ANALYSIS OF VALUE ADDED CASSAVA-BASED PRODUCTS AND PROFITABILITY OF HIGH QUALITY CASSAVA FLOUR BAKERY PRODUCTS IN ATEBUBU

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ADMINISTRATION

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DECLARATION

I Stanislaus Ganyo Yaw Amegashie, the author of this thesis, "**Analysis of Value Added Cassava-Based Products and the Profitability of High Quality Cassava Flour Bakery Products in Atebubu**" was done entirely by me in the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon. This work has never been presented either in whole or in part for any degree at this University or elsewhere.

Works by other authors, which served as sources of information, have duly been acknowledged by reference to the author.

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DEDICATION

This work is dedicated to

- My parents Mr. C.K. Amegashie and the late Mrs N.I. Amegashie of blessed memory.
- My dear wife Diana
- My children, Wendy, Jude and Lemuel

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ABSTRACT

The aim of this study among others, was to analyse the value additions of three cassava-based products namely, High Quality Cassava Flour (HQCF), gari and kokonte and to determine the profitability of HQCF bakery products in Atebubu.

A value added analysis was used to determine the profitablity of the three cassava-based products. Three profitability measures were used to determine the profitability of HQCF bakery products. These were, operating profit, profit per unit product and return on investment. A bar chart of output levels was used to represent the trend in production of HQCF. Finally, the Kendal's Coefficient of Concordance (W) was used to analyse the ranking of the constraints affecting the production of HQCF.

Only HQCF had positive values for the two prices seasons that were considered, that is, the lean price season and high price season. Production of dough nut (*"bofrot"*), and *"sweet bad"*, chips and meat pie with 50% HQCF composite flour yielded better financial returns than that of 100% wheat flour. Similar results were obtained from the production of bread and cake with 12% HQCF, and 100% HQCF respectively. However the use of 22% HQCF composite flour for bread yielded lower profit than the use of 100% wheat flour.

The rankings of the identified constraints affecting HQCF production were subjected to the Coefficient of Concordance analysis. The results were that farmers did not collectively agree to the rankings of the identified constraints, which included, drying space, distance from the

mill, frequent breakdown of the screw presser storage room, harvesting of cassava, distance from the farm, the absence of a micro finance scheme among others.

HQCF bakery products competed favourably with wheat flour bakery products in all the profitability measures used. The promotion and use of HQCF bakery products must be pursued by serving HQCF bakery products at state functions and institutions like the secondary schools that receive subvention for feeding This will go a long way to popularize HQCF bakery products and reduce the foreign exchange used for the importation of wheat and wheat flour into the country.

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LIST OF ACRONYMS

AGDP	Agricultural Gross Domestic Product
CBB	Cassava Bacterial Blight
BCP	Biological Control Programme
CMVD	Cassava Mosiac Virus Disease
CPHP	Crop Post Harvest Programme
CSIR	Council for Scientific and Industrial Research
DFID	Department for International Development
ERP	Economic Recovery Programme
FAO	Food and Agricultural Organization
FRI	Food Research Institute
FRI	Forest Research Institute
GRATIS	Ghana Regional Appropriate Technology Industrial Service
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
ISTRC	International Society for Tropical Root Crops
MOFA	Ministry of Food and Agriculture
MTADP	Medium Term Agriculture Development Programme
NRI	Natural Research Institute
NRTCIP	National Root and Tuber Crop Improvement Project
PPD	Postharvest Physiological Deterioration
SAP	Structural Adjustment Programme
SRDP	Smallholder Rehabilitation Programme

CHAPTER ONE

INTRODUCTION

1.1 Background

Cassava (Manihot esculenta) is probably the most important root crop in Ghana. Annual production has been rising consistently over the last decade and currently is estimated at ten million tonnes of fresh roots per annum. Cassava is a major source of daily carbohydrate intake to majority of Ghanaians and also serves as an important food security crop due to its ability to grow on marginal lands and its tolerance to drought (DFID, CPHP.1999).

Cassava is eaten from the fresh form, boiled, pounded to make *fufu*, fried, roasted or processed into a range of traditional products including *agbelima* and *gari*. Cassava is also cut into chips, sun dried and pounded or milled into flour known as *kokonte*. Cassava is also used on a small scale for industrial purpose and as source of carbohydrates in livestock feed. Cassava starch has varied uses in the paper, textile, pharmaceutical, oil drilling and petrochemical industries. It is also used extensively in the food industry. The by-products are pulp and juice. The pulp produced is a valued cattle fodder while the juice is used as fertiliser

There are many small-scale processors, mostly women engaged in transforming cassava roots into traditional cassava products like *gari*, *cassava dough*, *kokonte* among others. All over Ghana, however, wherever cassava is grown, pockets of processors can be identified. These processors produce basically to meet local demands and to some extent export to neighbouring countries such as Togo. In Watro (a village in the Atebubu district) the most important cassava products into which cassava root is processed are cassava chips, *gari* and *kokonte*. In order to exploit the industrial potential of cassava in the area, the Department for International Development (DFID), funded a collaborative project executed by the Natural Resource Institute (NRI) UK, and the Food Research Institute (FRI) Ghana to train farmers to process fresh cassava roots into High Quality Cassava Flour (HQCF).

Most people refer to cassava flour as *kokonte,* which is a relatively low-grade fermented and milled traditional product. The product can be of poor quality because drying times are typically long allowing microbial growth. Apart from the physical description of *kokonte* there is no known standard chemical composition analysis of this traditional product according to the Food Research Institute of Ghana and so can be said about *gari* another traditional cassava based product. Non-fermented "*kokonte*" flour in this study is however referred to as "High Quality Cassava Flour"(HQCF). HQCF is white in colour. It is free from extraneous matter including peel fragments and sand particles. Acidity, is less than 0.25 per cent, the ph is between 6-7. The average particle size ranges between 115-120 μm. The starch content is less than 70 percent. And viscosity (BU) is less than 750. The processing of cassava roots into high quality cassava flour involve peeling, washing grating/slicing/chipping, pressing, disintegration, sifting, drying, milling, screening, packaging and storage. In the production HQCF, the first eight stages of the process must be completed within 12 hours of harvesting the fresh cassava roots otherwise fermentation will set in which will affect the quality of the final product.

Bakery products like bread, pie, cake, and doughnuts, among others have become important convenient food items for the average Ghanaian. These products are prepared from wheat flour, which is imported. Research has shown that HQCF can be used wholly or in various proportions, substituting wheat flour in the preparation of bakery products.

Imported wheat flour currently dominates the market for flour in Ghana. Ghana imports approximately 250,000- 300,000 tonnes of wheat equivalent (wheat grain and flour) per annum (Dziedzoave et al, 1998). Most of the wheat is used in the food industry in the preparation of bread and snacks food such as biscuits, cakes, pies, and doughnuts. The food sector is an attractive market for HQCF because of its consumption of imported wheat flour. Research carried out in Ghana and many parts of the world has demonstrated that HQCF can be used to substitute for 50 per cent of wheat flour in many products (Dziedzoave et al, 1998).

Research in Peru has shown that HQCF can be used to substitute for wheat flour in plywood glues up to 46% by volume (Jones, 1994). Plywood manufacturers in Peru have successfully used HQCF to save cost. Similarly, glues containing cassava starch have been successfully tested by the timber industry in the Philippines (Fidel et al, 1992). Preliminary technical and economic evaluation in Ghana indicated the potential for locally produced HQCF to substitute for imported materials in the areas of plywood glue extenders, paperboard adhesives and as a partial substitute for wheat flour in a range of snacks foods. (Day et al, 1994). The exploitation of these market outlets offer the potential to improve the standard of living and income levels of farmers, primary processors and end users as well as intensify the integration of agriculture with industry.

Cassava is a key food security crop in Ghana, and is of particular importance to low-income farmers (including many women) because it can provide reasonable yields on marginal soils with little inputs even under drought conditions (Al-Hassan, 1989). In 1998 the International Fund for Agricultural Development committed $10 million towards increased production of cassava in Ghana. However, increasing production can only contribute to improving livelihoods if farmers have markets for their produce. Need assessment studies funded under the Regional Africa Project (Kleih et al, 1994) highlighted farmers' concern to expand market opportunities for cassava and improved producer prices. Studies under the Crop Post-Harvest Programme (CPHP) have demonstrated that market opportunities exist in Ghana that will enable cassava contribute significantly to poor people's livelihoods (Day et al, 1996) The starting point for these markets is the conversion of fresh cassava roots into stable, dried form (chips, gari, flour) that can be stored until required for sale, further processing or consumption.

The NRI, FRI, and the University of Ghana in collaboration, carried out commercial trails of HQCF as substitute for wheat flour and soft and hard dough biscuits with a major biscuit manufacturer and two bakeries in Accra. In soft and hard dough biscuits, HQCF replaced 35% and 60% of wheat flour respectively without reducing product quality. The potential, therefore, exist for the utilization of processed cassava as an industrial input.

1.2 Problem Statement

Cassava roots are perishable, spoiling starts within 3-4 days after harvest. They are also bulky containing 70% moisture by weight. In addition, they contain cyanogenic glucosides which breakdown to form hydrocyanic acid (HCN), a toxic compound

(ISTRC, 2000). Processing is necessary to reduce the moisture content and weight, improve product storage, enhance flavour, and reduce the HCN content to safe levels.

Cassava is one of the most important root crops in Ghana, and is of great importance for resource poor farmers. The contribution that cassava can make to sustainable livelihoods is constrained by the range of economic stability of current market outlets, and the highly perishable nature of fresh cassava.

The main market for fresh cassava for farmers in Watro is the Atebubu market which is about 14.5 Km from the village. Although the village has no market structure in the community, buyers from all over the country often come to the village to purchase fresh cassava roots. According to a baseline survey carried out by the FRI and other collaborative agencies, all cassava produced in Watro is sold. This was adduced, because farmers are not willing to lock up their lands with old cassava roots. The reason being that cassava root is a low value crop and storing or leaving it in the ground does not add to its value, rather it deteriorates. As a result when the growing season comes to an end, farmers dispose of their cassava roots at any price. To make some meaningful income from cassava roots, some farmers resorted to processing the fresh cassava roots to various cassava-based products, such as cassava chips, kokonte, and to a lesser extent gari. The DFID and CPHP added another dimension to the cassava-based products in Watro, by training farmers to process cassava roots into HQCF. Bakers in Atebubu use HQCF in various combinations for a variety of bakery products.

The questions to be asked are, what are the benefits in using HQCF for bakery products? If the use of HQCF is cost saving for the baker, are there any incentives for the supply of the commodity? What other product options are available for the processor (farmer) so far as other cassava-based products are concerned? What are the value additions to the various cassava based products? How sustainable is the commercial production of HQCF?

Answering these questions will help make an effective comparison between the production of HQCF and other cassava-based products in terms of profitability.

1.3 The Objective of the Study

The study aims at conducting value addition analysis on HQCF production and the production of other cassava-based products, and how the uses of HQFC by the bakeries affect their financial performance.

Specific Objectives

The specific objectives of the study are:

- To estimate the value added in processing fresh cassava roots into three cassava-based products (HQCF, *gari* and *kokonte*) to derive information for the analysis of value addition.
- To estimate the profit margins obtained by bakers in the use of HQCF compared with wheat flour to establish the comparative advantage.
- To assess the production figures of HQCF over the 2000- 2003 period to gather information for analysing the growth rate in production
- To identify the constraints and success drivers in processing fresh cassava roots into high quality cassava flour.

1.4 Relevance of the Study

Cassava roots account for about 22% of agricultural GDP and have the lowest entry barriers to production compared to other major crops in Ghana. Over 90% of Ghanaian farmers cultivate cassava either as a main crop or mixed with other crops. In spite of its dominance as the most widely cultivated food crop in Ghana, the full benefit of cassava roots in terms of the varied industrial use to which they can be put, are yet to be realised.

Ghana has the capacity to transform her cassava industry into a major economic growth pole, on account of the potential of cassava as an industrial raw material. HQCF has varied uses in the bakery, paper, plywood and pharmaceutical industry. There is therefore the need to investigate the operations involved in the processing of the various cassava-based products of industrial potential. The evaluation of the value added along the value chain will help identify the beneficial effect of each activity to the rural processor (the farmer). The study will also give more insight into which cassava based product generates more revenue and has linkages with other economic activities at the rural level.

HCQF production is relatively new. The awareness of the uses of HQCF in the bakery industry has been created through Agricultural Fairs in Accra. This study will seek to gather more information and weigh up the advantages and disadvantages of using HQCF in the bakery industry. The information gathered will inform future research work and donor agencies in the replication of similar projects in other cassava producing areas of the country.

Processing and packaging of primary agricultural produce are major issues of concern for the Ministry of Food and Agriculture. A study in this sector is therefore important to feed into government policy process on food and agriculture.

1.5 Organisation of the Study

Chapter Two reviews relevant literature on the study, the third chapter throws light on the area of study, methodology and method of data analysis. The forth chapter covers the results and discussions and finally the last chapter draws the, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this Chapter an in depth review of literature has been made on the importance of cassava roots in the economy of Ghana in relation to the contribution to Agricultural Gross Domestic Product (AGDP) and the production of the crop over the years. The Chapter also discusses the evolution of the crop in Ghana and the development of improved varieties of the crop in the country. A further searchlight is thrown on government policy on agriculture and how these policies have influenced developments in the cassava sub-sector of the Ghanaian economy. The concluding part of this Chapter looks at post harvest issues in the cassava sub-sector of the economy, the industrial potential of cassava roots and a review on value added analysis and the Coefficient of Concordance Analysis (W)

2.2 Importance of Cassava in Ghana

The importance of cassava is measured in terms of cropped area, total production, and contribution to Agricultural Gross-Domestic Product (AGDP) and food expenditure shares of citizens (Alderman and Higgens, 1992). The area planted to cassava, which was about 387,000 ha in 1986 increased to 590,000 ha in 1996. Over the same period, cassava production also increased from about 2.9 million mt to 7.11 million mt. Again from 1997 to 2003, cassava production rose from 6.9 million mt to 10.2 million mt. Cassava is by far the largest agricultural commodity produced in Ghana by weight, and represents 22 per cent of AGDP compared to 5 percent contribution from maize, 2 percent for rice, sorghum and millet, 14 percent for cocoa, 11 percent for forestry, 7 percent for fisheries and livestock (Al-Hassan, 1989).

The number of households engaged in cassava production also measures its importance. According to the 1987 / 88 Ghana Living Standard Survey (GLSS) 1.73 million sampled household (83%) were engaged in cassava production. By 1988 / 89, the GLSS recorded a one percent decline in the number of sampled household engaged in cassava production. The presentation of data from the 1991 / 92 GLSS 3 survey differs slightly from the earlier survey so it is not possible to track the trend in numbers of households engaged in the production of cassava. (Ofori et al, 1997). The GLSS survey according to (Ofori et al, 1997) appears to be recording a decline percentage, albeit small, of households growing cassava.

Nevertheless, according to the GLSS 3 report, cassava is grown extensively in all the ecological zones in Ghana. Earlier data sources however indicated negligible cassava production in the two Upper Regions (Al-Hassan, 1989). The apparent negligible spread of cassava into the Upper Regions, especially Upper West, is the reflection of the growing trend in cassava production through area expansion (Ofori et al, 1997). The Medium Term Agricultural Development Programme reports of a rapid spread of cassava in the Guinea Savannah Zones since the famine of 1983 (MOFA. 1990).

In addition, survey data on farmers' perception of trends in cassava production in their villages presented in Prudencio and Al-Hassan work (1994) shows a growing trend in cassava in 93 percent of the 30 villages in the survey. The common reason given for increasing production according to Ofori et al (1997) is population growth. This suggests that farmers are using cassava to improve long-term food security as well as hedge against intermittent food shortages.

2.3 Evolution of Cassava Production in Ghana

Cassava (Manihot esculenta Crantz) was introduced from Brazil, its country of origin, to the tropical areas of Africa, the Far East and the Caribbean Islands and specifically to the Gold Coast now Ghana by the Portuguese between the 16th and 17th centuries (Jones, 1959). The Portuguese grew the crop around their trading ports, forts, and castles and it was a "principal" food eaten by both the Portuguese and slaves. By the second half of the 18th century, cassava had become the most widely grown and used crop of the people of the coastal plain (Adams, 1957). According to Ofori et al (1997) the Akan name for cassava "Bankye"could most probably be a contraction of "*Aban kye*"(Gift from the castle).

The spread of cassava from the coast into the hinterland was very slow. It reached Ashanti (and Brong Ahafo) and northern Ghana, mainly Tamale in 1930 (Ofori et al, 1997). Until the early 1980's the Akans of the forest belt preferred plantain and cocoyam, and sorghum and millet were preferred in the north. Cassava became firmly established in most areas after the serious drought of 1982 / 83 when all other crops failed completely (Krong-Amoaku, Cudjoe and Adams, 1987). Cassava and its various preparations including *fufu*, *gari* and *kokonte* are now very popular foods through out Ghana.

2.4 Development of Improved Varieties

Between 1928 and 1962, the Department of Agriculture was responsible for cassava research and extension in Ghana. Since 1962, research institutions under the CSIR and the Universities have been responsible for cassava research. In contrast to the unconscious selection by "farmers," systematic breeding and selection, which started in 1930, have been carried out mainly to improve pest and disease resistance and yields of the local varieties (Ofori et al, 1997)

The Cassava Mosiac Virus Disease (CMVD) was first observed around 1930 and was considered serious enough to merit attention, as all existing local varieties were severely affected. This first government intervention involved the introduction of varieties from other West Africa countries, East Africa, the Caribbean and the Far East. Several crosses were carried out between the local and the improved varieties. Four outstanding varieties namely Queen, Gari, Williams, and Ankra, were released in 1935. These were high yielding (7-10t/h) of good taste, highly resistant to CMVD, and were grown widely through the country. However, by the late 1950s either due to increased virulence of the virus, a breakdown in varietal resistance or purity, all the newly released varieties except Ankra become highly susceptible, necessitating a second breeding intervention for CMVD resistance (Ofori et al, 1997).

The second intervention involved crosses between the local varieties and four other species closely related to M. esculenta, since it has been shown that no resistance could be found in any M.esculenta variety. Work with the interspecific crosses went on through out the mid 1950s to the mid 1960, out of which four selections K357, K162, K680, and K491 were released to farmers. The best, K680 yielded around 19t/h, had moderate resistance to CMVD with good palatability and cooking quality. These varieties were cultivated and maintained their good characteristics until the late 1970s and the beginning of the late 1980s when a third intervention had to be sought to obtain varieties resistant to two new pest (cassava mealy bug and cassava green spider mites) and new disease, Cassava Bacterial Blight (CBB) in addition to CMVD (Ofori et al, 1997)

In 1984, an FAO-financed programme to release available beneficial agents from the International Institute of Tropical Agriculture (IITA), through a biological control programme (BCP), was initiated. The programme focused on control of the cassava mealy bug and green spider mite through introduction of a parasitiod wasp (*Epidinocarsis lopezi) and* predatory insects (*Diomus sp.* and two *Hyperdspis spp*). In March 1985, a second batch of the natural enemies with one more predatory lacewing insect (*Sympherobius sp*) and predatory insects mites (*Neoseiulus idaeus* and *N. anonymus*) were introduced. Due to the effect of the BCP, three improved varieties of cassava (TMS 50395, TMS 4(2) 1425) and TMS 30572) have been released in Ghana that are largely tolerant to these pest and disease. The National Root and Tuber Crop Improvement Project (NRTCIP) released three high yielding, pest and disease resistance in 1996. These varieties namely Afisiafi, Gblemo Duade, and Abata Fitaa yield in excess of 200 percent per hectare of local varieties (Ofori et al, 1997).

2.4.1 The National Root and Tuber Improvement Project (NRTCIP)

The increasing importance of root crops, cassava in particular, in the economy of Ghana led government to enter into bilateral agreement with International Fund for Agricultural Development (IFAD) leading to the implementation of the Ghana Smallholder Rehabilitation and Development Programme (SRDP). The SRDP was to ensure food security by providing the needed inputs, resuscitating essential infrastructure and strengthening institutional capacity for research and delivery of essential production services. The NRTCIP, which took off in 1988, was a component of SRDP (Ofori et al, 1997).

2.5 Government Policies on the Agricultural Sector

2.5.1 Immediate Post Independence Period

The development strategy adopted by Ghana after independence in 1957 was of rapid industrialization with strong bias for import substitution. The rapid industrialisation policy aimed to shift employment away from agriculture. This was to be achieved by raising the productivity of farming to such levels that large number of farmers could be released to work in other occupation (GoG, 1964). As the productivity of those who remained in agriculture increased, their earning would also increase leading to further growth of the industrial sector through consumption linkages. Within this strategy, government was to maintain a high level of participation to support its socialist policies with respect to distribution and utilisation of national income.

The policy of the agricultural sector was to concentrate on a limited number of commodities, and to supply to them all available agricultural knowledge and technology. The development of research manpower was to be specific to the development of these commodities. The selected commodities were cereals and fish to fill the nutritional requirement, cocoa to improve the balance of payment situation, and rice and sugar for domestic consumption and export. Clearly the strategy at that time had no role for cassava as a crop; neither did the crop benefit from the general interventions in relevant farming systems because of lack of support to the farming sector.

2.5.2 Five-Year Development Plan (1975/76 –79/80)

By the mid 1970s there was concern over the "openness of the economy" because of a high marginal propensity to import as expressed in the 5-year Development Plan (GoG, 1977). Other issues of concern in the 5-year Development Plan were the high rates of unemployment and inflation. The thrust of policy at the time was the management of the balance of payments. The strategy was to cut back imports of raw materials and capital inputs (GoG, 1977). This resulted in the birth of the "Operation Feed Yourself " and operation Feed Your Industries" programmes).

This is probably the first official expression of recognition of a role of cassava in Ghanaian economy (Ofori et al, 1997) Unfortunately, the plans did not materialise because of the economic crisis of the late 1970s and political instability.

2.5.3 The Economic Recovery Programme and Structural Adjustment Programme

More recent changes in Ghana's economy and agricultural polices have favoured the development of the cassava sub-sector. The Economic Recovery Programme (ERP) followed by the Structural Adjustment Programme (SAP) that were initiated in 1983 and 1986, respectively introduced macroeconomics policies to favour trade and private enterprise. A flexible exchange rate system, and trade liberalization are the major macroeconomic policies that have affected the development of the cassava sub-sector.

The advantage of the trade and exchange rates reforms for cassava have been the entry of Ghana into the cassava chips export markets, particularly to the European Union. Ghana's export of chips export increased from less than 3,000 mt in 1994 to about 20,000 mt in 1996. Unfortunately this export potential could not be sustained. This was consequently due to poor institutional framework and uncompetitive prices offered to the farmers.

Ghana's inability to meet its quotas led to an eventual collapse of the trade (pers.com. Nanam Dziedzoave). Until her entry into the cassava chips market, formal trade in cassava was only gari to Europe and North America. The average recorded trade volume was 50 metric tonnes over the period 1985 to 1988 (Al Hassan, 1989). However there has been unrecorded informal cross-border trade of cassava between Ghana and her neighbours. A study of the effect of the CFA devaluation on cassava in Ghana shows that the flexibility exchange policy of Ghana limited the competitiveness of cassava product from Togo even with the CFA devaluation thereby resulting in increased export of gari and cassava dough by traders (Al-Hassan et al, 1996).

2.6 Post Harvest Issues

Cassava (Manihot esculenta Crantz) is grown throughout the humid tropics from Latin America to Africa and Asia, principally for its large starch storage root. The root provides the staple for over 500 million people and in 1991, world production was 162 million tonnes; it is of particular importance to populations in sub-Saharan African (Wenham, 1995)

Within 48 hours of harvesting, the roots of cassava suffer an abiotic stress-response known as post-harvest physiological deterioration (PPD) (Beeching et al, 1998). This response renders the root unpalatable and unmarketable. With increasing distance between farmers and markets due to urbanization, PPD has become a major constraint to the development of cassava root for farmers, processors and consumers. To reduce the effect of PPD, mechanized cassava processing is now a fairly well established activity and there are several cassava processing plants in the country.

Despite the steady increase in the rate of adoption of cassava processing technology, there are factors that mitigate the adoption of the technology. According to Ofori et al, (1997), mechanised cassava processing is often not viable a venture, because the products have to compete with traditional products, which are under priced, because traditional processors rely on family labour, which is not perceived as cost.

Cassava processors have usually, either little capital or no access to capital to enable them afford cassava-processing equipment. Most operators in traditional and small-scale cassava processing plants also have limited managerial capabilities and training due to little formal education, and these mitigate the successful management of a cassava enterprise.

2.6.1 Status of Cassava Research

The major thrust of research on cassava by the FRI, has been in the area of post harvest management including storage, processing, and utilisation. Studies conducted on storage of fresh cassava roots at the institute aim at improving the traditional methods of cassava processing (Ankra et al, 1980; Ankra 1980; Ankra and Osei-Yaw, 1981; Ankra, 1984).

Most of the post harvest research efforts in cassava processing in the past have been in the development of dry cassava products to replace fresh roots in the preparation of fufu and akple. However this research did not catch up well with Ghanaians because of the cost of the new product and the delicacy associated with the traditional methods of preparing these Ghanaian dishes. In more recent times, in collaboration with the NRI (UK) the FRI with sponsorship from DFID, researched into promoting cassava as an industrial commodity. Considerable work has been done in promoting HQCF for use in the bakeries, the timber industry and lately in the confectionary industry.

2.7 Processing

Processing cassava into various shelf-stable and semi-stable products are widespread activities carried out by traditional cassava processors and small-scale commercial processing unit. The traditional methods for processing cassava involve combinations of different stage processes including peeling, grating, dewatering, sifting, and fermentation, milling and roasting. The major products are agbelima, gari, and kokonte. During the processing, the cassava tuber is transformed from a highly perishable root crop into a convenient, easily marketable, shelf-stable product, which meets consumer demand for a staple food. Processing may improve palatability of the product and also reduces the level of cyanogenic glucosside in the tuber thereby detoxifying the product. Products fermented by some species of lactic acid bacteria such as agbelima and gari may attain anti-microbial properties

Several problems are encountered during traditional processing which have created an urgent need for mechanization and upgrading of processing. Operations are often uneconomical because the products are not properly costed. For instance there is heavy reliance on family labour, which is not perceived as cost. Even though this assertion may be true there are no empirical evidence to attest to this claim. Operations are carried out on very small scale and the areas of manufacture may be unorganised and scattered. The processing procedures are labour intensive and time consuming and mostly carried out manually. Operations are not adequately mechanised because processors cannot afford equipment and do not have access to capital. Processing is often carried out under unhygienic conditions and some unsanitary practices for example improper effluent disposal during the watering of mash cassava, have adverse effect on the environment.

2.8 Interventions for Processing

The major intervention in cassava processing was the introduction of a medium scale motorised cassava grater by the Agricultural Engineers Ltd in 1966. The cassava grater presented a great innovation in cassava since grating is central to traditional processing of cassava in Ghana. Since then, several equipment manufacturers, including engineering firms, research institutions; University departments, small-scale artisanal shops, blacksmith and mechanics, developed and produced various types of cassava processing equipment. Cassava processing machinery manufactured locally are drums graters, horizontal disc graters, cassava chipper, screw press, hydraulic press, cassava dough disintegrators, sieving machines, grading machines, plates mills hammer mills and mechanical dryers.

Over the past three decades there have been a gradual but steady increase in the adoption of cassava processing equipment in the industry. The adoption of mechanised cassava processing appears to have escalated in recent years through the assistance of Non-Governmental Organisation to various localities. Even though the introduction of processing equipment has to a large extent removed the tedium and drudgery associated with the processing of traditional based cassava products, the economic return of the use of processing equipment to the processor has not been investigated.

2.9 Profitability of Cassava Based Products

Al-Hassan and Egyir (2002) carried out a study where returns on investment were used as an indicator of the relative incentive to processing a cassava based product. The cassava based-products used in the study were, chips, kokonte and gari. The budgets for cassava production and processing of gari, kokonte and chips were estimated under two scenarios. Scenario (i) was farmers' process cassava with hired labour and (ii) farmers' process their own cassava with family labour.

In the first scenario, net earnings from cassava processing were estimated at 31,000 Cedis for chips (per mt) giving approximately 60 percent return on investment. Kokonte had 40,000 Cedis (per mt) giving 23 percent and 122,000 Cedis (per mt) for gari giving 32 percent. In the second scenario, the returns on investment were uniformly higher than the returns using hired labour for all the products. Net earnings from cassava processing were estimated at 59,000 Cedis (per mt) for chips giving approximately 240 percent return on investment. Kokonte had 55,000 Cedis (per mt) giving 100 percent and 268, 233 Cedis (per mt) for gari giving1 15 percent.

2.10 Cassava Based Products with Export Potential

Cassava Chips

Following the pioneering activity, by a private company in developing an export led industry in cassava chips in 1993, there has been improvement in the contribution of cassava to employment generation, additional income and the livelihood of participating rural producers. This was followed by a tremendous interest and response to the new industry. Other private individuals showed interest and became more active in the marketing of cassava chips and worked to access the export market and explored the utilization of cassava chips in livestock feed and industrial alcohol production.

Cassava Starch

The local market for starch is about 5,000 mt per annum (Ofori et al 1997). In the context of annual cassava production of about 7 million metric tonne, the industrial starch market offers relatively little potential to expand the market for cassava (Day et al 1996). Although the starch market in Ghana is very small, major opportunities for cassava starch lie in sub-regional and regional export.

In South Africa the annual consumption of cassava starch is about 300,000 mt per annum with an annual growth rate of 12,000 metric tonnes. A keen interest is currently being shown by investors from South Africa to invest in starch production in Ghana. A local company, GLUCOSET, which plans to produce high quality starch for both domestic and export market, is not sufficiently large to attract potential investment. It is estimated that, the Ayensu Starch Factory will export 380,000 ton of starch in the next four years. Total earning expected is US$95 million. It is worthy to note that even at this level of production, only 6.7 per cent of total cassava production in Ghana would have been processed into starch. The potential for further processing of cassava into other cassava-based products with industrial potential is therefore high.

The market potential for starch within Ghana comprises a number of end users who make use of maize, cassava, and potato starch which is mostly imported, (Day et al 1996). A survey carried out by NRI/ UoG indicated that the current market size is approximately 4,200 tonnes per annum, which compares well with figures in a survey carried out by Glucoset Limited of Ghana. (Anon, 1994).

2.11 Use of HQCF in Bakery Products and Industrial Uses

There is market potential for HQCF as a partial or total replacement for wheat flour in food and for the manufacturing of plywood and paperboard industry (Day et al 1996). HQCF could replace wheat flour in plywood production as glue extenders, and possibly in paperboard production.

The largest market potential for HQCF in the medium to long term in Ghana lies in food application (Day et al 1996). HQCF could potentially substitute for the large amount of wheat flour currently used in bread, snacks, and other food items. The market of wheat flour imported into the country is estimated at between 250,000 to 300,000 mt per annum. The possibility of replacing up to 20 percent imported wheat flour with cassava flour imply an annual demand of 60,000 mt or 14 times current demand.

A marketing survey conducted at an Industry and Technology Fair dubbed INDUCTECT '97 held in Accra from 28th February to 10th March 1997 clearly showed that composite flour inclusive of 20 percent HQCF was widely accepted by the public as comparable to 100 percent wheat flour. Glucose syrup, which is derived from further processing of HQCF, has a potential in the confectionary and pharmaceutical industry in Ghana; but the high quality specifications demanded by the end users, is making the market potential for glucose syrup (from HQCF) uncompetitive. (Pers.comm Nanam T.Dziedzoave.) Again some local processors in Kokofu (a village in the Atebubu district) were trained to further process HQCF to glucose syrup for some confectionary industry in Accra. However, the high price of fresh cassava at Kokofu made the end product, glucose syrup expensive relative to the imported price. As a result the local processors resorted to buying cassava starch from the Ayensu Starch Factory for processing the glucose syrup. It is more economical to use the cassava starch from Ayensu due to the relatively lower price at the factory.

There is inadequate data on the size of the non-bread wheat flour market in Ghana (Day et al 1996). Factors likely to contribute to the market expansion with the possibilities for inclusion of HQCF are urbanization, population growth and rising incomes (Ofori et al 1997). On the evidence of public response to snacks made from cassava composite flour presented at the INDUCTECH '97 Fair, the prospects look good. Research on the adoption process has demonstrated clearly the extensive delays, which occur between the time people, first hear or see a favourable innovation and the time they take to adopt them. The time of adoption is further worsened in the absence of the required institutions to seek further information about the innovation, weigh up the advantage and disadvantage of using it and the required market linkages. It is doubtful if any institutional arrangement was put in place after the INDUCTECH '97 Fair.

The use of HQCF in the Bakery Industry.

Besides the traditional use of HQCF, various investigations have been carried out on the use of HQCF for bread and biscuit manufacture. Cookies and bread are popular convenience foods. The rising cost of wheat flour is a constraint in the baking industry. To reduce the cost of bread and other bakery products, flour from roots and other tuber crops present an alternative. (Defloor et al 1994, 1995) have shown that the bread making potential of HQCF was much more dependent on the age of the cassava at harvest time, the season of planting and the time of harvesting, than on the effects of genotype.

Use of HQCF in the Plywood Industry

In the plywood industry, imported food grade wheat flour is used as an extender for expensive formaldehyde resin-based adhesive. Industrial trails of HQCF as an extender for plywood glue were carried out by NRI, FRI and Forest Research Institute of Ghana in collaboration with two commercial timber-processing companies in Kumasi. Cassava flour (prepared from peeled roots) at a substituting 50 percent of wheat flour has the potential to reduce plywood production cost by 35 per cent. Industry representatives have expressed the desire to purchase HQCF but stressed the need of quality, reliability and price competitiveness and the development of sustainable market.

Use of HQCF in the Paper Industry

Adhesives for paperboard manufacturing have traditionally been prepared from cornstarch or corn dextrin and other cornstarch derivatives. This choice has principally been based on availability, but the higher viscosity of the cooked cornstarch tended to make it more favoured than cassava starch. However the low gelatinisation of cassava starch and flour enhances their potential as substitute for cornstarch, but it will be necessary to increase the viscosity to appreciably higher levels. Sodium hydroxide and borax are normally used to modify the pasting temperatures and viscosity respectively of starch used in the manufacture of paperboard adhesives.

Research conducted by NRI and FRI indicated that HQCF could completely replace imported starches in the formulation of non-waterproof paperboard adhesives, with potential cost saving of up to 60 per cent.

2.12 The Conversion of Cassava roots into Kokonte

Kokonte is a partially fermented and dried cassava product. The production stages, include the following, harvesting of cassava, peeling the tubers, drying pounding of tubers / slicing, milling and bagging. The peeled tubers are not normally washed either because of the non-availability of water in the farms where the processing is normally done, or it is not considered necessary since the peeling is so carefully done as to keep the peel tubers sufficiently clean.

Pounding of the fresh cassava is preferred to slicing since it is faster and it helps the drying to proceed faster. However, some people do slice the tubers after peeling and before drying. Two types of kokonte are produced at the village level. These are sun-dried kokonte and fire-dried kokonte. As the names suggest the differences arise from the mode of drying. Spreading the pounded or sliced tubers in the sun for a period of between 3-4 days normally does the drying. The dried chips are whiter, and contain free starch that is desirable. Sun-dried chips are normally sliced or pounded and therefore comprise smaller pieces which dry faster.

Spreading whole tubers on platform over smouldering fire on the farm to dry produces fire-dried kokonte. The tubers are covered at night and fired every 4-5 days. Due to the size of tubers it takes a longer time to dry and because of the heat, the starch is partially gelatinised and does not produce sticky enough dough when cooked. The final product is dark in colour. Even though it is less preferred, its production continues because of the advantage of being able to work on it on the farm, whilst doing other work, and bringing home a less bulky final product.

2.13 Conversion of Cassava roots into Gari

Gari is a fermented product, unlike kokonte; it is partially gelatinised, and is very popular in Ghana (Al-Hassan, 1992) and in other African countries like Nigeria and Sierra Leone (Blanshard, 1994). The production of gari involves the following steps, harvesting of the cassava tubers, peeling of the tubers, washing of the tuber, grating of the cassava tubers, draining of grated mash, disintegration, sifting, roasting, sieving and packaging.

The washed tubers are grated manually in Watro, since there are no cassava graters in the community. The grated mash is loaded into baskets and left for 12hrs to drain. This draining step is designed to facilitate the next processing; dewatering. Dewatering is achieved by loading the drained mash into polypropylene sacks and placing very heavy stones on the sacks to press out the water or using the manual press to squeeze out the water.

The dewatered mash is disintegrated and sifted in one operation using the bamboo cane sieve after which it is roasted on the traditional roasting pan. It is allowed to cool and sifted again on the bamboo cane sieve packed and stored.

2.14 Conversion of Cassava roots into HQCF

The primary processing technique of converting fresh cassava roots into flour basically involve peeling and washing of fresh roots, and chipping, or grating of the peeled roots. The grated roots may either be pressed before drying or dried straight away, after which they are ground or milled and sieved to obtain fine flour. The chips may also be washed before drying or dried without further washing, after which they are milled and sieved to give fine flour (Orias and Calub, 1986). Depending on the procedure adopted different flour recovery rate may be obtained

According to Orias and Calub (1986) production of flour from chips is a more favoured technique in terms of production rate, flour recovery and processing cost, compared with the grates. Grating roots prior to drying results in considerable loss of free starch, higher labour cost, and a slower flour production process. Investigation has shown that using a pedal operated hammer mill, flour recovery from the chips is about 25-29 per cent at a production rate of 4.41-4.85 kg/hr.

Drying of cassava chips to a moisture level of 10-12 percent w.b was found to be ideal for easy grinding and longer shelf life of flour and chips (Weber et al, 1978). Emilia et al (1983) found that parboiling of cassava prior to drying marginally changed the pasting characteristics by reducing the pasting temperature and hot paste viscosity and by slightly increasing the paste stability. Parboiling and subsequent open pan roasting of cassava flour were therefore found to be the most effective method for upgrading the cooking characteristics of cassava flour.

2.14.1 Production of HQCF in Watro

The production HQFC was introduced to the community (Watro) through an IFAD-funded project implemented through collaboration between the International Institute of Tropical Agriculture (IITA), Ibadan and the Food Research Institute (FRI) of Ghana, in Feb; 1999. The project was aimed at promoting HQCF, for bread and other pastry products. The production process for HQCF is, harvesting of cassava tubers, peeling of the tubers, washing of the tubers, grating of the washed tubers, dewatering of grated mash, disintegration of mash, sifting of the disintegrated mash drying of sifted mash, milling and packaging.

It is similar to the production process for gari. However in the production of high quality cassava flour, the first eight units of processes must be completed within 12hrs. Dewatering of the grated mash is done immediately after grating and is completed within 15-30 mins. Fermentation is not allowed to take place. The disintegration of the dewatered mash is carried out to facilitate drying within a maximum period of seven (7) hours.

It is done together with sifting as a single operation using the traditional bamboo cane sieve. Sifting of the mash prior to drying helps to remove as much of the fibre as possible from the mash so that it is no longer necessary to sieve after milling. Drying is normally targeted to start between 9.30 a.m. and 10.00 a.m. and to end about 4.30 p.m. or any time before the sun goes down. Drying is carried out on black polypropylene sheets on raised platform. The dried material is stored in polyethylene-lined polypropylene sacks until sufficient quantities have been produced. The milling is done using the hammer mill.

2.15 Value Added Analysis

The value added is the market price of the commodity less the cost of raw materials and services purchased from other firms. (Gittenger, 1982). This definition is consistent with that of Baumol and Blinder (1970) in whose work it was revealed that, the value added is the revenue from selling a product minus the amount paid for goods and services purchased from other firms. The value added includes payment of taxes, interest, rent, profit, reserves for depreciation and compensation to management and other employees.
The value added is the returns to the processors from the use of the capital, labour, and management and it is an appropriate economic measure in comparing enterprises by size (Baumol and Blinder, 1991). In a wider sense the value added shows the economic impact

of resources used in production in the form of returns to these resources. The value added measures the share of output that remains in the export and processing sector to reward those who contributed labour, capital and managerial skills, (Gittenger, 1982).

Whilst details of estimation differ moderately in size or amount, the value added can be recognised as the residual after the deduction inputs during the production process.

In this study the three cassava based products i.e. gari, kokonte, and HQCF are produced locally and used locally, local market price was used to evaluate all tangible activities identified in the processing of fresh cassava roots to the three selected cassava based products.

2.16 Coefficient of Concordance Analysis (W)

The Kendall's Coefficient of Concordance Analysis (W) is the measure of the degree of agreement among "m" sets of "n" ranks. "W" is an index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of sum of ranks. The idea behind this index is to find the sum of the ranks for each thing being ranked and then to examine the variability of this sum if the ranking are in perfect agreement, the viability among these sums will be a maximum (Mattson, 1986).

This analysis is a statistical procedure to identify and rank a given set of constraints / problems in the most pressing one up to the least pressing using numerals; 1,2,3,4…n in that order. Computing the total rank score for each problem, the problem with the least score is ranked as the most pressing whilst the one with the highest score is ranked as the least the pressing problem. The total rank score computed is then used to calculate the Coefficient of Concordance (W) to measure the degree of agreement in the rankings.

The limits for "W" cannot exceed 1.00 and cannot be negative. That is it can only be positive in sign and ranges from 0 to 1. It will be 1.00 when the ranks assigned by each judge (farmers) are the same as those assigned by other judges (farmers) and will be 0.00 when there is a maximum disagreement among the judges (farmer).

2.17 Conclusion

Cassava roots have contributed significantly to the economy of the country as regards its share of Agricultural Gross Domestic Product. (AGDP) and the production of the crop over the years. Since its introduction by the Portuguese during the 16^{th} and 17^{th} century, cassava roots have had a rather chequered historical development in terms of government policy. It took the country nearly twenty years after independence to recognise the role of cassava roots in the economy of this country. It can be argued that the country has not fully tapped the potential of cassava roots. Besides the widely used traditional cassava based products namely *gari, kokonte* and cassava dough, the country has not made any significant strides in the use of cassava based export potential products like, cassava chips and cassava starch. In the case of cassava based industrial products like, HQCF, glucose syrup, industrial alcohol (from cassava roots) and glues for the plywood most of the work done are still at the research level and on pilot basis. With the enormous industrial potential of cassava roots, it is now time for policy makers to initiate realistic, pragmatic and demand driven programmes for the country to tap the full potential of cassava roots.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter presents, information on the area of study, the choice of farmers and bakers for the study. The theoretical framework for the main object, the analytical techniques employed to address the solutions to the research problem that have been raised. The research hypotheses amenable to statistical test have been provided; description of the classificatory variables identified and the sources of data for the study.

3.2 The Study Area

3.2.1 Atebubu

The study was conducted in the Watro and Atebubu communities all situated in the Atebubu District. Sixteen small-scale bakers were involved in the study. All the bakers reside in the Atebubu town. Three other groups, a gari processing group made up of eight farmers, a kokonte processing group made up of ten farmers and twelve farmers, who produce HQCF were also involved in the study. All the three groups (gari, kokonte, and HQCF) reside in Watro. The HQCF processors in Watro benefited from the training under the Department for International Development (DFID). According to the project, the farmers were selected based on their willingness to participate in the project, interest and the hectares of land under cassava cultivation. Watro was selected on the basis of attested levels of cassava production and again having previous experience as a pilot village in the testing of a technology (Yam mini-set technology)

The Atebubu is situated in the northern part of the Brong-Ahafo Region. The total area of Atebubu is equivalent to 15.54% of the Brong-Ahafo Region. The vegetation is predominantly wooded guinea savannah. Soils are inherently low in fertility. Population density is comparatively low. Shifting cultivation is practiced with relatively longer (2-3 years) fallow periods as a major land use pattern.

Atebubu is an old commercial town. It harbours the district administrative capital. The town has pipe born water, electricity and telecommunication facilities. These facilities have greatly enhanced commercial activities in the area. Recently constructed in the area (Atebubu) is a modern market complex through the Ghana, German government co-operation.

Bread baking is one of the major commercial activity in the area. The bakery products range from bread, cakes, meat pie, doughnut, sweet bud and other cookies. Through a collaborative effort, the Food Research Institute (FRI), the National Board for Small Scale Industries, Ministry of Food and Agriculture and the Natural Research Institute (UK) trained some selected bakers in the area to use HQCF, wholly or in various proportions to prepare popular bakery products based on tested recipes by food scientist and professional bakers.

3.2.2 Watro

Watro is located about 14 .6 km to the east of Atebubu. The total area is about (600 x 250 Sqm), with an estimated population of about 900 persons. This number is made up of about 170 children, 500 women and 230 men. It has 62 households. In Watro, the total land under cassava cultivation about 6,000 hectares. Each farmer in the community cultivates on the average between 5-9 hectares of cassava. Yields are however very low, the average yield per hectare being about 2.5 tons per hectare. This implies a total production level of 30,000 tons, which is equivalent to about 30 percent of the district output. The different varieties of cassava planted in the village in order of preference are, Togo, Akosua Tuntum, Katawire and Ampenkyene, which are all local varieties. Gblemo Duade is least preferred because of its high moisture content.

The production of HQCF was introduced to the community through an IFAD- funded project implemented in collaboration with the Institute of Tropical Agriculture (IITA), Ibadan and the Food Research Institute (FRI) of Ghana, in 1999. The project was aimed at promoting the utilisation of HQCF for bread and other pastry products. Farmers in Watro produced HQCF for sale to bakers at Atebubu, who have been trained in the utilisation of HQCF for various bakery products.

3.3 Data Requirement

Data was collected on one cycle of production of a cassava-based product using a structured questionnaire. Information was gathered on resource requirement for the production of HQCF based bakery products, and wheat flour based bakery products. Data collected include quantity, price of all ingredients used in one batch and price of the final products using a structured questionnaire. Secondary data was collected from the Atebubu District Directorate of Agriculture on the monthly production of HQCF from 2000- 2003.

3.4 Method of Analysis

Theoretical Framework

The central concept that constitutes the framework of this study is the measure of profitability. Profit is defined as revenue minus cost. Suppose that the firm produces "n" outputs (y_i ....y_n) and uses m inputs (x_i ......x_m). Let the price of the output goods be (p_i ......p_n) and the price of the inputs be (w_i...w_m).

The profit the firm receives, π can be expressed as :

$$\Pi = \sum_{i}^{n} P_i Y_i - \sum_{j}^{m} W_{ij} X_{ij} \qquad (3.1)$$

The first term is the revenue and the second term is the cost.

Computation of Value Added

Components that were involved in the computation of the value added in this study included, the price of the raw material (fresh cassava roots at the farm gate price) and the price of the final product of the cassava based product. One cycle of production was used as common denominator for the computation of the three selected cassava-based products.

For HQCF, the first eight steps in the process must be completed in 12 hours. The study considered the quantity of fresh cassava roots that were processed through the first eight processes and quantity of the final product generated in one cycle of production. Appendix I presents the flow chart of HQCF production. To achieve an ideal product in the production of gari the process should be completed in twenty-four hours. Appendix II presents the flow chart for gari processing. Appendix III presents the flow chart for kokonte. The process takes between three to four days.

The following was used to compute the value added for the three selected cassava-based products.

Value Added (VA) = Price of the final commodity less the cost of raw materials used to produce a unit of the product.

$$VA = P_{CBP} - P_{RMCBP} \qquad (3.2)$$

Where

P_{CBP} = Price of X kg of the cassava based product produced.

P_{RMCBP} = Cost of the raw material to produce X kg of a cassava based product

Estimation of Profit

All the small-scale bakers interviewed were engaged in other kinds of commercial activity, example petty trading and dressmaking, besides baking. Baking was not done on a daily basis. However all the respondents did bake on market days. In Atebubu, the market days are observed in a five-day cycle. Baking on a market day was used as the common denominator for the bakers and thus constituted one cycle of production for the bakers.

The following were used to compute the five profit variables (Revenue, Operating profit, Cost per unit product, Profit per unit product, and Return on investment)

(i) Revenue Estimation

$TR = \Sigma Q_i P_i$ ....(3.3)

Where,

TR = Total Revenue (Sale of bakery product)

Q_i = Quantity sold of final product, (numbers)

P_i = Price per unit of final product i (cedis)

(ii) Operating Profit Estimation

$OP = TR - TC$ ....(3.4)

Where

OP = Operating profit

TR = Total revenue (Sales)

TC = Total cost. (Cedis)

(iii) Cost Per Unit Product Estimation

$= \Sigma_j W_{ij} X_{ij} / Q_i$

Where the numerator is total cost in cedis and the denominator is final output of bakery products (numbers).

(iv) Profit Per Unit Product Estimation

$= OP / Q_i$

Where the numerator is operating profit in cedis and the denominator is final output of bakery products (numbers)

(v) Return On Investment (for every thousand cedis) Estimation

$= [(OP) / \Sigma W_i X_i]^* 1000$ (cedis)

A paired sample t- test, using the software SPSS, was used to compare the mean levels of operating profit, cost per unit product, profit per unit product and the return on investment, of the various HQCF composition bakery products with 100% wheat flour bakery products. Five and ten percent significance levels were used.

Statement of the hypothesis

H_0: there is no significant difference between the means of operating profit of 50% HQCF product and 100% wheat flour product.

H_i: there is significant difference between the means of operating profit of 50% HQCF product and 100% wheat flour product.

The statement of the hypothesis was repeated for the means of cost per unit product, profit per unit product and return on investment estimated for the various proportions of HQCF bakery products and 100% wheat flour products.

HQCF production and growth rate

A bar chart of output levels was used to analyse the trend in production of HQCF in the forty-eight months between 2000 and 2003

The following formula was used to calculate the monthly production growth rate of HQCF.

$GR = [(F_T - F_{T-1})/ F_{T-1}]\ 100$ ....(3.5)

Where

GR = Denotes growth in production of HQCF.

F_T = Quantity of HQCF produced in the current month

F_{T-1} = Quantity of HQCF produced in the previous month

Success Drivers

A bar chart was used to analyse the success drivers associated with the processing of fresh cassava roots into high quality cassava flour.

The Kendal's Coefficient of Concordance (W) was used to analyse the ranking of the constraints affecting the production of HQCF.

The formula for the Coefficient of Concordance (W) is given by:

$$W = \frac{\sum T^2 - \left(\sum T\right)^2 / n / n}{m^2\left(n^2 - 1\right)/12} \qquad (3.6)$$

This is simplified to the computational formula for W as:

$12T / nm^2 (n^2 - 1)$

Where; T = sum of ranks for each item being ranked,

M = number of ranking (farmers)

N = number of factors being ranked (constraints affecting the production HQCF)

The coefficient of Concordance (W) is tested for significance in terms of the F distribution. The F-ratio is given by: (m-1) Wc / (1-Wc), with ((n-1) – (2/m)), degree of freedom for the numerator and (m-1)[(n-1)-(2/m)] degrees of freedom for the denominator (Allen Edwards, 1964) Wc is the calculated W.

Statement of the hypothesis

H_0: there is no agreement between the ranking of the constraints that influence the production of HQCF in the Watro area.

H_i: there is agreement between the ranking of the constraints that influence the production of HQCF in the Watro area.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the discussions of empirical results of the study. The chapter seeks to address the research questions that prompted this study.

4.2 Value Added Analysis

The value added analysis was done for the three cassava-based products namely HQCF, *gari* and *kokonte*. There is a high seasonal variability in fresh cassava prices in the study area. Therefore, the value added analysis took into account this seasonality by estimating value added in the low price season and the high price season. Table 4.1 below presents estimates of value added and the components of value added.

Table 4.1 The Value Added Analysis (Lean Season)

CASSAVA PRODUCTS			
Value added components	HQCF	GARI	KOKONTE
Number of bags of fresh Cassava roots	6	5	5
Price of a bag (35kg) (Fresh cassava roots)	¢ 20,000	¢ 20,000	¢ 20,000
Cost of raw materials used in one cycle of production	¢ 120,000	¢ 100,000	¢ 100,000
Quantity of output generated From a cycle of production	100 kg	30 bowls (one bowl is 2.5kg)	90 kg (one bag)
Price per unit of output	¢ 2,000	¢ 2,500	¢ 60,000
Total Value of product	¢ 200,000	¢ 75,000	¢ 60,000
Value Added (¢)	¢ 80,000	-¢ 25,000	-¢ 40,000
% Share of cassava roots in total cost of production	70.59	71.43	76.92

Source: Field Survey Data (2004)

Table 4.2 below gives an account of the value added analysis of the three cassava-based products for the high price season.

Table 4.2 The Value Added Analysis of The Three Cassava-Based Products (High Price Season)

	CASSAVA PRODUCTS		
Value added components	HQCF	GARI	KOKONTE
Number of bags of fresh Cassava roots	6	5	5
Price of a bag (35kg) Fresh cassava roots	¢ 30,000	¢ 30,000	¢ 30,000
Cost of raw materials used in one cycle of production	¢ 180,000	¢ 150,000	¢ 150,000
Quantity of output generated From a cycle of production	100 kg	30 bowls (one bowl is 2.5kg)	90 kg (one bag)
Price per unit product	¢ 2,000	¢ 6,000	¢ 100,000
Total Value of product	¢ 200,000	¢ 180,000	¢ 100,000
Value Added (¢)	¢ 20,000	¢ 30,000	-¢ 50,000
% Share of cassava roots in total cost of production	78.26	78.95	83.33

Source: Field Survey Data (2004)

From tables 4.1 and 4.2 above only HQCF recorded positive values of value addition for both the low price season and the high price season. *Gari* recorded a positive value of value addition for the high price season and negative value for the low price season. For *kokonte,* negative values were registered for both the low and high price seasons. Even though value added estimates for HQCF were positive in both seasons, the high price season estimate was 75% lower than the low season estimate. This is because output price remained unchanged as cassava price increased by 20%.

The value added for *gari* rose from a negative value for the low price season to a positive value, for the high price season. This was so because in the case of *gari* as the price of the raw material went up by 50%, there was a corresponding hike in the price per unit product by 140%. *Kokonte* registered negative values for both price seasons.

The price of the raw material for any commodity with industrial potential is very important. If the price of the raw material accounts for the largest percentage share of the total cost, it negates the value of processing the raw material into another product.
The Ayensu Starch Factory is a case in point, where there was a disagreement between the farmers and factory management, over the price of cassava roots offered by the factory management to the farmers. Whiles the factory was prepared to offer ¢ 150,000 for a tonne of cassava, the farmers, based on the prevailing market price of the raw material (cassava roots) demanded ¢ 500,000 for a ton.

In a case study of cassava development in Ghana, Ofori et al (1997) sated that processing of cassava roots to various traditional products such as *gari, kokonte* etc are often uneconomical. They further stated that in all these processing activities, there is a heavy reliance on family labour, which is not perceived as cost.
The observations made in the area of study are that all the processing activities relied heavily on family labour and the raw material (cassava root) came directly from their farms. For most of the processors, their immediate concern is to halt the deterioration of the cassava roots. Value is therefore not put on the activities involved. Once the storage life is secured, the economic value of the product becomes a concern to the farmer at the time of sale of the commodity, when very little or nothing is gained.

4.3 Estimation of Profits of HQCF Bakery Products and Wheat Flour Bakery Products

The study worked with sixteen small-scale bakers all based in the Atebubu area. The number of HQCF bakery products by the small-scale bakers ranged from one to four, with majority of the respondents (10) working with two bakery products. The HQCF bakery products that were identified in the study area included, bread, bofrot, sweet bad, cake, chips and meat pie.

Forty three percent of respondents produced bofrot. The proportions of HQCF used for bofrot was 30% and 50%, with majority (57%) of those producing bofrot using 50% HQCF. About 43% of the respondents traded in bread. The compositions of HQCF used were 12%, 22% and 6%. Again about 43% of the bakers traded in sweet bad the composition of HQCF used were 30%, 40% and 50%. Only 25% of the respondents baked cake with HQCF only. Twenty-nine percent of the respondents baked chips and they used flour with 30%, and 50% HQCF. Finally 12% of the respondents traded in meat pie, and they all used flour with 50% HQCF composition.

The paired sample T-Test could not be done for operating profit for bofrot 30% HQCF and for meat pie with 30% HQCF, because the standard error of the difference was zero.

Table 4.3 Paired Samples T-test for Bofrot 50% HQCF and Bofrot 100% Wheat Flour

Variables	50% HQCF	100% W.F	t	Significance
Operating profit (¢)	40,589.50	37,644.50	3.468	0.040**
Cost per unit product (¢)	291.56	311.99	-5.413	0.012**
Profit per unit product (¢)	208.42	187.99	5.411	0.012**
Return on investment (¢)	740.62	617.10	3.549	0.038**

Source: Field Survey Data (2004)
NB *** 1% Significance level ** 5% Significance level * 10% Significance level

From Table 4.3 the production of bofrot with 50% HQCF yielded better financial returns than it did for bofrot with 100% wheat flour. Comparing the mean operating profits of the two products, bofrot with 50% HQCF made a 7.8 percent more gain. Similar results were obtained for other variables that were considered. For example, for the mean cost per unit product for bofrot with 50% HQCF, there was a 6.5 percent reduction when compared to bofrot, with 100% wheat flour.

The aim of every entrepreneur is to maximise profit and minimise cost. The use of HQCF therefore satisfies the aspiration of the small-scale baker.

Table 4.4 Paired Samples T-test for12% HQCF Bread and 100% Wheat Flour Bread

Variables	12% HQCF	100% W.F	t	Significance
Operating profit (¢)	175,129.00	193,129.00	-4.16	0.029**
Cost per unit product (¢)	1,716.88	1,667.84	-3.19	0.049**
Profit per unit product (¢)	2,283.60	2,33.14	-4.54	0.020**
Return on investment (¢)	1,371.27	1,435.53	-7.11	0.006***

Source: Field Survey Data (2004)
NB. *** 1% level of significance ** 5% level of significance

From Table 4.4 the production of bread with 100% wheat flour yielded better financial returns than it did for bread with 12% HQCF. Comparing the mean operating profits for bread with 100% wheat flour and bread with 12% HQCF, bread with 100% wheat flour made a 9.3 percent more on mean operating profit than bread with 12% HQCF. Similar results were obtained for other variables that were considered. Example there was a 2.9% reduction in the mean cost per unit product for bread with 100% wheat flour when compared with bread with 12% HQCF.

Table 4.5 Paired Samples T-test for 22% HQCF Bread and100% Wheat Flour Bread

Variables	22% HQCF	100% W.F	t	Significance
Operating profit (¢)	109,281.00	125,881.00	-7.545	0.084*
Cost per unit product (¢)	1,690.26	1,599.67	3.835	0.162
Profit per unit product (¢)	2,309.72	2,400.32	-7.545	0.084*
Return on investment (¢)	1,367.47	1,500.61	-4.252	0.147

Source: Field Survey Data (2004)
NB***1% level of significance**5% level of significance* 10% level of significance

From the Table 4.5 bread with 100% wheat flour yielded better financial returns for two out of the four variables that were considered. When compared to bread with 22% wheat flour, bread with 100% wheat flour recorded a 13% more in mean operating profit. There was also a 3.7 percent more in the mean profit per unit product for bread with 100% wheat flour when compared to bread with 22% HQCF.

Table 4.6 Paired Samples T-test for 50% HQCF Sweet Bad and 100% Wheat Flour Sweet Bad

Variables	50% HQCF	100% W.F	t	Significance
Operating profit (¢)	58,580.00	57,580.00	3.468	0.040**
Cost per unit product (¢)	265.68	276.99	-60.04	0.000***
Profit per unit product (¢)	234.32	222.99	60.10	0.000***
Return on investment (¢)	883.77	806.77	18.47	0.000***

Source: Field Survey Data (2004)
NB. ***1% level of Significance**5% level of Significance*10% level of significance

From Table 4.6 sweet bad with 50% HQCF yielded better financial returns than it did for sweet bad with 100% wheat flour. Sweet bad with 50% HQCF recorded 1.7% more in mean operating profit when compared to sweet bad with 100% wheat flour. For mean cost per unit product, there was a 4.1 percent reduction for sweet bad with 50%HQCF when compared to sweet bad with 100% wheat flour. Similarly, the mean profit per unit product for sweet bad with 50% HQCF registered a 5 percent more when compared to sweet bad with 100% wheat flour.

Table 4.7 Paired Sample T-test for 30% HQCF Sweet bad and 100% Wheat Flour Sweet Bad

Variables	30% HQCF	100% W.F	t	Significance
Operating profit (¢)	-	-	-	-
Cost per unit product (¢)	327.52	305.93	2.10	0.282
Profit per unit product (¢)	166.70	194.06	-1.70	0.337
Return on investment (¢)	531.25	648.45	-1.72	0.335

Source: Field Survey DATA (2004)

From Table 4.7 a reduction in the composition of HQCF from 50% (Ref. Table 4.6) to 30% in the preparation of sweet bad did not register any differences in financial return for all the variables that were considered between sweet bad with 30% HQCF and sweet bad with 100% wheat flour.

Table 4.8 Paired Samples T-test for 100% HQCF Cake and 100% Wheat Flour Cake

Variables	100% HQCF	100% W.F	t	Significance
Operating profit (¢)	60,500.25	54,510.75	1.01	0.384
Cost per unit product (¢)	1,136.85	1,250.20	-3.21	0.049**
Profit per unit product (¢)	863.14	749.79	3.21	0.049**
Return on investment (¢)	761.03	600.46	3.12	0.052*

Source: Field Survey Data (2004)
NB. ** 5% level of significance * 10% level of significance.

From Table 4.8 cake with 100% HQCF yielded better financial returns than cake with 100% wheat flour for all the variables that were considered. Cake with 100% HQCF recorded 10.9 percent more in mean operating profit than it did for cake with 100% wheat flour. Again cake with 100% HQCF recorded a reduction of 9 percent in mean cost per unit product when compared to cake with 100% wheat flour. Similarly there was a 15.1 percent increase on the mean profit per unit product for cake with 100% HQCF when compared to cake with 100% wheat flour.

Table 4.9 Paired Samples T-test for 50% HQCF Chips and 100% Wheat Flour Chips

Variables	50% HQCF	100% W.F	t	Significance
Operating profit (¢)	31,480	28,297	66.03	0.000***
Cost per unit product (¢)	290.12	317.43	-34.59	0.000***
Profit per unit product (¢)	209.86	182.55	34.66	0.000***
Return on investment (¢)	736.92	584.37	8.18	0.004***

Source: Field Survey Data (2004)
NB*** 1% level of significance

From Table 4.9 chips with 50% HQCF yielded better financial returns than chips with 100% wheat flour. From the Table above chips with 50% HQCF recorded 11.24 percent more in mean operating profit than chips with 100% wheat flour. In terms of mean cost per unit product for both products, chips with 50% HQCF recorded an 8.6 percent reduction when compared to chips with 100% wheat flour. Similar results were obtained for mean profit per unit product. As a result of the 50% reduction in wheat flour in the preparation of chips with 50% HQCF, there was a corresponding 14.9 percent more gain in profit per unit product.

The initial cost of investment into a bakery product like chip is relatively low there by affording a wide range of entrance into the business especially at the rural level. The consumers of such product (HQCF Chips) in most rural settings are school children. The analysis of 50% HQCF chips and 100% wheat flour chips clearly demonstrates that 50% HQCF chips has better economic returns in all the variables that were considered. The vigorous promotion of HQCF in making chips will catch the consumers at an early age there by influence their taste and preference for the product.

Table 4.10 Paired Samples T-test for 50% HQCF Meat Pie and 100% Wheat Flour Meat Pie

Variables	50% HQCF	100% W.F	t	Significance
Operating profit (¢)	-	-	-	-
Cost per unit product (¢)	238.38	249.33	-152.2	0.004***
Profit per unit product (¢)	263.60	250.66	152.29	0.004***
Return on investment (¢)	1,115.33	1,005.48	42.99	0.015**

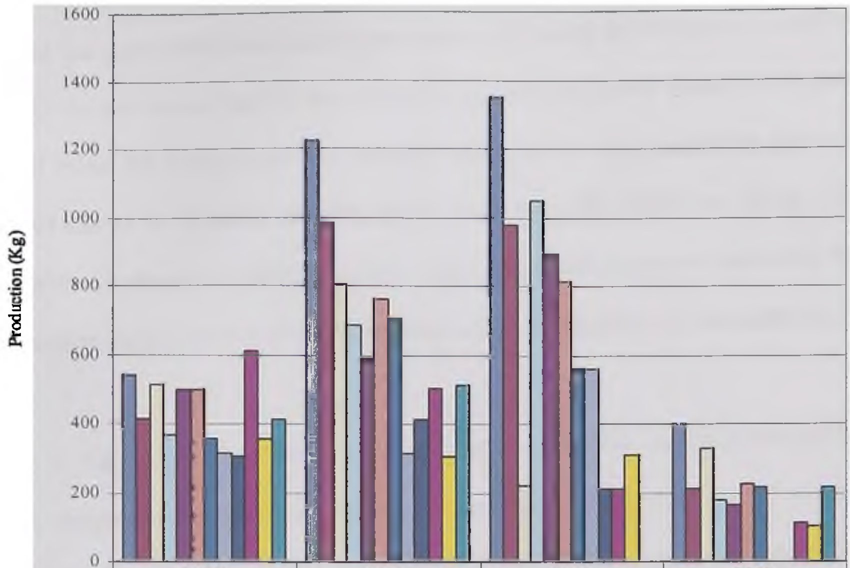
Source: Field Survey Data (2004)
NB. *** 1% level of significance ** 5% level of significance

From Table 4.10 meat pie with 50% HQCF yielded better financial returns than it did for meat pie with 100% wheat flour. For meat pie with 50% HQCF, there was a 4.3 percent reduction in mean cost per unit product when compared with meat pie with 100% wheat flour. Similarly meat pie with 50% HQCF recorded a 5.2 percent more, in mean profit per unit product when compared with meat pie with 100% wheat flour. From the analysis when wheat flour is reduced by 50% in the preparation of meat pie there was a corresponding reduction in cost per unit product and an increase in profit per unit product.

4.4 Production and Growth Rate of HQCF 2000 – 2003.

Figure 4.1 gives a bar chart description of the production figures of HQCF from 2000 to 2003. Production was generally low at the inception of the project (2000) it picked up in 2001 and 2002 and then declined in 2003. The months of January recorded the highest production figures for 2001, 2002 and 2003 with the exception of 2000.

Figure 4.1: HQCF PRODUCTION (2000-2003)



	2000	2001	2002	2003
Jan	540	1225	1350	405
Feb	415	985	980	211
March	512	805	222	331
April	365	688	1050	180
May	500	588	895	165
June	500	761	812	225
July	358	705	558	216
Aug	315	314	558	
Sept	305	416	211	
Oct	610	505	214	115
Nov	360	306	309	105
Dec	412	511		215

Year

Source: Atebubu District Directorate (MOFA 2003)

From the figure 4.1 in the year 2000 the highest production was recorded in the month of October (610 kg) with September recording the least (305kg). The production figures for HQCF for 2001 Fig 4.1 shows a remarkable increase in production of HQCF. From January to July with the exception of the month of May, production figures were above the 600kg mark on a monthly basis. These production figures were not achieved for the same period last year (2000) when production figures fell below the 600kg on a monthly basis. Again for the second half of the year 2001, production figures except for August did not fall below the 400kg mark on a monthly basis. For the same period the previous year (2000) except for October and December, production fell below the 400kg. The increase in the production of HQCF could be attributed to the experience gained in the previous year in the production of HQCF and the economic benefits that were achieved.

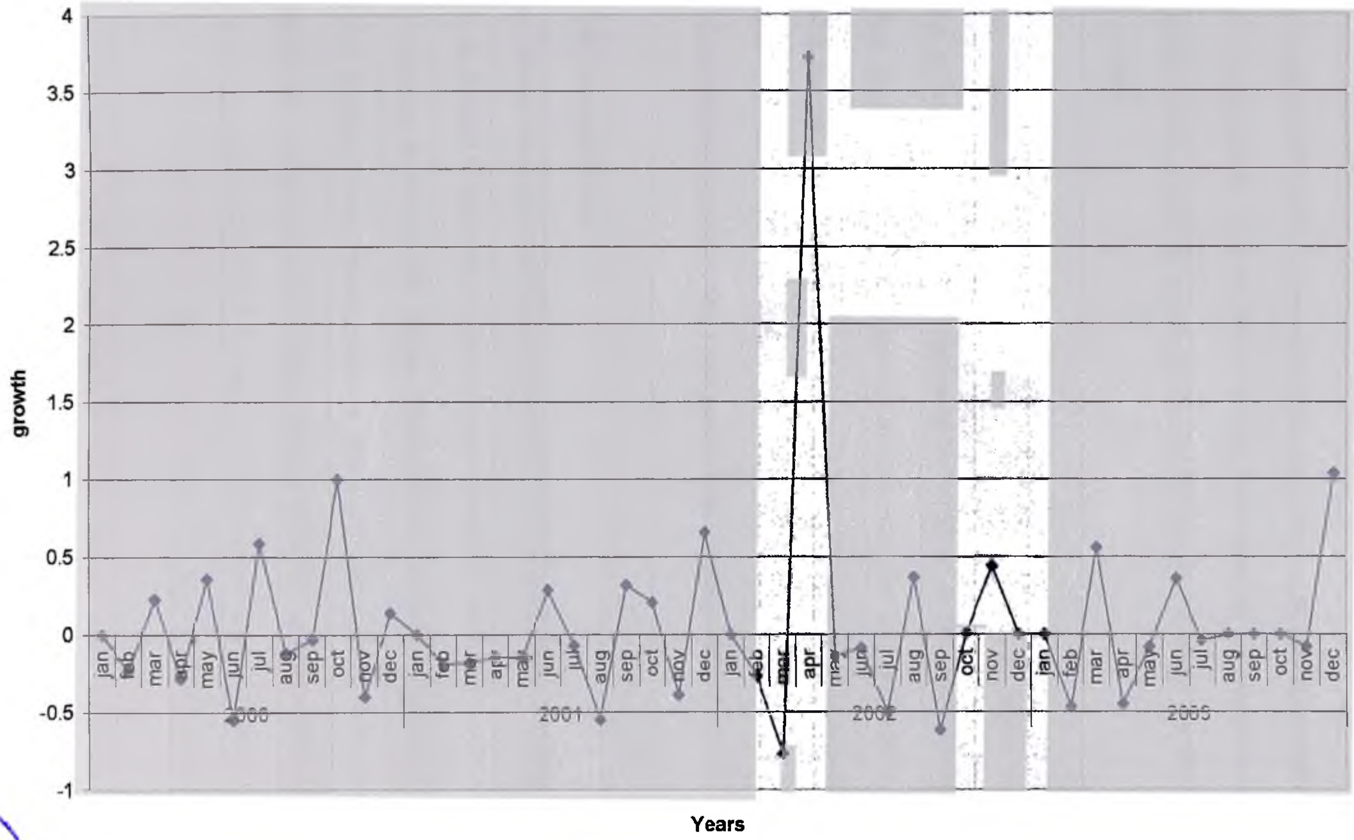
Referring to Fig 4.1 the first half of year 2002 performed better in the production of HQCF as compared to the previous year's production (2001). Five out of the six months, for the first part of the year (2002), hit production figures above the 800kg mark. The same story cannot be said for the first half of the previous year (2001).

The second half of the year had only two months hitting above the 400kg and the remaining recording below the 400kg mark. The previous year had three months hitting above the 400kg in the last half of the year.

In the year 2003 Fig 4.1 production of HQCF was available for only tens months, with the month of August and September having no production figures. The production trend followed a similar trend as the preceding years, with January recording the highest production figure of 405kg with 105kg being the least for the year 2003.

Production figures for 2003 were the worst for all the years since the inception of the project. The sustainability issue comes to the fore again. For the first seven months, only one month hit above the 400kg mark, with the rest recording low figures. For the months of August and September, no production was recorded. When production was restored, it barely managed to hit above the 250kg mark as the highest for the latter half of the year.

Fig 4.2: Growth in HQCF Production (2000-2003)



SOURCE: ATEBUBUB DISTRICT DIRECTORATE (MOFA)-2003

Fig 4.2 depicts the trend in percentage growth in the production of HQCF from the year 2000 to 2003.

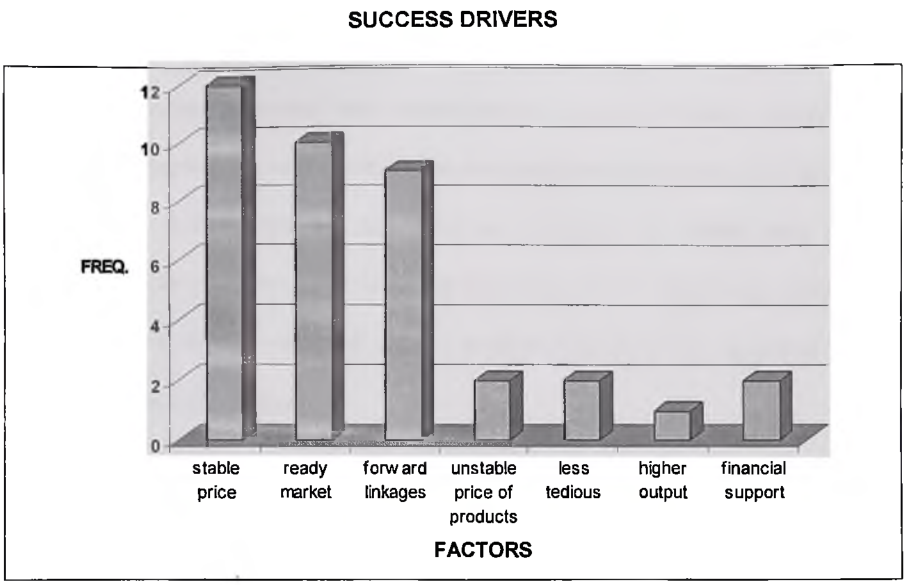
Generally, there was an inconsistency in percentage growth in the production of HQCF for the period (2000-2003). Only sixteen out of the forty-eight months recorded positive values in percentage growth. There was a preponderance of negatives values in percentage growth, month by month for the first five months of every year for the period 2000 to 2003.

All the respondents were farmers, a fall in percentage growth in HQCF for the first quarter of every year, could be attributed to the workload on the farm. Normally during the first quarter of the year, farmers devote more time to land preparation and other farming activities. Since their main occupation is farming that need (farming) would be satisfied first before other off-farm activities, hence the negative values in percentage growth in HQCF production in the first quarter of the respective years.

4.5 The Success Drivers

Seven factors were given as the success drivers for the production of HQCF. (Fig 4.3) gives an account of these factors. All the respondence attributed more stable price as the major success driver for the project. Other factors mentioned amongst others were forward linkages, ready market, unstable prices of other cassava-based products, the relatively less tedium associated in the processing of HQCF, and the relatively higher out put in the production of HQCF as compared to other cassava-based products in the study.

FIG 4.3



Source: Field Survey Data (2004)

For the three cassava-based products, only HQCF maintained a stable price of ¢2,000 for 2.2kg for both the low and high season prices. For gari, the price of 2.5kg (one bowl) changed with the season. For the low price season it went for ¢ 2,000 and ¢ 6,000 accounting for the high price season. For the third commodity, kokonte the price was unstable ranging from ¢ 40,000, ¢ 60,000 and ¢100,000 for 90kg of kokonte.

The stable price of HQCF enabled the farmers to make projections as to how much income was to be earned in advance from a given amount of HQCF produced. The stable price of HQCF was an added advantage to the processing of cassava roots to HQCF, then to the other cassava based product considered in the study.

As a result of the cost saving measure, more profit per unit product and more profit per unit cost of product, bakers were willing to purchase HQCF from the farmers. The bakers therefore served as a source of ready market by which the farmers readily disposed of their commodity (HQCF).

The HQCF is further processed into assorted bakery products, thereby satisfying the desire of linking agriculture to medium and small-scale enterprises at the micro level. The sustainability of this linkage has an enormous benefit to the farmer (the primary producer). It is an assurance that whatever quantity of the commodity (HQCF) is produced, there is a high tendency of the product (HQCF) to be absorbed by the secondary processor (the baker).

The baker will employ some labour in the preparation of the various bakery products using composite flour, thus implying that the production of HQCF generates some kind of employment at the micro enterprise level.

For one cycle of production of HQCF, six bags (each weighing 35kg) of fresh cassava roots were used. While for the other cassava based products (gari and kokonte) five bags (each weighing 35kg) were used. According to the processors, the tedium, associated with the processing of the cassava-based product, determined the amount of bags of fresh cassava roots that can be conveniently handled in a cycle of production. The ease of an operation therefore plays an important role in the adoption of an innovation.

4.6 Constraints Affecting the Production of HQCF

In this study "n" includes factors such as drying space, distance from the mill, frequent breakdown of the screw-presser, storage room, harvesting of cassava, distance from the farm, lack of washing tools, lack of tools for peeling, packaging materials, micro-finance and lack of processing equipment.

Hypothesis and Significant Test for W: (F-Test)

H_0: there is no agreement between the ranking of the constraints that influence the production of HQCF in the Watro area.

H_i: there is agreement between the ranking of the constraints that influence the production of HQCF in the Watro area.

Constraints that affected the production of high quality cassava flour identified in the study area were as follows;

A – Drying Space

B- Distance from mill.

C- Frequent breakdown of the screw-presser

D- Storage room

E- Harvesting of cassava

F- Distance from the farm

G - Lack of washing tools

H - Lack of tools for peeling

I - Packaging materials

J - Micro-finance

K - Lack of processing equipment.

Table 4.11 on the next page is a summary of the coefficient of Concordance analysis. It outlines the constraints that were identified in the study area and the ranks that were scored for the constraints by the respondents. It also shows that total weight scored for the identified constraints.

Table 4.11 Coefficient of Concordance Analysis: Response from Survey.

Farmer	A	B	C	D	E	F	G	H	I	J	K
1	1	5	3	2	10	7	8	9	11	4	6
2	1	5	3	2	8	4	11	10	9	6	7
3	4	6	3	1	8	5	11	10	9	2	7
4	1	5	3	2	10	7	11	9	8	4	6
5	2	3	1	6	8	5	11	10	9	4	7
6	3	6	4	2	7	8	11	10	9	1	5
7	1	7	3	2	8	5	9	10	11	4	6
8	1	2	3	4	8	6	11	10	9	5	7
9	2	5	4	7	9	1	10	11	8	3	6
10	1	3	7	2	8	6	9	5	11	4	10
11	1	4	3	2	9	6	10	11	8	5	7
12	1	5	2	4	8	7	10	9	11	3	6
Total	19	56	39	36	101	64	122	114	113	45	80
Ranking	1	5	3	2	8	6	11	10	9	4	7

Source: Field Survey Data (2004)

Table 4.12 Summary of the coefficient of Concordance Analysis

Constraints	Rank	TWS	1	2	3	4	5	6	7	8	9	10	11
Drying space.	1	19	8	2	1	1	0	0	0	0	0	0	0
Storage room	2	36	1	7	0	2	0	1	1	0	0	0	0
Breakdown of screwpresser	3	39	1	1	7	2	0	0	1	0	0	6	0
Micro-Finance	4	45	1	1	2	5	2	1	0	0	0	0	0
Distance from hammer-mill	5	56	0	1	2	1	5	2	1	0	0	0	0
Distance from Farm	6	64	1	0	0	1	3	3	3	1	0	0	0
Lack processing equipment.	7	80	0	0	0	0	1	5	5	0	0	1	0
Harvesting	8	101	0	0	0	0	0	0	1	7	2	2	0
Packaging	9	113	0	0	0	0	0	0	0	3	5	0	4
Lack. Tool for peeling	10	114	0	0	0	0	1	0	0	0	3	6	2
Lack tools for washing	11	122	0	0	0	0	0	0	0	1	2	3	6

Source: Field Survey Data (2004)

NB: TWS is the Total Weight Score

Var T = 13092.2, m = 12 n =11

Coefficient of Concordance (W) = $12T/ nm^2 (n^2 - 1)$

$= 12(13092.2) / 11(12)^2 ((11))^2 - 1)$

= 0.075

= 7.5%

The low value of 0.075 (7.5%) is indication that, the farmers interviewed do not collectively agree to the constraints affecting the production of HQCF. However, the farmers perceive the drying space (with the lowest value of 19) as the most pressing constraint affecting the production of HQCF and the lack of tools for washing as the least constraint having the highest score of 122.

Hypothesis and Significant Test for W: F-Test

H_0: there is no agreement between the rankings of the constraints that affect the production of HQCF

H_1: there is agreement between the rankings of the constraints that affect the production of HQCF.

F-ratio = ((m-1) Wc) / (1 –Wc)

((12-1) 0.075 / (1- 0.075)

= 0.891

Degree of freedom for the numerator (df1) = (n-1) – (2/m)

= 11- 0.16

= 10.84

Degree of freedom for the denominator (df2) = (m –1) * ((n –1) - (2/m))

= 11* (10 – 0.16)

= 108.24

F-ratio (Fcal) = 0.891

The calculated F. ratio, 0.89 is not statistically significant at 5% level. It is therefore, conclude that there is no agreement among the farmers in the rankings of the constraints that affect HQCF production in the Watro area.

Even though when the identified constraints were ranked and subjected to the Kendal Coefficient of Concordance analysis, the alternate hypothesis (H_1) was rejected, the identified problems were institutional based rather than economic based. In introducing an innovation, there is the need for the formation of institutions that will nurture, nourish, encourage and sustain the adoption of the innovation. The processing of HQCF was an entirely new activity for the farmers.

The drying space was ranked first because it determined the amount of sifted mash to be dried and consequently the amount of HQCF to be produced. The farmers hitherto were used to drying on their farms or any available space irrespective of hygienic condition. They were used to the production of cassava-based products that did not require or have any standard quality measure. As stated by Ofori et al (1997) "processing of cassava roots to traditional cassava based products is often carried out under unhygienic conditions and some unsanitary practices, such as improper effluent disposal". They went on again to say, "Products may be of inconsistent organoletic and microbiological quality, because no formal quality system is applied during processing to assure the quality of the product".

The processing of HQCF requires certain standard measures to meet required quality standard. The conditions under the various stages of the processing activities therefore mattered. The farmers from the onset of the project strived to meet the quality standard with whatever tools and equipment that were available to them. The enthusiasm to produce HQCF was high because it offered a viable economic alternative. Expectation were that, as the years progressed all the necessary institutional arrangement would be put in place for sustained growth in production.

The drying space or place, the storage room, processing tools and equipment all play important roles in producing HQCF on sustainable basis, without altering quality standard. The afore mentioned constraints therefore suggest that the institutional arrangement that were necessary to produce HQCF on a sustainable basis were not properly prioritised, not adequate or were completely absent.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction.

This Chapter forms the concluding part of the study. It draws its conclusions from the empirical results of the study. The chapter offers recommendations and the way forward for the production and promotion of HQCF in the country.

5.2 Conclusions

The results from the study indicate that the price of the raw material is important as it affects the value addition that consumers can take. Ghana, as a producer of primary agricultural produce needs to add value to her primary agricultural produce to derive optimal benefit. This will strengthen the link between agriculture and industry.

For the rural processor and investor to be encouraged to add value to our agricultural produce, the prices of primary agricultural produce of industrial potential must be moderate. When the price of the primary agricultural produce, takes a very high percentage of the total cost of production, it reduces the benefits of value addition. In spite of the high price of fresh cassava in the study area, only HQCF registered positive financial returns in both high and lean seasons prices in the analysis of value addition.

The cost saving measures of HQCF made HQCF bakery products more profitable in all the variables that were considered for all the bakery products except HQCF bread. Ghana imports all her wheat requirements. The bulk of wheat flour imports is used for assorted pastry products like bread, biscuits, chips, bofrot, meat pie and more. The increase in the of price of wheat on the world market, calls for the vigorous pursuit of policy to encourage the substitution of HQCF partially or in full in the preparation of popular pastry products in the country. This will save the country some foreign exchange and enhance the integration of our agriculture with industry.

The lack of processing tools and equipment and the necessary institutional arrangement had an adverse effect on the sustainability of HQCF production. The production of HQCF holds an enormous economic advantage in the cassava sub sector of the economy. To step up and popularise the production of the commodity, the basic infrastructure and equipment must be set up in other potential cassava producing areas in Ghana. The rural processor cannot benefit from the advantages of the economics of scale if he is to rely on rudimentary equipment with high downtime.

Ready market, stable price and forward linkages among others contributed immensely to the success of HQCF production. From the study it was established that there was ready market for the commodity (HQCF). The bakers needed the commodity because of the economic benefit they derived from its usage. The farmers readily produced HQCF because of the competitive advantage it has in terms of financial returns of value addition as compared to the other cassava-based products that were considered in this study.

5.3 Recommendations

There is the need to institute some pricing mechanism for primary agricultural produce with industrial potential based on quality and weight. In Ghana the only agricultural commodity with such pricing mechanism is cocoa. With the government policy to encourage value addition of primary agricultural produce, the issue of pricing of primary agricultural produce with industrial potential must be established. For example, cassava varieties with high starch content suitable for industrial purposes only, must be priced such that it will be attractive for the industrialist to buy for value addition purposes.

There are various end users of fresh cassava in Ghana; the chop barkeeper, the foodstuff trader, the rural processor and industrialist. How much should a kilogram of cassava be sold to make it attractive to both the farmer and other users? This is an issue that policy makers must address if we are to add value to our primary agricultural produce and link agriculture to industry. For the rural processor, a contractual arrangement (contract farming) between the seller of fresh cassava and the buyer of HQCF is recommended.

To expand farms and meet the quantity requirements of rural processors (the farmers) require financial assistance. Future projects should incorporate a micro finance scheme to meet the financial services need of beneficiary. Such a scheme will offer short-term loans for farmers to expand their farms and employ more farm hands for the maintenance of their farms. Such a scheme will also help mobilise funds from the community and encourage saving habits in the community.

The farmers combined their farming work with the production of HQCF. When labour demand was high it had an adverse effect on the production of HQCF. For smooth running of a rural enterprise of this nature, there is need for specialization, where farmers will solely supply the raw material (cassava roots) for processing into HQCF. Combining farming with processing may result in inefficiency. The other option is to provide the farmers with financial assistance to employ more labourers on their farms, so that the farmer assumes a supervisory role on the farm thereby leaving the farmer with more time to concentrate on the processing activities.

With the escalating price of wheat flour at both the local and international markets the promotion of HQCF becomes relevant. In all the analysis that were done to determine the profitability of HQCF bakery products, with the exception of bread, the other bakery products yielded better results in terms of all the profitability variables considered. There is the need to go beyond the awareness level and set the necessary institutions to vigorously pursue the promotion of the use of HQCF. The Ghana Regional Appropriate Technology Industrial Service (GRATIS) must be proactive in the manufacture of tools and equipment for the processing of cassava roots into HQCF. The availability of funds for interested rural processors for their work will go a long way to promote the production and utilisation of HQCF. This can be achieved by the District Assemblies providing some guarantee for the lending institutions when they credit available to processors. Another strategy is the serving of HQCF bakery products at state functions as a means of popularising HQCF bakery products.

This study revealed that HQCF bakery products compete favourably with wheat flour bakery products in both consumer acceptance and financial terms. It is time for policy makers to institute the necessary measures through food policy, trade policy, promotional campaigns, the utilisation of HQCF bakery based products in our educational institutions and the hospitality industry in the country. This will enable the country to fully tap the industrial potential of cassava roots.

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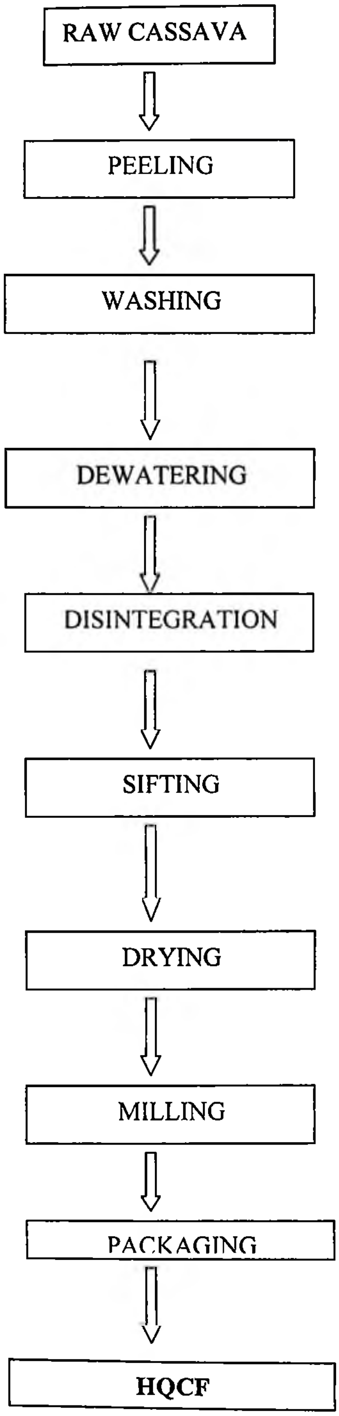
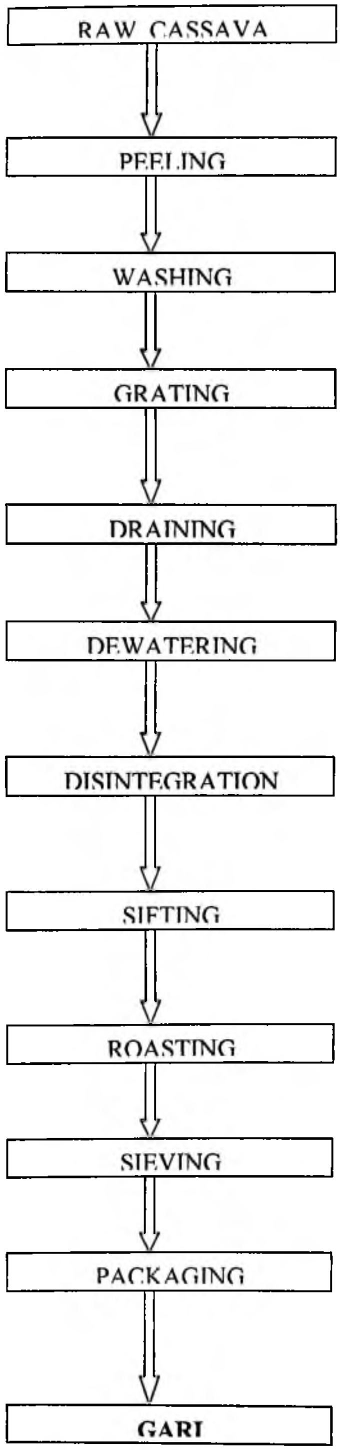
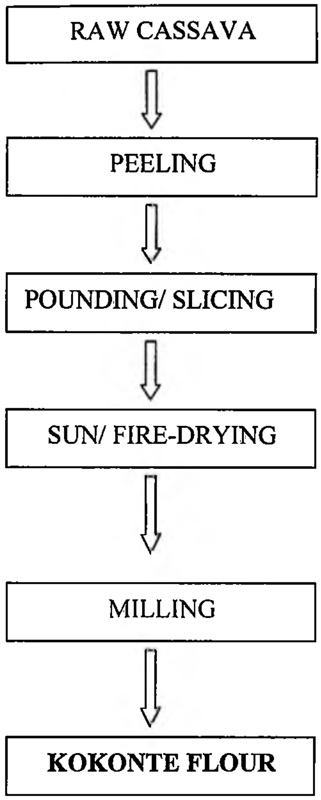
APPENDIX I FLOW CHART FOR HQCF PRODUCTION



APPENDIX II FLOW CHART FOR GARI PROCESSING



APPENDIX III FLOW CHART FOR KOKONTE



APPENDIX IV TABLE I

COST OF CASSAVA ROOTS & LABOUR COST (Low P Season)
HQCF PRODUCTION

Item	Quantity	Unit Price (¢)	Total Cost (¢)	% Share of Total Cost
Fresh cassava roots	Six bags	20,000	120,000	70.59
Peeling Washing Dewatering Disintegration Sifting	2 labourers	15,000	30,000	17.65
Milling	2 bags	10,000	20,000	11.76

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX IV TABLE 2

COST OF CASSAVA ROOTS & LABOUR COST (High Season)
HQCF PRODUCTION

Item	Quantity	Unit Price (¢)	Total Cost (¢)	% Share of Total Cost
Fresh cassava roots	Six bags	30,000	180,000	78.26
Peeling Washing Dewatering Disintegration Sifting	2 labourers	15,000	30,000	13.04
Milling	2 bags	10,000	20,000	8.70

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX V TABLE 3

COST OF CASSAVA & LABOUR COST (Low Season)
GARI PRODUCTION

Item	Quantity	Unit Price (¢)	Total Price (¢)	%Share of Total Cost
Fresh cassava roots	5 bags	20,000	100,000	71.43
Peeling Washing Grating Dewatering Disintegration Sifting Patching	2 labourers	10,000	20,000	14.29
Fuel	One bundle	10,000	10,000	7.14
Patching Pan (Hiring)	One	10,000	10,000	7.14

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX V TABLE 4

COST OF CASSAVA ROOTS & LABOUR COST (High Season)
GARI PRODUCTION

Item	Quantity	Unit Price (¢)	Total Price (¢)	%Share of Total Cost
Fresh cassava roots	5 bags	30,000	150,000	78.95
Peeling Washing Grating Dewatering Disintegration Sifting Patching	2 labourers	10,000	20,000	10.53
Fuel	One bundle	10,000	10,000	5.26
Patching Pan (Hiring)	One	10,000	10,000	5.26

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX VI TABLE 5

COST OF CASSAVA ROOTS & LABOUR COST (Low Season)
KOKONTE PRODUCTION

Item	Quantity	Unit Price	Total Cost (¢)	% Share of Total Cost
Fresh cassava roots	5 bags	20,000	100,000	76.92
Peeling Pounding	2 labourers	10,000	20,000	15.38
Milling	One bag	10,000	10,000	7.70

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX VI TABLE 6

COST OF CASSAVA ROOTS & LABOUR COST (High Season)
KOKONTE PRODUCTION

Item	Quantity	Unit Price	Total Cost (¢)	% Share of Total Cost
Fresh cassava roots	5 bags	30,000	150,000	83.33
Peeling Pounding	2 labourers	10,000	20,000	11.11
Milling	One bag	10,000	10,000	5.56

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX VII TABLE 7

COMMODITY PRICES IN THE FIRST QUARTER OF 2004 AT ATEBUBU

COMMODITY	QUANTITY	PRICE (¢)
Sugar	450g	2,000
Margarine	250g	3,000
Soda Powder	450g	15,000
Yeast	450g	12,000
Flavour	28ml	5,000
Nut meg	Depending on size	One nut for ¢1,000 / two nuts for ¢ 2,000
HQCF	1 kg	2,000
Baking Powder	450g	15,000
Oil	1 lit	12,000
Egg	1 crate	25,000
Fire Wood	1 bundle	6,000
Charcoal	1 pan (10kg)	5,000
Wheat flour	2.5 kg	10,000
Corned beef	400g	15,000

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENT & PRICES OF 50%HQCF (BOFROT) & 100% WHEAT FLOUR BOFROT

APPENDIX VIII TABLE 8

PERCENTAGE HQCF: 50%			WHEAT FLOUR: 100%		
Ingredients	Quantity	Cost (¢)	Ingredients	Quantity	Cost (¢)
Sugar	787.5g	3,500	Sugar	900g	4,000
Margarine	337.5g	4,208.5	Margarine	237.5g	3,028.25
S.P.	5g	166	S.P.	5g	166
Yeast	7.5g	266	Yeast	6.25g	166.25
Oil	2.25 lit	25,000	Oil	2.37 lit	27,500
Flavour	5 ml	1,120	Flavour	5 ml	1120
Nut meg	1.5 nuts	1,500	Nut meg	-	-
W.F.	2.5 kg	10,000	W.F.	5kg	20,000
HQCF	2.2 kg	4,400	Labour		3,000
Labour		3,000	Fuel		4,000
Fuel		4,000			
Out put: 195.5 pieces Unit price: ¢ 500 Sales revenue: ¢ 97,750 Total cost: ¢ 57,160.5 Operating profit: ¢ 40,589.50 Cost per unit product: ¢ 291.56 Profit per unit product: ¢ 208.42 Return on investment: ¢ 740.62			Out put: 201.25 pieces Unit price: ¢ 500 Sales revenue: ¢ 100,625 Total cost: ¢ 62,980.50 Operating profit: ¢ 37,644.50 Cost per unit product: ¢ 311.99 Profit per product: ¢ 187.99 Return on investment: ¢ 617.10		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENTS & PRICES OF 12% HQCF (BREAD) & 100% WHEAT FLOUR BREAD

APPENDIX IX TABLE 9

PERCENTAGE HQCF: 12%			WHEAT FLOUR: 100%		
Ingredient	Quantity	Cost (¢)	Ingredient	Quantity	Cost (¢)
Sugar	3.7kg	16,500	Sugar	3.7kg	16,500
B.P.	8.75kg	291.25	B.P.	8.75g	291.25
Nut meg	4.5kg	4,000	Nut meg	4.5 nuts	4,000
Yeast	11.5g	299.50	Yeast	11.25g	299.50
Margarine	437.5g	5,250.	Margarine	437.5	5,250
Flavour	1.25 ml	280	Flavour	1.25 ml	280
HQCF	2.75kg	5,500	W.F.	21.86kg	87,500
W.F.	18.75	75,000	Labour		6,000
Labour		6,000	Fuel		6,750
Fuel		6,750			
Out put: 73.75 pieces Unit price: ¢ 4,000 Total cost: ¢ 119,870.75 Sales revenue: ¢ 295,000 Operating profit: ¢ 175,129 Cost per unit product: ¢ 1,716.88 Profit per unit product: ¢ 2,283.60 Return on investment: ¢ 1,371.27			Out put: 80 pieces Unit price: ¢ 4,000 Total cost: ¢ 126,870.75 Sales revenue: ¢ 320,000 Operating profit: ¢ 193,129 Cost per unit product: ¢ 1,667.84 Profit per unit product:¢ 2,332.14 Return on investment: ¢ 1,435.53		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENTS & PRICES OF 22% HQCF (BREAD) & 100% WHEAT FLOUR BREAD

APPENDIX X TABLE 10

PERCENTAGE HQCF: 22%			WHEAT FLOUR: 100%		
Ingredients	Quantity	Cost (¢)	Ingredients	Quantity	Cost (¢)
Sugar	2.25kg	10,000	Sugar	2.25 kg	10,000
Margarine	375g	4,500	Margarine	375g	4,500
Nut meg	2.5 ml	2,500	Nut meg	2.5g	2,500
B.P.	5g	166	B.P.	5g	166
Yeast	10.5g	333	Yeast	12.5g	333
Flavour	5 ml	1,120	Flavour	5 ml	1,120
W.F.	11.25kg	45,000	W.F.	14.5 kg	55,000
HQCF	3.3 kg	6,600	Labour		4,500
Labour		4,500	Fuel		6,000
Fuel		6,000			
Out put: 47.5 pieces Unit price: ¢ 4,000 Total cost: ¢ 80,719 Sales revenue: ¢ 190,000 Operating profit: ¢ 109,281 Cost per unit product: ¢ 1,690.26 Profit per unit product: ¢ 2,309.72 Return on investment: ¢ 1,367.47			Out put: 52.5 pieces Unit price: ¢ 4,000 Total cost: ¢ 84,119 Sales revenue: ¢ 210,000 Operating profit: ¢ 125,881 Cost per unit product: ¢ 1,599.67 Profit per unit product:¢ 2,400.32 Return on investment: ¢ 1,500.61		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENT & PRICES FOR 50% (HQCF) SWEET BUD & 100% WHEAT FLOUR SWEET BUD

APPENDIX XI TABLE 11

PERCENTAGE HQCF: 50%			WHEAT FLOUR: 100%		
Ingredient	Quantity	Cost ¢)	Ingredients	Quantity	Cost (¢)
Sugar	900g	4,000	Sugar	900g	4,000
Margarine	450g	5,400	Margarine	450g	5,400
Oil	2.5lit	30,000	Oil	2.5 lit	30,000
B.P.	15g	500	B.P.	15g	500
Nut meg	2 nuts	2,000	Nut meg	2nuts	2,000
Flavour	5ml	1,120	Flavour	5ml	1,120
W.F	2.5kg	10,000	W.F	3.75kg	15,000
HQCF	2.2kg	4,400	Eggs	2	2,000
Eggs	2	2,000	Labour		6,000
Labour		3,000	Fuel		6,000
Fuel		4,000			
Out put: 250 pieces Unit price: ¢ 500 Total cost: ¢ 66,420 Sales revenue: ¢ 125,000 Operating profit: ¢ 58,580 Cost per unit product: ¢ 265.68 Profit per unit product: ¢ 234.32 Return on investment: ¢ 883.77			Out put: 260 pieces Unit price: ¢ 500 Total cost: ¢ 72,020 Sales revenue: ¢ 130,000 Operating profit: ¢ 57,980 Cost per unit product: ¢ 222.99 Profit per unit product:¢ 226.84 Return on investment: ¢ 806.52		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENTS & PRICES OF 100% HQCF CAKE & 100% WHEAT FLOUR CAKE

APPENDIX XII TABLE 12

PERCENTAGE HQCF: 100%			WHEAT FLOUR: 100%		
Ingredient	Quantity	Cost ¢)	Ingredients	Quantity	Cost (¢)
Sugar	1.35kg	6,000	Sugar	1.65kg	7,333
Margarine	1.37kg	16,500	Margarine	1.25kg	15,000
Egg	1.25 crates	31,250	Egg	1.25 crates	31,250
Flavour	12.5 ml	2,800	Flavour	10 ml	2,240
B.P.	11.25g	374.75	B.P.	8.75g	291.25
HQCF	6.6kg	13,200	W.F.	7.5kg	30,000
Labour		3,750	Labour		3,750
Fuel		3,125	Fuel		3,125
Out put: 68.75 pieces Unit price: ¢2000 Total cost: ¢ 76,999.75 Sales revenue: ¢ 137,500 Operating profit: ¢ 60,500.25 Cost per unit product: ¢ 1,136.85 Profit per unit put: ¢ 863.14 Return on investment: ¢ 761.03			Out put: 73.75 pieces Unit price: ¢ 2,000 Total cost: ¢ 92,989.25 Sales revenue: ¢ 147,500 Operating profit: ¢ 54,510.75 Cost per unit product: ¢ 1,250.20 Profit per unit product:¢ 749.79 Return on investment: ¢ 600.46		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENTS & PRICES OF 50% HQCF CHIPS & 100% WHEAT FLOUR CHIPS

APPENDIX XIII TABLE 13

PERCENTAGE HQCF: 50%			WHEAT FLOUR: 100%		
Ingredients	Quantity	Cost (¢)	Ingredients	Quantity	Cost (¢)
Oil	1.4 lit	16,750	Oil	1.4 lit	16,750
Nut meg	2nuts	2,000	Sugar	-	-
Flavour	2.5ml	1,120	Nut meg	2nuts	2,000
B.P.	7.5g	249.50	Flavour	2.5 ml	1,120
W.F.	2.5kg	10,000	B.P.	10g	333
HQCF	2.2kg	4,400	W.F.	5kg	20,000
Labour		4,000	Labour		4,000
Fuel		3,000	Fuel		5,000
Margarine	125g	1,500			
Sugar	112.5g	500			
Out put: 150 pieces Unit price: ¢ 500 Total cost: ¢ 43,519.50 Sales revenue: ¢ 75,000 Operating profit: ¢ 31,480 Cost per unit product: ¢ 290.12 Profit per unit product: ¢ 209.86 Return on investment: ¢ 736.92			Out put: 155 pieces Unit price: ¢ 500 Total cost: ¢ 49,203 Sales revenue: ¢ 77,500 Operating profit: ¢ 28,297 Cost per unit product: ¢ 317.43 Profit per unit product:¢ 182.55 Return on investment: ¢ 584.37		

SOURCE: FIELD SURVEY DATA (2004)

QUANTITY OF INGREDIENTS OF 50% HQCF MEAT PIE & 100% WHEAT FLOUR MEAT PIE

APPENDIX XIV TABLE 14

PERCENTAGE HQCF: 50%			WHEAT FLOUR: 100%		
Ingredients	Quantity	Cost (¢)	Ingredients	Quantity	Cost (¢)
Margarine	500g	6,000	Margarine	500g	6,000
B.P.	10g	333	B.P.	10g	333
Nut meg	4nuts	2,000	Nut meg	4 nuts	2,000
Corned beef	200g	7,500	Corned beef	200g	7,500
Oil	1.3 lit	16,000	Oil	1.5lit	16,000
W.F.	2.5kg	10,000	W.F.	5kg	20,000
HQCF	2.2kg	4,400	Fuel		4,500
Fuel		4,500	Labour		6,000
Labour		6,000			
Out put: 240 pieces Unit price: ¢ 500 Total cost: ¢ 56,733 Sales revenue: ¢120,000 Operating profit: ¢ 63,267 Cost per unit product: ¢ 238.38 Profit per unit product: ¢ 263.60 Return on investment: ¢ 1,115.33			Out put: 250 pieces Unit price: ¢ 500 Total cost: ¢ 62,333 Sales revenue: ¢ 125,000 Operating profit: ¢ 62,667 Cost per unit product: ¢ 246.33 Profit per unit product:¢ 250.66 Return on investment: ¢ 1,005.48		

SOURCE: FIELD SURVEY DATA (2004)

APPENDIX XVI

STRUCTURED QUESTION FOR THE HIGH QUALITY CASSAVA FLOUR PROCESSOR

1. Which area do you receive cassava supply from?

   ………………………………………………………………………………

2. In what units do you purchase your cassava?

   ………………………………………………………………………………

3. For one cycle of production / one operation what quantity of cassava is used?

   ………………………………………………………………………………

4. How much is the price of this quantity?

   ………………………………………………………………………………

5. In what units do you sell the final products?

   ………………………………………………………………………………

6. How many units are produced from one operation?

   ………………………………………………………………………………

7. How much do you sell the final product from one operation?

   ………………………………………………………………………………

8. Please list the tools/ equipment used in performing the following activities.

   a) Peeling; ……………………………………..
   b) Washing;……………………………………
   c) Dewatering;…………………………………..
   d) Disintegration;……………………………….
   e) Sifting;……………………………………….
   f) Drying;……………………………………….
   g) Milling;……………………………………….

h) Packaging;...

9. Of the tools / equipment mentioned above which do you own and which do you hire?

HIRED EQUIPMENT / TOOL	OWNED EQUIPMENT / TOOLS

10. Referring to the above question (9) the equipment owned; how long have you owned it / them and at what price did you buy them / it.

EQUIPMENT	NUMBER OFYEARS	PRICE

11. Please complete the table below in a single process (one operation) for the labour requirement and cost.

TYPE OF ACTIVITY	NUMBER OF LABOURERS	COST
PEELING		
WASHING		
DEWATERING		
DISINTEGRATION		
SIFTING		
DRYING		
MILLING		
PACKAGING		

12. How long have you been producing HQCF?

....

13. Why do you prefer to process cassava into HQCF but not any other cassava-based product?

....

....

....

SUCCESS DRIVERS AND CONSTRAINTS

14. Is processing of cassava roots into HQCF profitable?

....

15. If yes give reasons; if no give reasons.

YES.

Reasons...

....

....

....

NO.

Reasons...

....

....

....

16. Do you consider the following as some of the major problems affecting the production of HQCF in this area?

a) Distance from the mill

b) Storage room
c) Frequent breakdown of the screw presser
d) Harvesting of cassava
e) Distance from the farm
f) Micro-finance
g) Lack of washing tools
h) Lack of processing materials
i) Lack of tools for peeling
j) Drying space
k) Packing materials

17) Yes / No

18) If yes how do you rank them?

IDENTIFIED PROBLEMS	RANKING

19.What are your reasons for the rankings?

IDENTIFIED PROBLEM	RANKING	REASON

20. What suggestions will you offer for the identified problems?

IDENTIFIED PROBLEM	SUGGESTIONS

21. Referring to question (17) if no what are the problems?

APPENDIX XVII

STRUCTURED QUETIONNAIRE FOR THE GARI PROCESSOR

1. Which area do you receive cassava supply from?

....

2. In which units do you purchase your cassava?

....

3. For one cycle of production / one operation what quantity of cassava is used?

....

4. How much is the price of this quantity?

....

5. In what unit do you sell the final product?

....

6. How many units are produced from one operation?

....

7. How much do you sell the final product from one cycle of production?

....

8. Please list the tools / equipment used in performing the following activities.

    a) Peeling;....................................

    b) Washing;....................................

    c) Grating;.......................................

    d) Draining;...................................

    e) Dewatering;...............................

    f) Disintegrating;..............................

    g) Sifting;.......................................

    h) Roasting;.....................................

i) Sieving;......................................

j) Packing;..

9. Of the tools / equipment mentioned above which do you own, and which do you hire?

HIRED EQUIPMENT	OWNED EQUIPMENT

10. Referring to the above question (9) the equipment owned, how long have you owned them / it, what price you bought them / it.

EQUIPMENT	NUMBER OF YEARS	PRICE

11. Please complete the table below in a single processing / operation for labour requirement and cost.

TYPE OF ACTIVITY	NUMBER OF LABOURERS	COST

12. How long have you been producing gari?

....

13. Why do you prefer to process cassava into gari but not any other cassava-based product.

APPENDIX XVIII

STRUCTURED QUESTIONNAIRE FOR THE CASSAVA KOKONTE PROCESSOR

1.Which area do you receive cassava supply from?

....

2. In what units do you purchase your cassava?

....

3. For one cycle of production / one operation what quantity of cassava is used?

....

4. How much is the price of this quantity?

....

5. In what unit do you sell the final product?

....

6. How much do you sell the final product from one cycle of production?

....

7.Please list the tools and equipment used in performing the following activities.

a) Brushing off of dirt;...................................
b) Peeling ;...
c) Slicing;..
d) Sun-drying;..
e) Bagging;..

8. Of the tools / equipment mentioned above which do you own and which do you hire.

HIRED EQUIPMENT	OWNED EQUIPMENT

9.Referring to the above question (8); equipment / tools owned and how long you have owned them / it and what price you bought it.

EQUIPMENT / TOOLS	NUMBER OF YEARS	PRICE

10. Please, complete the following table below in a single processing (one operation) for labour requirement and cost.

TYPE OF ACTIVITY	NUMBEROF LABOURERS	COST
Brushing off of dirt		
Peeling		
Slicing		
Sun-drying		
Bagging		

11.How long have you been producing cassava chips?

....

12. Why do prefer to process cassava into chips but not any other cassava-based product.

....

....

....

APPENDIX XIX

STRUCTURED QUESTIONNAIRE FOR THE BAKERIES.

1. Where do you get your supply of HQCF from?

....

2. Do your suppliers always meet your demand?

....

3. How long have you been in the bakery business?

....

4. How long have you been using HQCF?

....

5. Please list the bakery product that uses composite flour.

a)

b)

c)

6) Please complete the following table below in a single processing (one operation).

Name of Product;.............................

PERCENTAGE HQCF:			WHEAT FLOUR		
Ingredients	Quantity	Cost	Ingredient	Quantity	Cost
Out put: Unit price: Sales Revenue: Operating Profit			Out put: Unit price Sales Revenue: Operating Profit		

.7.Please can you state any other cost that you incur in your production activity in one cycle of production?

a) Labour;…………………………………..
b) Kneading / Milling cost;……………………………..