Rivers	Ogba/Egbema/Ndoni	Mgbede	Gari

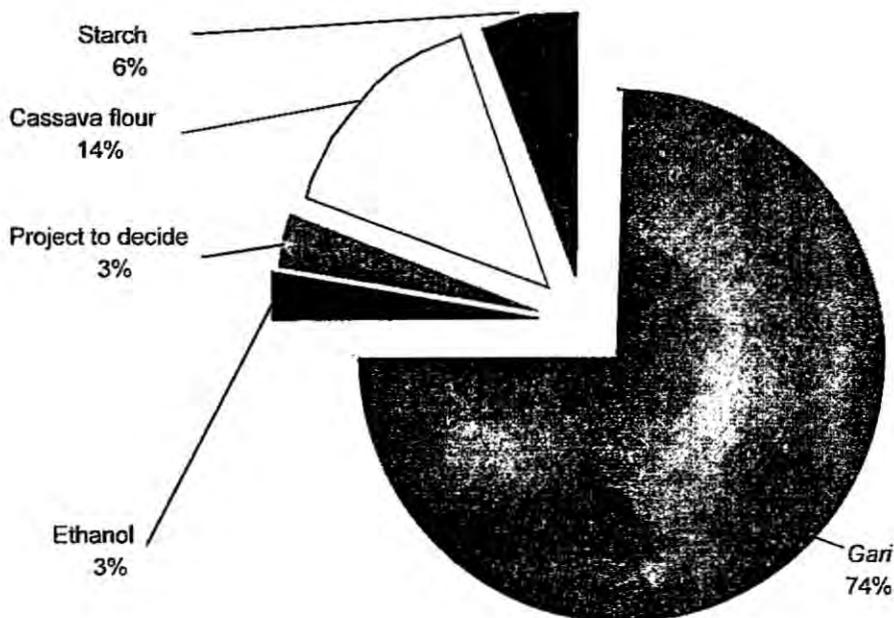


Figure 2. Proportion of communities choosing different cassava products for SME.

survey observed that *fufu* was competing with *gari* on the domestic market. However, these products were not selected by any of the prioritized communities. This was partly because of the negative experiences in cassava chip processing in those communities that had tried it and the lack of knowledge in the processing of shelf-stable, powdered *fufu* that was suitable for commercialization.

Community knowledge and availability of fabricators. The success of SMEs particularly in the food sector is dependent on the availability, use, and adequate maintenance of appropriate equipment for the selected products. Table 2 presents the baseline situation in respect of availability of local fabricators in prioritized communities and the knowledge of potential sources of equipment in each community.

As shown in Figure 3, equipment fabricators were not available in most of the prioritized communities. Only two communities (Ikot Udo Abia in Akwa Ibom State and Ekuku-Agbor in Delta State) have resident equipment fabricators who could provide the required maintenance for equipment to be used in the proposed cassava processing plants. Figure 4 also shows that about two-thirds of the communities did not know where to source for the equipment required for the selected cassava product. This suggests that the success of this project would rely heavily on the ability to establish functional links between cassava processors and equipment fabricators or skilled technicians with the required ability to advise on proper use and assist in the maintenance of the equipment when required.

Availability of cassava roots and production costs. Cassava is the main crop grown in

all the communities visited in this survey. Each community intends to be able to meet the supply of fresh cassava roots to the proposed cassava processing plant. All the communities hoped to source for fresh cassava roots from their community all year round. Some communities however indicated that apart from their community, cassava supply to the plant would also come from cooperative groups within the community and neighboring communities. All the communities however insisted that supplies to the processing plant should be consistent.

The production costs of selected cassava products in the prioritized communities vary widely. As shown in Table 3, *gari* is most cheaply processed in Cross River and Ebonyi states where the production costs vary between ₦8.69/kg (Ekpaomaka in Ebonyi State) and ₦24/kg (Okpudu-Okpoma in Cross River State).

Table 2. Baseline availability of local fabricators and knowledge of potential sources of equipment in prioritized communities.

States	Prioritized community	Availability	Knowledge of source of equipment
Abia	Uzuakoli	NA	No
	Oboro	NA	Yes
	Ogwe	NA	No
Akwa Ibom	Ikot Udo Abia	A	No
	Itu Mbonuso	NA	No
	Odobo	NA	No
Anambra	Umunya	NA	Yes
	Mgbakwu	NA	Yes
	Ndikelionwu	NA	Yes
Bayelsa	Odi	NA	No
	Tungbo	NA	Yes
	Imiringi	NA	No
Cross River	Ikot Nyong	NA	No
	Ochon Town	NA	No
	Okpudu Okpoma	NA	No
Delta	Ekuku-Agbor	A	Yes
	Okpara Waterside	NA	Yes
	Patani	NA	Yes
Ebonyi	Ekpaomaka	NA	No
	Okposhi-Eheku	NA	Yes
	Ishiagu	NA	Yes
Edo	Ogueka	NA	No
	Igueben	NA	No
	Ebese-Ivbiano	NA	No
Enugu	Okpuje	NA	Yes
	Akwu Achi	NA	Yes
	Ehamufu	NA	Yes
Delta	Ekuku-Agbor	A	Yes
	Okpara Waterside	NA	Yes
	Patani	NA	Yes
Imo	Ntu	NA	No
	Etekwuru	NA	No
	Aghobu	NA	No

Note: A = available; NA = not available

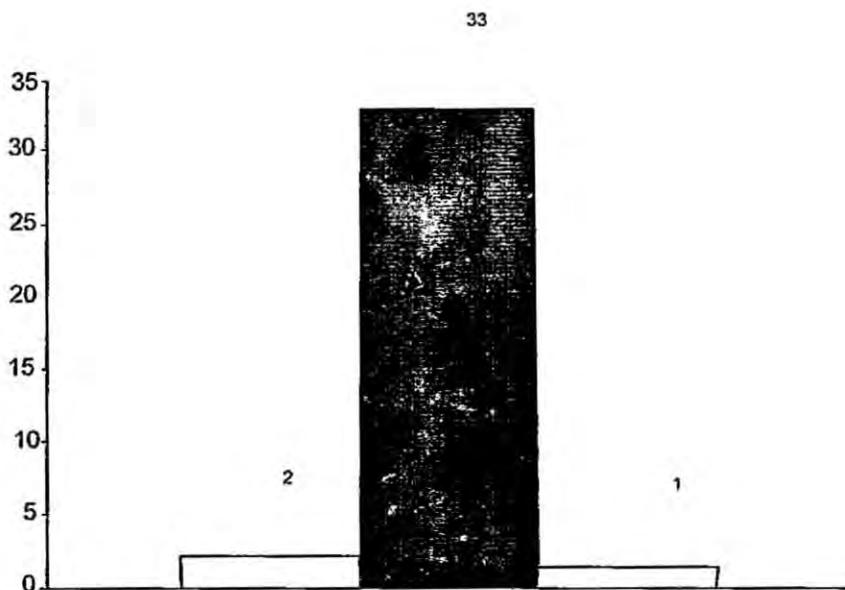


Figure 3. Availability of equipment fabricators in the communities selected for siting cassava processing plants.

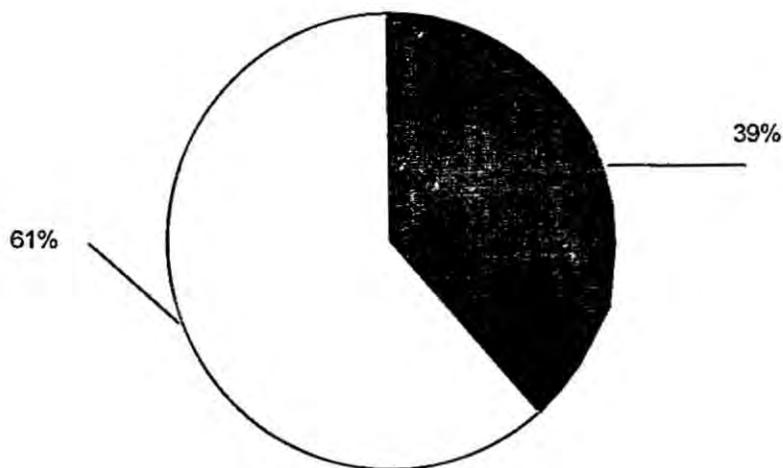


Figure 4. Community's knowledge of where to source for the required equipment for selected products.

Table 3. Production costs of selected cassava products and costs of land in prioritized communities.

State	Senatorial zone	Selected community	Selected product	Land cost N'000/plot	Production costs (N/kg)
Abia	Abia North	Uzuakoli	Project to decide	150	14.5
	Abia Central	Oboro	Ethanol	125	14
	Abia South	Ogwe	Gari	55	36
Akwa Ibom	Uyo	Ikor Udo Abia	Gari	25	18.8
	Ikor Ekpene	Itu Mbonuso	Gari	25	34.8
	Eket	Odobo	Gari	75	40.0
Anambra	Anambra North	Umunya	Gari	150	59.09
	Anambra Central	Mgbakwu	Gari	275	50
	Anambra South	Ndikelionwu	Gari	200	71.21
Bayelsa	Yenagoa	Odi	Gari	125	47.57
	Sagbama	Tungbo	Gari	105	26.99
	Brass	Imiringi	Gari	165	54.21
Cross River	Cross River South	Ikor Nyong	Gari	NS	26.67
	Cross River Central	Ochon Town	Gari	NS	11
	Cross River North	Okpudu	Gari	NS	24
Delta	Delta North	Ekuku-Agbor	Gari	150	8.69
	Delta Central	Okpara	Starch	100	11.65
	Delta South	Patani	Gari	50	9.05
Ebonyi	Ebonyi Central	Ekpaomaka	Gari	25	60
	Ebonyi North	Okposhi-Eheku	Gari	50	42
	Ebonyi South	Ishiagu	Gari	25	42
Edo	Edo South	Ogueka	Starch	50	41.02
	Edo Central	Igueben	Flour	30	41.02
	Edo North	Ebese-Ivbiaro	Flour	200	41.02
Enugu	Enugu North	Okpuje	Gari	NS	41.15
	Enugu West	Akwu Achi	Gari	NS	67.27
	Enugu East	Ehamufu	Gari	NS	41.15
Imo	Owerri	Ntu	Flour	120	73.6
	Orlu	Erekwuru	Flour	75	105.11
	Okigwe	Agbobu	Flour	107.5	125.62
Ondo	Ondo North	Iju	Gari	NS	27.67
	Ondo Central	Ipele	Gari	NS	27.67
	Ondo South	Ode-Irele	Gari	NS	27.67
Rivers	South East Rivers	Wiiyaakara	Gari	250	65
	Central Rivers	Umuebulu	Gari	225	64.28
	Southwest Rivers	Mgbede	Gari	150	57.02

Note: NS = not supplied.

In contrast, *gari* was more costly to process in Anambra, Bayelsa, Delta, Enugu, and Rivers states where production costs varied between ₦6.67/kg (Imiringi in Bayelsa State) and ₦71.21/kg (Ndikelionwu in Anambra State). The focus of the project in these states should therefore target cost reduction either by reducing labor input (substituting with machines) or establishing market links with communities where cheaper raw material could be obtained as well as finding a technique that reduces the cost of fresh root production in the areas. The choice of *gari* as the product for SME in these communities was based on their processing ability (know-how) and ease of use of existing local technology, relative ease of storage, domestic value and social importance, and most importantly, the perceived high opportunity cost of *gari* processing. There is high potential for diversification especially by introducing multiple-use equipment to some of the locations.

In communities where other cassava products (ethanol, flour, and starch) were selected for SME, attempts have been made to establish the production costs of these products. But in the case of ethanol selected by Oboro community in Abia State, estimates deriving from experiences in *gari* have been used. It is also noteworthy from Table 3 that when compared to other communities, the production cost of cassava flour in Imo State (₦105.11/kg–₦125.62/kg) was far higher than in Edo State (₦42/kg).

The cost of land constitutes a significant component of the capital outlay of any project. This survey reveals that nearness of a community to urban centers seemed to make the cost of land more expensive. That is, the more remote a location was, the cheaper the land. On the other hand, locations with higher prices per plot were those near major highways or interconnecting paved roads, and traders and consumers of agricultural products patronized them. As shown in Table 3, a plot of land (50 × 100 ft = 0.45 ha) costs between ₦25 000 (Ikot Udo Abia and Ikot Ekpene in Akwa Ibom State and Ogueka and Ebese-Ivbiaro in Edo State) and ₦275 000 (Mgbakwu in Anambra State) in the prioritized communities. Most of the prioritized communities however opted to supply the land required for the project.

In some cases, women and youths could only acquire land courtesy of the adult male (husband and father) in the family. As shown in Figure 5, this gender difference in access to land also extended to wage rates in about half of the prioritized communities. The implication of this was that where women and youth were the preferred owners of the cassava processing plant, their right to land and wage rate differences had to be reaffirmed so that perceived benefits from the project did not go to unintended beneficiaries.

Sale of cassava and cassava products. The cassava products commonly produced for domestic and commercial uses in the communities studied were *gari*, starch (mostly wet starch), *fufu*, tapioca, and *kpokpogari*. *Gari* is the most commercially produced and consumed cassava product due to the availability of a ready market, high demand from within and outside the communities, and cash income. The commodity trade flows between communities and markets are shown in Figure 6.

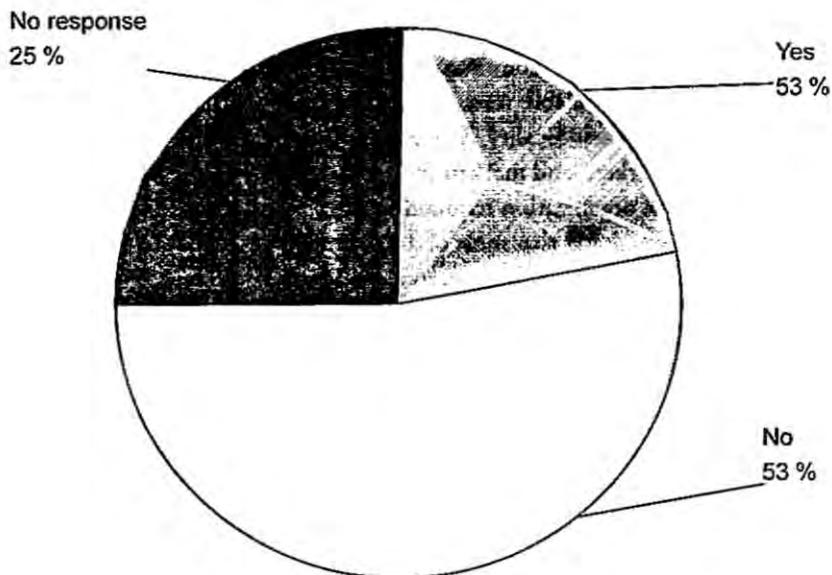


Figure 5. Gender differences in wage rates in selected communities.

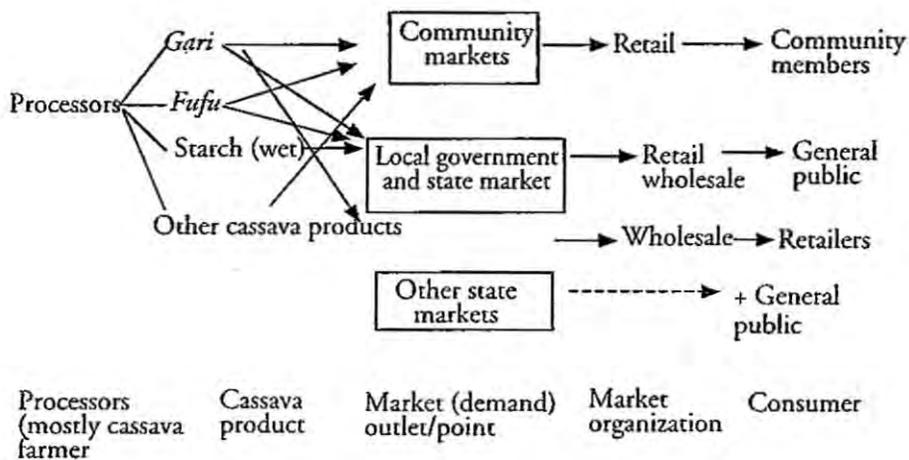


Figure 6. Market chain for cassava products in the surveyed communities.

Export market

Cassava processors in the prioritized communities who were also farmers had a range of market outlets depending on available resources, level of access to market information, and established links outside their locality. These could be at the community level, local government or state level markets, and markets in other states of Nigeria, or in a few cases, export markets. The level of organization required to offer cassava products at these levels of market differs. This survey shows that most of the communities studied have major four or five-day markets where they sell their cassava roots and process cassava in their localities. Cassava roots were purchased by members of the community and nearby communities who process them further for their own use or for sale. Where the prioritized community is located along major interstate highways (e.g., Ipele in Ondo State and Ekuku-Agbor in Delta State), appropriate sites on these highways have transformed into major market locations for cassava products. The implication of these findings is that establishing clear market outlets for cassava products are as important as securing the transformation of fresh cassava roots to these products. The absence of appropriate market linkages and market outlets for the products emanating from this project could lead to disenchantment from the participating communities and affect the sustainability of the proposed processing plants.

Constraints to cassava processing. The major constraints to cassava processing were equipment related problems, finance, low profit levels, bad access roads and transportation difficulties, insufficient supply of cassava roots, and high costs of production (Fig. 7). The high cost of the equipment in addition to accessories and installation costs and building to house them constitute the bulk of problems identified by the prioritized communities. When put together, the cost is enormous for rural farmers or processors and far beyond their reach. Other communities also complained of shortage of processing equipment. The owners of the few available charged high fees to give the required service and sometimes the rush for the service was high. In the case of communities where only one or two grating machines served almost the entire community, the processors were usually stranded in situations when serious machine breakdown occurred. Moreover, most of the communities lacked the technical know-how with respect to appropriate use and maintenance of the equipment. Many of the processors and operators of the cassava processing machines were used to the traditional methods of processing and lacked appropriate knowledge of how to produce high quality cassava products. Many of them however hoped for capacity building.

Finance is another main constraint identified by most of the prioritized communities (Fig. 7). Poverty, especially the inability to gain access to basic necessities of life (such as food, clothing, shelter, etc.); inability to fulfill basic economic and social obligations and lack of self-esteem; inadequate income to meet basic needs; lack of skill or opportunity for gainful employment; and lack of access to productive assets and social constraints to self improvement were some of the prevailing social and economic conditions in many of the prioritized communities. In order to reduce the problems associated with these, the target beneficiaries in this project should be assisted to acquire loans especially to purchase needed equipment, and bear other main capital outlay items for the proposed cassava processing

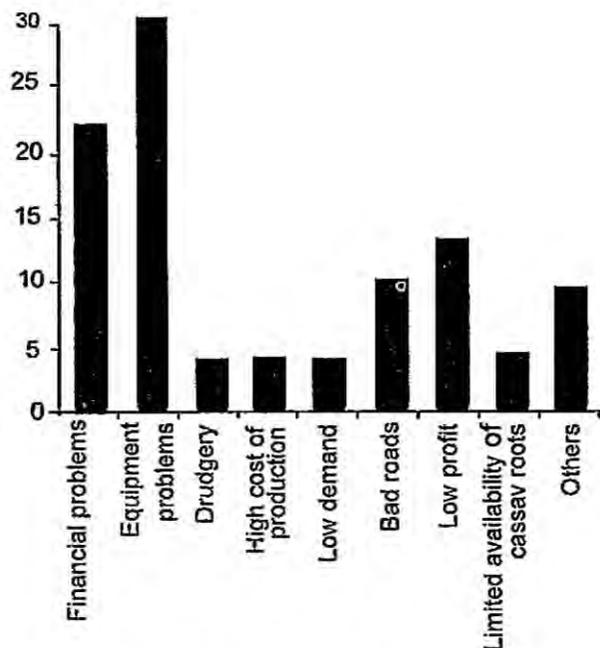


Figure 7. Frequency of mention of key constraints to cassava processing in the operational states.

plants. Many of those already in the business also needed more money to expand the business. Establishing an integrated community cassava processing plant, in which many of the stakeholders were, would transform the economic image of cassava.

The processors also complained that after conversion of cassava to the different products, they were only able to sell at low profit (Fig. 7). This was discouraging. The reason for the low profitability of cassava processing was due to the fact that almost all the critical unit operations were labor-intensive and time consuming and output per capita was small. The introduction of basic labor substituting equipment would therefore be of benefit to most communities.

In several locations in Ebonyi, Enugu, and Delta states, the problem of bad roads was frequently mentioned as a key constraint to cassava processing (Table 4). This resulted in transportation difficulties and high transport costs. Consequently, the farmers and cassava processors transported their cassava roots and products by carrying them on their heads. This limited the quantity taken to the market or processing sites. Where and when transportation was available, it was so expensive that in the end, the farmers had little for the months of hard labor. Hence, farmers abandoned their cassava roots on the farms for many years.

Other constraints to cassava processing mentioned by the communities were the drudgery of processing, high costs of production, low demand for cassava products, and limited availability of cassava roots. The migration of youths to the urban cities caused labor scarcity in the rural industries. This might be due to the poor wages earned by these workers, hence, the search for greener pastures in large cities.

Table 4. Community response to constraints in cassava processing.

State	Senatorial zone	Selected community	Selected product	Main constraints
Abia	Abia North	Uzuakoli	Project to decide	Equipment, low profit, inadequate finance, drudgery
	Abia Central	Oboro	Ethanol	Equipment, drudgery, low profit, finance, health problems from smoke
Akwa Ibom	Abia South	Ogwe	<i>Gari</i>	Nil
	Uyo	Ikot Udo Abia	<i>Gari</i>	Equipment, finance
Anambra	Ikot Ekpene	Itu Mbonuso	<i>Gari</i>	Equipment, cassava diseases, finance, glut in <i>gari</i> supply
	Eket	Odobo	<i>Gari</i>	Equipment, finance
	Anambra North	Umunya	<i>Gari</i>	Equipment, finance, high cost of production
Bayelsa	Anambra Central	Mgbakwu	<i>Gari</i>	Equipment, finance, high cost of production
	Anambra South	Ndikelionwu	<i>Gari</i>	Equipment, finance, high cost of production
	Yenagoa	Odi	<i>Gari</i>	Poor transportation infrastructure, finance, equipment
Cross River	Sagbama	Tungbo	<i>Gari</i>	Finance, low profit, equipment
	Brass	Imiringi	<i>Gari</i>	Equipment, transportation
	Cross River South	Ikot Nyong	<i>Gari</i>	Unsteady market
Delta	Cross River Central	Ochon Town	<i>Gari</i>	Equipment, finance, no warehouses
	Cross River North	Okpudu Okpoma	<i>Gari</i>	Equipment, bad roads,
	Delta North	Ekuku-Agbor	<i>Gari</i>	Limited availability of cassava roots, high cost of processing, low prices of products, low profit, bad roads
Ebonyi	Delta Central	Okpara Waterside	Starch	Limited availability of cassava roots, high cost of processing, low prices of products, low profit, bad roads
	Delta South	Patani	<i>Gari</i>	Seasonal variation in cassava supply, equipment, finance,
	Ebonyi Central	Ekpaomaka	<i>Gari</i>	Equipment, finance, bad roads, unsteady market
Ebonyi	Ebonyi North	Okposhi-Eheku	<i>Gari</i>	Finance, bad roads
	Ebonyi South	Ishiagu	<i>Gari</i>	Equipment, bad roads, low profit, distance to processing site

Table 4. Community response to constraints in cassava processing contd.

State	Senatorial zone	Selected community	Selected product	Main constraints
Edo	Edo South	Ogucka	Starch	Finance, equipment, low profit
	Edo Central	Igueben	Cassava flour	Finance, equipment, low profit
	Edo North	Ebese-Ivbiaro	Cassava flour	Finance, equipment, low profit
Enugu	Enugu North	Okpuje	Gari	Bad roads, equipment, low profit, finance
	Enugu West	Akwu Achi	Gari	Finance, low market prices, low profit, drudgery equipment
	Enugu East	Ehamufu	Gari	Finance, bad roads,
Imo	Owerri	Ntu	Cassava flour	Equipment
	Orlu	Etekwuru	Cassava flour	Equipment
	Okigwe	Agbobu	Cassava flour	Equipment, transportation
Ondo	Ondo North	Iju	Gari	Low prices
	Ondo Central	Ipele	Gari	Equipment, fuel scarcity, low profit
	Ondo South	Ode-Irele	Gari	Equipment, unsteady market,
Rivers	South East Rivers	Wiyaaakara	Gari	Declining extension services, finance, equipment
	Central Rivers	Umuebulu	Gari	Unsteady market, finance, equipment
	Southwest Rivers	Mgbede	Gari	Equipment, power failure, fuel scarcity, low demand, low profit

Willingness to own cassava processing plant. All the communities visited were ready to source for processing plant through loans at low interest rates. In some communities, individual investors were willing to finance the project. Women and processor groups were also willing to own a cassava processing plant. But in these cases, it was advisable that the land use status of such groups be ascertained before assenting to their request. In some communities, women and youths could only have access to land through the adult males of the community. This situation may impinge on the long-term sustainability of the project if the terms of usufruct rights are not clearly defined before the commencement of the project. Most of the communities were ready to start the building of the plant as soon as government was ready.

In some communities, it was clearly stated that there were no functional registered associations, cooperatives, NGOs, investor groups or individuals willing to finance processing of cassava products. In many others, the names and contact persons of such groups were provided. All the communities prioritized were willing to support machines for cassava processing and are ready to source for the processing plant through loans.

Plant ownership preferences. As shown in Figure 8, all kinds of ownership preferences are offered in the prioritized communities. The importance of these was that each community had to be addressed by its own specific options. This is presented in Table 5. In Oboro community, Abia State, it was important to identify the partners and the terms of partnership before the commencement of the project. At Umunya, Anambra State; Ishiagu, Ebonyi State; and Okpuje and Akwu-Achi, Enugu State, the investors indicated an interest by clarifying how much they were willing to invest and the contractual agreement among the investors.

In Ogueka, Edo State, they were to confirm if there were other NGOs competing for the projects and what the NGOs or contending NGOs were willing to offer as counterpart contributions to the project. In communities where the entire community or a specific cooperative association were mentioned, it was ascertained who the preferred owners of the cassava processing plant were, the declaration of interest in terms of offering community land free of charge to the project, the record of cooperative activities as well as a clear identity of the individuals who would be responsible for the day-to-day management of the plants.

The implication of the foregoing argument is that there was a need to ensure that internal wrangling within the prioritized communities with respect to the ownership of the cassava processing needed to be avoided to ensure the sustainability of the project. In many

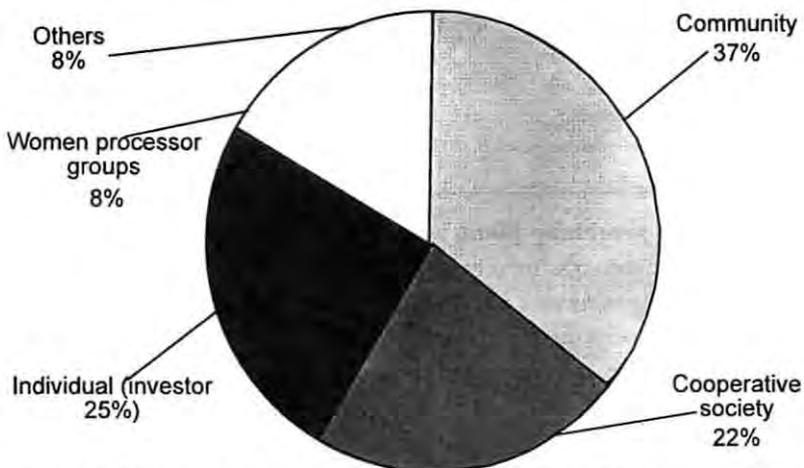


Figure 8. Dominant cassava processing plant ownership preferences in the prioritized communities.

Table 5. Cassava processing plant ownership preferences in prioritized communities.

State	Senatorial zone	Selected community	Selected product	Plant ownership preference
Abia	Abia North	Uzuakoli	Project to decide	Cooperative society
	Abia Central	Oboro	Ethanol	Partnerships
	Abia South	Ogwe	Gari	Indifferent
Akwa Ibom	Uyo	Ikot Udo Abia	Gari	Cooperative society
	Ikot Ekpene	Itu Mbonuso	Gari	Cooperative society
	Eket	Odobo	Gari	Cooperative society
Anambra	Anambra North	Umunya	Gari	Investors
	Anambra Central	Mgbakwu	Gari	Community
	Anambra South	Ndikelionwu	Gari	Individual
Bayelsa	Yenagoa	Odi	Gari	Cooperative society
	Sagbama	Tungbo	Gari	Individual
	Brass	Imiringi	Gari	Individual
Cross River	Cross River South	Ikot Nyong	Gari	Cooperative society
	Cross River Central	Ochon Town	Gari	Community
	Cross River North	Okpudu Okpoma	Gari	Community
Delta	Delta North	Ekuku-Agbor	Gari	Community
	Delta Central	Okpara Waterside	Starch	Community
	Delta South	Patani	Gari	Women group
Ebonyi	Ebonyi Central	Ekpaomaka	Gari	Community
	Ebonyi North	Okposhi-Eheku	Gari	Community
	Ebonyi South	Ishiagu	Gari	Investors
Edo	Edo South	Ogucka	Starch	NGO
	Edo Central	Igueben	Cassava flour	Community
	Edo North	Ebese-Ivbiaro	Cassava flour	Community
Enugu	Enugu North	Okpuje	Gari	Investors
	Enugu West	Akwu Achi	Gari	Investors
	Enugu East	Ehamufu	Gari	Investors
Imo	Owerri	Ntu	Cassava flour	Community
	Orlu	Erekwuru	Cassava flour	Cooperative society
	Okigwe	Aghobu	Cassava flour	Cooperative society
Ondo	Ondo North	Iju	Gari	Individual
	Ondo Central	Ipele	Gari	Processor groups
	Ondo South	Ode-Irele	Gari	Community
Rivers	Southeast Rivers	Wiiyaakara	Gari	Group
	Central Rivers	Umuebulu	Gari	Community
	Southwest Rivers	Mgbede	Gari	Community

instances, such internal problems have delayed project takeoff, hindered smooth operations, or led to unceremonious termination of the project.

Availability of land and other infrastructure. Land is available for building cassava processing plants in all the communities prioritized. All the communities claimed to possess large contiguous farmland for cassava production and for the processing plant. They were also willing to give the land for this project. In most cases, the land could be acquired from any member of the community except women and youths, who could own land courtesy of the adult male (husband and father) in the family. It is important to note that cassava farmlands in these communities were difficult to estimate because of the fragmented farm areas (though each community described this as multiples of acreage of farmland) generally cultivated. Another major factor was the nature of land tenure ownership. About 70–80% of the land was owned and managed by men who grew cassava and other root crops such as yam for marketing and consumption while women and grown-up children who grew cassava as a cash crop, managed the rest of the farmland. Consequently, the success of a cassava processing plant in many of these communities may rest largely on the establishment of large cassava farms with planned (phased) planting and harvesting periods.

The basic infrastructure assessed includes road, transportation, electricity, water supply, communication, and storage structure (Table 6). As shown in Figure 9, 72% of the prioritized communities have good access roads. The importance of this is that in some communities (Umuriya in Anambra State; Ikot Nyong and Ochon Town in Cross River State; Okposhi-Eheku in Ebonyi State, Okpuje and Ehamufu in Enugu State; and all the prioritized communities in Imo State), discussions with local and state governments on the provision of access roads to project sites should be explored. In addition, the Niger Delta Development Commission's (NNDC) attention could be directed to these locations to facilitate the construction and maintenance of roads in these communities. As pointed out earlier, the absence of access roads is one of the key elements responsible for the high production costs and low level of access to market in these communities.

Table 6. State of key infrastructure in selected communities.

State	Prioritized community	Road	Water	Electricity	Means of transport	Communi- cation	Storage facilities
Abia	Uzuakoli	Good	Pipe borne	NEPA	VMB	NR	NR
	Oboro	Good	Borchole	NEPA	VMB	GSM	NR
	Ogwe	Good	Hand pump	NEPA	VMB	GSM	NR
Akwa Ibom	Ikor Udo Abia	Good	Stream/borchole	NEPA	VM B	Nil	Nil
Anambra	Iru Mbonuso	Good	Stream	Nil	VMB	Nil	Nil
	Odobo	Good	Stream	NEPA	VMB	GSM	NR
	Umunya	Bad	Stream/borchole/ well	NEPA	VMB	GSM	Nil
Bayelsa	Mgbakwu	Good	Borehole	NEPA	VMB	GSM	Nil
	Ndikelionwu	Good	Stream/borchole/ tankers	NEPA	VM	GSM	Nil
	Odi	Good	Stream	Nil	VMB	GSM	Nil
Cross River	Tungbo	Good	Pipe borne	Generator	VMCP	GSM	Nil
	Imiringi	Good	Unsatisfactory	NEPA	VMC	GSM	Nil
	Ikor Nyong	Bad	Unsatisfactory	Nil	HV	NR	NR
Delta	Ochon Town	Bad	Unsatisfactory	Nil	HV	NR	NR
	Okpudu	Good	Borehole	NEPA	HWV	NR	NR
	Ekuku-Agbor	Good	Pipe borne	NEPA	VM	GSM	Nr
Ebonyi	Okpara	Good	Pipe borne	NEPA	VM	GSM	Nr
	Patani	Good	Pipe borne	NEPA	VM	LD/GSM	Nr
	Ekpaomaka	Good	Unsatisfactory	NEPA	VMB	GSM	Private
Edo	Okposhi- Eheku	Bad	NR	NEPA	VMB	Nil	Private
	Ishiagu	NR	Pipe borne	NEPA	VMB	PO, GSM	Private
	Ogucka	Good	Borchole	NEPA	VM	GSM	Homestead
Enugu	Igueben	Good	Borehole	NEPA	VMR	GSM	Homestead
	Ehese-Ivbiaro	Good	Stream	NEPA	VM	GSM	Nr
	Okpuje	Bad	Stream/borchole	Nil	VMBWH	PA, GSM	Nil
Imo	Akwu Achi	Good	Stream	NEPA	VMBWH	PA, GSM	Private
	Ehamufu	Bad	Stream	Nil	VMBWH	PA, GSM	Private
	Ntu	Bad	Stream/borchole	NEPA	B	Nil	Nil
Ondo	Etekwuru	Bad	Stream/borchole	NEPA	B	Nil	Nil
	Agbobu	Bad	Stream	Nil	B	Nil	Nil
	Iju	Good	Stream/well	NEPA	VMH	GSM	NR
Ondo	Ipele	Good	NR	NEPA	VM	GSM	NR
	Ode-Irele	Good	Borehole	NEPA	VM	GSM	NR

Note: V = vehicle; M = motorcycle; B = bicycle; W = wheelbarrow; C = canoe; P = power boats; H = head portage; LD = land phone; GSM = global system of mobile communication; PA = postal agency, PO = post office; NR = no response

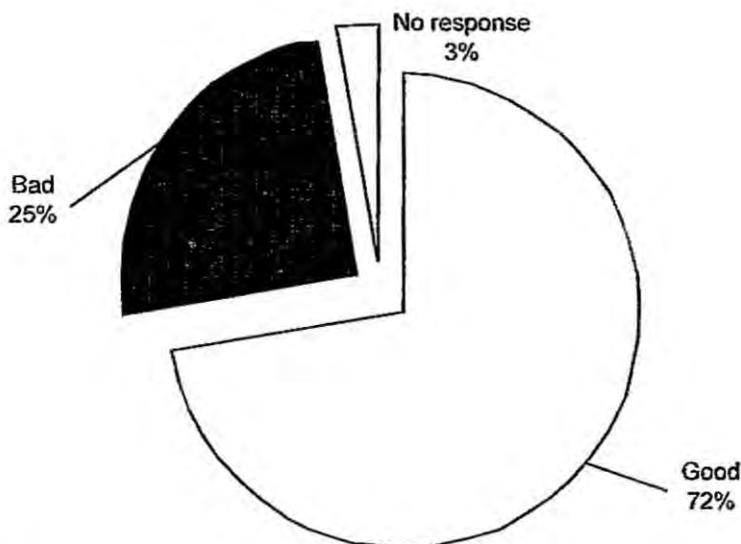


Figure 9. State of roads in prioritized communities.

The bicycle is the major means of transportation in these communities and this was done with ease irrespective of the state or nature of the roads. Goods may be moved several times to a centrally located market where clients converge with buses, lorries, or vans to load the products (Table 6).

About 78% of the prioritized communities have access to electricity (NEPA) though irregular and unreliable. However, Tungbo in Bayelsa State gets electricity using generating plants. Similar arrangements may be made for the communities without electricity (Fig. 10). This may be done in conjunction with NDDC, the local and state governments, or oil companies operating in the area.

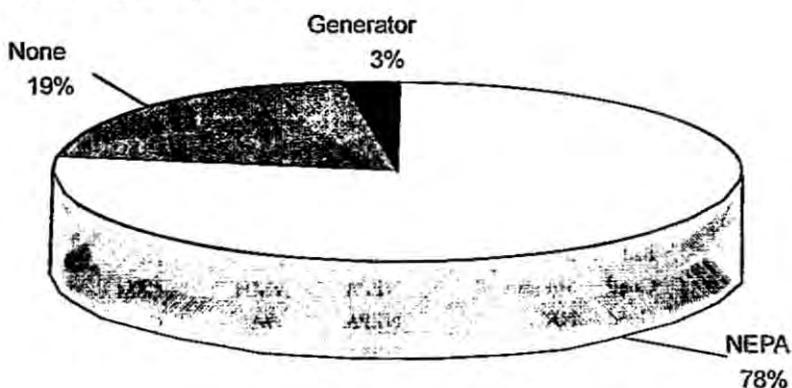


Figure 10. Electricity supply in prioritized communities.

Streams are the major source of water supply in the prioritized communities (Fig. 11). But boreholes and pipe borne water were also found in some communities. The main limitations here are the issues of quality and standards. For the food industry, pipe borne water or boreholes are the only acceptable water by the National Agency for Food and Drugs Administration and Control (NAFDAC). It is important therefore that in communities where pipe borne water was not available (in this case 29 of the 36 prioritized communities), the construction of an adjoining borehole was recommended. People with commercial tankers sold water to Ndikelionwu communities in Anambra State (one of the prioritized communities). A 20-liter container was sold for ₦5 or ₦10 depending on the season of the year and it was only available to the few who could afford borehole water.

In today's business environment, the position of communication and telecommunication is paramount. It offers a cheaper alternative to frequent travel in making business contacts and contracts, and provides an ample opportunity to reach out and be reached with current advances in the business environment. The most frequently mentioned communication facility in the prioritized communities is the global system of mobile communication (GSM). Communication is possible in 26 of the prioritized communities via GSM (Fig. 12). To a lesser extent, post offices, postal agencies, and land phones are also mentioned. Particular attention needs to be paid to the six communities where there were no communication facilities (Ikot Udo Abia and Itu Mbonuso in Akwa Ibom State; Okposhi-Eheku in Ebonyi State; and the three communities in Imo State). The possibility of facilitating their linkage to the GSM network should be explored. This will allow such communities to link up with equipment fabricators, project facilitators, and other market links more easily and contribute to the overall success of the project.

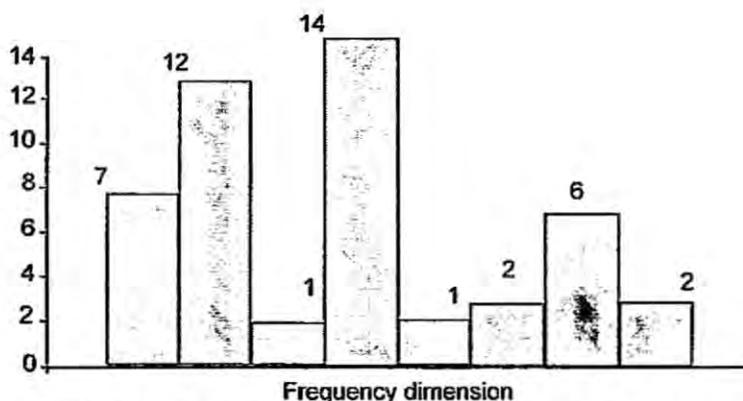


Figure 11. Available water supply in prioritized communities.

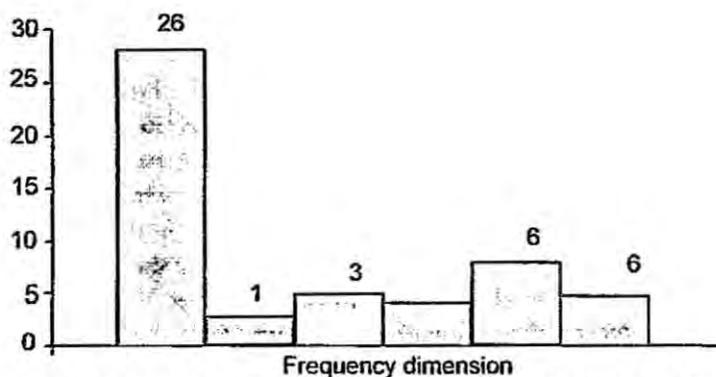


Figure 12. Frequency of mention of communication facilities in prioritized communities.

Storage facilities for cassava tubers and products are not available in most of the prioritized communities (Fig. 13). Since cassava tubers have rapid postharvest deterioration, processing into the various products rarely exceeded demand for each market day. This situation may however change with the introduction of commercially oriented cassava processing plant. There is need for appropriate storage facilities for the different cassava products which emanate from the plants. As such, each processing plant should be constructed with an in-built store capacity for handling fresh cassava roots for short periods and for holding stocks of cassava products for longer periods.

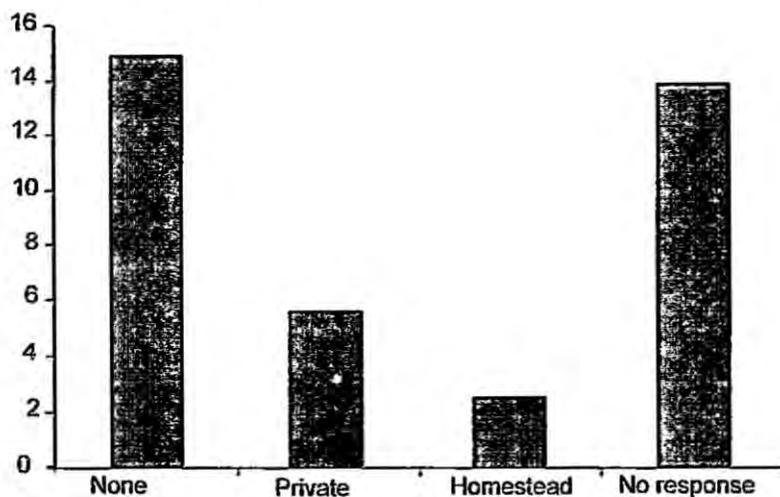


Figure 13. Availability of storage structures in prioritized communities.

Managing cassava waste. All the cassava processors in the prioritized communities claimed to be aware of the environmental hazards associated with cassava processing. Frequent mention was made of effluent liquid, cassava peels, and the offensive odor associated with cassava processing units. There is however a wide variation in how each community manages these wastes. In some communities, it is mandatory to locate cassava processing units outside the residential area of the community. In others, the effluent liquid is either drained into open or closed pits and the peels used in most cases for livestock feed or converted into manure for pineapples, plantains, and other crops.

As regards the quality and hygiene, in most instances, the peeled cassava roots were not usually thoroughly washed due to insufficient water. The graters were sometimes washed after the day's operations, but usually, the washing was not thorough. The grated cassava was most times placed on the bare floor without considering hygienic practices. The fried *gari* was placed in open containers where a lot of contamination took place. There is need to train processors in the area of quality control if *gari* and other cassava products are to meet the required standard for both local and international markets.

Political and institutional support

Political support. Political goodwill is the first indicator of support for a development project. To a great extent, this project is already enjoying wide government patronage. The sustainability of such support is however important for the eventual success of the project and the provision of basic infrastructural facilities is the most physical demonstration of political support. In this regard, Table 6 gives a holistic view of the situation of key infrastructure in the prioritized communities. In this respect, the rating of Cross River and Imo states need to be improved. Bad roads, unsatisfactory water sources, carrying cassava roots and products on the head, and absence of communications and storage infrastructures are setbacks for the take off of a meaningful development project.

At the other extreme, Anambra, Edo, and Delta states with good roads, boreholes, electricity, and adequate means of transport, communication and storage signify a good foundation for the establishment of profitable business ventures.

Institutional support. The main institutions investigated in this survey were financial institutions/banks, equipment fabricators, training institutions, NGOs, cooperative societies, and cassava processing industries. As shown in Table 7, only the Edo State team did not cover the financial institutions and both Bayelsa and Delta states did not cover fabricators. While this is not an indication that these institutions were not available in both states, it suggests that reaching them might have been difficult.

Table 7. Availability (number interviewed) of institutional support in the operational states.

State	Financial institutions/banks	Fabricators	Training institutions	NGOs	Cooperative societies	Cassava processing industries
Abia	4	4	0	0	0	0
Akwa Ibom	3	5	1	1	1	0
Anambra	9	9	0	0	6	0
Bayelsa	3	0	0	1	2	0
Cross River	4	3	0	0	9	0
Delta	2	0	0	2	3	0
Ebonyi	5	4	2	0	4	3
Edo	0	7	2	0	0	5
Enugu	6	3	0	0	0	0
Imo	3	4	0	0	0	0
Ondo	4	3	1	1	0	2
Rivers	3	3	2	0	0	1

Financial institutions/banks. The most frequently mentioned financial institutions in all the operational states were the Nigerian Agricultural Credit and Rural Development Bank (NACRDB), First Bank Plc, Union Bank Plc, and the United Bank for Africa (UBA) Plc. A visit to these banks mostly located in state capitals showed that there were differences in interest rates and loan disbursement and repayment procedures. For the commercial banks, the interest rate is between 19 and 21%, while NACRDB lends at 8%. The general problems discouraging farmers and processors from accessing bank loans were high interest rate, protocol, illiteracy, and repayment schedules. Apart from these, the banks were willing to lend to interested persons/groups including farmers/agroprocessors. However, at the community level, only a few farmers have benefited from credit/loans for their farming operations.

Fabricators. Few of the prioritized communities have resident local fabricators. Most of the fabricators interviewed are located in major cities and state capitals. They have the capacity to fabricate and maintain different types of cassava processing machines. They also render after-sales services and some have the ability to service other machines. Power failure, poor access to raw materials, and finance were some of the problems confronting the business.

Cooperatives/farmer associations/NGOs. There are cooperative societies in many of the prioritized communities. But most of the organizations were weak and needed regular capacity building to meet up with the challenges of group approach to project implementation. The training institutions in all the states were willing to take the responsibility of training farmers and processors, or groups if the need arose.

Only a few NGOs operated in the states. The NGOs, where available, were active in microcredit and financing of agroprocessors and capacity building. The sources of funds to most of them included grants from donor agencies (Ford Foundation, Center for Population and Development, EED Germany, New Nigerian Foundation, etc.), loans from banks, savings from members, and revolving fund schemes.

Market/industrial demand and access

In all the communities assessed, it was discovered that large quantities of cassava products were produced daily. Large volumes of these products were daily evacuated from these communities by marketers (middlemen) to cities such as Lagos, Onitsha, Aba, Abuja, Port Harcourt, Kano, and Warri, etc. This further justifies not only high production and availability of cassava roots in these communities, but also confirms that the proposed projects would be self-sustaining when established and fully functional.

Two marketing arrangements are obtainable for cassava products in the operational states. These include direct purchase of the products from the producers by distant wholesalers/middlemen. In some cases, they contracted indigenous agents on a monthly or yearly basis for daily collection of the products. Their houses or stores served as collection centers from where the products were hauled to the cities. The other arrangement was direct purchase of the products by retailers/middlemen usually indigenous market association members. During scarcity, the distant wholesalers usually had an understanding with the retailers/rural assemblers to mop up the product for distant evacuation. *Gari* was bagged in 100 kg while wet *fufu* was either in 50, 100, or 200 kg before loading into the trucks to their final destinations. The effort of the producers and processors to determine the prices of their products is still weak and breaks down at every little bumper harvest or during the wet period.

In some cases, direct producers traveled away from the market vicinity to cities or other distant markets to break the monopoly and exploitation of the wholesalers, retailers, and contract agents. But produce officers on the highways, police extortion, and insecurity from armed robbers were problems to the sellers. Sometimes payment of school fees at the beginning of every academic year¹ by wards/school children created good opportunities for the middlemen to cart away products at giveaway prices. Other factors that helped middlemen to influence the prices were their membership in one commodity line or another, economic frustration, poverty level, and environmental hazard in the farm. But price control by middlemen breaks down completely during the dry season when they have to struggle to meet city demand. This survey shows that a price range of ₦1200–₦1500 was obtainable during the wet season and was as high as ₦2600–₦3000 during the dry season for a basin of *gari* weighing 30 kg. *Fufu* was sold in wraps of 500 gm, 1 kg, or 2 kg at a price of ₦20, ₦30, and ₦60, respectively, during the wet season and about double the price during the dry season.

Industrial demand for cassava-based products in the operational states was still low and did not contribute significantly to high cassava production in these states. Most micromillers who were into starch production enterprises were not doing well. Some had closed down

completely due to poor or no access to market. Some were operating at low capacity. Others switched over to *gari* processing enterprise where a market was easily available locally. Some of the processors who owned large cassava farms were also diverting to *fufu* production, which involves less technical inputs.

Some starch producers hoarded market information, which hindered cassava product development efforts. Many people who owned cassava farms virtually abandoned their two/three-year farms due to poor market access for starch production for which the farm was cultivated. This scenario presents a great challenge to the project and a good opportunity to expand enterprise development and create an effective market linkage framework to support the project.

Profitability of selected cassava products. The results of profitability analysis for the cassava products selected by each of the prioritized communities are presented in Table 8. In each case, the depreciation on processing shed, machinery, tools, and implements were based on the estimate from the straightline method. The cost of capital (10%) was based on the interest rate from the state microcredit agency. The essential operations in cassava roots processing into *gari* (peeling, washing, grating, fermentation, dewatering, depulping, sifting, frying, and packaging), cassava flour, and starch (peeling, washing, rasping, milling, sieving of pulp, and drying) were taken into consideration in the analysis.

As shown in Table 8, *gari* processing was not profitable with the current level of input-output relationships, technology, and infrastructural environment in Abia, Anambra, Bayelsa, and Cross River states. While high costs of production and poor levels of infrastructural facilities may explain the losses in Cross River and Imo states, the loss in Anambra State was due to high fixed costs shown in the negative net returns (–N17/kg), but positive gross margin (N6.64/kg). In contrast, *gari* processing in Akwa Ibom, Ebonyi, and Ondo states were profitable. In these communities, the level of infrastructural facilities available was satisfactory (Table 6) and production costs are moderate (Table 3). The implication of these findings is that the success and sustainability of the projects in Abia, Anambra, and Bayelsa states required careful planning, appropriate coordination of diverse agencies, and physical demonstration of governmental commitment to rural development especially in the prioritized communities. One way by which the project could incorporate sustainability was by introducing flexible technologies that allow communities to diversify cassava products produced in tune with market situations and realities.

The production of starch in Oguéka, Edo State and Okpara Waterside, Delta State was profitable and should be encouraged. Benefit-cost ratio (B/C) in each of these communities were above Unity suggesting that processing starch in these communities would yield an additional 40–50k for every naira of cost incurred at current levels of input-output relationships.

Cassava flour processing was profitable in Edo State, but not in Imo (Table 8). The prioritized communities in Edo State had the best combination of infrastructural facilities in the survey (Table 6). Both land and production costs were cheaper in the communities prioritized in Edo when compared to Imo (Table 3). All these reinforce the argument

presented in the case of *gari* processing above that profitability of cassava processing was directly related to the processing environment provided by government and other development institutions in the community.

Table 8. Profitability indices for selected cassava products in the prioritized communities.

State	Senatorial zone	Selected community	Selected product	Net return N/kg output	Gross margin N/kg output	B/C ratio
Abia	Abia North	Uzuakoli	Project to decide	-61.25	-44.39	0.28
Akwa Ibom						
Anambra	Abia Central	Oboro	Ethanol	na	na	na
Bayelsa	Abia South	Ogwe	<i>Gari</i>	-81.88	-59.87	0.24
Cross River	Uyo	Ikor Udo Abia	<i>Gari</i>	5.40	5.41	1.48
	Ikot Ekpene	Itu Mbonuso	<i>Gari</i>	5.31	3.08	1.15
	Eket	Odobo	<i>Gari</i>	2.71	2.71	1.10
	Anambra North	Umunya	<i>Gari</i>	-17.01	6.64	0.68
	Anambra Central	Mgbakwu	<i>Gari</i>	-17.01	6.64	0.68
	Anambra South	Ndikelionwu	<i>Gari</i>	-17.01	6.64	0.68
	Yenagoa	Odi	<i>Gari</i>	-115.56	-66.39	0.39
	Sagbama	Tungbo	<i>Gari</i>	-43.31	-21.11	0.59
	Brass	Imiringi	<i>Gari</i>	-110.58	-101.97	0.29
	Cross River South	Ikot Nyong	<i>Gari</i>	2.49	2.49	1.09
	Cross River Central	Ochon Town	<i>Gari</i>	-2.25	-2.25	0.80
	Cross River North	Okpudu Okpomza	<i>Gari</i>	-733	-7.33	0.90
Delta	Delta North	Ekukur-Agbor	<i>Gari</i>	8.85	19.08	1.2
	Delta Central	Okpara	Starch	32.73	60.87	1.4
	Delta South	Patani	<i>Gari</i>	8.85	19.08	1.2
Ebonyi	Ebonyi Central	Ekpaomaka	<i>Gari</i>	6.78	16.33	1.19
	Ebonyi North	Okposhi-Eheku	<i>Gari</i>	6.78	16.33	1.19
	Ebonyi South	Ishiagu	<i>Gari</i>	6.78	16.33	1.19
Edo	Edo South	Oguelka	Starch	29.65	43.78	1.50
	Edo Central	Igueben	Flour	25.81	34.17	1.80
	Edo North	Ebese-Ivbiano	Flour	25.81	34.17	1.80
Enugu	Enugu North	Okpuje	<i>Gari</i>	2.03	3.23	0.95
	Enugu West	Akwu Achi	<i>Gari</i>	2.03	3.23	0.95
	Enugu East	Ehamufu	<i>Gari</i>	2.03	3.23	0.95
Imo	Owerri	Ntu	Flour	-19.10	-3.98	0.74
	Orlu	Etekwuru	Flour	-56.12	-34.87	0.47
	Okigwe	Agbobu	Flour	-105.46	-73.64	0.83
Ondo	Ondo North	Iju	<i>Gari</i>	12.33	19.14	1.45
	Ondo Central	Ipele	<i>Gari</i>	12.33	19.14	1.45
	Ondo South	Ode-Irele	<i>Gari</i>	12.33	19.14	1.45
Rivers	South East Rivers	Wiyaaakara	<i>Gari</i>	-7.86	-7.86	0.88
	Central Rivers	Umucbulu	<i>Gari</i>	6.85	6.85	1.11
	Southwest Rivers	Mgbede	<i>Gari</i>	0.10	0.10	1.00

Note: na = not available.

Observations, conclusions, and recommendations

Observations

Cassava chips and *fufu* were not selected by any of the prioritized communities. This was partly because of negative local experiences in cassava chip processing in those communities that have tried it and lack of knowledge in processing shelf-stable, powdered *fufu* that was suitable for commercialization. The choice of *gari* as the product for SME in these communities was based on their processing ability (know-how) and ease of use. It was also due to existing local technology, relative ease of storage, domestic value and social importance, and most importantly, the perceived high opportunity cost of *gari* processing. There was high potential in the diversification especially by introducing multiple-use equipment to some of the locations. This suggests that the success of this project would rely heavily on the ability to establish functional links between cassava processors and equipment fabricators or skilled technicians with the required ability to advise on proper use and assist in the maintenance of the equipment when required.

Men who grow cassava and other root crops such as yam for marketing and consumption, owned and managed about 70–80% of the land while women and grown-up children who grow cassava as a cash crop managed the rest of the farmland. Where women and youths were the preferred owners of the cassava processing plant, their right to land and wage rate differences had to be reaffirmed so that perceived benefits from the project did not go to unintended beneficiaries. In some communities, the ownership of land by women and youths was restricted and as such clarifications had to be made. The implication of the foregoing argument is that there was a need to avoid that internal wrangling within the prioritized communities with respect to the ownership of the cassava processing plants to ensure the sustainability of the project. In many instances, such internal problems have delayed project takeoff, hindered smooth operations, or lead to unceremonious termination of the project.

The absence of appropriate market links and outlets for the products emanating from this project could lead to disenchantment from the participating communities and affect the sustainability of the proposed processing plants. Furthermore, industrial demand for the cassava-based products in the operational states was still low and did not contribute significantly to the high cassava production in these states. Most micromillers who were into starch production enterprises were not doing well. Some had closed down completely due to poor or no access to market. Some were operating at a very low capacity. Others switched over to *gari* processing enterprise where a market was easily available locally. Some of the processors who owned large cassava farms also diverted to *fufu* production, which involves less technical inputs. Therefore, establishing clear market outlets for cassava products are as important as securing the transformation of fresh cassava roots to these products.

Finally, some starch producers who hoarded market information hindered cassava product development efforts. This scenario presents a great challenge to the project and a good opportunity to expand enterprise development and create an effective market linkage framework to support the project.

Conclusion

Theory dictates that product prices and total revenue of producers vary directly. This means that declining prices stemming from a bumper cassava crop harvest anticipated in the event of the preemptive management of CMD would lead to less than proportionate increases in consumption of cassava products and corresponding declines in revenues for producers. In this respect, a viable policy option that would protect cassava farmers and processors is considered desirable. To that extent, this project is worthwhile. Such a policy would contribute to more than proportionate increases in the consumption of cassava products through increased diversity of available cassava products, opening up of new market opportunities, and creating a buffer system where cassava processors could hold stock and influence supply in prompt reaction to market forces.

Recommendations

At this point, the following recommendations were proposed:

- The need to explore all available opportunities for the provision of access roads and GSM facilities to project sites in some communities. These include Umunya in Anambra State; Ikot Nyong and Ochon Town in Cross River State; Okposhi-Eheku in Ebonyi State; Okuje and Ehamufu in Enugu State; and all the prioritized communities in Imo State. This may be initiated through the NNDC, local and state governments, and the respective GSM service providers. This will allow such communities to link up with equipment fabricators, project facilitators, and other market links more easily and contribute to the overall success of the project.
- The need to establish a functional equipment fabricators association where issues of mutual interest could be tabled and addressed. It will also ensure that cassava processors located in areas where local fabricators were not available can reach out to the association for necessary assistance.
- Storage facilities for cassava tubers and products were not available in most of the prioritized communities. Since cassava tubers have rapid postharvest deterioration, processing into the various products rarely exceeds demand for each market day. This situation may however change with the introduction of a commercially oriented cassava processing plant. There is need for appropriate storage facilities for the different cassava products that emanate from the plants. As such, each processing plant should have an in-built store capacity for handling fresh cassava roots for short periods and for keeping stocks of cassava products for longer periods.
- The need to train processors in the area of quality control if *gari* and other cassava products are to meet the required standards for both local and international markets.
- One way by which the project can incorporate sustainability is to introduce flexible technologies that would allow communities to diversify cassava products produced in tune with market situations and realities.
- Intensify awareness on and train end-users of cassava products for bakery and confectionery products.

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