December 1986

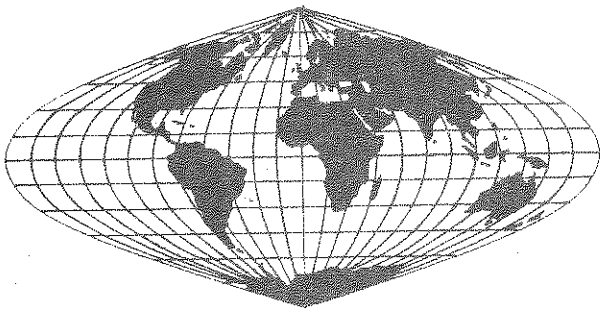
A. E. Research 86-30

CORNELL/INTERNATIONAL AGRICULTURAL ECONOMICS STUDY

GARI PROCESSING IN GHANA:

A STUDY OF ENTREPRENEURSHIP AND TECHNICAL CHANGE IN TROPICAL AFRICA

Ross G. Kreamer



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December 1986

It is a pleasure to introduce Ross Kreamer's study of the role of entrepreneurship in African development. Unlike most recent analyses of food and agriculture in Africa, it is a story of progress and accomplishment rather than retrogression. The focus is on the gari industry of Ghana and the impact of two technological innovations: the mechanical cassava grater and the manual screw press. The combination of the two has made possible greatly increased labor productivity and a sharp upturn in the output of gari. The availability of cheap food energy in the form of gari is credited with having averted widespread privation among urban consumers during the "Great Hunger" of 1982-84.

Several categories of entrepreneur have helped bring about this change: the cassava intermediaries, who bear considerable risk in supplying the highly perishable roots over long distances to both processors and markets; the gari processors, who have adapted the technical improvements to their high-volume system of gari production; the mill owners, who provide the site and facilities of the processing center; and the manufacturers of small-scale processing equipment who fabricate the gari equipment, and who, if encouraged, might form the basis of an indigenous manufacturing capability in Ghana. The characteristics of these entrepreneurs and their businesses are examined by Mr. Kreamer.

He demonstrates that, in addition to the new technologies, business organization has played a significant role in their success. The processors, for example, tend to organize into groups of 15-25 under the leadership of a "Queen" or "Secretary," who ensures the smooth flow of operations at their processing center. They offer a model to others interested in high-volume production.

Mr. Kreamer concludes that the economic environment of these entrepreneurs could be improved by minimizing taxes and regulations on their businesses, and by the government's enacting policies which would promote the agricultural sector. To encourage producers, the government should improve the transport system and provide effective extension services. The current hands-off approach to cassava pricing by the government should be continued.

Much of the information was gathered by Mr. Kreamer during a four-month visit to Ghana in 1985 and it is appropriate to acknowledge those who assisted him. Particularly helpful were K. K. Eyeson, Dr. Florence Dovlo, and Sam Nyarko of the Food Research Institute; Albert Pappoe, Gilbert Amegatcher, Karl C. Allorbi, Johnie Akabuo, Melody Attah, Alex Ashalley-Antony, and Eddie Nani-Nutakor of the

University of Science and Technology, Kumasi; and Seth Vordzorgbe of USAID/Accra. The study was made possible by a grant from the University of Idaho's Post-Harvest Institute for Perishables.

At Cornell, special thanks are due to Lillian Thomas for preparing the tables and figures and seeing the manuscript through the press, and to Lewis Relyea for preparing the plates and printing the final copies. Professor Edward McLaughlin shared with me the pleasure of working with Mr. Kreamer.

Comments and suggestions are welcome. These should be addressed to:

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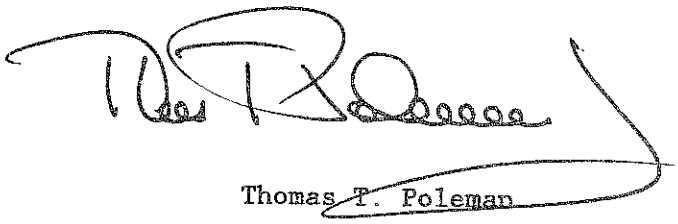

Thomas T. Poleman

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GLOSSARY

Agbeli — Ewe term for cassava meaning "There is Life."

Agbeliku — Bits and pieces of grated cassava that do not pass through the raffia sieve. In some systems, the agbeliku is retained, dried, milled, and incorporated into gari. In others, it is thrown out.

Ankroe — The Bono term for a rectangular gari roasting pan common in the Techiman area but absent from Anloga-Kumasi.

Asante — The major ethnic group of the Akan people of southern Ghana.

Asantehene — Paramount Chief and spiritual head of the Asante ethnic group. The Asantehene resides in Kumasi.

Bono — An Akan group closely related to the Asante.

Cassava — A starchy root crop indigenous to the New World. More cassava is consumed in tropical Africa than in any other area of the world. Chapter II introduces cassava.

Cassava grater — The most important and widely adopted labor-saving innovation in gari processing. It is manufactured locally and comes in a variety of styles.

Cedi — The official currency of Ghana.

YEAR	Cedis Per $1.00 U.S.
1975	1.15
1976	1.15
1977	1.15
1978	2.75
1979	2.75
1980	2.75
1981	2.75
1982	2.75
1983	25.00
1984	50.00
1985	53.00
1985	57.00

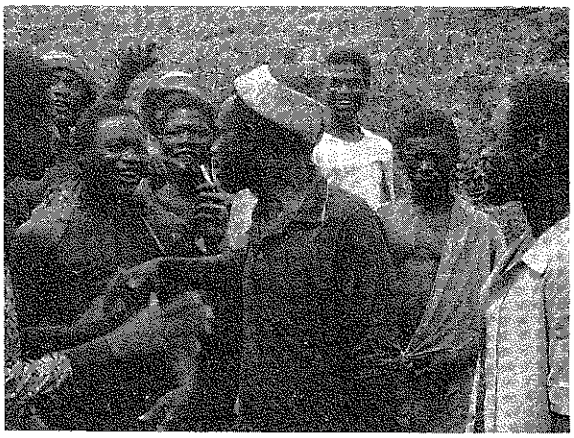
For most of the past ten years the official exchange rate for the cedi has been grossly overvalued. During this study the unofficial value (blackmarket rate) was approximately three times the bank rate.

Cocoa Sack	In gari trade, a measure equal to approximately 90 kilograms. This is highly variable. See Chapter V for an explanation of "Bush Weight" and "Accra Weight." The cocoa sack is roughly equivalent to three headpans.
Contact Man	The village agent who represents the cassava contractor. This person expedites the location and removal of marketable quantities of cassava.
Contractor	Usually refers to the cassava intermediary who supplies the processing center. However, the term is also applied to long distance gari intermediaries. The term implies that the individual's business is large scale although distance travelled is probably a more important criterion.
Ewe	An ethnic group in Ghana, Togo, and Benin. The Ewe are renowned for their expertise in gari production. In Ghana, the Ewe are principally from the coastal (Anlo) area of the Volta Region.
Gari	Processed form of cassava common to West Africa. It is granular in appearance and is prepared by grating, pressing and roasting the roots.
Garianyo	An Ewe term to described the appearance of quality gari.
Gariku	The bits of gari which do not pass through the final screening. They are milled and reincorporated into the next batch of gari. Table 5.1 shows that it can represent a significant loss.
Headpan	A common unit of sale among Anloga-Kumasi processors. It is equal to 30 kilograms or two kerosine tins.
I.T.T.U.	Intermediate Technology Transfer Unit, an extension arm of the University of Science and Technology's Technology Consultancy Centre. The ITTU in Suame Magazine is explained in Chapter VII.
Kerosine Tin	The common measure of gari used by Anloga-Kumasi Processors. It is equal to approximately 15 kilograms gari.
Konkonte	A less preferred form of processed cassava made by peeling, splitting, and drying the tuber in the sun. Konkonte pieces are the size of a thumb.
Machine Tool	Any of a variety of power driven tools. In Kumasi the important machine tools are the center lathe and grinding machine. These are contrasted with hand tools, e.g., chisels and hack saws.

Manual Screw Press	The relatively simple innovation in gari processing that has made the most impact since the mechanical grater. Its widespread adoption in Ghana took place in 1983, the height of the Food Crisis and the return of over one million Ghanaians expelled from Nigeria.
Margarine Tin	The common retail unit of sales equal to 0.5 kilogram gari. The common tin in use is a Blue-Band brand margarine tin.
Mill house	The house in which the cassava grater, corn mill, and storage area are located. This is the essential element of the processing center.
Nkuga	An Ewe term (big eyes) to describe gari that has large sized grains. This is an indication the gari is not quality because the grains remain hard when reconstituted.
Nkuvi	An Ewe term (small eyes) to describe gari that has small-sized grains. This signifies inferior quality gari because it becomes soggy when reconstituted.
Olonka	A term for a measure of gari approximately equal to 2.3 kilograms. Also called an American Tin.
Processing Center	The organizational unit common among gari processors in Anloga-Kumasi. The center includes a mill and open yard for processing cassava.
Seat	The common unit of high-volume cassava sales defined as the distance between uprights of the truck bed. Table 5.1 shows that volume measures have different weights.
Secretary	The chief processor who represents the other gari processors in the group. They are also referred to as "Queen Mother" and "Officer-in-Charge." Her importance cannot be overemphasized.
Suame Magazine	The largest concentration of informal sector workshops in Ghana. Suame is located on the outskirts of Kumasi.
TCC	The Technology Consultancy Centre began in 1972 as an effort to open up the expertise and facilities of the University of Science and Technology to small-scale entrepreneurs. Its purpose from the start has been to promote industrial development in Ghana. The TCC is a branch of the University of Science and Technology, Kumasi, Ghana.

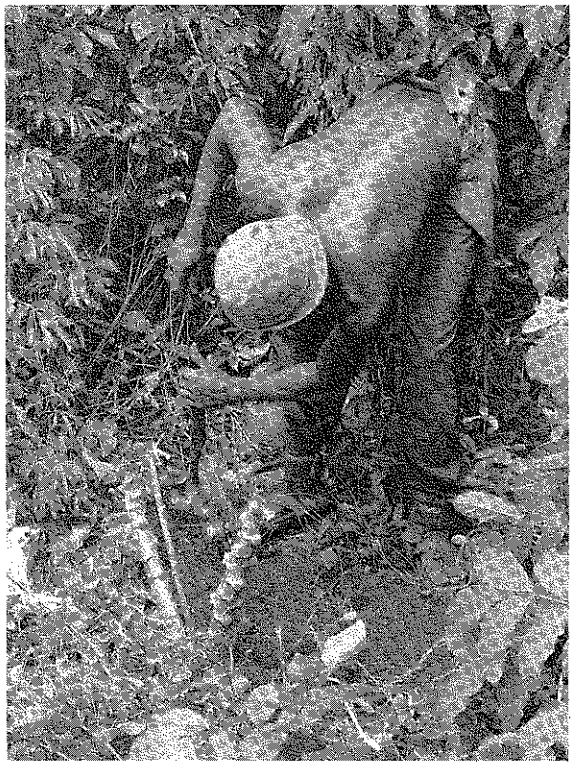
Yakayake	A processed form of cassava similar to gari. It is sold as a reconstituted, steamed cake. The screw press is used to express the starchy fluid from the grated cassava.

PLATE 1



The bulk of cassava destined for Anloga-Kumasi comes from over 125 kilometers away. Long distance delivery evolved to meet the demand of high-volume gari processors for reliable quantities of cassava. This demand relates directly to their adoption of improved processing technology. Delivery of the perishable roots is organized by the Contractor, top far left.

From farm to processor, many tasks must be accomplished. Top left shows contractor and village contact (in hat) negotiating cassava price and labor cost with villagers. The contact expedites the procedure by monitoring size of tubers and farms and condition of the paths leading to farms.



Cassava is harvested by cutting the stem and carefully loosening the soil around the roots (above). The tubers are uprooted by pulling on the stem, as shown on right. Women load the tubers in baskets (right) and convey them to the truck, a distance of one kilometer.

PLATE 2

Much of the cropland in the supply area is planted to cassava. The photo on left shows a typical cassava farm in Brong Ahafo Region. Note the cassava plants, most in excess of 2.5 meters in height. Other vegetation includes hardwoods and Borassus sp. palm.

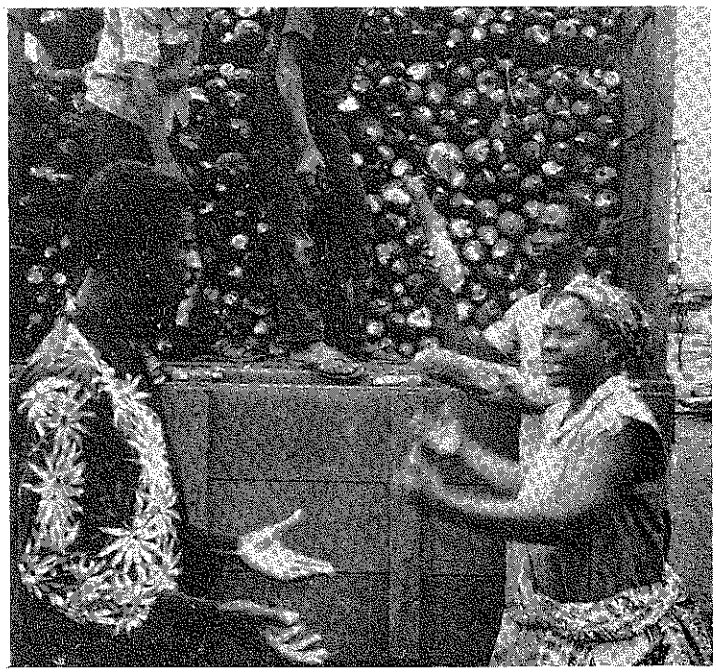
The role of women in this marketing step is to carry baskets of cassava; the role of men, to clear paths, uproot and load the tubers. This truckload of cassava was harvested and assembled in six hours with help from 14 people.

The truck driver and contractor carefully inspect the cassava as it arrives at the truck. Negotiations specify that tubers meet with contractor's approval. Rotten tubers are thrown away and exceptionally large tubers are saved to one side. To accept rotten tubers increases the contractor's loss at the next transaction--the processing center. Large tubers are packed last to give a neat appearance.

Despite poor feeder roads and frequent delays, the highly perishable crop is moved to market.

PLATE 3

The end of the marketing chain is Anloga-Kumasi. At right, the contractor and leader of the processing group (the Secretary) negotiate the price of cassava. Note the neat, orderly appearance of the tubers. The secretary represents the group of 15-25 women processors in all aspects of the gari business.



The unit of measure is the "seat," the volume of cassava between two adjacent uprights of the truckbed. Eight of ten seats are evident in the bottom photo. Once the price and number of seats has been determined, the cassava is unloaded. The cassava now belongs to the individual processors.

Credit is often extended to the processors for the entire load of cassava. Provision of credit is a feature of this system from cassava farmer to gari retailer. It facilitates business.

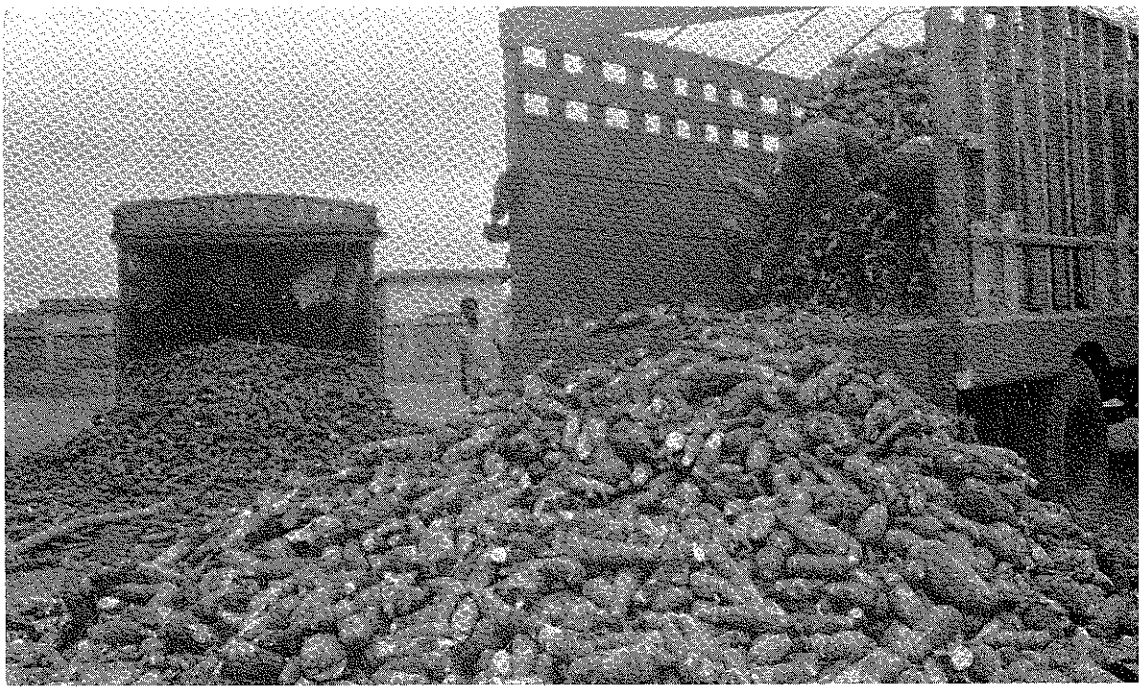
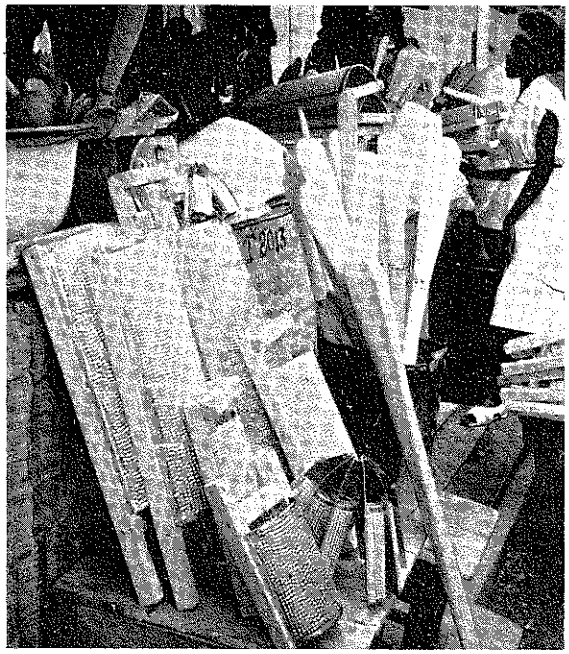
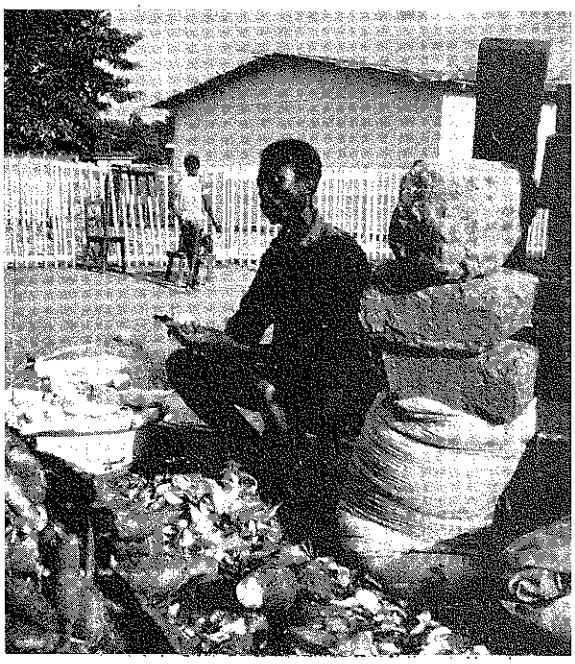


PLATE 4





Processing technology varies greatly in southern Ghana. Traditional tools such as the hand grater, top left and bottom, are relatively cheap and available in most markets. Above right, shows the traditional method of expelling the starchy fluid from grated cassava. It takes three to five days. Although effective, this method is slow and presents a bottleneck to both gari output and worker productivity.

The cassava, top right, was not delivered to the site. A characteristic of traditional gari systems in Ashanti and Brong Ahafo is self-supply of cassava, a practice that takes time away from processing. For cassava to continue to play an important role in supplying low-cost calories, bottlenecks in marketing and processing must be eliminated.

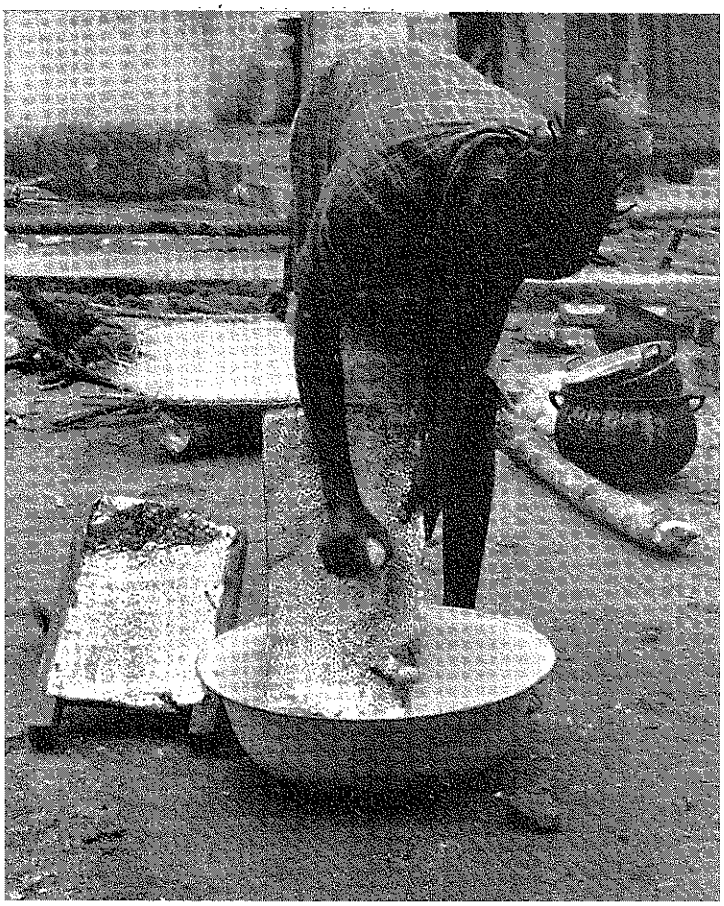
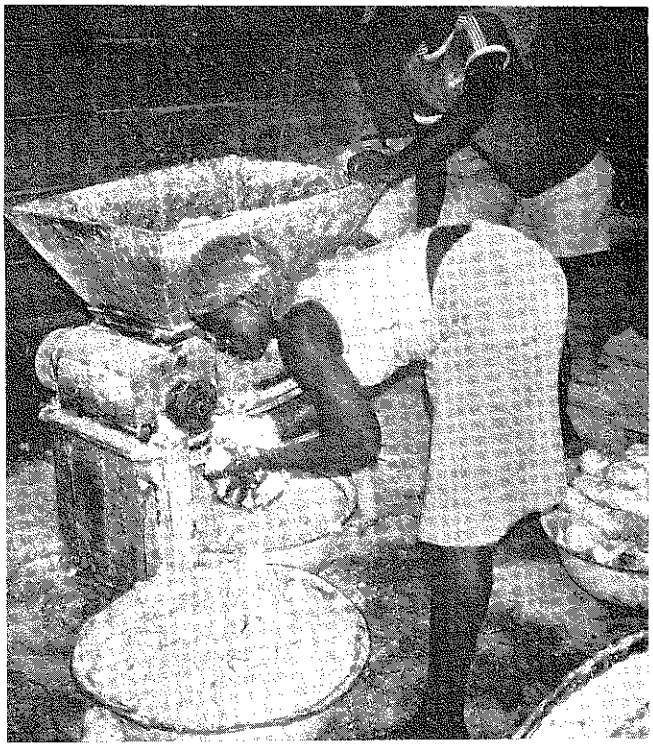


PLATE 5

In Anloga-Kumasi the processing bottleneck has been eliminated through group organization and access to improved equipment. Group activity is focused on the processing center: a mill house sited on a piece of open land called the yard, at top.

The motorized cassava grater is one of two innovations in processing equipment characteristic of Anloga-Kumasi. The grater, at right, is located within the mill house. Grated cassava, dough, is moved to fermentation baskets (bottom photo). Peeling and fermenting steps are similar in both traditional and improved gari processing.



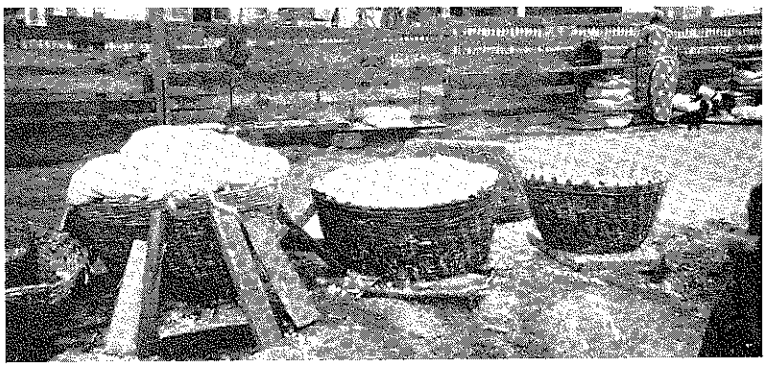
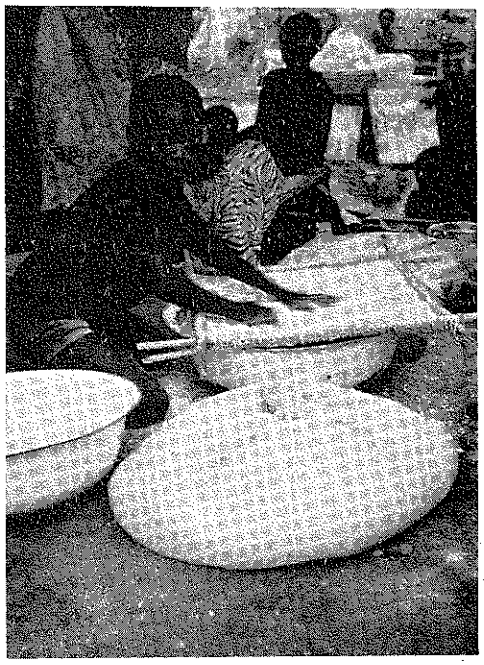


PLATE 6

After fermenting overnight, the dough is transferred to the screw press, at right. This simple innovation greatly reduces time needed for pressing, from several days to a few hours. A press is owned by each processor. The press is manufactured locally.

The pressed dough, cake, is removed to the roasting shed, bottom right, where it is sieved and then roasted. High heat evaporates moisture in the garifying step. Roasting is hot, smoky business. Off-cuts from timber mills and carpentry shops are used as firewood.



Children commonly help their parents in the Anloga-Kumasi gari industry, above and below right.

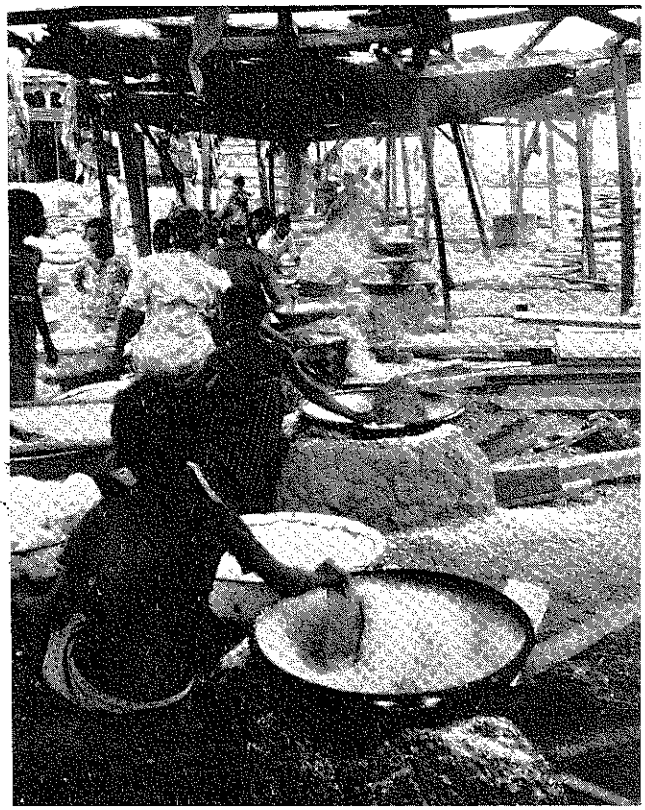
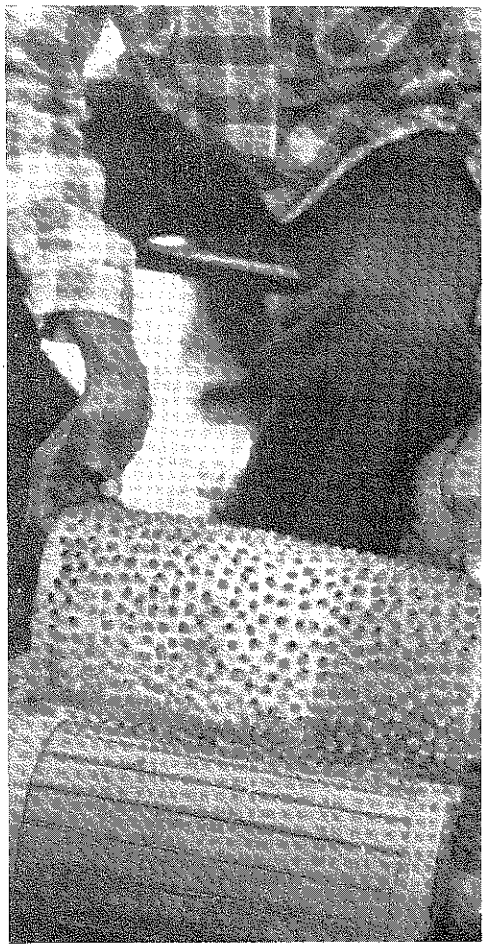
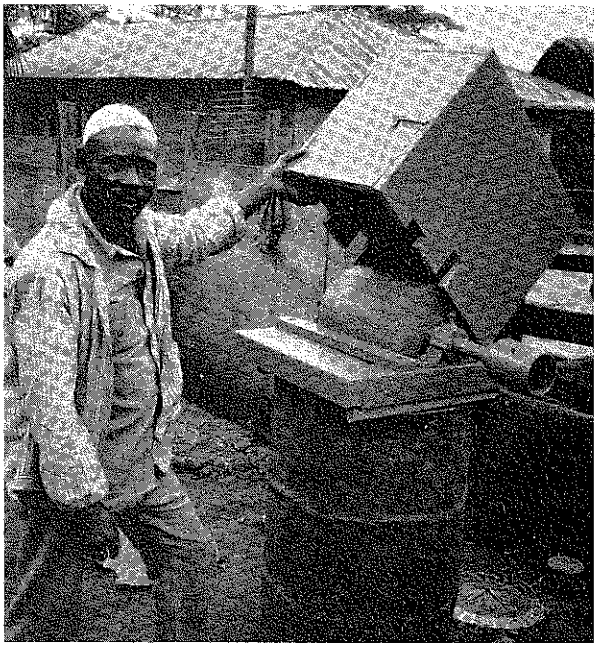
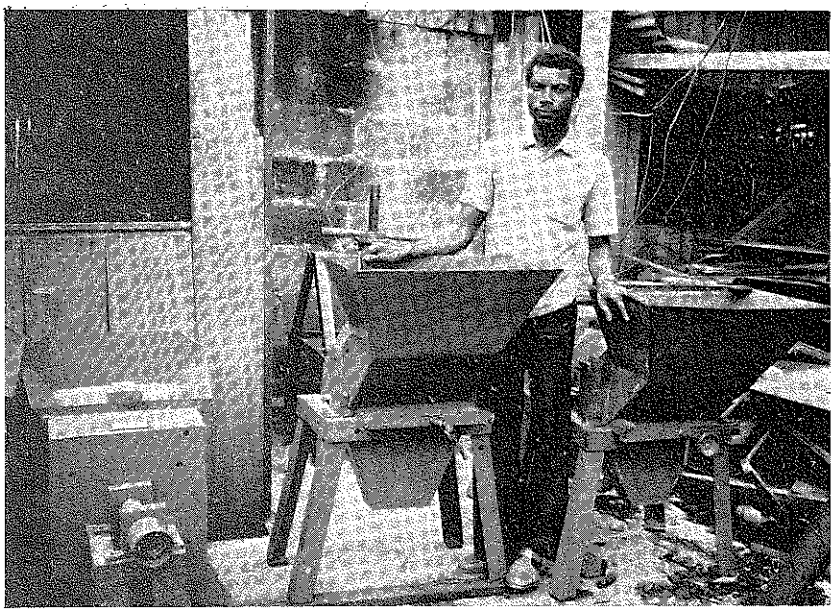


PLATE 7





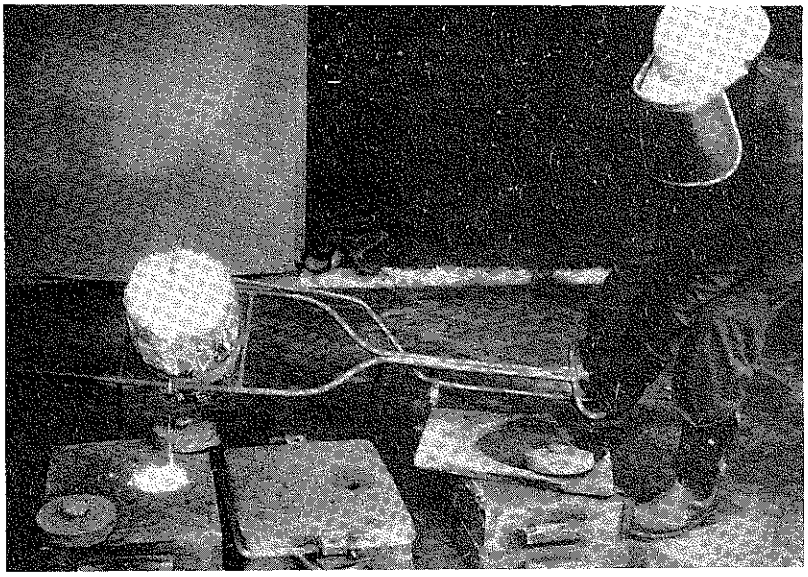
In Ghana, the demand for improved processing equipment is met by small-scale industrialists. Quality and mechanical efficiency vary widely. Two styles are shown, top right and bottom. The simple drum grater, top, comes with either of two grating surfaces--band saw blades or stippled sheet metal, top left.



More sophisticated equipment is available in Kumasi. The graters shown at the bottom compare with imported models. Note the difference of design and materials--the drum grater is made mostly of wood. The bottom graters were made in the owner's machine shop.

The contribution of equipment manufacturers to solving processing bottlenecks is significant.

PLATE 8



Left shows the casting of a corn grinding plate. This is an example of a technology earmarked by TCC for development.

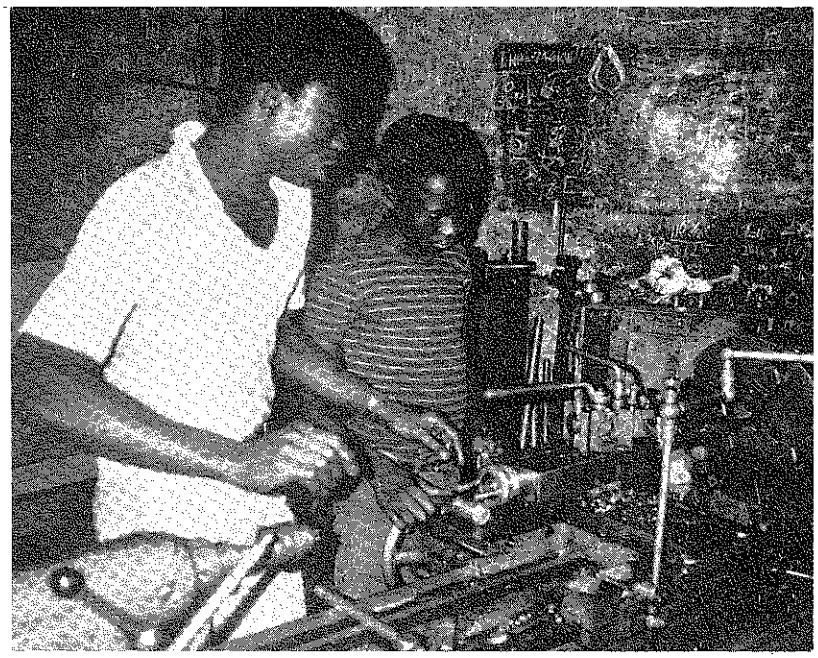
Suame Magazine is Kumasi's sprawling informal industrial area. An estimated 40 thousand people work in Suame, most of them directly or indirectly involved in vehicle repair. The cassava truck (Plates 2 and 3) was modified in Suame.

A survey of Suame workshops revealed that only ten workshops manufacture food processing equipment. These shops fabricate a variety of machines, including cassava graters, corn mills and rice hullers.

Located within Suame is the Intermediate Technology Transfer Unit (ITTU), an extension arm of the University of Science and Technology's Technology Consultancy Centre (TCC). The purpose of the ITTU is to provide advice and training on technical and economic aspects of business. It is an important factor in fostering development of small-scale manufacturing capability in Ghana.

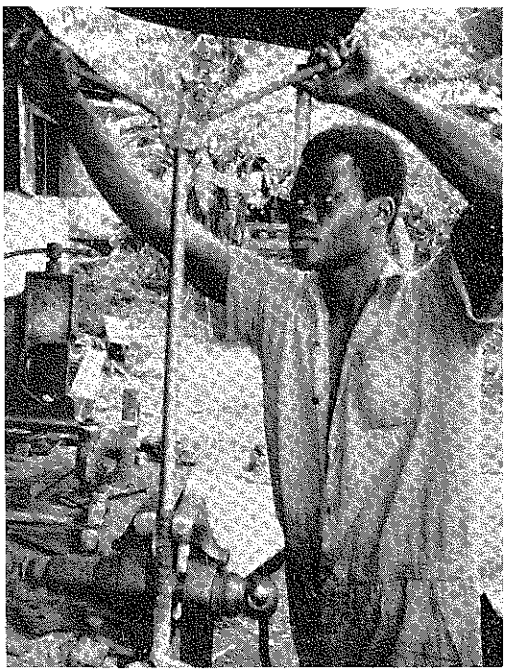
Materials are a constraint to production of food processing equipment. The scrap dealer at right (in hat) shows that nothing is wasted. This scrap came from machine shops of the mining industry, a major source of Suame scrap.

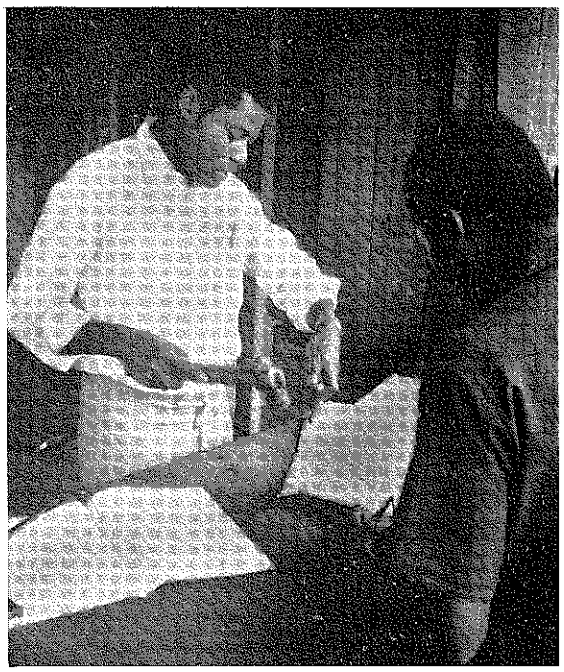
PLATE 9



At SIS a skilled machinist provides instruction to a younger apprentice, at right.

One small-scale workshop stands out from the rest. SIS, Engineering, Ltd., is known for the quality of its products and its commitment to apprentice training. Bottom left shows an apprentice working on a wing nut screw press. This is a form of worker-incentive program, with proceeds from the press going to the apprentice. Bottom right shows SIS Managing Director working on a template of an original design for a manual cassava grater. Attention to design is a feature of this workshop.





CHAPTER I
INTRODUCTION

With few exceptions, agricultural production in Africa in recent years has been characterized by declining productivity. In large part this has been a consequence of government policy that has actually discouraged production and private initiative. Over the past decade, stagnation of Ghana's food crop sector, coupled with a rapidly increasing population, has resulted in high consumer food prices. The situation is exacerbated in the urban centers where limited employment opportunities simply cannot absorb the huge influx of labor from rural areas. Lacking both adequate employment opportunities and access to agricultural land on which to sustain themselves, the urban poor are especially vulnerable to increases in food prices, particularly increases in the cost of starchy staples which constitute the bulk of their diet (56, pp. 218-263).

Of the starchy staples cultivated in Ghana, cassava, per calorie, is the least expensive to the consumer. Cassava is easily propagated and can be harvested throughout the year. It has a wide range of tolerance for soil fertility and moisture, and is a reliable food source in times of drought. Cassava's low cost, relative to other starchy staples, and its widespread availability, enhance its appeal as a food item for Ghana's urban centers and food deficit areas.

Production costs of cassava are largely attributed to labor, primarily at time of harvest. However, between harvest and market the highly perishable tuber is usually processed into a variety of products, of which gari is perhaps the most important. An analysis of the marketing costs of gari reveals that processing costs constitute the largest single portion of final retail price. Therefore, an obvious solution to the problem of providing increased calories at the least possible cost would be to reduce the costs of processing cassava. Added to this is the need for providing processors with a reliable supply of inexpensive cassava. For cassava to contribute increasingly to the diet of the urban poor, bottlenecks in the organization of marketing and processing must be overcome.

In Ghana, improvements in cassava processing have increased food availabilities. Many of the bottlenecks associated with organizing the delivery of fresh cassava to processing centers have been eliminated. Moreover, processing technology has been improved. As a result, processors have achieved greater labor productivity, and overall output of gari has increased. Furthermore, the improved equipment which has encouraged these developments is manufactured locally. Thus, one approach to solving the problem of providing low-cost calories has emerged from within Ghana, and largely from small-scale private initiative.

This study is an examination of how Ghanaian entrepreneurs have brought this about. Among the categories of entrepreneurs considered

are: the cassava contractors, who bear considerable risk in supplying cassava to both markets and processors; the processors, who have evolved an efficient system of high-volume gari production; the mill owners, who provide the facilities of the processing center; and the manufacturers of small-scale processing equipment who fabricate gari equipment, and who, if encouraged, might form the basis of an indigenous productive capability in Ghana. Implications of the findings for possible government policy are set forth in the concluding chapter.

The geographical focus of this study is the Kumasi area of Ghana. It was chosen for a variety of reasons. Ghana suffered a major food crisis in 1983, the culmination of over a decade of declining productivity in the agricultural sector. In a very real sense cassava staved off famine in the urban areas. Moreover, Ghana is a nation of smallholder farmers. In 1970, slightly more than 57 percent of the population was engaged in farming activities on a full-time basis (16, p. 33). In addition, there were others employed elsewhere who maintained sizeable farms and garden plots to supplement their families' diets. In 1985, the proportion of GDP ascribed to agriculture was 53 percent, up from 41 percent in 1965. However, Ghana's average index of food production per capita (1972 = 100) fell dramatically to a value of 72 in 1980-82. That Ghana's agricultural sector has stagnated is not in dispute (55, p. 176; 54, p. 228).

Kumasi was chosen because it is a large and growing urban center with an important foodstuffs market, and a dynamic informal sector, with a long tradition of small-scale manufacturing. All the equipment described in the case studies was fabricated in Kumasi. The Kumasi area features a wide variety of processing technologies, from traditional to state-of-the-art.

During the years 1977-1983, when I lived in Ghana, I gained an appreciation of Ghanaian entrepreneurs and the contribution they make to the economy. From the evidence presented in this study it is apparent that private initiative can be relied upon in difficult times. For the future development of the food processing subsector, the challenge rests in how government can stimulate productive entrepreneurship at the grassroots level.

Data for this study were collected in the field, 6 June through 9 October 1985. Among the elements of the study were samples, case studies, and surveys of the cassava marketing and processing chain and of Kumasi's informal industrialists. Specifics on the methodology are included the Appendix.

The study begins with a description of cassava's role as a supplier of low-cost calories to urban populations in Chapter II. An account of production and consumption of cassava in the context of Ghana's forest zone follows in Chapter III. In Chapter IV, the traditional method of processing cassava into gari is considered in some detail. Improvements in traditional gari processing technology follow in Chapter V. Included in Chapter V is a comparison of case

study processors in Anloga and Ayigya Kumasi. Improvements in the marketing and processing chain of Anloga-Kumasi are highlighted in Chapter VI, as well as recent developments in the gari industry of Techiman. Chapter VII investigates the contribution of Ghana's small-scale equipment manufacturers in the evolution of the gari industry, and describes the growing informal sector of Kumasi. Policy implications for promoting small-scale technological change are summarized in Chapter VIII.

CHAPTER II
CASSAVA, THE FOOD OF THE URBAN POOR

Cassava (Manihot esculenta) is a shrubby perennial belonging to the family Euphorbiaceae. It is widely distributed throughout the tropical world, and is known among other things as manioc, yuca, and mandioca (39, p. 1). Over 90 different cultivated varieties have been identified and collected in Ghana. In height, the plant ranges from one to four meters, depending upon cultivar and growing conditions (15, p. 4). Figure 2.1 shows the characteristic palmate leaves borne on one to five stalks. Cassava's edible portion is the swollen root which radiates from the stem just below the soil surface. These roots enlarge as starch is deposited, and may attain a length of 30 to 90 centimeters, a diameter of five to 15 centimeters, and a weight in excess of seven kilograms.

Appeal of Cassava

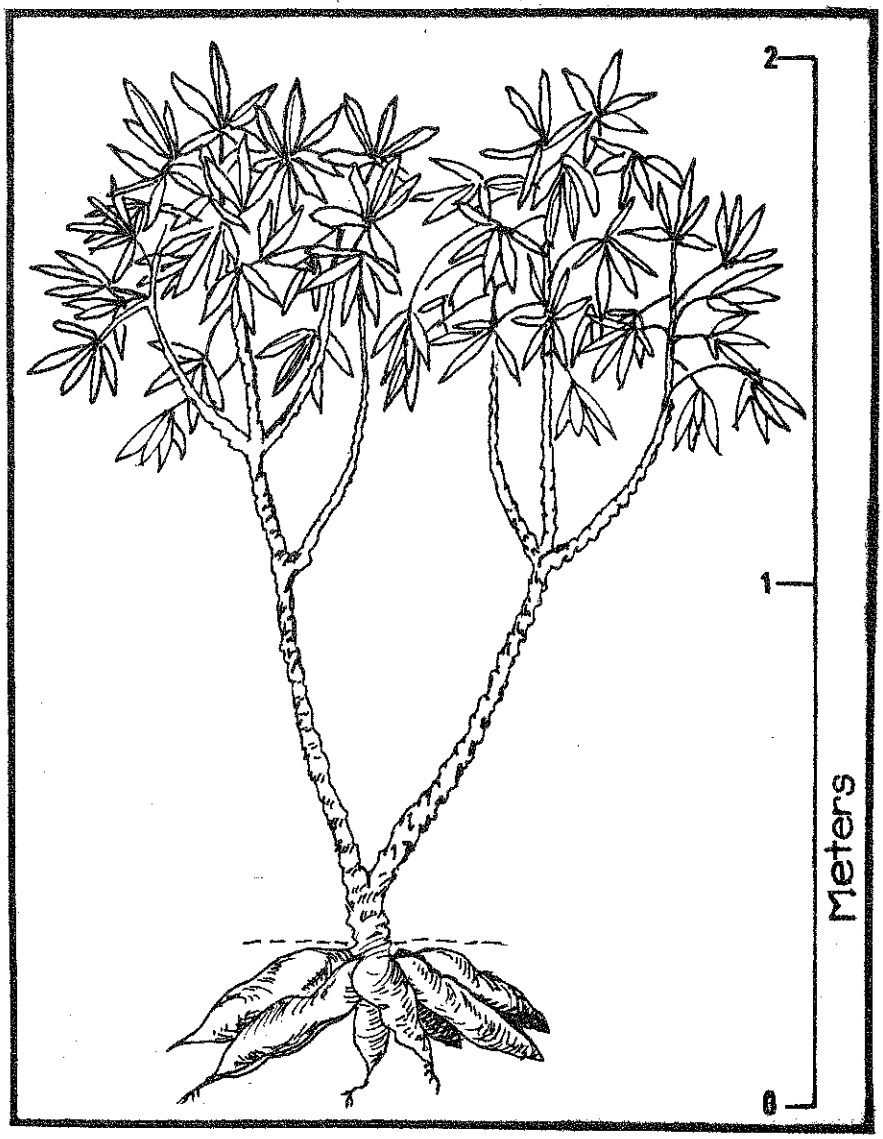
For the consumer, cassava is usually the cheapest source of food energy available--especially the processed forms. That cassava can be processed into a relatively stable form is perhaps its chief attribute. Thus, for both economic and agronomic reasons cassava is an important crop.

Cassava appeals to low resource farmers for a variety of reasons. It is a hardy, high-yielding crop that is adapted to a wide range of growing conditions. Cassava is particularly noted for its ability to produce an economic crop on even the most impoverished soils. Costs of production vary, but, when compared with other starchy staples, cassava is among the least expensive.

Good Yield

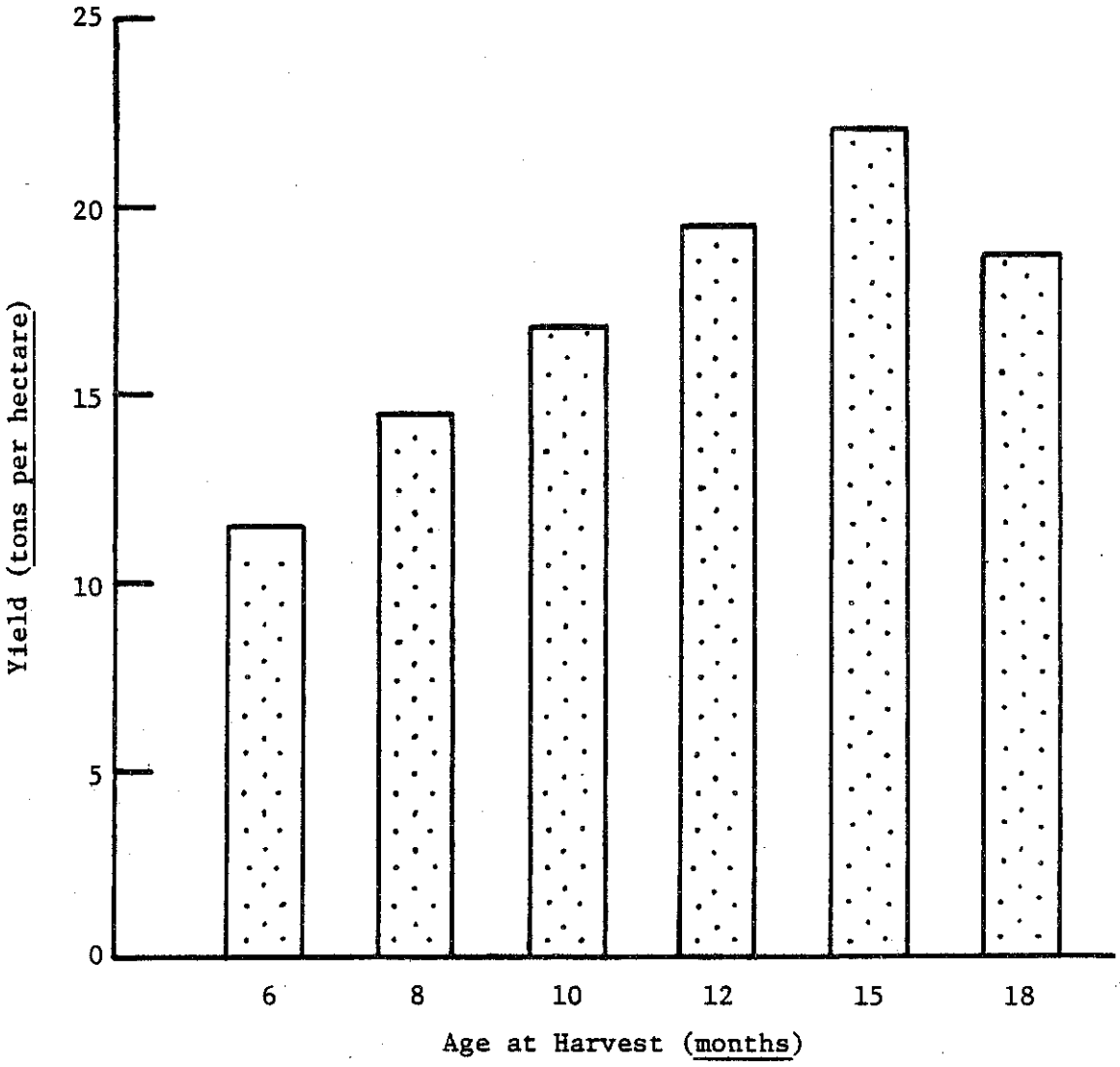
Cassava yield varies with cultivar, age, and growing conditions. Yields are generally higher on better soils. The best yields are obtained between 12 and 15 months, and decline thereafter. Figure 2.2 presents yields for Ankra cultivar at different ages. After increasing to a high of 22 tons per hectare at 15 months, the yield per hectare at 18 months dropped to 18 tons, a lower yield than was recorded for cassava at 12 months. Similar results were recorded by Ezedinma, in Nigeria; furthermore, he presents evidence that dry matter content is proportionately higher in cassava planted in September than in the early cropping season (17, pp. 111-115). This finding is of importance to processors of cassava. That not all cassava is harvested at the optimum age is an indication that yield is not the sole consideration of the subsistence farmer.

FIGURE 2.1. LINE DRAWING OF CASSAVA (Manihot esculenta)



Source: Adapted from J. H. Cock, Cassava: New Potential for a Neglected Crop (Westview Press, 1985), p. 13.

FIGURE 2.2. YIELD OF ANKRA VARIETY CASSAVA AT DIFFERENT AGES*



*Data from E. V. Doku, Cassava in Ghana (Univ. Press, Accra, 1969), p. 26.

Extremely Adaptable

Soil: Wide Range of Fertility. Cassava is widely adaptable. It demonstrates a wide range of tolerance of soil fertility and water requirements. Although cassava yields best on fertile, light loamy soils, it does well on soils of low fertility and with textures ranging from sand to clay. Cassava is reputed to deplete soil nutrients, but this contention is not supported by the evidence (8, p. 2). Its reputation is perhaps based on the practice of planting cassava last in the bush-fallow rotation, when the soil is exhausted.

Moisture: Drought Tolerant. Cassava grows best where rainfall is abundant; however, it can withstand a range in average annual rainfall between 0.5 and 5 meters (29, p. 15). Farmers are attracted to cassava's ability to withstand prolonged periods of drought which other crops would not survive.

Costs of Production

Labor. Production costs of cassava in large part depend upon labor costs. In traditional farming systems labor costs are low because labor is shared among family members. Cassava yields more calories per unit of labor than any other staple (11, p. 26). Table 2.1 compares the productivity of selected crops in terms of wheat equivalents per hectare and per man-hour. Clearly, cassava is superior with respect to both productivity per unit labor and per unit time.

Most of the costs of production are associated with labor at time of harvesting. After planting, cassava is usually weeded twice, by hand, until the bushy canopy forms to shade out weeds. Labor requirements per hectare vary widely, depending upon cassava's position in the cropping system (21, p. 16). Although basic, labor-consuming tasks of production (e.g., plowing and harrowing land) may be mechanized, such practices are dependent upon topography and the farmer's resource endowment.

Other Inputs. Aside from labor, production costs are minimal. Propagation is by planting a stem cutting, a nonedible portion of the plant. In most cases stems are selected from the previous harvest and therefore free of cost. Although cassava is responsive to fertilizer, high costs may preclude its use among low-resource farmers. Some national cassava programs have been supplying farmers with superior, disease-resistant cultivars which maintain high yields even on soils of low fertility (26, pp. 42-45).

Storage and Processing

Cassava may be stored in the ground until needed. After two years, however, the tubers become increasingly susceptible to disease (28, p. 108). Although cassava may be stored in the ground, it remains

TABLE 2.1. RELATIVE RETURNS TO LABOR OF SELECTED AFRICAN CROPS*

Crop	Labor Input	Yield of Wheat Equivalent	
	(man-hours/hectare)	(kg./hectare)	(kg./man-hour)
Cassava	1870	3285	1.75
Sweet Potato	1160	1824	1.58
Maize	900	1340	1.49
Millet	500	650	1.30

*Data from C. Clark and M. Haswell, Economics of Subsistence Agriculture (London, 1964), p. 81.

an extremely perishable crop. Once uprooted, cassava tubers[1] do not store well; spoilage begins after the second day unless they are processed. Therefore, some form of processing is necessary to prevent complete loss of cassava. Traditional processing technologies extend the shelf-life of cassava products. The processing technology for gari will be examined in Chapter IV.

Gari and Konkonte. Two traditional forms of processed cassava are gari and konkonte. Prepared by simply splitting the peeled tuber and drying it in the sun, konkonte is perhaps the least difficult form of processed cassava to make. Of the two, konkonte requires much less labor--simply peeling, splitting, and sun drying--but has a lower market value per calorie than gari, and costs the consumer more to prepare. Gari is a grated, slightly fermented and roasted form of cassava, granular in appearance. Because gari production is labor intensive, involves several steps and requires comparatively simple equipment, it has been the object of several technical innovations over the years. Most of these changes have resulted in increased labor productivity through mechanization.

The gari industry is far from static. Innovations in processing technology occur at different levels and locations, making it a particularly dynamic industry. Ghana and Nigeria are two West African countries that have developed small-scale gari industries to help meet the demand for calories.

Uses of Cassava

Leaves and Peels. Many parts of the plant are utilized by both man and animals. Throughout West Africa the leaves, which are comparatively high in digestible protein, are prepared as a sauce for the bulky staples. In some areas, leaves, stems, and peels are fed to small ruminants and other livestock. Dried cassava roots are widely used in tropical areas as feed for pigs, cattle, and poultry (32, pp. 242-249).

Tuber: Charged With Calories. Without question, the tuber is by far the more important part of the cassava plant. Cassava is primarily a source of energy. Table 2.2 indicates that cassava provides the highest food energy per day, per hectare of the major tropical staples. Aside from the processed forms of gari and konkonte, cassava is eaten fresh by boiling, roasting, or frying the tuber. In southern Ghana, the most popular form of cassava is fufuo, a boiled and pounded form of cassava.

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[1]Although technically a root, the starchy storage organ is frequently called a tuber. Refer to J.W. Purseglove, Tropical Crops: Dicotyledons (Longman Group Ltd., 1968), pp. 172-180.

TABLE 2.2. MAXIMUM RECORDED YIELD (IN DRY WEIGHT AND FOOD ENERGY) OF TROPICAL FOOD STAPLES*

Crop	Maximum Annual Yield (tons/hectare)	Food Energy per Day (kilocalories per hectare)
Cassava	71	250
Maize	20	200
Sweet Potato	65	180
Rice	26	176
Sorghum	13	114
Wheat	12	110
Banana	39	80

*J. H. Cock, Cassava: New Potential for a Neglected Crop (Westview Press, Boulder, Colo., 1985), p. 73.

The Demand for Cassava

The importance of cassava in Ghana is evidenced by its name in the Ewe language, "agbeli," which means "there is life." Cock, in his book on cassava, presents FAO estimates of cassava consumption in Ghana; as a source of dietary energy, cassava contributed 19 percent of total calories, an amount equal to 380 calories per person per day. These values are only slightly less than those for neighboring Togo. In 1955, the relative importance of cassava in the urban diet was apparent; in Kumasi and Secondi-Takoradi, 38 and 46 percent, respectively, of total calories from starchy staples were derived from cassava and cassava products (8, p. 11; 40, p. 152).

Cheap Calories. Although reliable expenditure data are not available for recent years, it is reasonable to assume that cassava's position in the average Ghanaian diet has not diminished. This is especially true in the urban areas, where limited employment opportunities preclude gainful absorption of the inflow of labor from rural areas (48, p. 134). Per calorie, cassava is the cheapest source of calories, and underemployed urban dwellers simply cannot command a more expensive diet. Increasingly, the urban poor will depend upon cassava and cassava products to form the bulk of their diet.

CHAPTER III
PRODUCTION AND CONSUMPTION OF CASSAVA IN GHANA

This chapter presents the geographical setting of the study, with special reference to the Ashanti and Brong-Ahafo Regions. A brief history is included of cassava's new world origins and subsequent spread through West Africa and Ghana. Production and consumption characteristics of cassava in Ghana are considered, along with the impact of population pressure on cassava production. Gari is introduced as the important processed form of cassava for the urban diet. Chapter III concludes with a discussion of cassava marketing in Kumasi and Techiman, two important marketing centers.

Geography of Ghana

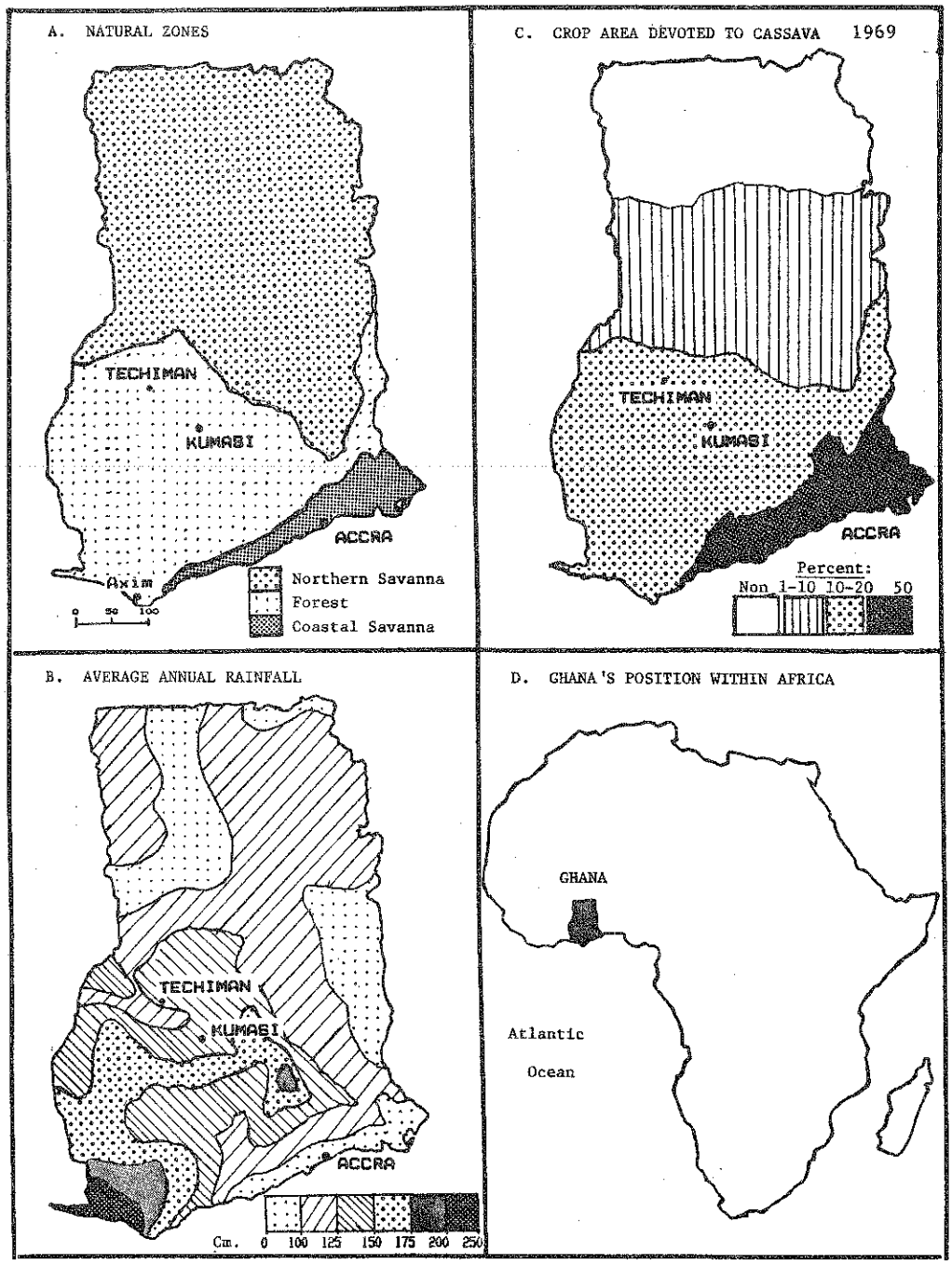
Ghana is situated in West Africa along the Guinea Coast between 4° and 11° north latitude. With a land area of 239,000 square kilometers, Ghana is approximately the size of Oregon or the combined area of Indiana and Illinois. Map 3.1D shows that Ghana is bounded on the west by Ivory Coast, on the north by Burkina Faso, and on the east by Togo. To the south, Ghana's coastline extends west to east for 530 kilometers (52, p. 3).

Three Major Natural Zones

Climate. Map 3.1A indicates three major natural zones: 1) the Coastal Savanna, 2) the Northern Savanna, and 3) the Forest Zone. These divisions reflect differences in climate and vegetation which are a result of seasonal movement of the equatorial low pressure belt. As a consequence of the seasonal north-south movement, the Forest Zone receives much more rainfall than either of the other two zones. Map 3.1B shows that, in the main, the Forest Zone receives 125 centimeters per annum and above, whereas the two Savanna Zones record less. Rainfall in the Forest Zone is distributed seasonally in two rainy periods, March-July and September-November, separated by dry seasons (40, p. 128). In contrast to this bimodal distribution of rainfall, that of the Northern Savanna is restricted to one season, March-September, after which the desiccating (Harmattan) winds from the northeast transform the green countryside into a brown, dusty landscape. Rainfall along the Coastal Savannah is in large part determined by two factors: the orientation of the coast east of Axim (Map 3.1A), and the effects of the cold water current (Benguella) which meets the African continent along Ghana's coast. East of Axim, the air masses accompanying the current are parallel to the coast, resulting in less rainfall (28, p. 45).

Northern Savanna. The Northern Savanna, lying to the north of the Forest Zone and stretching southeastward to the Coastal Savanna, comprises almost two-thirds of Ghana's total land area. Vegetation

MAP 3.1. GEOGRAPHICAL CHARACTERISTICS OF GHANA



Sources: Natural zones adapted from W. O. Jones, Manioc in Africa (Stanford, 1959), p. 173; rainfall from T. E. Hilton, "Ghana," World Atlas of Agriculture (IGDA, Novara, 1976), p. 211; area devoted to cassava adopted from E. V. Doku, Cassava in Ghana (Univ. Press, Accra, 1969), Figure 4.

here is characterized by a continuous grassland with scattered stands of short, fire-resistant trees. Compared with soils of the forest, those of the Northern Savanna contain less organic matter and have a lower nutrient status. Cereal crops, such as millets and sorghum, dominate the agriculture of this area. In 1950, cereals occupied almost 95 percent of all land planted to starchy staples, while cassava represented less than one percent (29, p. 147). Although percentage composition of crops is unknown for recent years, there is no reason to question the predominance of cereals in the zone's agriculture.

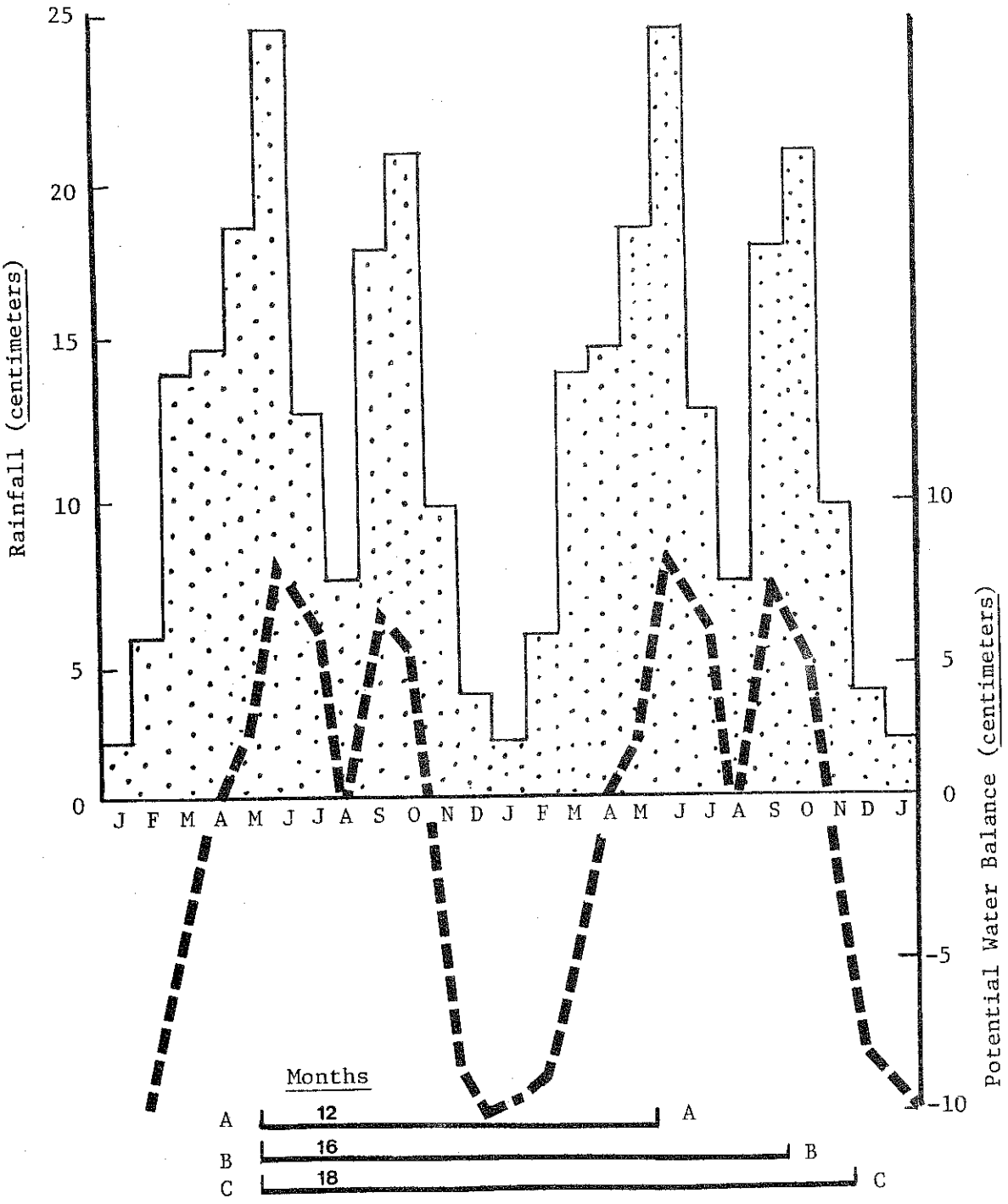
Coastal Savanna. The smallest of the natural zones is the Coastal Savanna. It is the most densely populated zone of the country, containing the rapidly growing capital city of Accra and its metropolitan area (population 1.42 million), and the large administrative capitals of Secondi-Takoradi and Cape Coast (50, p. 1659). Soils of the Coastal Savanna are among the least productive, being younger and more closely related to the underlying parent material (24, p. 211). As would be expected in an area with high urban population and comparatively poor soils, cassava is an extremely important crop. Map 3.1C shows that in 1969, in excess of 50 percent of total crop acreage of the zone was devoted to cassava. It is highly likely that the proportion has increased in the ensuing years.

Forest Zone. Agriculture in the Forest Zone has traditionally focused on export cocoa production and commercial timber extraction. As a result, much of the natural vegetation has been altered or destroyed, with less than 20 percent of the original forest surviving in reserves (52, p. 229). Forest soils are the most productive in the country. They are characterized by an accumulation of organic matter in the surface horizon, and are deep and well-developed in areas with annual rainfall between one and two meters. Figure 3.1 presents the mean monthly rainfall pattern typical of the bimodal rainy season. The major cropping season corresponds to the increase in monthly precipitation from March to July, and the minor season, to the increase between September and November. Plantains, maize and cassava are among this zone's principal crops. Map 3.1C shows that by 1969, agricultural land in the Forest Zone planted to cassava amounted to 10 to 20 percent of total crop acreage. This proportion has undoubtedly increased, especially in view of the stagnation of the food crop sector over the past decade.

Ashanti Region

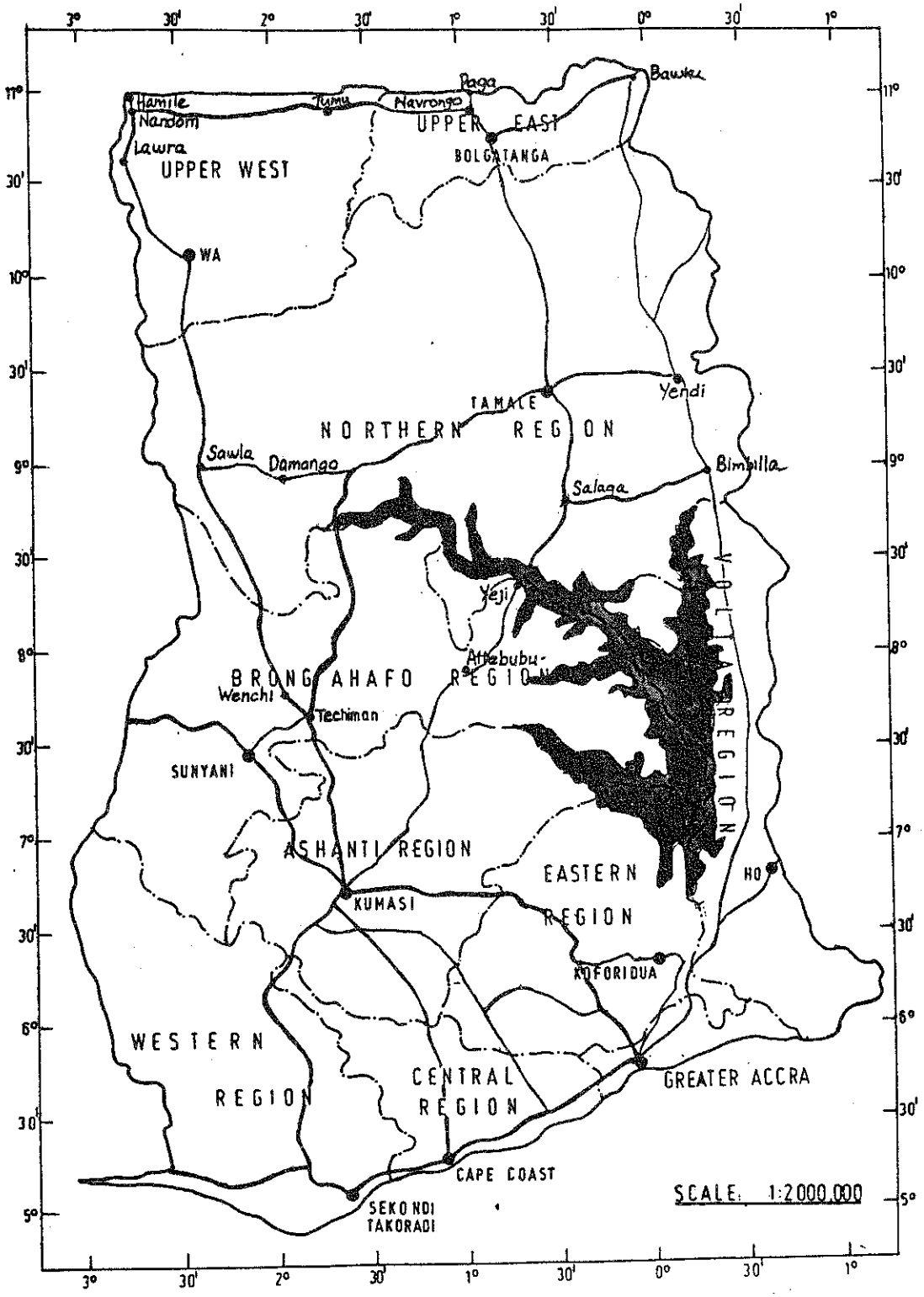
Situated in the heart of the Forest Zone is the Ashanti Region, one of ten administrative areas of Ghana (Map 3.2). The 1984 census listed just over two million residents in Ashanti, a 41 percent increase over the last census taken in 1970. Among Ghana's ten regions, Ashanti has the largest percentage share, with 17 percent of total population, a position it maintained from the 1970 census (18, p. 57). Agriculture in Ashanti, as elsewhere in Ghana, is characterized by small-holder farmers, many of whom are cocoa producers.

FIGURE 3.1. KUMASI: MEAN MONTHLY RAINFALL AND MEAN MONTHLY POTENTIAL WATER BALANCE IN RELATION TO THREE TYPICAL CASSAVA GROWING CYCLES (A, B, and C)*



Sources: J. B. Wills, Agriculture and Land Use in Ghana (Ghana Ministry of Agriculture, 1962), p. 48; IITA, Research Highlights for 1981 (1982).

MAP 3.2. GHANA: ADMINISTRATIVE REGIONS AND HIGHWAY SYSTEM



Kumasi. The capital of the Ashanti Region, Kumasi, is a rapidly expanding urban area. Kumasi has been an important center of commerce and trade since the eighteenth century, when it was capital of the Asante Kingdom (44, pp. 30-33). The 1984 census placed metropolitan Kumasi's population at approximately one-half million, making it one of Ghana's larger cities. It is a major marketing center and hub of overland transportation; paved roads connect Kumasi with Accra, Cape Coast, and Secondi-Takoradi to the south, and Techiman and Tamale to the north (1, pp. 22).

Brong-Ahafo Region

The Brong-Ahafo region was carved from the Ashanti Region in 1958. In terms of percentage share of total population, Brong-Ahafo ranks fifth with nearly 10 percent or almost 1.2 million persons. Brong-Ahafo's average compound rate of growth for the intercensus period, 3.5 percent, was second only to that of the Northern Region. The region is known for its industrious farmers, who traditionally have produced surplus quantities of maize, yam, and cassava for Ghana's urban markets (46, p. 163-165).

Techiman. Techiman lies approximately 125 kilometers northwest of Kumasi in the transition zone between the high forest and wooded savanna. Map 3.2 indicates Techiman's strategic location at the junction of the primary road linking north and south. The periodic market in Techiman is a major assembly market and transportation point for agricultural commodities destined for markets throughout Ghana.

Distribution of Cassava in Ghana

An Introduced Species

Cassava is indigenous to tropical America, possibly originating in Southern Mexico, Guatemala or South America (43, p. 352-360). From Brazil, cassava was introduced to the Congo Basin area of Central Africa by the Portuguese in the sixteenth century (29, p. 60). Over the next three centuries cassava spread and became established as a foodstuff in West Africa (15, p. 1).

Cassava in Ghana

Cassava became a major food crop on Ghana's coastal plain in the nineteenth century, during successive migrations of people from Nigeria, Togo, and Benin into what is now southeastern Ghana. There, it became associated with the Ewe ethnic group. Due to increasing population relative to agricultural land, the fallow period shortened and, consequently, productivity declined. Thus, conditions were set for the widespread propagation of cassava (29, p. 79).

Cassava in Ghana's Forest Zone and Savanna

Cassava spread rapidly throughout the Forest Zone after its introduction in the 1930s. The actual mechanism for dispersal is not known; however, it seems reasonable to suppose migrating Ewes took the crop with them. Although introduced to the Northern Savanna at about the same time, cassava did not become established to any extent. It has been suggested that the virtual absence of cassava from the Northern Savanna may be ascribed to the seasonal pattern of concentrated rainfall followed by a long dry period--i.e., too much rainfall promotes growth of fungal diseases (15, p. 24).

Area Planted to Cassava

Cassava's spread within Ashanti and Brong-Ahafo is linked to the exploitation of high forest land for the purpose of establishing cocoa farms. This took place on a wide scale during the 1930s and 1940s. As timber was cleared and farmers moved onto the land to plant cocoa, slash-and-burn quickly became the dominant form of food crop agriculture (33, p. 3).

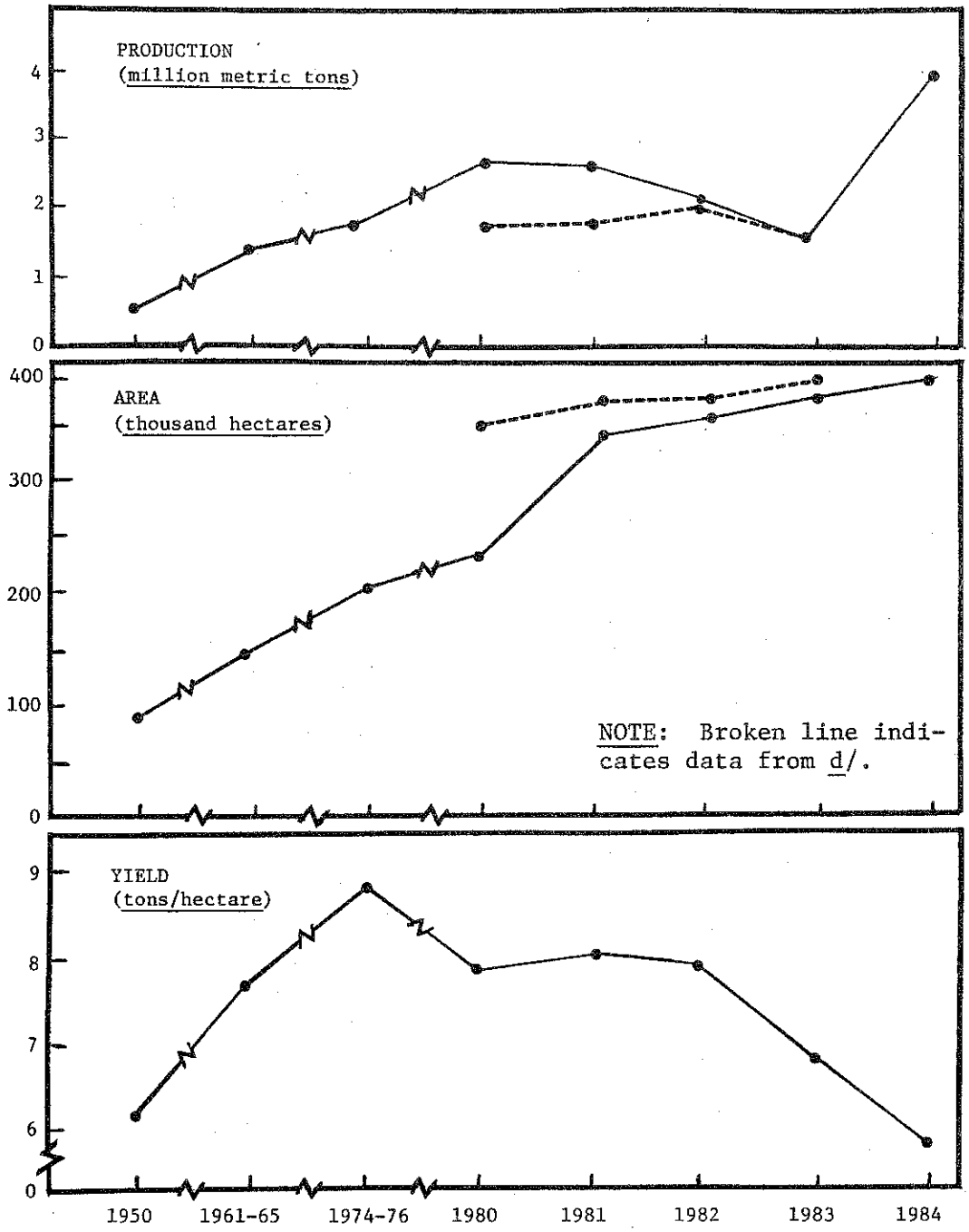
Maize and Cassava go Hand in Hand. That maize and cassava feature prominently in the agriculture of the forest zone is well documented. Although not a preferred staple, cassava serves as the subsistence farmer's insurance against crop failure and famine. In view of the decline in agricultural productivity, 1973-1983, it is likely that cassava contributed significantly to correcting the calorie deficit during the period (45, pp. 233-234).

The Decline of Cocoa, the Increase in Food Crops. Figure 3.2 indicates that the trend of total area planted to cassava has been progressively upward. The range represents the discrepancy between data provided by USDA and Ghana's Ministry of Agriculture, and points to the difficulty of quantifying production of a nonannual crop. However, they both point to an increase in area planted. It is not clear whether recent data take into account substitution of maize and cassava for cocoa in many areas of the forest zone.

Much of the cocoa land in Techiman District has been transformed into maize and cassava farms. In order to gain a better understanding of cassava's role in the food crop system, a survey was made of farmers selling cassava in Techiman Market. Most of the farmers surveyed stated that they switched to maize and cassava because, unlike cocoa, the prices for these crops were not controlled. Furthermore, they may be marketed by the producer and are not subject to government marketing boards, which is the case with cocoa. The recent increase in producer price of cocoa is unlikely to change this pattern in the near future--at least in Techiman area.

Population Pressure. Population increase has had a direct impact on cassava production. Increasing population density, always high in

FIGURE 3.2. GHANA: PRODUCTION, AREA, AND YIELD OF CASSAVA, 1950,[a] 1974-76, 1980, 1981, 1982[b], 1983[c], and 1985[d]



Data from a/ Gold Coast, Annual Report of the Department of Agriculture for the Year 1950-51 (1952), p. 23. b/ FAO, Food Production Yearbook, 1982 (Rome, 1983), Vol. 36, p. 128. Figures based on estimates. c/ USDA, ERS, World Food Aid Needs and Availabilities, July 1984, p. 10. Estimate made of 60 percent decline in cassava production due to drought and pest infestations. d/ ERPS, Ghana, Ministry of Agriculture data, 1985 (unpublished).

Ashanti, has reduced the length of the traditional bush-fallow cycle. As continuous cropping degraded the forest soils, cassava once again asserted itself as the crop of last resort. That cassava cultivation has increased significantly over the past 15 years is evidenced by the expanding "cassava belts" which encircle Kumasi and many other towns in the forest zone (33, p. 3).

Production of Cassava

Decision to Plant Based on Price

Among the 48 Brong-Ahafo cassava farmers interviewed in Techiman Market, the decision to plant was based upon the previous year's price in 80 percent of the cases. Figure 3.3 shows that the average wholesale price of cassava for a 90-kilogram bag jumped dramatically in 1983 from 383 cedis to 1,497 cedis, a rise of almost 400 percent. During 1984 these farmers expanded the area planted in expectation of continued high prices. However, wholesale prices dropped in 1984 and 1985, prompting more than a few to abandon their cassava until prices improve. Unfortunately, this rational decision may increase the loss attributed to tuber rot. It remains to be seen what impact, if any, the improved availabilities of maize and plantain will have on cassava price and the farmer's decision on how much to plant.

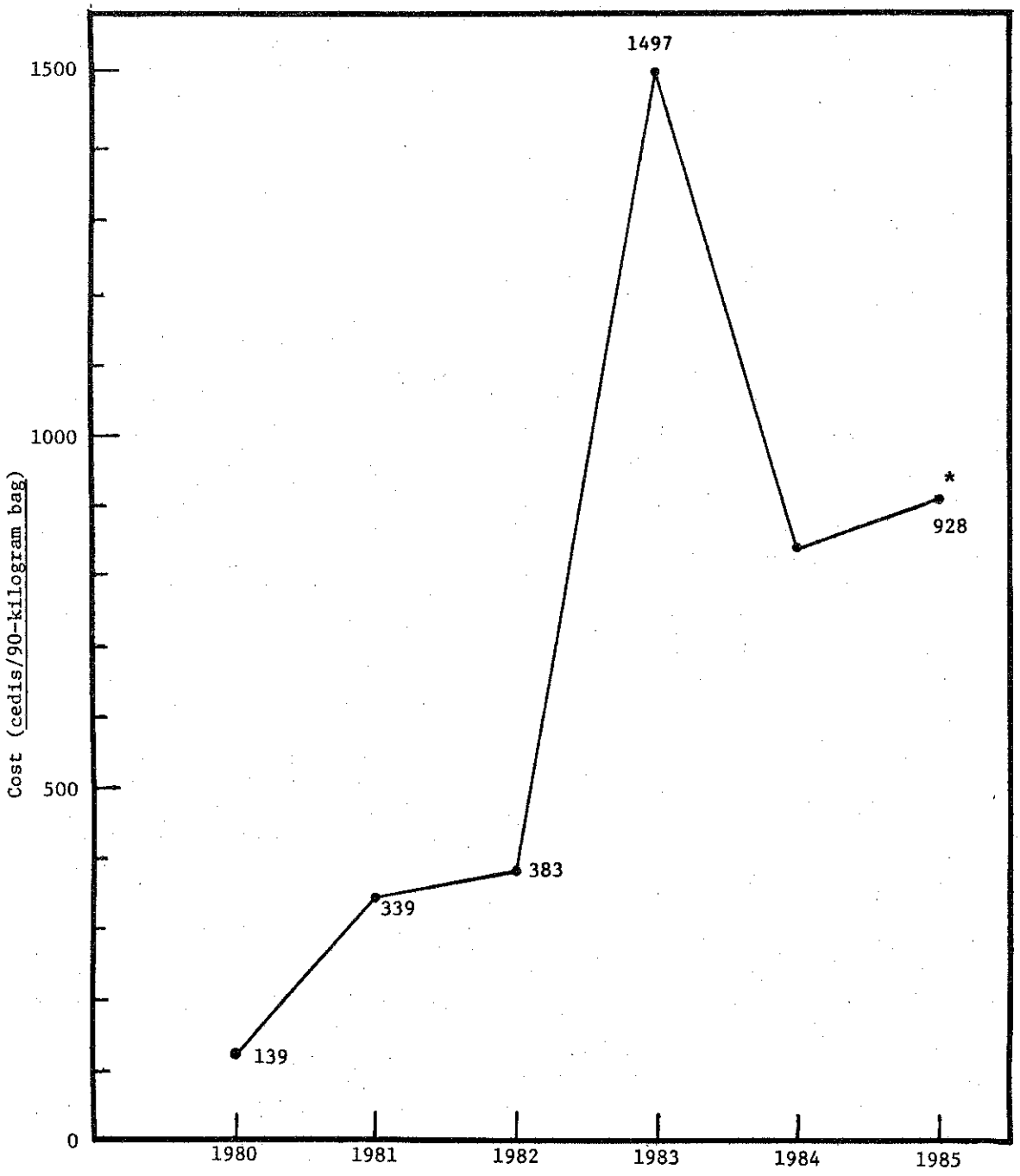
Propagation

The method of cassava propagation varies with geographic location. In Ghana, cassava is planted either as a single crop, or intercropped with maize, oil palm or cocoyam. When cassava follows another crop in rotation, it may be planted without additional soil preparation once the preceding crop has been harvested.

Soil preparation. Soil preparation depends on four factors: soil structure, drainage, labor, and desired tuber size. In many areas of the forest zone where soils are well-drained, cassava is cultivated without altering the soil surface. In the farmland surrounding Kumasi the size of tubers is much smaller than those from farms in Brong-Ahafo. This relates not only to the comparatively more fertile soils of Brong-Ahafo, but also to preference for large tubers. Thus, by devoting additional labor to ridge the soil, the farmers ensure the development of large tubers.

Planting: Timing, Material and Spacing. Throughout West Africa cassava is planted after the onset of the major cropping season, between March and June. A second planting may follow during the minor season, September through November. Similarly, in areas with year-round rainfall, cassava is planted throughout the year. The important point is that cassava must have moisture during the first month after

FIGURE 3.3. GHANA: NATIONAL AVERAGE WHOLESALE PRICE OF CASSAVA, 1980-85



*Estimated cost based on data through June 1985.

Source: ERPS, Ghana, Ministry of Agriculture, 1985.

planting to ensure proper setting of roots; however, once established cassava is extremely drought resistant.

Planting material for cassava is obtained from stems at least eight months old, and between 2.5 and 3.5 centimeters in diameter (21, p. 7; 8, p. 62). These cuttings should range between 20 and 25 centimeters in length and come from the lower 100 centimeters of the stalk--the woody portion. In Brong-Ahafo cuttings are placed in the soil up to two-thirds their length, usually at an angle to the soil surface. Inverted placement should be avoided (22, p. 55).

Spacing is random, with distances between plants ranging from 0.8 to 1.5 meters. Cock (1985) states that from 7,000 to 20,000 pieces are planted per hectare. High density is common on soils of low fertility, or if cassava is grown in monoculture. The most common plant density is approximately 10,000 plants per hectare, a figure typical of the Brong-Ahafo farms surveyed (8, p. 64).

Harvest Flexible: Throughout the Year

Cassava may be harvested throughout the year. However, for maximum yields a system in which planting and harvesting coincide with the yearly moisture cycle is recommended (26, pp. 45-47). Figure 3.1 presents the mean monthly potential water balance for the bimodal pattern of rainfall. Higher yields are obtained in planting systems B and C because harvest occurs during the positive water balance; reduced yields are expected in planting system A for the opposite reason. The primary advantage of planting system A is that it permits greater flexibility of land use planning. deVries, in his review of optimum harvest time of cassava, cautions against generalized conclusions, stating that it depends on temperature, cultivar, and rainfall distribution pattern, and therefore should be determined separately (12, pp. 9-13).

Harvest usually depends on end use of the tuber. For the gari industry of Anloga-Kumasi a large tuber is preferred. This preference is in large part due to the relative ease of gripping the larger tuber when peeling. For fufuo, smaller, fresher tubers are selected.

Seasonal differences in rainfall spell difficulties for cassava harvest. During the rainy season, uprooting is comparatively less difficult, but removal of cassava to market is problematic because of poor roads. Conversely, the dry season facilitates removal of cassava to assembly markets, but places an increased demand on labor to uproot tubers. As will be seen in Chapter V, all parties involved in the marketing chain prefer harvesting cassava in the dry season.

Consumption of Gari in Ghana

Like cassava, gari came to West Africa from the New World. Its production in Ghana until very recently has been associated almost exclusively with the Ewe ethnic group. Processing cassava into a storable form was a logical outcome of the need to provide calories in the face of increasing population pressure. Among the Ewe it is considered a traditional food. The importance of gari in their diet is reflected in the words of an Anloga-Kumasi gari processor: "without gari what would they eat!" Although this remark was to some extent made in jest, the point is well taken that gari is an important staple of the diet. Other, more preferred staples are taken, but gari's position is indisputable. Its relative contribution to the diet is probably a function of the availability of other staples, such as maize.

Gari in Ashanti and Brong-Ahafo

Although gari is not a preferred food among the Asante ethnic group, it was eaten widely during the Akombae Kese (Asante for the "Great Hunger,") of 1983. According to informants throughout the survey area of Kumasi and Techiman, there was little else to eat. Gari probably accompanied the Ewe as they spread out from their traditional home in the southeast corner of the Volta Region and occupied new land in the forest zone. (The Volta Region was the only region to register a decline in population growth in the 1984 Census.) Today, gari is found throughout Ghana, although its distribution is not entirely the result of the Ewe diaspora--a good product sells itself. However, it is likely that the presence of gari in Ashanti and Brong-Ahafo is directly linked to Ewe cocoa farmers or craftsmen, who planted maize and cassava and processed gari. Some evidence to support this is provided by the informant processors. All processors stated they had learned from Ewe women living in their areas.

Gari in Kumasi. Gari is abundantly available in Kumasi. This may be attributed to the following: Kumasi has a rapidly growing population fueled by urban migration, and Kumasi is less than 50 percent ethnic Asante. Therefore, consumption of gari is greater than would be expected if it were dominated by Asante (1, pp. 25-26).

Marketing of Cassava

Before cassava can be eaten, either in processed or fresh form, it must usually enter the marketing channel. Cassava moves to market by many arrangements. From farm gate to consumer, cassava may pass through either a long chain of intermediaries or a relatively abbreviated chain. Some farmers market their own; others use intermediaries. In Kumasi, the bulk of cassava entering the Central Market is handled by intermediaries. However, the reverse was found to be true

in Techiman. The following section outlines the characteristics of cassava marketing in these two important markets.

Kumasi Central Market

Kumasi Central Market is one of West Africa's largest open air markets. The major wholesale cassava section, Asawasi, is located beyond the rail line (Map 3.3). Asawasi Market serves as one of three delivery points for produce coming to Kumasi Central Market. Both wholesale and retail lots are sold in Asawasi. Although retailers are found scattered throughout Kumasi Central Market, the bulk of cassava is sold in Asawasi. Data for Kumasi Central Market were collected 16-28 September 1985.

Organization of Supply. Most of the cassava arriving at Kumasi Central Market for wholesale and retail purposes was found to come from surrounding villages, at most 40 kilometers from Kumasi. Cassava comes from surrounding villages on three-ton trucks. The cassava is packed or heaped into baskets of about 90 kilograms each. Women farmers are primarily responsible for movement of cassava to market. Supply of cassava is organized through three arrangements: contract, customer, and self supply.

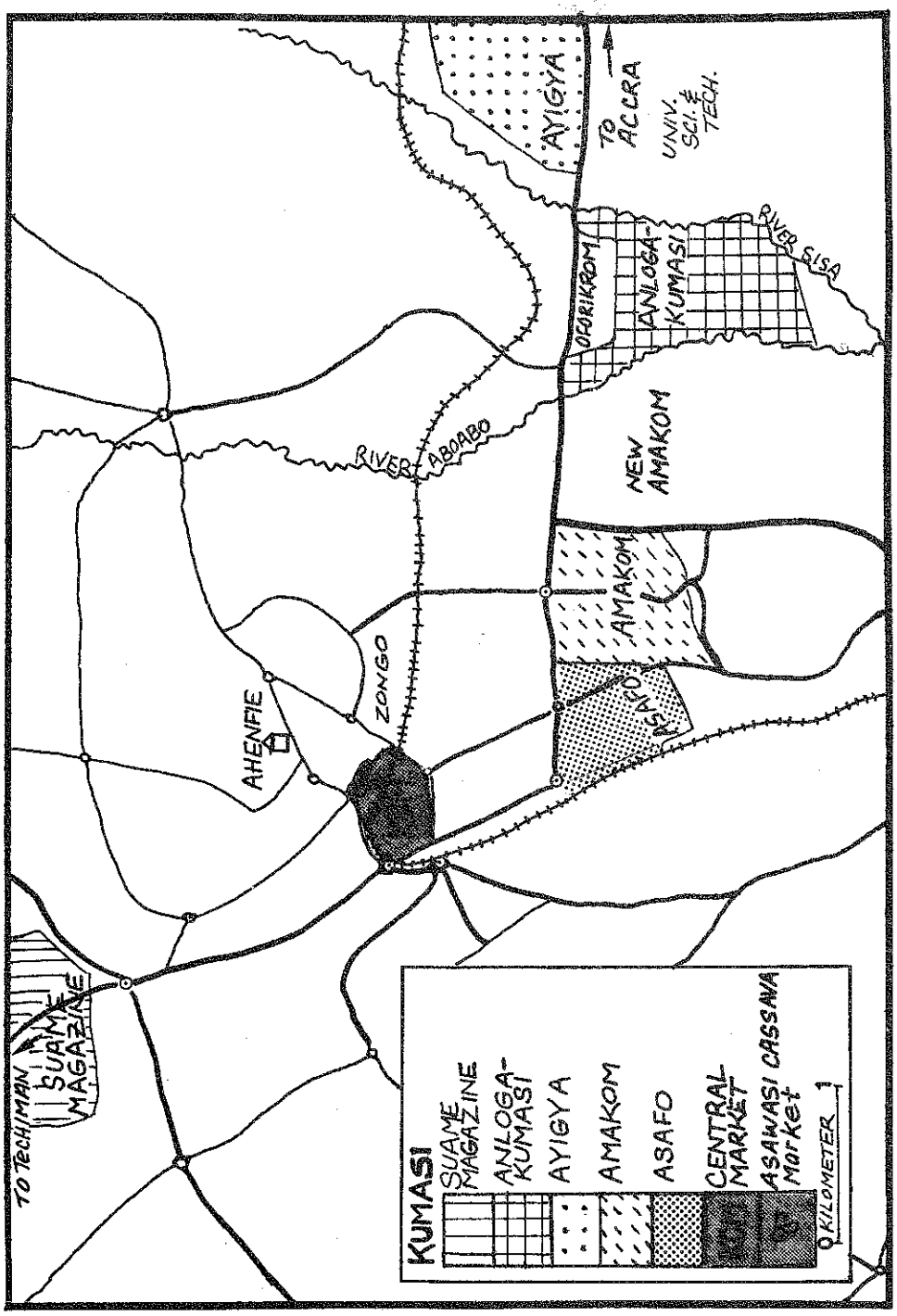
1. Contract Supply. Under contract supply, the market woman contracts with the farmer for a specified supply of cassava. She advances the farmer an annual amount to cover production costs. At maturity, the cassava is delivered to the market woman; however, timing of movement of the contract cassava is apparently at the discretion of the farmer. The farmer then sells the cassava to the market woman at the price prevailing in the market. The market woman credits the farmer until the loan is repaid. It should be noted that the farmer is obligated only to the extent that the loan must be repaid. Cassava may be sold to anyone. During the survey period, 85-90 percent of cassava marketed in Asawasi entered under this arrangement.

2. Customer Supply. In this system, the farmer has a regular customer (retailer or wholesaler) to whom she supplies cassava. There is no loan as in the contract supply; costs of production and transport are borne by the farmer. It is apparent that both contract supply and customer supply provide the farmer a measure of security and protection from uncertain market conditions.

3. Self Supply. A very small proportion of farmers sell cassava without entering into either of the other two agreements. This group is comprised mostly of subsistence farmers who only occasionally sell amounts in excess of home consumption.

Fluctuation of Price. Daily base price is a function of supply. According to the market supervisor, price setting is very difficult: "What can you do with a spoiled tuber?" Within a limited range price is determined by a lengthy bargaining process between buyers and sellers. The following factors influence the lower limit below which

MAP 3.3. KUMASI METROPOLITAN AREA WITH RESEARCH AREAS HIGHLIGHTED



retail price will not fall: price paid to farmer, government flat tax, porterage charge (cash or in kind), and market women's society taxes.

Prices varied widely over the research period, on both a daily basis and within each day. Canteen operators enter early in the day when supply is relatively low. They prefer the freshest cassava and are prepared to pay more for it. By early afternoon all trucks have arrived, and canteen owners have long since retreated. As the day advances the price tends to fall. Gari processors, not concerned with freshness, are prepared to wait for price to fall. For example, a basket load priced at 260 cedis on day one sold for as little as 100 cedis two days later; some baskets dropped to as low as 60 cedis. However, scarcity of supply would tend to even out the absolute level of price fluctuation, but movement would be in the same direction as outlined.

Source of Demand. Gari processors and canteen owners are the major buyers of Asawasi cassava. As mentioned above, canteen owners are prepared to pay more to ensure freshness. The gari processors, however, prefer the older and consequently cheaper tubers. They tend to be hard bargainers. Other wholesale buyers include women who, in turn, retail smaller lots (3-5 tubers) throughout the market. Occasionally housewives come to buy smaller, household quantities hoping for better prices at the 'source.'

Techiman Market

A striking difference between Techiman and Kumasi Central Market is the large proportion of farmers marketing their own cassava in Techiman Market. Those farmers interviewed preferred to market their own produce and thereby increase their share of market price. As is noted in greater detail in Chapter IV, Techiman Market is well connected by trade with markets throughout Ghana. Indeed, in the important gari-producing borough of Anloga of the city of Kumasi, it was found that the bulk of cassava comes from the Techiman area, 125 kilometers away. Chapter VI describes how this marketing system evolved. Cassava from Techiman area is also sold in northern markets, from one side of Ghana to the other. The integration of the marketing chain for fresh cassava is very tight, with cassava contractors maintaining regular customers and supplier farmers.

Thus, Ghana has evolved a marketing system that moves cassava considerable distances in response to demand. Intermediaries enter into agreements with suppliers and customers to reduce the risks of marketing a highly perishable crop. Ashanti and Brong-Ahafo Regions are primary producers of cassava and are likely to continue to supply both fresh and processed forms to meet growing consumer demand.

CHAPTER IV
GARI PROCESSING: THE TRADITIONAL METHOD

The method of processing cassava into gari is not indigenous to West Africa. Like the starchy tuber from which it is made, gari originated in the New World, probably in Brazil, and was introduced to West Africa at the close of the nineteenth century (8, p. 15). The similarity between Brazil's farinha de manioca and West African gari strikes those who are even marginally familiar with the two products. In the years since its introduction, gari or gari-like products have proliferated throughout the African cassava belt, each a result of locally adapted processing techniques. Among the more notable forms of processed cassava are: 1) ugali, from Central and East Africa, 2) attieke, from Ivory Coast, and 3) gari, found in countries ranging from Guinea to Nigeria.

In Ghana, as elsewhere in the West African gari belt, improvements in processing technology have gradually begun to replace the predominately labor intensive, traditional methods. For example, in Nigeria large-scale fully mechanized processing plants have been introduced (35, pp. 56-70). But in Ghana these improvements take the form of simple machines that tend to increase both labor productivity and the quantity of gari available. Nevertheless, the transformation of Ghana's gari industry is far from complete; the full range of processing technology from manual to mostly mechanized is employed to make gari. Not infrequently a traditional processing center occurs within close proximity of an improved or mechanized center. The focus of this chapter is the traditional processing technology, its characteristics, and how it differs from improved processing technology.

Traditional vs. Improved: The Distinction

The distinction between traditional and improved gari technology lies in two areas: the choice of equipment, and the organization of the enterprise. In the context of this study, improved technology implies more than use of machines in processing cassava. As processing operations move in scope from meeting household needs to producing for larger markets, business organization and management become increasingly important. Examples abound of efficient, well organized manual operations producing for the commercial market, and of mechanized units that failed because of poor management. Thus, traditional technology and good management are not mutually exclusive; however, the absence of improved equipment is a hallmark of traditional gari processing technology.

Equipment: Improved

Two innovations in processing equipment characterize the improved technology: the mechanized cassava grater and the wingnut screw press,

both manufactured locally on a wide scale. That traditional technology is defined by the lack of this equipment emphasizes the impact the grater and press have had on the gari industry in Kumasi and elsewhere in Ghana. As will be set forth in Chapter V, changes in business organization are arguably a consequence of adopting mechanized technology.

Equipment: Traditional

Producing gari by the traditional method requires relatively simple equipment. A manual grater, fashioned from a flattened can, and heavy stones or cement blocks substitute for the mechanized grater and screw press. Aside from these substitutions, the equipment used to prepare gari by either traditional or improved method is similar. Once flattened and attached to a wooden frame, the tin can is carefully stippled to ensure an adequate rasping surface. Such cassava graters are commonly available, comparatively inexpensive, and require only minimal maintenance. Almost any heavy object will suffice as a means of expressing starchy fluid from grated cassava. Among the presses to be seen in Brong-Ahafo and Ashanti Regions are tree trunks, stones and cement blocks--all either free or obtained at a nominal cost.

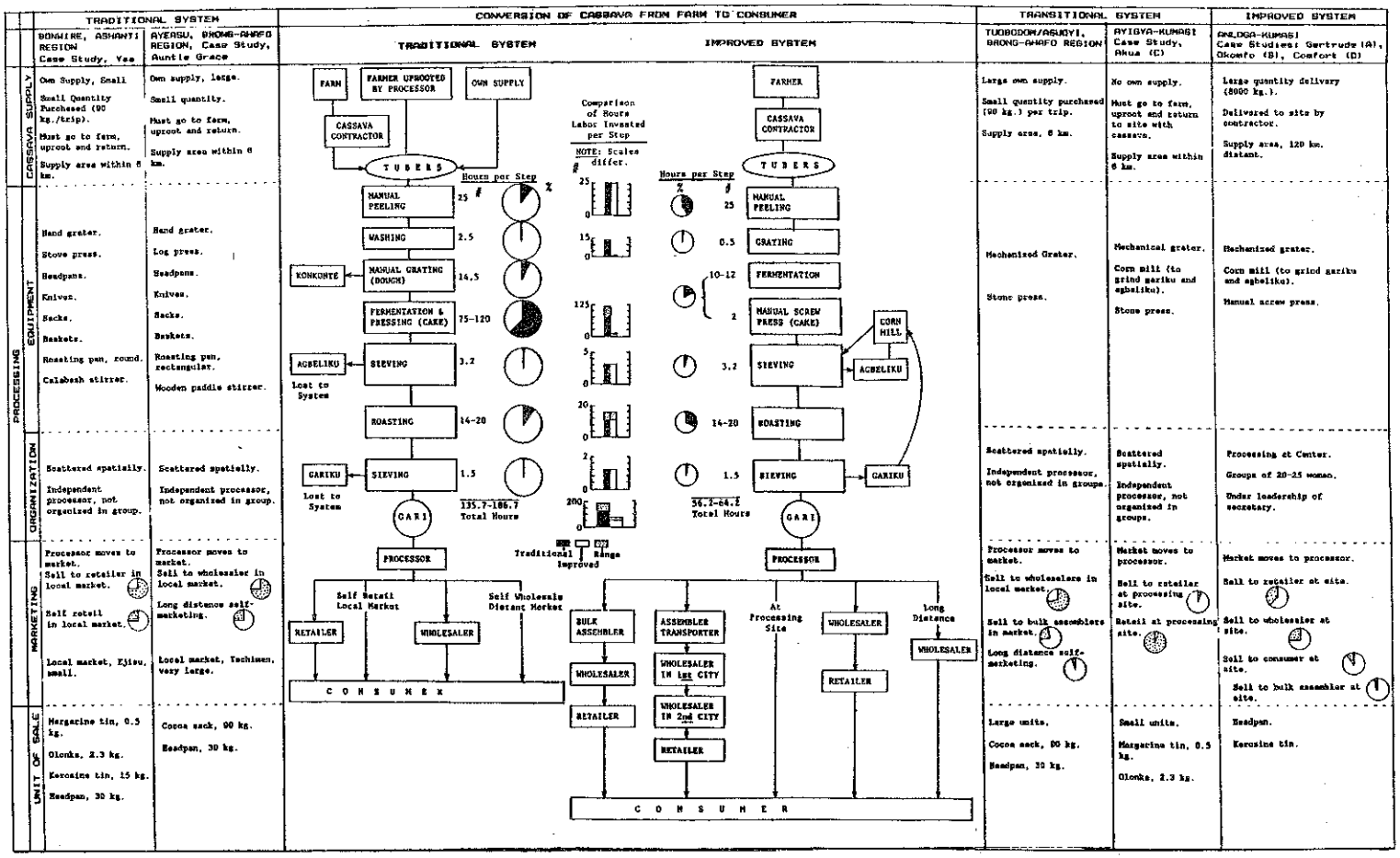
Steps in the Traditional Process

The traditional method of preparing gari persists in sections of rural Ghana, and remains the preferred method for small, household quantities of gari even among commercial processors who employ improved technology in their businesses. This method of processing usually takes 4-7 days depending upon labor available and quantity processed. The basic steps of the traditional method are diagrammed in Figure 4.1.

Peeling is Slow. First, the fresh tubers are peeled by hand. This step is tedious and demands some measure of skill due to irregular size and shape of the tuber. Typically, the near end of the tuber is covered with a clean cloth and grasped by the free hand. The peel is then removed from the distal half of the tuber by inserting a knife between the inner peel and flesh, and carefully separating the two. Once completed, the procedure is repeated on the other end. The cloth, of course, reduces the amount of dirt transferred from the rough outer peel to the flesh. When cassava is abundant or the amount of labor not commensurate with the task ahead, peeling may become quite careless, with deep, broad strokes replacing the careful separation of peel from flesh. Whether the tubers are washed after peeling depends upon a ready source of water. However, because quality of gari is associated with a creamy white color, most traditional processors wash tubers prior to the next step, grating.

Grating is Tedious. Manual grating reduces the tuber to a pulp, the dough, which is then fermented. The tuber is grasped by both hands and forced against the grating surface with a powerful, downward

FIGURE 4.1. COMPARISON OF MARKETING AND PROCESSING SYSTEMS OF CASSAVA CONVERSION TO GARI



motion. Care is taken to avoid abrading the thumb and palm, and, as a result, at least some portion of the tuber remains ungrated. This ungrated portion--usually small among practiced graters--is saved and dried in the sun to form konkonte. Skill is required not only to avoid abrasions but also to produce the desired particle size of dough characteristic of quality gari. Almost anyone interested in gari is prepared to comment on the relative merit of a particular batch of gari based on particle size.

Fermenting, Pressing and Sieving. As the tubers are grated, the dough is transferred to either a fermentation basket, usually large (1.5 meters by 1 meter) and tightly woven of split raffia fronds, or a clean jute (or synthetic fiber) bag and set in the sun. The dough is compacted in the basket to prevent air pockets, which impede anaerobic fermentation and result in bluish, blackened areas of dough, unsuitable for processing. The basket thus filled is covered with a plastic sheet and allowed to stand overnight. On the following day, heavy stones are placed on the covered basket (or bag) to extrude the starchy fluid. These stones are left on the dough for three to five days during which fermentation and souring take place. Fermentation is a necessary step in the process because it eliminates or greatly lowers the hydrocyanic acid (HCN) content of cassava and promotes the characteristic gari flavor (21, p. 32). Failure to reduce the HCN content to safe levels would pose a serious threat to consumers' health. That HCN toxicity is virtually unheard of attests to the skill of gari processors.

Extruding the fluid from the dough yields a dry, compressed cake which is then screened through a raffia fiber sieve. Some of the screened cassava does not fall through the sieve; this is termed agbeliku and is either saved and sun-dried as konkonte or thrown away. The decision to conserve or discard the agbeliku is based on scarcity. Among the traditional processors interviewed in Brong Ahafo and Ashanti, all chose to cast off the agbeliku, apparently because each had an adequate supply of raw cassava. However, during the lean season gari processors are probably more concerned about conserving this edible portion.

Roasting: Hot and Smoky. The screened cassava dough collects in an enamel-ware pan, from which small amounts are transferred by calabash gourd to a shallow, round aluminum pan for roasting. Roasting is by far the most difficult and unpleasant task of the process. The intense heat and smoke associated with roasting have driven away more than one processor to find other, easier work. Even among successful commercial processors the prospect of roasting is unpleasant.

The roasting pan is positioned on a low hearth, usually of clay construction, under which a fire is built and maintained throughout the gari frying process. Once transferred to the pan, the sieved dough must be stirred and beaten with a calabash or wooden paddle to prevent caking. Experienced processors know when garification is complete by the swishing sound made by the drier, crisp gari as it is stirred in

the pan. Thus, heat reduces the moisture content of the gari particle, ensuring a storable product with a shelf life of several months.

As soon as the gari is ready, it is removed from the roasting pan to another container. The last step involves grading the product, a simple procedure of screening the gari through a raffia sieve. This yields gari of relatively uniform particle size. Lumps of gari (gariku) not passing through the sieve may be either retained or discarded, depending upon the processor.

This basic procedure is followed in villages throughout Ghana. To understand how these steps are carried out in practice, a survey was made of traditional processing technology in two areas of the Forest Zone: in Bonwire, a village outside Kumasi, and in Ayeasu, a village near Techiman. The purpose of the survey was to collect information on the incipient gari industry, especially on the local adaptations of the basic theme.

Bonwire: Beginnings of Traditional Gari Production

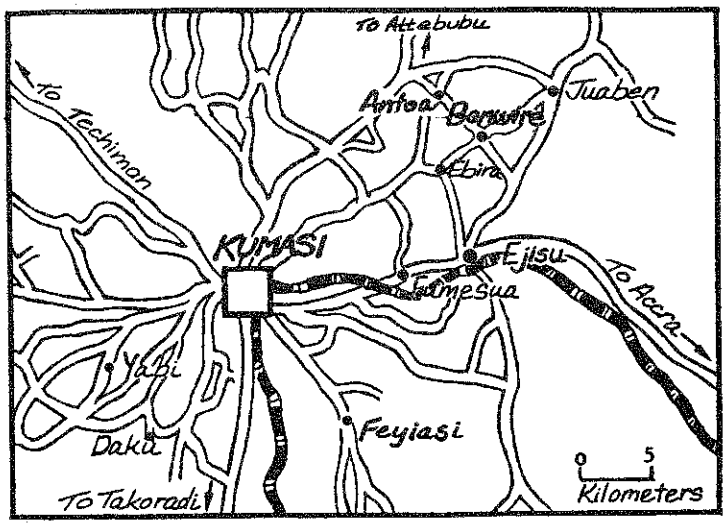
Bonwire is a typical Asante village lying 16 kilometers to the east of Kumasi (Map 4.1). Primarily known for the intricately patterned cloth (kente) woven exclusively by men, Bonwire is also an agricultural community producing cocoa, oil palm, and a variety of vegetable and root crops for the Kumasi market. (Bonwire is connected to other villages in the district by an extensive system of feeder roads.) A walk down any path leading from Bonwire to the surrounding farmland reveals the relative importance of cassava as a food crop. Cassava in Bonwire, and in most other ethnic Asante villages, is prepared as fufuo, a boiled and pounded form of fresh cassava. Traditionally, gari has been relegated to the position of lean season or famine food; however, both gari consumption and production are on the increase in Bonwire.

The Great Hunger

Gari processing began in a big way during the protracted food shortage of 1982-84, a period when the price of both raw and processed forms of cassava rose dramatically. Ancient village elders stated that they had experienced only one other hunger period of comparable magnitude--when they were adolescents. For them, this most recent shortage demonstrated the value of gari, both as a foodstuff and as an economic venture. Although not necessarily preferred, gari has become an acceptable part of the diet.

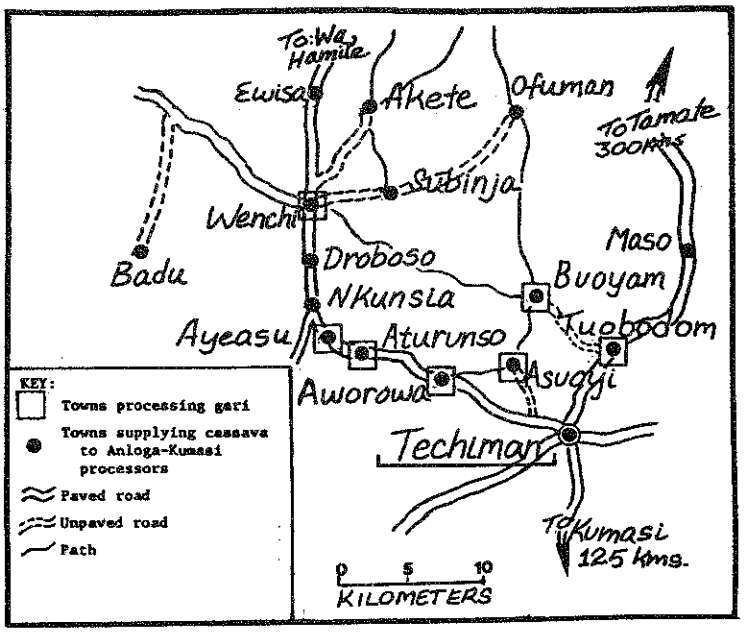
New Entrants in Gari Processing. Ten traditional gari processors were interviewed in August and September 1985. All are women, Middle School leavers, 16-21 years of age. They turned to gari processing in 1983 at height of the hunger period. At that time many other women in Bonwire were engaged in gari processing. Estimates range from 20 to 30

MAP 4.1. ASHANTI REGION SURROUNDING KUMASI*



KEY: Paved Roads
Railroads

MAP 4.2. TECHIMAN AREA TOWNS INVOLVED IN CASSAVA AND GARI TRADE*



*Source: Adapted from Survey of Ghana, Accra Map, 1969.

processors; many of these are now inactive or have chosen to process gari only in the peak season, January to April.

Why They Began. The informants advanced two reasons for their entry into the gari processing business: food security and lack of other employment opportunity. The first is common among members of the food processing sector. They reasoned that even if the profit margin were low, they would, at least, be able to feed themselves and their families. The second justification relates to their comparatively weak economic position within the community. Given a choice, none would pursue a career in gari processing. They would prefer retail trading; however, because of the high capital cost of entering into trading, these young women turned to gari. The start-up costs were low, and the market demand for gari relatively strong. When asked whether they would remain in the gari business, each informant stressed that she would switch to trading as soon as she had accumulated sufficient capital for purchasing trading stock.

Of the ten processors interviewed, Yaa Asantewaa, perhaps best exemplifies the status of gari in the community. Although not a preferred line of work, gari processing appealed to Yaa because entry costs are comparatively low and the raw material is abundantly available. The case could be made that in Bonwire gari processing provides stop-gap employment, in much the same manner that cassava provides relief from famine. When demand increases, so does entry into gari processing. When demand decreases, it is likely Yaa will leave gari processing for other work. The important aspect of Yaa's operation is her relative lack of business organization.

The Case Study of Yaa Asantewaa

Like her peers, Yaa began making gari in 1983. At 16 years of age, Yaa is the youngest of the women interviewed. Because she was an orphan living with a family of modest means, Yaa had limited economic opportunity and turned to gari following completion of Middle School. She, too, would prefer a job in another trade, but without training she plans to stay with gari processing until she has saved enough money to invest in trading.

Yaa learned the business by watching others roast gari. An Ewe woman is credited with introducing gari processing to Bonwire, and it was from the early entrants into the industry that Yaa first observed the process. She makes gari in the open courtyard of her guardian's compound house. Although September is not the major gari season, and Yaa divides her time among farming activities, she processes and markets at least two kerosine tins (30 kilograms) of gari each week.

Choice of Technology. Yaa employs the simple methods of traditional technology. With the help of a sister she rasps the raw tubers on a homemade grater. She had not heard of either the mechanized grater or the screw press and doubted whether her operation would ever

expand to afford a grater. Nevertheless, the idea of manual screw press appeals to her. Such expenditures are a long way off. Currently she rents on a daily basis both a roasting pan and a raffia sieve, and owns the rest of the equipment.

Yaa's operation lacks the sophistication of those found among the Ewe of Anloga-Kumasi. For example, the roasting pan rests unsteadily on three concrete blocks. Both smoke and heat from the fire plague Yaa as she roasts the gari. The standard Ewe clay hearth greatly reduces the transfer of unwanted heat and smoke and conserves expensive fuel wood. Throughout Bonwire the same poorly constructed hearth was in evidence, and all roasters complained of heat and smoke. Perhaps because fuel wood is not the serious issue it is in urban areas, Yaa and her colleagues have not turned to a more efficient hearth design. Yaa is not alone in gathering firewood free of charge from the surrounding countryside. Still, free firewood does not explain their reluctance to construct clay hearths. If Yaa were roasting every day, rather than the two days per week she currently roasts, perhaps a hearth that reduces heat and smoke would make more sense.

Supply of Cassava. Cassava for Yaa's gari comes from local farms. Yaa processes much more cassava than she grows and relies on Bonwire farmers to provide a steady supply. During the period of this research she purchased cassava from eight different suppliers. There are no formal agreements or regular suppliers; Yaa simply walks from house to house until she finds a farmer with cassava for sale. Yaa accompanies the farmer to the field and helps uproot the cassava. Occasionally, a willing farmer cannot be located. Yaa must then turn to local cassava merchants who charge more for their cassava than the farmers charge. Higher cassava costs translate into reduced profits for the processor because gari price is relatively insensitive to random fluctuations in the price of cassava. Thus, from the standpoint of profit gari processors would want to ensure a steady and reliable supply of cassava. Furthermore, it would seem in their interest to have cassava delivered to the processing site--time spent away from the site uprooting cassava means time not invested in processing. That the processors of Bonwire have not set up a system for ensuring delivery of cassava is understandable given the comparatively low volume of their operations. If gari production were to assume greater economic importance in their lives, then they would probably arrange to have cassava delivered to their processing sites.

Gari Marketing. All ten processors independently market gari in Ejisu, a district headquarters located 10 kilometers from Bonwire, on the major road linking Kumasi with Accra (Map 4.1). Yaa sells her gari to market women who in turn either retail the gari in Ejisu Market or supply bulk quantities to institutions such as secondary schools. Infrequently, Yaa herself sells gari in the Ejisu Market.

The standard measure of gari is the kerosine tin, a volume holding approximately 15 kilograms. During September 1985, the wholesale price of the kerosine tin in Ejisu Market was 240 cedis. At the retail

level, a kerosine tin is broken into 36 margarine tins (0.5 kilograms), which, in September 1985, sold for 10 cedis each. When Yaa sells a kerosine tin to the market women, she adds two margarine tins free of charge. Yaa estimates a profit of 60 cedis per kerosine tin if she sells to market women, and 100-120 cedis if she retails the amount. Of course this estimate is over and above any amount of gari she retains for self consumption and excludes occasional gifts of gari.

Gari marketing has gradually returned to normal after the hunger period of 1983. During that time processors were virtually free from marketing costs: customers came directly to the source. The gari was sold only in retail amounts of the margarine tin, or less. The cost was high--40 cedis per margarine tin. It was this high cost in 1983 that attracted Bonwire women to gari processing as a livelihood. Since then, the price of foodstuffs, gari included, has declined steadily and perhaps with it some of the early enthusiasm of the Bonwire gari roasters.

Beginnings of Gari Industry in Techiman District

Gari processing is not new to the Techiman area of Brong Ahafo. For at least 30 years gari has been processed by ethnic Ewes living in surrounding villages. However, since the food scarcity of 1983-84, gari processing has become a big business for both men and women who are not ethnic Ewes and therefore have no traditional ties with the product. All of the twenty processors interviewed in the Techiman area claim to have learned gari processing from Ewe women. Several ethnic Bono towns (Map 4.2, page 34) along the surfaced road connecting Techiman with Wenchi were visited during the research period. The following data were collected on ten separate trips, between 15 August and 25 September 1985.

Why Cassava is Processed

Economic opportunity was cited by the informants as the primary reason for processing gari. The high gari prices of 1983 attracted the Bono of Techiman area just as they had the Asante of Bonwire. Reducing the risks associated with marketing cassava was also mentioned as an important factor in their decision to prepare gari. All of those interviewed maintain mixed-crop farms of at least two to five hectares. Always an important staple crop, cassava's position since 1983 has improved. However, along with increased prices came higher marketing risks. With few of the cassava farms located near feeder roads, the marketing of cassava from areas serviced only by narrow farm roads (usually impassible in the rainy season) has always been problematic. While waiting for transportation, it was not uncommon for these farmers to watch their uprooted cassava rot. Even if the truck arrived at the appointed time, there was no assurance that the farmer would sell the cassava in Techiman Market. Thus, processing cassava into gari reduces risk and allows the farmer to capture the value-added.

Although the practice of processing cassava into gari may have become widespread during the food crisis of 1983, it is not likely to diminish in the face of improved agricultural output. The recently expanded gari market in Techiman will continue to influence the decisions of cassava farmers. An excellent example of the farmer-processor is Auntie Grace Gyamfi. Her operation is of interest in its marketing aspect. Auntie Grace is one of a growing number of processors who increasingly market their gari farther afield--an outcome of Techiman Market's strategic location.

Case Study of Auntie Grace, a Cassava Farmer and Gari Processor

Auntie Grace, a full-time cassava farmer and gari processor, lives in Ayeasu, a small, roadside village 14 kilometers from Techiman on the Wenchi Road (Map 4.2). Like Grace, everyone else in Ayeasu is a farmer. Her cassava and mixed crop (maize, pepper and tomato) farm is a 45-minute walk from Ayeasu down a path cutting through the extensively cropped countryside. At some point in the past most of the surrounding bush was stumped to allow tractors easy access. Grace, however, manages her farm with the conventional hoe and cutlass.

Grace began processing gari in 1983, at 22 years of age. She reasoned that because she had a large cassava farm and the price of gari was high, she should process her cassava into gari and "make more money." Grace then spent one day with a Togolese (Ewe) woman in a nearby village mastering the basics of traditional gari preparation. From that day on, Grace has incorporated gari processing into her regular farming activities.

Choice of Technology. The technology employed by Grace is not unlike that used by Bonwire processors: labor intensive. Grace's equipment, however, differs slightly from that found in Bonwire. She uses a roasting pan (ankroe in Bono) fashioned from a 55 gallon drum, cut longitudinally into a trough with the ends welded. This trough is placed on a hearth of two parallel clay walls (38 centimeters in length) spaced far enough apart to support the trough's weight. The roasting trough has a capacity three times that of the round aluminum pan. Grace stirs the gari with a hand-held wooden paddle (20x11 centimeters), a style typically used in this area.

Types of Gari. Auntie Grace processes cassava at the farm gate and not in her compound. All others carry headloads of cassava from their farms to their compounds, and then prepare gari. To Grace the advantages are obvious: only processed gari is carried to the house; firewood is more abundant on the farm than around the compound; and loss of cassava dough due to untethered livestock is eliminated. Having studied the Techiman gari market, she now processes two types of gari: garifufuo and sikyeregari. Garifufuo differs from standard Ewe gari in the time allotted to roasting; it is not completely dried during the roasting step. Grace removes the partially roasted gari to a cement floor within her house, where it air dries for three days.

According to Grace, garifufuo is the preferred form of gari among northern markets in Ghana. This comparatively moist gari is prepared by mixing with boiling water and stirring until stiffened into a paste. However, the moisture content of sikyeregari is only slightly higher than that of Ewe gari. Prior to achieving the characteristic swishing sound of well roasted grain, sikyeregari is removed from the trough and dried under the sun for approximately three days. This form is eaten by soaking in water and mixing with sugar (sikyere in Bono).

Moisture content of gari can be roughly estimated by squeezing a handful and then slowly releasing it. Well roasted gari should separate, whereas garifufuo should remain clumped together. Grace admits that the distinction between the two types she processes is sometimes blurred.

Supply of Cassava. The supply of cassava destined for the Techiman area processors derives almost exclusively from their own production; however, three of the twenty respondents stated that they, at times, process cassava belonging to other family members. This differs markedly from Bonwire, where processors rely on others for the bulk of their supply of cassava. In large part, this is because the recent entrants in Techiman area are primarily surplus producers, and, in Ghana, are renowned for their skill in crop production. Thus, Grace processes on average two cocoa sacks (90 kilograms per sack) of gari each week from her farm. During the dry season, when demand is high and farming activities reduced, she claims to double the amount processed.

Gari Marketing. Grace pursues an aggressive marketing strategy. Unlike Yaa who sells at only one market, Grace closely follows the gari price in two markets to determine where she sells gari. She is able to do this because Techiman is a large assembly market and distribution point for agricultural commodities going north and south in country. The price she most closely follows is the Hamile price, usually the highest quoted for northern markets. (Hamile is a small border town in the northwest corner of Ghana along the Burkina Faso border.) In June 1985, a cocoa sack of gari sold for 2,800 cedis in Techiman Market. By August, the price per cocoa sack had fallen to 900-1,200 cedis, whereas the price in Hamile had remained steady throughout the period at 4,000 cedis per sack. Therefore, Grace resolved to market her gari in Hamile rather than in Techiman, at least until either the Techiman price improved or the Hamile price fell. During the research period she made two marketing trips to Hamile, each time selling four sacks of gari. Marketing costs for each trip totalled 2,400 cedis (transport, round trip, 800 cedis; loading and market fees, 200 cedis a bag; and haulage, 200 cedis a bag), in addition to personal expenses for the four days away from Techiman. Assuming that personal expenses amounted to 1200 cedis per trip, Grace cleared 1,750 cedis more per bag in Hamile than she would have had she sold her gari to an intermediary in Techiman Market for 1,200 cedis per bag. Although the gari trade is lucrative, Grace doubts she would seriously consider becoming a gari contractor. She stresses that she is primarily a farmer, not a business woman.

However, as cassava processing develops into an industry in Techiman area, independent processors, such as Grace, are likely to make the transition from part-time to full-time businesses.

An Emerging Industry or a Temporary Response to an Emergency?

The question remains: do these case studies of traditional technology processors suggest an emerging industry, or are they a temporary response to a food crisis? Certainly, the basis of the gari industry is broadening in the Techiman area. Reasons for this expansion are many: 1) the marketing facilities necessary to promote large volume cassava processing are in place; 2) large numbers of both buyers and sellers meet and freely exchange price information from other markets; 3) Techiman's geographic location supplies an extensive, year-round demand area, reaching the markets of the northern savanna and the population centers of the south; and 4) as a source of calories, gari is much easier and cheaper, per unit energy, to transport than raw cassava. Increasingly, surplus producers of cassava have turned to gari processing as an effective means of reducing the bottlenecks associated with marketing the more perishable raw form, and of increasing the value-added of their farming activities. Given the ability of Techiman's gari to penetrate markets in traditionally food deficit areas, it is likely that the economic importance of gari processing will continue despite increases in the availabilities of the more preferred staples.

The future direction of Bonwire's gari industry is less clear. Facing comparatively limited marketing opportunities, the processors of Bonwire are subject to the cyclical nature of demand for gari. The decline in gari price corresponds with the harvest of maize and plantain, and in 1985 the harvests of both were good. Thus, by the end of the research period four of the ten processors had suspended operations until the resumption of area secondary schools in late October. These processors will probably have to seek out the urban Kumasi Market, if they intend to make gari a year-round business. Otherwise, in good crop years, it will remain a seasonal activity. Considering the Asante predilection for commerce and trade, the growth of a traditional gari industry in Bonwire is rather doubtful. In Bonwire and surrounding villages, the development of the gari industry will depend upon the introduction of mechanized processing equipment.

CHAPTER V
GARI PROCESSING: IMPROVED TECHNOLOGY

In Ghana, the advent of the mechanized cassava grater heralded sweeping changes throughout the gari industry. Although prevalent in the traditional gari producing areas of Volta and Greater Accra Regions (Map 3.2) for perhaps 20 years, the mechanical cassava grater was uncommon in Ashanti and Brong-Ahafo before 1980. The past six years have witnessed a proliferation of locally manufactured, mechanical graters. For many processors, the power grater has meant increased revenue through improved production capacity per unit time. Hours formerly spent grating by hand are now freed for other production tasks. What may have taken four workers all day to grate is now accomplished in 20-30 minutes. However, compared with current processing technology employed in the noted gari processing center of Anloga-Kumasi, a system incorporating only the mechanized grater would have to be considered an intermediate or transitional step. The state-of-the-art technology in Anloga-Kumasi includes the manual screw press, a simple yet highly efficient device for extruding the starchy fluid from grated cassava.

As the research period drew to a close, I attended a demonstration of what may become the state-of-the-art gari technology--a high-volume system introduced by AGRICO, Ltd., an engineering firm based in Accra. It is comprised of eight machines, manufactured in India and assembled in Accra (49, pp. 15-16). The AGRICO system includes such motorized equipment as a cassava peeler and a gari grader, and has a suggested daily production rate of 1800 kilograms or 20 cocoa sacks of gari. In 1985 this system cost approximately 750,000 cedis, an amount far beyond the means of most processors, but certainly within the reach of a few. Whether this system becomes widely adopted remains to be seen; however, it represents an improvement in processing technology and suggests that the distinction between traditional and improved technology is not clear-cut. Technological improvements, by nature, are gradual. Thus, the step from hand grater to mechanized grater is significant in the evolution of gari processing as an economic activity.

Figure 4.1 shows that hand grating requires a considerable investment of time. However, this bottleneck has been overcome by the introduction of the mechanical grater. Akua Kese represents a category of processor who has adopted the mechanical grater, but not the manual screw press. Thus, she employs a transitional technology. An important distinction between Akua and the improved technology processors (presented later in this chapter) is in the supply of cassava and its impact on choice of technology.

Transitional Technology: The Case Study of Akua, an Urban Gari Processor

Akua, aged 45, has had more than 15 years experience in the gari business, and from earliest memory has lived in an environment dominated by gari processing. Her mother and aunts were gari processors, and her decision to enter into full-time gari business is in large part based on this early exposure. Gari, she emphasizes, is the business she knows best.

Characteristics of Akua's Business

Unlike either Yaa or Grace, Akua, an ethnic Ewe (Togolese by birth), utilizes the services of a mechanical grater, but otherwise processes gari in traditional manner. She is an urban-based processor working near her compound house in Ayigya-Kumasi (Map 3.3), an area of concentrated gari activity not far from the high-volume processors of Anloga-Kumasi. Akua was selected for the following reasons: she is a full-time gari processor; she has adopted some but not all the technological improvements available in Kumasi--i.e., she does not use the screw press; and she lacks the entrepreneurial ability common among the Anloga-Kumasi case studies. Therefore, Akua's case study offers a comparison of gari processing in a transitional state between traditional and improved technology.

Mechanical Grater. The major difference between Akua's enterprise and those of traditional processors is the use of a mechanized grater. This grater has greatly reduced the drudgery of gari processing. Akua admits that she had almost taken for granted the convenience of the grater, until the power-rationing of 1984, which interrupted the service of the electric powered graters in her area. During that period she was forced at times to grate the cassava by hand.

Akua is one of more than a score of women who grate their cassava at a nearby mill. The mill, a small wooden shed, is equipped with two machines, a corn mill and a cassava grater, both powered by a single 7HP electric motor. On busy days women must place their baskets of peeled and washed cassava in queue to await their turns. For each load grated, the mill operator collects a set fee which is established by the local miller's association. After grating, Akua places the cassava dough in a maize sack; she allows the dough to ferment overnight before placing heavy cement blocks on top of the sack to extrude the starchy fluid (Plate 4). After three to five days the caked dough is removed from the stone press and sieved and roasted under a shelter Akua built to protect herself from the sun and rain.

A distinguishing feature of Akua's operation not found among the traditional processors of Bonwire and Techiman area is her attention to reducing waste. Akua scrupulously saves the gariku and agbeliku produced during the process. They are then dried and ground in a corn mill, and later incorporated into finished gari. Savings from this

technique alone represented approximately 10 percent of the processed weight of gari made by Akua and the Anloga-Kumasi processors. Perhaps they are waste-conscious because their operations completely rely on an outside source of comparatively expensive cassava. In villages surrounding Techiman, where the bulk of cassava comes from own production, gari processors seemed unconcerned about reducing waste and loss; almost every processing site was strewn with agbeliku and gariku. This situation would possibly change if processors began to rely more on purchased cassava than on own supply. However, the major constraint to implementing this technique is simply the limited number of conveniently located corn mills in the countryside around Techiman.

A characteristic common to both traditional and transitional processing is the method of peeling tubers. The thick inner peel is carefully separated to reduce the amount of the tuber attached to the discarded peel. Uncharacteristically perhaps, the same careful attention to peeling is not found among the high-volume processors of Anloga-Kumasi. Quite the contrary: the proportion of edible tuber in discarded peels was calculated to be 35-40 percent, by fresh weight. To low and medium volume processors this would represent a significant loss.

Organization of Akua's Enterprise

Akua proudly claims to operate a "one-woman enterprise." She refuses to hire additional labor because she lacks the capital. Nevertheless, on at least 85 percent of the visits over a three-month period, she was observed to have had one or more family members helping at the site. These helpers peel cassava and sieve the caked dough, for which they are paid in kind with gari.

Akua's output of gari varied over the period from July-November 1985, a reflection of both the demand for gari and the supply of cassava. Figure 5.1 presents daily production data, in kilograms, for Akua (C) and the gari processors in Anloga-Kumasi (A, B and D). Periods of inactivity for Akua (e.g., 27 July-5 August) coincided with the failure of farmers and market women to supply her cassava as promised. Lacking a cassava farm of her own, Akua is dependent upon intermediaries for a regular supply. Her primary suppliers are part-time farmers who maintain small plots of cassava within the urban area. These suppliers tend tc be either night watchmen or university employees; they cultivate small margins of largely unproductive soils along the roadside and railroad right-of-way within five kilometers of Ayigya along the Accra road. As would be expected, the average tuber size is small (0.5 kilograms)--by Brong-Ahafo standards merely a quarter of the average size.

A typical week's schedule involves four days of on-site work, and three days of farm visits to purchase cassava. This pattern is not unlike that followed by Yaa, the Bonwire processor. Admittedly, Akua would rather remain at the worksite, and have cassava delivered, than

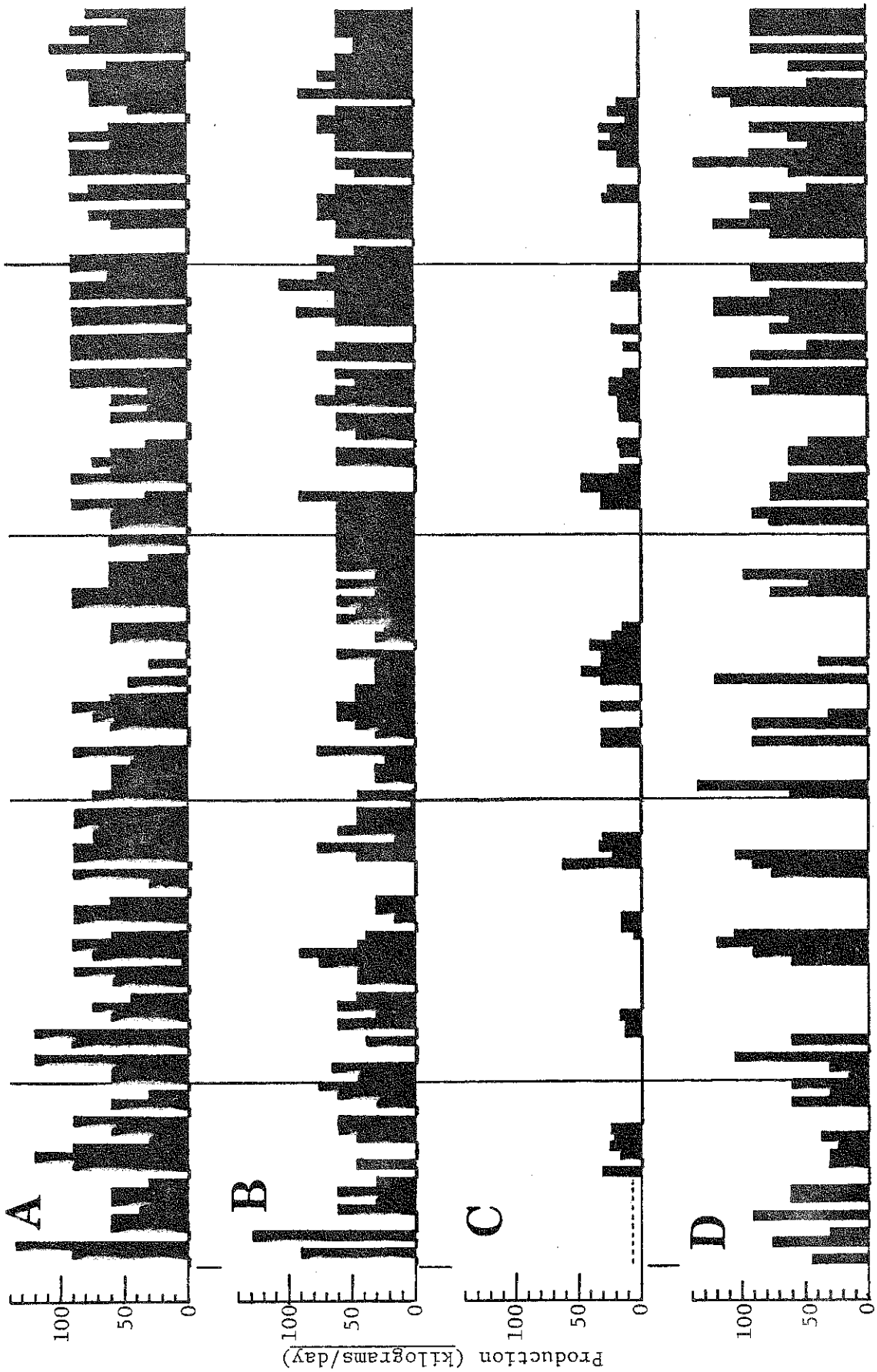


FIGURE 5.1. DAILY GARI PRODUCTION FOR CASE STUDY PROCESSORS, 11 JULY - 30 NOVEMBER 1985

devote time to weekly purchasing trips. Indeed, the uncertainty attached to an unreliable supply of cassava is her major production constraint. This concern seems unfounded in view of the large number of small-volume cassava contractors who operate in the area. Thus, there must be another, more fundamental reason. If there is an advantage to purchasing cassava at the farm gate, it lies in Akua's superior bargaining position. On four farm visits Akua virtually dictated the price to the farmer. Then, after the price per headpan was determined, she loaded it with many more tubers than one would expect to buy in a headpan measure (90-100 kilograms).[1] However, given the comparatively small amount purchased per trip (one or two headpans), it is doubtful that this price advantage offsets the loss in potential earnings which would result if regular supply permitted daily production. For example, the sustained high production recorded on 4-11 October and again on 8-19 November, Figure 5.1 C, may be attributed to the delivery of seats (approximately 650 - 1,000 kilograms per seat) of cassava directly to her site.

Gari Marketing: Retail at Site. Figure 5.1 shows that Akua (C) processed 38 kilograms of gari between 4-10 August 1985. During the same week, Akua made of profit of 210 cedis on sales of 960 cedis, for a margin of 22 percent. Her marketing strategy differs markedly from that of either Yaa or Grace. Whereas they transport their gari to market, Akua has the customer come to her. This arrangement is in part facilitated by her location, which lies along a busy access path running through Ayigya. Another selling point for her rather passive marketing strategy is that demand for gari remains relatively strong among Kumasi's poor, despite the general seasonal fluctuation in demand resulting from the arrival to market of plantain and maize. By selling retail quantities (margarine tin) at her processing site, Akua receives a higher price per kilogram than the high-volume processors who market their gari in wholesale quantities. However, on occasion she sells larger quantities (15-kilogram kerosine tin, or 30-kilogram headpans) directly to market women, who, in turn, retail the gari at Ayigya Market or Kumasi Central Market. During the research period, Akua wholesaled approximately 124 kilograms, an amount representing 11 percent of her total production for the period. Marketing, she maintains, is not a constraint, even in the period of slack demand, because of her location and the quality of her gari.

Although the screw press is relatively inexpensive and readily available at nearby blacksmith shops, it is not a part of Akua's processing system. Perhaps this is because Akua has not yet succeeded in organizing a dependable supply of cassava delivered to her site. Her gari operation ceases when she goes to the farm to purchase cassava.

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[1]An example of the "Bush Weight" method of produce volume determination. This is contrasted with the "Accra Weight" which gives less. Although of unequal volumes, the two measures attract the same price. The "Bush Weight" typically gives more of a commodity, whether cassava or gari, than the "Accra Weight," which is based on a weighed volume.

Because the advantage of the screw press lies in its greatly shortened pressing time, it would appeal to high-volume processors who have a regular (perhaps daily) supply of cassava. Otherwise, the screw press would be largely underutilized. Apparently, Akua is not producing at a level sufficient to justify investment in a screw press.

Comparison of Traditional vs. Improved Technology

Anloga - A Borough of Processors and Carpenters.

Anloga-Kumasi is a burrough of Kumasi predominately populated by ethnic Ewe. Map 3.3 shows Anloga's position within the Kumasi urban area. Anloga, or Oforikrom as it is more properly termed, has grown from little more than a single farming cottage in 1950 to a bustling community of about 3,600 people in 1985. The area is commonly referred to as Anloga, because most of the inhabitants emigrated from the Anlo area of the Volta Region. Thus, for the purposes of this study, it is called Anloga-Kumasi (5, p. 13). The primary economic activities of Anloga-Kumasi include carpentry and furniture making among men, and gari processing among women. Mention either carpentry or gari in Kumasi, and Anloga comes to mind.

The women of Anloga-Kumasi have specialized in gari production. Their production is not based on home-consumption; rather, theirs is a high-volume, commercial operation, employing an improved level of technology and organized along group lines. This study is, in part, an analysis of how the Anloga-Kumasi gari processors have overcome production bottlenecks to supply the urban market with increased availabilities of gari.

Figure 4.1 shows the steps of the improved technology as practiced by Anloga-Kumasi processors. The steps are similar to those followed by traditional processors of Chapter IV with the following exceptions: cassava is machine grated; time required for fermentation and pressing is greatly reduced because of the screw press; and both agbeliku and gariku are saved and reprocessed into gari.

The Power Grater and Screw Press

The key difference between the two methods is the savings in time resulting from adoption of the power grater and manual screw press. Among the processors of Anloga-Kumasi, the reduction of processing time translates into a significant increase in volume of gari produced. Figure 5.1, A, B and D, provides daily production data for three Anloga-Kumasi processors. From Figure 5.1 it is clear that all of the three produced substantially more gari than C (Akua), the transitional technology processor. For example, it indicates that during the week of 4-10 August 1985, case study A processed 390 kilograms--an almost ten-fold increase over Akua's production for the same period. This increase in production may be attributed to the adoption of the screw

press and, perhaps more importantly, to differences in the organizational structure of the enterprise.

Access to Improved Technology

Adoption of improvements in processing technology requires capital, usually more capital than the individual low-volume processor can acquire. Capital accumulation in Ghana is not restricted to one sex; throughout West Africa, Ghanaian women are noted for their business acumen and entrepreneurial abilities. Consequently, one would expect female ownership of the cassava graters, which requires an expenditure of 35-70,000 cedis. However, only three of the more than sixty cassava mills visited during the research period are owned by women. Mechanization usually implies the entry of men into a business otherwise dominated by women. This dichotomy stems from the traditional role of men as mechanics, and because few women are trained to operate or maintain mechanized equipment (47, pp. 43-48). The screw press, however, is owned individually, and virtually every processor in Anloga-Kumasi owns her screw press.

The Impact on Employment

Thus far improvements in gari technology have not displaced labor. If anything, the screw press and mechanical grater have encouraged entry into the gari processing business in Kumasi. Continued interest in mechanizing each step of the process may eventually lead to improvements which put women (and men) out of work. Clearly, this should not be the objective of research and development in an underdeveloped country (27, pp. 234-240). Completely mechanized processing units are now available in Ghana. It remains to be seen whether or not mechanized units or modifications of them will gain widespread acceptance. High-cost (750,000 cedis per unit in 1985 prices) and dependable cassava supply are but two problems facing the adoption of completely mechanized units. At least in the foreseeable future, improved technology will imply that level of technology currently employed by the high-volume processors of Anloga-Kumasi.

Organizational Unit in Anloga-Kumasi: The Processing Center

The bulk of gari available in Kumasi markets is processed within the urban area. In Anloga-Kumasi alone an estimated 230-260 women process gari. Although gari processing is the domain of women, male relatives, including sons, grandsons, and even husbands may assist. The level of processing technology is uniform throughout Anloga-Kumasi: mechanical cassava graters and manual screw presses. Can technology alone account for the tremendous increase in amount processed per unit time? Apparently not. Entrepreneurship in the gari industry takes more than access to improved technology: it requires organizational ability.

Within Anloga, the range in the organizational structure of gari processing is wide, from one-woman contractors to formal groups of 15-25 women gathered around a mill house. The more productive of these large units are extremely well organized. These groups are headed by an appointed representative, the Secretary, who in turn is approved by the mill owner.

The Processing Center: Mill House and Yard

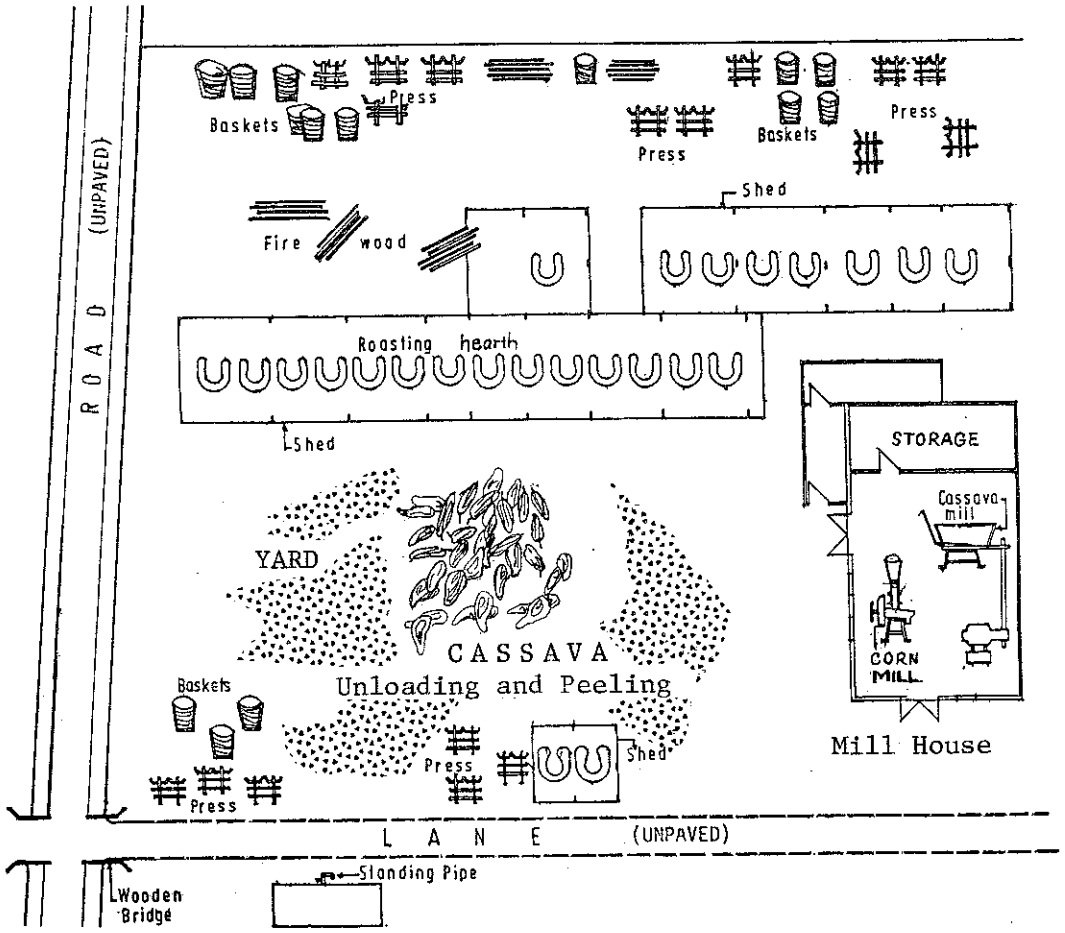
Figure 5.2 shows the spatial arrangement of a typical processing center. Nine such centers were in operation during the research period. Processing centers may vary in size, but each is comprised of a mill house situated on a piece of open land. Constructed of wood on a concrete slab, the mill is a secure shed in which are located the cassava grater and corn mill. Adjacent to the mill, and in some arrangements connected to it, are simple roasting shelters erected by individual processors. The position of the mill and roasting sheds usually describes an open area, or yard, where contractors deliver loads of fresh cassava, and where peeling takes place. It is an unusual circumstance to find these areas free of activity. A convenient location along a street such as that diagrammed in Figure 5.2, induces more contractors to make deliveries of cassava, thereby increasing the volume of activity. Behind the roasting sheds and around the center's perimeter, each processor sets up her screw press (Plate 6). The piercing aroma of an active processing center is unmistakable; and as one walks from site to site, the overriding impression is one of fermenting cassava. For the processors of Anloga-Kumasi it is the sweet smell of business.

Position of the Secretary

The person charged with overall responsibility for the smooth flow of operations at the center is the Secretary. Every center has its secretary. These women tend to be literate, and are respected members of the community. The secretary is the person representing the vested interests of the entire group. She deals directly with the miller, and, through him, with the mill owner, in settling accounts and arbitrating disputes.

The secretary must fulfill many duties. Aside from maintaining good relations, the secretary keeps careful account on a daily basis of the volume of cassava received and grated at the center. She is responsible for collecting milling fees from each processor and paying the miller for services rendered. One of her more important duties involves negotiating price with cassava contractors. She represents the entire group in negotiations for the delivery and payment of cassava. This is a time when group solidarity is extremely important.

FIGURE 5.2. SPATIAL ARRANGEMENT OF CASE STUDY PROCESSING UNIT, ANLOGA-KUMASI



NOTE: Figure is for processing center under direction of Secretary Okomfo Ofori. Drawing not to scale.

To do otherwise would give the contractor an upper hand in negotiations. The effectiveness of the secretary is also reflected in her ability to secure credit from the cassava contractor. Perhaps her most tedious duty is allocating the entire truckload of cassava among group members. This entails physically separating the cassava tubers into equal shares, a lengthy, back-breaking process requiring several hours.

Aside from these weighty responsibilities, the position has several benefits. All sales of gari should be cleared through the secretary. In practice, this rule pertains only to periods of low demand and ensures equitable distribution of sales among processors. However, the secretary usually has first option on gari sales. Similarly, in periods of low supply she has the right of first refusal on cassava arriving at the center. According to the three secretaries interviewed, the benefits of the job are commensurate with its responsibilities.

Benefits of Group Organization

Not all of Anloga-Kumasi's processors belong to groups working at processing centers. A walk down any of Anloga's thoroughfares is a walk past processors who, for one reason or another, eschew group work. Nevertheless, the benefits of group organization are apparent. For example, a large number of processors can command a large and regular supply of cassava. When the group has demonstrated that it can process a high volume of cassava, contractor(s) will respond by bearing the risk and supplying the amount needed. This assurance is fundamental to the maintenance of a sound gari business.

Another incentive for working at a processing center is that many services are provided in one convenient location: efficient grating of cassava, grinding facilities for agbeliku and gariku, storage for gari and processing equipment, easy marketing of gari, and a place for meetings.[2] Processors belonging to these groups are able to carry out all the steps of gari production at the center without ever leaving the premises. This separates work from home life, and thus keeps the compound free from the mess associated with cassava processing. At day's end the processor secures her gari and equipment (e.g., roasting pan, sieves, containers) inside the mill before going home. Gari sales at the center are facilitated by the large number of processors and the relative accessibility of the site to both wholesalers and retailers who come by vehicle. Large quantities (e.g., up to 10 cocoa sacks) of gari can be assembled within minutes; contracts for institutional quantities are negotiated with the knowledge that the center's processors will be able to fulfill their obligation without difficulty. Thus,

[2]During the research period, meetings of Kumasi-wide gari secretaries were held at case study A's center to discuss the proposed flat tax.

the center offers each processor the benefits accruing to an economic unit based upon the strengths of group organization.

Cassava to Gari: Characteristics of a High-Volume System

By 6:30 a.m. each day the operations of a high-volume processing center are in full swing. On any given day it is probable that a processor will be involved in the complete range of activities: receiving a shipment of cassava, peeling and milling cassava, fermenting and pressing, and roasting and marketing gari. This implies a huge investment of time, and requires that each processor balance these activities on a daily basis to maximize the flow of gari. Closing times of 10:30-11:00 p.m. were not uncommon among the case study processing centers. It is an unusual sight indeed to find a center free of activity, for these women maintain at least some gari-in-process, even though they may temporarily suspend work to attend church or other social functions such as funerals.

Arrival of Cassava: Negotiations

The gari cycle begins with the arrival, usually from Brong-Ahafo, of the cassava truck. Cassava contractors plan for early morning arrivals, to take advantage of the comparatively cool hours of the day to transport the perishable tubers. Negotiation of cassava price begins as soon as the truck arrives at the center. The contractor and secretary are the two principals involved in negotiations. Plate 3 shows secretary Gertrude Kwamo and contractor Kwabena Twi engaged in a discussion of the relative merits of his cassava. Price is based on the "seat," a standard measure describing the distance between any two adjacent uprights, wooden staves which hold the boards of the truck bed in place (see Plate 3). Thus, the seat is a volume of cassava. After negotiations on the number of and price per seat have been completed--and this process may take from 15 minutes to all morning depending on the market--the contractor instructs his assistants to unload the truck. The pile of cassava unloaded from a fully packed, eight-ton (10-seat) truck is enormous, at times exceeding five meters in diameter with a height of nearly two meters. Should the secretary note any damaged or rotten tubers, she will be reimbursed by the contractor for an amount representing the cost of the unacceptable tubers. Contractors differ in their methods of reimbursement, but a standard one is to reduce the quantity (i.e., seats) of cassava for which payment is due. This guarantee of quality is, of course, offered in the spirit of fostering good business relations.

Dividing the Cassava

The secretary then divides the load into equal piles, commonly two times the number of seats purchased. For example, a 9-seat delivery becomes 18 shares. Care is taken to distribute an equal number of

large, medium and small tubers to each pile. For a large truckload this tedious procedure may take three hours. When the task is completed, another processor selects the share going to the secretary, after which the secretary allocates the remaining piles to each shareholder. From that point on, each processor is an independent gari producer.

Frequently, the number of possible shares exceeds the number demanded by group members. Surplus cassava, however, is never a problem to dispose of, because independent processors are permitted to buy the excess provided they mill their cassava at the center.

Peeling Cassava

Losses occur at several steps in the transformation of cassava into gari. Certainly this is understandable given the highly perishable nature of cassava. As Table 5.1 indicates, the most significant loss on a percentage of edible fresh weight basis occurs during the peeling step. This high proportion of loss may be directly attributed to a peeling technique which differs markedly from that practiced by either transitional or traditional processors.

Haste Makes Waste. High-volume processing does not encourage careful peeling. Speed of performance is the important consideration. Whereas lower volume, traditional processors usually separate the peel from the tuber, the high-volume processor slices the peel from the tuber. Thus, the edible portion of the peel would represent a loss to the processor. However, among Anloga-Kumasi processors the amount of loss ascribed to peels is inconsequential; in their view, at least with peeling, haste does not make waste. Yet, an analysis of loss associated with the conversion process, presented in Table 5.1, clearly shows that among the seven samples losses were considerable, representing 12-18 percent of edible tuber by fresh weight. If these processors permit loss in peeling, they are scrupulous in preventing loss of gariku and agbeliku.

Peeling is a communal effort. At times, entire families assist the processor in preparing the tubers for milling. Plate 5 offers a typical scene from the yard of a processing center (note the number of small children). Some loss may be attributed to age or inexperience of the younger helpers, but this would be difficult to quantify. A group of four can peel a half-seat measure (350-500 kilograms) within 4.5 to 6 hours. As peeling proceeds, the tubers are heaped onto a pile. After all tubers have been peeled they are arranged in baskets or headpans and taken to the mill to be grated. Processors prefer milling cassava as soon after peeling as possible to prevent the unavoidable discoloration of the tuber's vascular tissue, which tends to darken the final product. Consequently, if a truck were to arrive, say, by 10:00 a.m., the processors might not quit work for the day until 10:00 p.m., or after all the cassava has been milled.

TABLE 5.1. ANALYSIS BY WEIGHT OF CONVERSION PROCESS FROM ONE-HALF SEAT* OF CASSAVA TO GARI IN SEVEN SAMPLES†

(kilograms)

	Sample							
	1	2	3	4	5	6	7	AVERAGE
WEIGHT OF:								
Unpeeled Cassava	380	354	525	489	507	318	388	423
Peeled Cassava	280	259	340	339	379	231	284	307
Peels, Total	100	95	185	150	128	86	104	121
Peels, Inedible	60	57	111	90	77	52	62	73
Peels, Edible	40	38	74	60	51	34	42	48
(Loss as percent)	(12.5)	(12.7)	(17.9)	(15.0)	(11.8)	(12.8)	(12.8)	(13.6)
Grated Cassava Dough	277	257	327	332	372	225	279	296
Cassava Dough Lost	3	2	13	7	7	6	5	6
Pressed Cassava Dough	223	191	128	272	268	185	227	213
Fluid Expressed	54	66	109	60	104	40	52	69
Losses due to Sieving, Roasting and Spilling	8	7	5	11	8	4	7	7
Gariku Input	12	15	9	13	19	10	11	13
(As percent of total gari output)	(9.6)	(16.5)	(6.9)	(10.0)	(14.4)	(9.6)	(8.8)	(10.8)
Gariku Output	8	13	16	22	31	11	12	16
(As percent of total gari output)	(6.4)	(14.3)	(12.3)	(16.9)	(23.5)	(10.6)	(9.6)	(13.4)
FINAL WEIGHT OF GARI EXTRACTED	124	91	130	130	132	104	125	119

*A "seat" is the common measure of cassava purchased by gari processors. One seat is the distance between two truckbed uprights.

†Data collected 12-30 August 1985, Kumasi, Ghana. All weights measured by Salter 30- and 45-kilogram spring scales. Estimates for edible portion of peel (40 percent) determined by separating and weighing edible portions from three samples not included in the analysis.

Cassava peels can have economic value, especially as a feed component for swine (23, pp. 242-245). This fact is not lost on the astute pig farmers who collect, free of charge, Anloga-Kumasi's never-ending supply of cassava peels. Interviews with six area farmers reveal that perhaps 20-30 percent of feed costs are defrayed by utilizing this free source of carbohydrates. They indicated a willingness, if asked, to at least pay something for the feed source, although not very much. Two farmers claim to have sited their piggeries close to Anloga-Kumasi because of the abundance of cassava peels. They collect peels two to three times a week. In Medie, a cassava processing village near Accra, a cocoa sack of peels commands 80 cedis, and there are approximately two sacks of peels per half-seat of cassava. When asked why peels are not sold, the secretaries explained that by offering peels free of charge they are assured a tidy worksite. Thus, for the processor, the potential economic value of peels does not exceed the value of ensuring a clean work site free from decomposing peels. If the Accra example is an indication, perhaps in the future they will have both.

Mechanical Grating

Milling cassava reduces the drudgery of gari processing. The cassava grater depicted in Plate 5 has a throughput of a half-seat of peeled cassava (approximately 300 kilograms) every 30 minutes. This represents a tremendous savings of time and labor compared with the manual method, which requires 14.5 hours for a similar volume of cassava. The processor assists the miller by filling the hopper with peeled cassava, and then placing the container under the grater. As the miller carefully forces the cassava against the rasping surface, the processor collects the dough falling through the outlet into the receptacle. Technique is important here; the miller strives to achieve a smooth, even-grained dough, which yields as little agbeliku or gariku as possible.

Loss attributed to milling is minimal (Table 5.1), slightly more than one percent of grated weight. Milling losses are to a large extent dependent upon the design of the collection area. The grater used in this study was not designed to permit easy collection of dough. As a result, the dough dropped directly onto the cement floor, from which it was scraped up and placed in the container. However, the majority of processing centers in Anloga-Kumasi utilize graters featuring outlets designed to facilitate collection of cassava dough.

The Manual Screw Press

With the introduction of the screw press, the time involved in fermenting and pressing dough has decreased dramatically. Up to seven days may be required when stones are used to express the starchy fluid. In Anloga, fermentation typically is allowed to continue only overnight, after which the dough is transferred from the basket to a cotton

sack and placed under the screw press. Thus placed, the dough is satisfactorily pressed in 1.5-2.0 hours, although processors may leave sacks under the press until they are ready to roast. It is this great savings of time, both in pressing and in grating, that enables Anloga-Kumasi's processors to produce a high volume of gari for the urban market.

Fermentation of Dough

The method of packing the fermentation basket with dough remains unchanged from traditional technology. Similar equipment and procedure are employed. Care is taken to eliminate all airspaces, so that the anaerobic fermentation will proceed evenly. Airspaces result in discoloration of dough in localized areas, and the dough must be discarded. Although high-volume processors prefer to ferment overnight, they sometimes allow dough to continue fermenting for an entire day or more. This occurs particularly in busy periods, when the amount of pressed dough ready for roasting backs up. Thus, fermentation serves as a relief valve during high pressure times.

Less Today Than Before. If the screw press has revolutionized gari processing in Anloga-Kumasi, it has also changed the product. According to processors, their gari has a different, less fermented taste. This was corroborated by nearly everyone in Anloga-Kumasi who cared to comment on the topic. Processors attribute the difference to reduced fermentation and the quick removal of starch from the pulp. In traditionally prepared gari the characteristic flavor is a result of the lengthy fermentation step.

Approximately 25 percent, by weight, of the grated dough is extruded as fluid. In many areas this fluid is easily processed into starch, and represents an economic by-product. For example, according to informants, the fluid expressed from a half-seat of cassava yields over one kilogram of processed starch, an amount worth 100 cedis in 1985. However, very few high-volume gari processors regularly conserve the fluid. At most, these processors may prepare enough to meet household needs for laundry or cooking. The case study processors forego the opportunity to prepare starch in order to devote their full energies to gari production.

Despite their apparent lack of concern for loss resulting from peeling technique, or revenue foregone from either peels or starch, the Anloga-Kumasi processors are conscientious about limiting waste. It is perhaps their attention to reducing loss at the sieving and roasting steps that distinguishes them from traditional processors of Bonwire or Techiman District. Their attitude toward conservation and access to a corn mill are the important factors, for otherwise both groups use similar equipment.

Roasting: Hot and Smoky

Sieving and roasting occur simultaneously at the processing centers. The procedure is similar to that followed by Akua, the Ayigya-Kumasi processor, yet the pace is generally much faster. Young children may assist their mothers by sieving the pressed cake while their mothers stir the gari. Plate 6 gives a view of roasting pans in full production in case study B's processing center. As Plate 6 clearly indicates, gari roasting for many processors is a technique which is honed from early childhood.

Gariku: Waste Not, Want Not. To facilitate screening the pressed cake, the processor adds a handful or two of milled gariku to the damp cake. The gariku acts as a drying agent, and, according to processors, serves a two-fold purpose of reducing roasting time and lowering the output of agbeliku and gariku. Table 5.1 lists the weight of gariku input, added during the sieving step, in seven half-seat samples processed in Anloga-Kumasi. It is apparent gariku input represents a significant proportion of final extraction weight, ranging from 6.9 to 16.5 percent of gari produced. In each sample the amount of gariku added exceeds the amount of gari lost to sieving, roasting and spilling. Although this loss is considerable, it should not be construed as loss through total carelessness. The incidence of loss from sieving and roasting was observed to increase as the day continued, indicating a positive correlation between loss of gari and fatigue of the processor (resulting from exposure to heat and smoke). Loss associated with spilled gari is to an extent unavoidable given the number of helpers and manual transfers, and the informal arrangement of the roasting area. In any case, this form of loss represents a small but significant amount of total gari extracted (Table 5.1). However, this loss is not considered important by the processors. Perhaps only changing the roasting technology--the equipment--would reduce this hearth loss.

Each roasting cycle yields at least some gariku. Table 5.1 shows that the yield of gariku is highly variable. Among the seven samples, the amount of gariku, expressed as a percentage of total extracted gari, varied from a low 6.4 percent (8 kilograms) to a high 23.5 percent (31 kilograms). Of course, the entire amount of gariku will be milled and incorporated into the next or future batches of gari. It should be recalled that among the recent (1983 to date) entrants in Bonwire and in Techiman area, no attempt is made to conserve gariku, and thus its production represents an economic loss. Granted, some gariku could be diverted to livestock feed, but the bulk would be lost. Assuming a gariku yield of 10 percent of extracted weight, the high-volume processors of Anloga-Kumasi would realize an increase in their overall marketable output by a similar amount.

Production of Anloga-Kumasi Gari

Throughout the gari producing zone of central and southern Ghana the volume of production follows a seasonal pattern. This cycle is marked by increases in production during the "lean" period immediately preceding the maize harvest of the major cropping season, in July. As maize and other, more preferred commodities reach market, the demand for and therefore production of gari tapers off. Demand for gari improves toward the end of the minor cropping season and declines after harvest, provided it has been good. However, rainfall in Ghana's forest belt during the decade 1973-83 was generally disappointing, and consequently harvests of maize, plantain, and yam declined throughout the period. Thus, the seasonal fluctuation in demand tended to moderate as gari was called on to fill the growing calorie deficit--especially among the urban poor. This trend culminated in 1983 in widespread drought and bushfires, which destroyed food crops and ruined the vital cocoa crop, Ghana's primary source of foreign exchange. The demand for gari was never higher than during the 1983 "Hunger"; at that time there was little else to eat. Fortunately, three years of plentiful rain have filled the markets with maize and plantain; food is plentiful and the government has taken steps to increase incentives for producers. In many areas, gari, the dependable famine food, has resumed its former position of less preferred commodity.

The Anloga-Kumasi Gari Processors: High Volume

Production data for this survey were collected on a daily basis from 11 July through 30 November 1985, and are presented in Figure 5.1. Case studies A and B are secretaries of large, Anloga-Kumasi processing centers; case study C is the transitional gari processor based in Ayigya-Kumasi; and, case study D is an independent who frequently purchases and mills cassava at secretary A's center. These informants provided valuable insights into the remarkably efficient, high-volume gari industry of Anloga-Kumasi.

Production Outstrips Others. Figure 5.1 clearly sets forth the dominant position of Anloga-Kumasi's gari processors. For any given month, the lowest volume produced by A, B or D exceeded that processed by C; the closest was in August, when D's volume exceeded C's by 480 kilograms, or 2.6 times C's production. The widest margin was in November, when B produced almost 10 times the amount of gari that C processed. This superior performance can only be attributed to the adoption of improved processing technology and efficient business organization. Although case study C now uses the mechanical grater, she has not yet succeeded in arranging the delivery of a regular supply of cassava to her site; and, without an assured supply of cassava, her production will always be significantly less than that of the Anloga-Kumasi processor.

Seasonal Demand. Because daily production totals were recorded for only five months, the data presented in Figure 5.1 do not

adequately reflect the seasonal demand typical of gari markets. Production data for a complete 12-month cycle would indicate whether Anloga-Kumasi processors do, in fact, respond to seasonal fluctuations in demand. Nevertheless, the drop in case study A's production, from 1879 kilograms in August to 1320 kilograms in September, suggests the decline which would be expected during the period immediately following the maize harvest. This represents a 30-percent fall in production. Similarly, case study D registered an almost 10-percent decline in gari processed from August to September. That processors B and C actually increased production over the period may at first seem contradictory; however, a more likely interpretation is that demand for gari in Kumasi remains relatively strong throughout the year. Case study C, for example, markets gari in small, household quantities (0.5-kilogram and 2.3-kilogram containers) to customers in her vicinity, whereas gari processed in the production-line units of Anloga-Kumasi is primarily marketed in wholesale quantities. It should be noted that although processor B increased production by almost a quarter, she also carried an unusually high inventory (360-420 kilograms) from 15 August to 15 September. In general, the processors prefer to maintain rather limited inventories, as is reflected in the volume of stocks (180 - 210 kilograms) kept by the other case study processors during the months of August and September.

Factors Affecting Production. Several factors affect the volume of gari produced by the centers. In analyzing their own cyclical pattern of production, the secretaries indicated that there were two seasons of peak activity: May through July, and December through March. That the processing centers are busy May-July is understandable given that this season corresponds with the period preceding the maize harvest. During that period stocks of staples are low and prices high. However, the processors offered a slightly different explanation. In their view, the Brong-Ahafo farmers prefer marketing the bulk of the cassava during the May-July rainy season. This is so because uprooting tubers on a wide scale is facilitated by the loose, rain-soaked soil. Also, and perhaps more importantly, it is the season farmers plant most of their cassava for the following year. The second period, December-March, is described by the processors as the "season of high profits." By December, the drying winds from the Sahara (the Harmattan) have begun to desiccate the countryside in Brong-Ahafo. As the soil dries, the cassava becomes progressively more difficult to uproot. Marketing costs and, consequently, cassava prices go up, but apparently by less than the increase in the price of gari to consumers. All Anloga-Kumasi processors interviewed stated that the profit margin was greatest and general working conditions the best during the dry season. That is, with less rain at the processing center there are fewer interruptions. Other periods of activity include October and April, months when Kumasi area secondary schools are scheduled to reopen. These boarding schools rely heavily on comparatively low-cost gari to feed students.[3] Thus, at

[3]Gari's importance to the diet of students is indicated by its names: "College Savior," "Foundation," and "Concrete."

least for the Anloga-Kumasi processors, the calendar year is marked by consistently high activity.

The cassava contractors corroborated what the processors had outlined regarding periods of activity. They, too, prefer the dry season, primarily because feeder roads, and even the more remote farm trails, have become passable by the heavy cassava trucks. Until the rains cease and the roads dry out, the business of cassava contracting can be quite problematic. It is not uncommon for the heavily laden trucks to become mired en route from farmsite to feeder road. Delays of this sort could be disastrous to a contractor transporting a highly perishable crop such as cassava. To reduce the probability of having their trucks mired up to the axle, contractors may hire a tractor to haul the cassava to an accessible assembly point. This represents a rather significant marketing cost, which usually cannot be passed on to gari processors. Therefore, tractor haulage may be seen as a measure of last resort, and is done only infrequently.

Passable roads in Brong-Ahafo ensure a steady supply of cassava to Anloga-Kumasi. Contractors stated that their volume of business increases during the dry season because they are able to make more trips per unit time. The processors added that not only were deliveries more frequent, but also they were more reliable; with transport difficulties reduced, contractors were able to return on the appointed day. Profits per trip apparently do not increase in the dry season. Although the price of a "seat" of cassava goes up in Anloga, so do the contractor's costs, e.g., the farm price of cassava and the cost of labor to uproot and load the cassava. However, because of increased incentives to farmers and laborers, the contractor is able to assemble marketable quantities of tubers in much less time than would prevail in the rainy season. The shortened turnaround time characteristic of the dry season enables the contractor to deliver a higher volume and therefore improve his overall income for the period.

The Flow of Gari at Anloga-Kumasi Case Study Sites

Case Study A: Gertrude Kwamo

Production data in Figure 5.1 indicate Gertrude's preeminence among the case study processors. Yet, by Anloga-Kumasi standards she began processing gari relatively recently, in 1983 during the food crisis. Until then, Gertrude had been a vegetable oil trader in Kumasi Central Market. Encouraged by the high price of gari (1983 average: 3,700 cedis per 90-kilogram bag) and the offer of a place of work, she began processing in Anloga-Kumasi. Within a few months she had been elected leader of the processing center, a position she continues to hold.

Gertrude stated that the manual screw press was the primary reason she entered into the gari business. The press allows her to increase production per unit time. She suggested the press had evolved from a

smaller one of a similar design used by yakayake sellers to extrude starch from grated gari. The concurrent problems of widespread drought and the repatriation of nearly 1.3 million Ghanaians (10 percent of the population) in early 1983 set the stage for increased demand of cassava products.[4] She further stated that the idea of a large screw press now in common usage throughout Anloga-Kumasi, may have come via Nigeria with the returnees in 1983. Whatever its origin, the screw press was rapidly copied by blacksmiths and metal workers in Kumasi and elsewhere in Ghana.

Case Study B: Okomfo Ofori

Okomfo represents the majority of Anloga-Kumasi processors: a life-long gari processor. She became secretary of her processing center in 1969, long before gari was big business. Of the three Anloga-Kumasi processors interviewed, Okomfo managed the busiest worksite. Her management techniques and level of technology were similar to case studies A and D. Like Gertrude, she stated that the manual screw press was the primary reason she remained in the "tedious business" of gari processing.

Case Study D: Comfort Attah

Comfort began processing gari in 1979. At that time, she was secretary for a processing center located on what is now an access road cutting across her front yard. Her participation in group processing ended when the road was constructed. Thus, Comfort is an example of a free-lance processor. She set up a roasting shed in her front yard, and depends upon center A for the bulk of her cassava and grating services.

Figure 5.1 shows that Comfort's production remained below that of Gertrude and Okomfo through September. However, during the months of October and November, her production outstripped Okomfo's, falling just short of Gertrude's for November. This suggests that although Comfort is an independent, her access to cassava and milling services is not restricted. The extent to which her free access is related to her status as a former secretary is difficult to assess. As is noted elsewhere, this flexibility ensures that a continuous supply of cassava can be demanded by the processors.

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[4]In February, 1983, Nigeria expelled an estimated 1.3 million Ghanaians, most of which were in turn sent to their regions by the Ghana government. It has been suggested that a significant proportion subsequently migrated to the regional capitals.

Quality Considerations of Anloga-Kumasi Gari

That gari is most closely associated with the Ewe ethnic group is not in dispute. However, as the data suggest, gari has spread beyond ethnic affiliation and is now consumed by households throughout Ghana, especially those in urban areas.[5] Nevertheless, when the rather subjective notion of quality is introduced, it is to the Ewe one must turn. Anloga-Kumasi processors are Ewe, yet they are outspoken in admitting that their gari does not meet with Ewe standards of excellence. Reasons for the inferior quality of the gari reflect a rational approach to marketing and production decisions.

Criteria of Quality Gari

Criteria on which to judge gari quality are based on color, taste, and size of grain. Properly roasted gari should be creamy in color, but not whitish or translucent, for that would indicate partial roasting. The taste of gari should be sharp, but not too sharp. For example, gari that tingles the palate along the hinges of the jaw is deemed too sharp. Among gari connoisseurs, the term "biscuit" describes the preferred taste: an almost sweet sharpness not unlike that of an English biscuit. In some markets a noticeable difference in taste translates into a price difference of as much as 30 percent by volume. The third quality characteristic is size of grain, nku in the Ewe language, meaning eyes. Thus, gari may be variously described as nkuga (big eyes) or nkuvi (small eyes). According to the processors, nkuga grains when reconstituted do not absorb water completely, and therefore yield a nonuniform gari. At the other extreme are the nkuvi grains which soak up water too fast. Consequently, the preferred grain size is somewhere midway between the two; garianyo describes the preferred medium sized grain. In general, the notion of quality gari is embodied in the expression: garianyakpo, or "the appearance of the gari is correct."

Why the Gari is Inferior

With this much attention to quality, one might reasonably question why Anloga-Kumasi gari is intentionally inferior. When asked, the processors flatly stated that most of their gari is consumed by non-Ewes, consumers who would tend not to be as discriminating as Ewes. They know the market, and in Kumasi it generally does not discern quality. They argue that because there is no price distinction based on quality, they are not compelled to produce quality gari. There is no reason to improve quality because that would imply changes which imply increased costs. Indeed, if there is a preference in Kumasi, it

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[5]A survey of markets in Northern Ghana (15 October - 15 November 1985) revealed that gari was available in each of the 19 markets surveyed.

is for reddish or yellowish gari, which to the discriminating eye indicates poor gari. The Anloga-Kumasi processors make a point of producing the darker gari. It is perhaps a result of the 1983 Hunger that the prevailing preference is for off-color gari. This may be explained by reviewing the situation of the day. During 1983, Anloga-Kumasi processors responded to tremendous increases in demand by supplying equally large quantities of gari, much of it to traditionally nongari consumers. Upon reflection, the processors stressed that their mission was to supply quantity, not quality; that at times a queue formed in front of the roasting pan and remained there through most of the day. Thus, a large proportion of Kumasi gari consumers was introduced to hastily prepared gari, and this exposure shaped their preference.

Poor Quality, Good Quantity

However, for processors and consumers alike, a preference for poor quality has not been bad. Market indifference to quality has contributed to the acceptance of a wider range of cassava for processing, and therefore to a reduction in postharvest loss. For example, cassava with markedly discolored tissue is no longer thrown away. This is important because contractors frequently present entire truckloads of tubers that have begun to rot. Rather than discard the affected portion, the processors now incorporate it in the gari--thus the reddish color. In this case a reduction in quality means an increase in marketed quantity available. Moreover, acceptance of lower quality gari to some extent reduces the marketing risk borne by cassava contractors.

Improved processing equipment has had an impact on the quality of gari. It should be remembered that Anloga-Kumasi processors prefer hand grated gari for home consumption because the nku are of uniform shape and size. Mechanized grating, while expedient, yields gari of uneven texture. Furthermore, there is a perceptible change in the taste of gari ascribed to the use of the screw press. The lengthy period of stone pressing promotes the characteristic gari flavor, which is altered by the comparatively short pressing period required in the improved process. Thus, while it may be argued that improvements in processing technology and organization have contributed to changes, if not lower standards of quality, this is more than offset by the tremendous increase in calories available to the urban diet.

Although Anloga-Kumasi gari is admittedly of inferior quality, this apparently has had little, if any, impact on the processors' ability to dispose of their product. Aside from the slight seasonal slack in demand in late August, the case study processors were able to sell their gari without resorting to lengthy periods of storage. By the end of September, stocks on hand represented approximately two days of production. For the processor, of course, the important aspect of gari production is profitability. The Anloga-Kumasi processors have advanced beyond the objective of food security. They have demonstrated

the Akan proverb: "there is both food and money in the ground; but you must work for it."

Profit Margin: Who Makes What

That gari is generally assumed to be a profit-making venture is not in dispute. This impression is largely based on 1983 consumer prices, when the olonka in Kumasi fetched 250-300 cedis; by 1985, the KCM price per olonka had fallen to 50-60 cedis, yet the sentiment held that gari processing was profitable. In fact, during the research period the Ghana government announced that each gari processor would have to pay a flat tax of 12,000 cedis per annum. Obviously, such a decision implies the perception of a profitable enterprise, yet lacking careful analysis it can hardly be more than arbitrary. Table 5.2 presents an analysis of operating costs and revenue, per seat of fresh cassava, that prevailed during the research period. The three values for revenue reflect changes in price per headpan of gari resulting from changes in demand. From a high of 700 cedis the price dropped to 650 cedis on 1 August, where it remained until 25 September, when it fell to 600 cedis; with the resumption of secondary schools, the price increased to 650 cedis on 10 October, and remained at that level through the end of November. It is rather surprising to note that variable costs, especially cassava, changed relatively little during the five-month observation period. Thus, the change in gari price was the more important value in determining operating ratio and profit margin. During the study period the three Anloga-Kumasi processors (A, B & D) posted margins of 27.4, 27.2, and 27.2 percent, respectively. These values reflect the weighted average over the entire period of observation. In a study of economic efficiency in gari processing of 35 respondents in Kumasi, 1984-1985, Agyako-Mensah calculated an average margin of 18 percent (3, pp. 29-35). If the six respondents who recorded net negative returns on sales are removed from the sample, this margin increased to 23 percent. Because of the tendency to overestimate costs and understate production, this value is probably on the low side. Thus, the Anloga-Kumasi margin estimates of 27 percent are consistent with the earlier study.

Low Margin, High Volume

By Kumasi trading standards, a profit margin of 27 percent is not attractive. Those engaged in the retail trade of canned goods and readymade clothing admit to margins of 70-100 percent. This form of economic venture requires considerable capitalization, and is precisely the business most Bonwire gari processors (Chapter IV) hope eventually to enter. Nevertheless, case study A, Gertrude, herself a former KCM market trader, quit retailing to become a gari producer, not because of the margin but on account of improved net income. In the gari business, income is intimately linked to volume of production, which in turn depends on a seemingly inexhaustible supply of cassava. Retail

TABLE 5.2. OPERATING COSTS AND REVENUE OF ANLOGA-KUMASI GARI PROCESSORS PER SEAT OF CASSAVA, JULY-NOVEMBER 1985

(cedis)

	Costs
Cassava	3000
Incentive to driver	40
Milling charges	160
Labor	120
Knife sharpening	30
Firewood	250
Depreciation, shelter	0
Depreciation, equipment	10
Gariku milling	40
KCC hawker's tax	20
KCC cassava tax	100
TOTAL	3770

Price Alternatives	600/headpan	650/headpan	700/headpan
Gross Revenues	4800	5200	5600
Net Revenues	1030	1430	1930
Margin	22%	27%	33%

NOTE: 53 cedis = U.S.$1.00 in 1985.

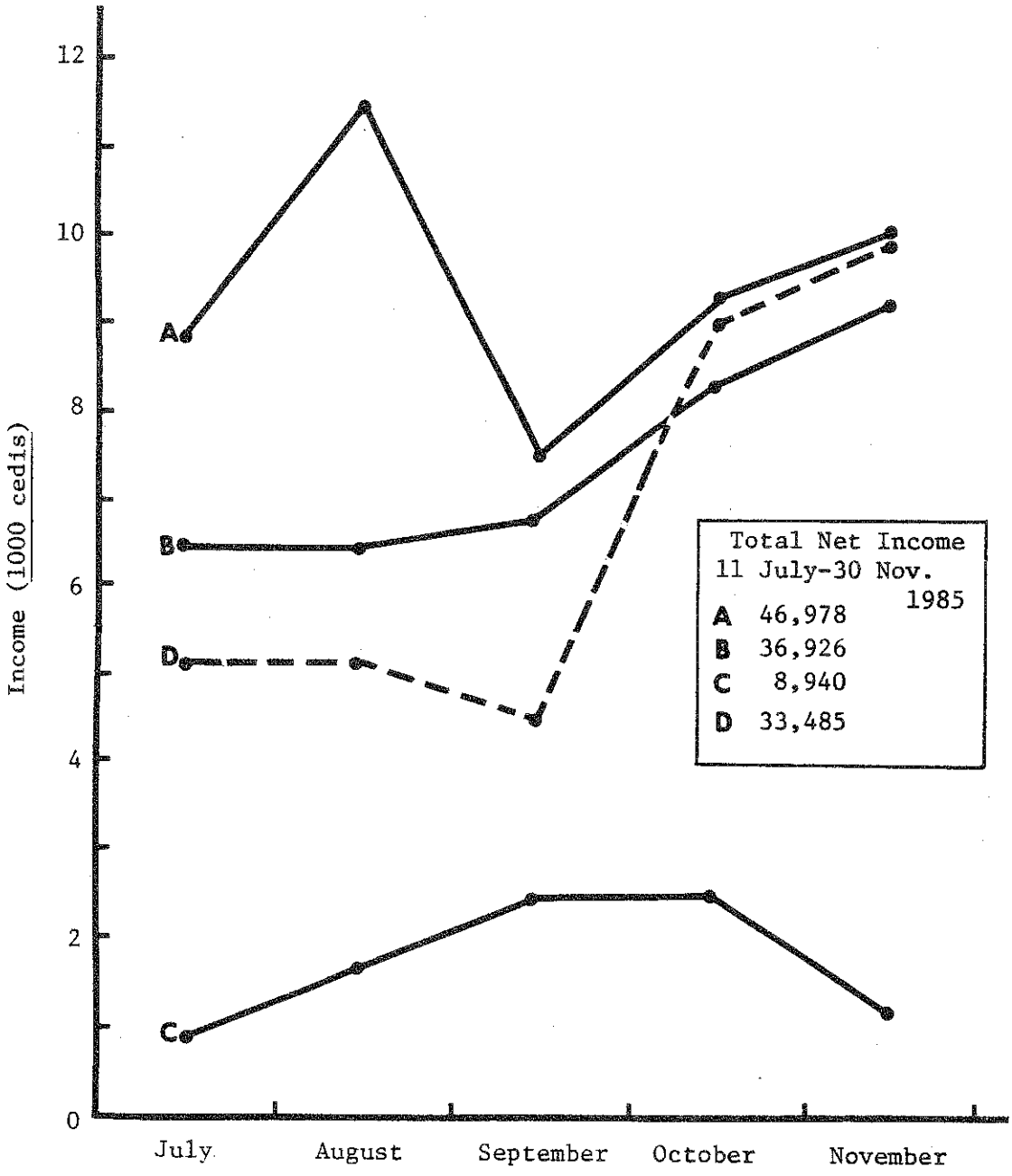
trading, however, is dependent upon manufactured goods, which, due to Ghana's economic position at the time, were in extremely short supply.

Estimated Income: Processors

Figure 5.3 shows estimated monthly net income for the four case study processors over the period 11 July--30 November 1985. It is apparent that case studies A, B, and D, had, by the end of November, generated income sufficient to cover a flat tax of 12,000 cedis. Although estimates for annual income would require observations throughout the year, it is not unreasonable to expect at least a doubling of the total recorded for the period. Thus, case study A would earn in excess of 94,000 cedis per annum, roughly twice the pay of a university professor. The same cannot be said of case study C--the transitional technology processor--and her situation illuminates the problem of supposing that all gari processors earn enough to bear a tax of 12,000 cedis. If the tax were imposed, she would be operating at a net profit of only 5,880 cedis. Any attempt to tax processors, therefore, should be based on an accurate assessment of net income.

Thus, technical improvements have brought about increased output of gari and greater worker productivity. Both employment opportunities and net income are enhanced through adoption of improved technology. The organizational unit of the processing center has contributed significantly to the development of the gari industry in Anloga-Kumasi. To understand how the transformation of the gari industry came about, Chapter VI will examine the impact of new technology on the marketing subsystem.

FIGURE 5.3. NET INCOME: CASE STUDY GARI PROCESSORS, 11 JULY-30 NOVEMBER 1985



CHAPTER VI
TRANSFORMATION OF THE GARI INDUSTRY: IMPACT OF NEW TECHNOLOGY ON THE MARKETING CHAIN

The theme of this chapter is the evolution of the marketing system made possible by technical innovation. To understand how this came about, this chapter examines in some detail both the origin of the Anloga processing center and the emerging gari industry in Techiman, Brong-Ahafo. Emphasis is on the principals whose entrepreneurial abilities have been brought to bear on the marketing and processing chain.

The highly integrated cassava marketing and processing chain characteristic of Anloga-Kumasi has evolved over the last 20 years. As late as 1950, the area which has become the densely populated precinct of Anloga, was forested farmland lying on the outskirts of Kumasi. Yet by 1983 it had developed into perhaps the single largest contributor of gari in the Kumasi metropolitan area.

The bulk of cassava supplied to Anloga-Kumasi processors comes from the Techiman area, 125 kilometers away. In addition, the Techiman market, employing the new technology, has come to supply gari to markets throughout Ghana.

Development of the Processing Center in Anloga-Kumasi

It is difficult to imagine an Anloga-Kumasi without processing centers. Certainly the notion of group work in gari processing is not original to Kumasi, although in Anloga it has arguably reached its full expression. However, when Togbui Kordah set up his first hand-built mechanical grater in 1966, gari processors were walking six kilometers round-trip to Amakom (Map 3.3) to have their cassava grated. Perhaps more importantly, gari was processed primarily for household consumption; it was an individual activity completed within the courtyard of the processor's compound. Although the grater (a joint effort by Togbui and an Asafo machinist-blacksmith, Chapter VII), dramatically reduced the time invested walking to and from Amakom, it had little impact on production in Anloga. According to Togbui, expansion of the gari business was both hampered and encouraged by landlords who objected to having gari processed on their rental property. Hampered, because relatively few processors owned housing at that time; encouraged, because it provided the impetus for Togbui to establish a center where processors could convene to produce gari. With the advent of the processing center in 1969, the course for expansion of the Anloga-Kumasi gari industry was set.[1]

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[1]Shortly after the center was on-line, the Ghana Government enacted the Aliens Compliance Order which effectively brought gari production to a standstill--but only temporarily. The industry

The Experience of Togbui Kordah, 1930 -

Togbui attributes the success of the processing center to the individual processors, especially their leader, the secretary. Based on his experience in the 1930s as a miller in the Volta Region, he was confident the concept was sound: that by providing milling services at a convenient location, employment opportunities would improve. However, Togbui was quick to point out that a good idea is only as good as the hard work behind it; and in the case of gari processing, volume of production and income are a function of hard work.

From 1969 to 1982 several mills (cassava grater and corn mill) were established in Anloga. By 1985 only six of these were continuously operational. According to Kordah, they failed because the mill owners either did not site the mills in a "strategic location," or neglected to provide enough space to attract a sufficient number of processors. Basic to any site's success, of course, is an honest, capable secretary, and, in Kordah's view, her importance cannot be overestimated.

The Experience of John Abolo, 1980 -

In 1982, the organizational aspects of Kordah's successful processing center were carefully analyzed by John Abolo, a sergeant in the Ghana Army interested in investing in a productive activity. His preparation for "life after the military" began in 1980, when he bought a corn mill and diesel engine from India. The next step was deciding where they should be located. Abolo listed two factors that guided his decision: the machines should be located where there is a consumer preference for maize, and where there is some evidence of maize and cassava processing. Not all areas of Kumasi fulfilled his first criterion. The principal maize consumers in Kumasi are the Ga, Fante and Ewe ethnic groups, along with the northern groups from Ghana and the Sahelian countries; alternatively, among the local Asante population the preferred staple is fufuo, prepared from a combination of plantain and cassava. Thus, he reasoned that the mill should be sited in a quarter predominately populated by maize consumers. To do otherwise would almost certainly mean reduced income, resulting from slack demand for milling services. Why Anloga-Kumasi was chosen as the location is immediately apparent: the inhabitants are high per capita consumers of maize, and it is a major center for maize and cassava processing. It was Abolo's ambition to take Kordah's idea and improve upon it. After a lengthy and involved process of acquiring suitable land and installing the mill, Abolo opened "Mawule Enterprises" (case study center A) in November 1982. Since then, processing center A has assumed a position of importance among Anloga-Kumasi centers. It is

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rebounded as more Ghanaian Ewes began roasting. Today, the composition of foreign (Togolese) gari processors is roughly 50 percent of the total number.

arguably as prominent as Kordah's original center (case study center B).

Criteria for Organizing a Center

Location. Aside from location, type of facilities provided was the other fundamental criterion cited by the mill owners as a basis for evaluating a processing center. Location is considered essential because cassava trucks must have easy access to site. The more conveniently located the site, the better supplied with cassava the center. Several contractors mentioned that they preferred dropping cassava at centers A and B, simply because the sites were easily approachable. Whether location within Anloga has any impact on the contractor's decision to deliver cassava would require further investigation. For example, during times of scarcity, would contractors supply cassava to remote sites? However, to the extent that contractors are reluctant to venture down rutted, narrow streets, they would also be inclined to sell at more convenient locations. Time series data (11 July - 30 November 1985) for one remote center indicate location apparently has no negative impact of the total volume delivered to site; both the remote and the most accessible (B) were supplied with roughly equal amounts of cassava. Similarly, location is an important consideration for gari sales. Sgt. Abolo maintained that his center is comparatively better situated for sales than the other sites because it is adjacent to the town market and near the lorry park. It was observed that convenience of location was particularly important for larger sales (20 cocoa sacks and above), although for smaller lots (one to three headpans) processors relied on regular customers who presumably are indifferent to location. It may be concluded that although an accessible location enhances a center's position, an inaccessible site does not necessarily hinder its functioning. As long as the mill is in operating order, the processors will produce gari.

Facilities. The basic facilities provided at the center include: milling services for cassava and gariku; storage for gari and individual processing equipment; pipe water for washing tubers and cleaning equipment; and space for roasting gari. In an effort to improve service and cut costs, Sgt. Abolo installed two engines, one electric, the other diesel. With the diesel engine he is able to mill even in the event of a power-outage. The advantage of electric power lies in the comparatively short time required to grate a volume of cassava. Although diesel power takes longer, it is cheaper to operate on a per-volume basis. Thus, in the event of a crisis, Abolo has the flexibility to switch methods. For example, on numerous occasions, when double loads of cassava were received, peeling was finished only after nightfall. Rather than delay grating until the following day, the miller simply opted for electric power and completed the task later that night. As both mill owners explained, success in gari business requires providing the best possible services in the best work environment.

Organization: The Secretary at the Helm. However altruistic they may seem, mill owners are engaged in gari processing for primarily one reason: profit. That profits are linked to production is no secret. The key to increased gari production is organization, and this rests in an alliance between secretary and mill owner. The more cassava milled, the greater the income for the mill owner. Obviously, mill owners would prefer to have motivated secretaries running their centers. For this reason the owner exercises the right of approval over the person appointed secretary by the group. Aside from output the owner places few expectations on the processors. To ensure against lost revenues, however, the mill owner stipulates that all cassava delivered to site be milled at the center. The secretary enforces this rule with the assistance of the miller, who in case studies A and B is related to the owners. Thus, the organizational hierarchy strengthens the position of the owner, while rewarding those processors associated with the center.

Ownership of the Processing Center

With few exceptions, ownership of the processing center is in the hands of men. In Anloga-Kumasi, the processing centers, such as case study centers A and B, are owned by men. A survey revealed female ownership of only one mill, operating out of a small store front but lacking an activity yard.[2] Although not all processing centers in the Kumasi metropolitan area were personally surveyed, the secretaries and processors of Anloga-Kumasi indicated that the pattern of male ownership is typical. Thus the question arises, is the processor-mill owner relationship an exploitative one? An analysis of the evidence suggests that the relationship is mutually beneficial, with both parties perceived as winners.

Specialization. Specialization is the hallmark of the processing center. Management of the center is clearly divided between the secretary and the miller; the owner stays in the background, visiting the center when problems arise. Personnel management and organization of cassava supply and gari sales--virtually everything but operating the mill--is the responsibility of the secretary. And this separation of power ensures smooth operation. In exchange for a set milling fee per volume of cassava, the mill owner bears all costs associated with operating and maintaining milling services. No other charges or fees are assessed. Throughout the research period, milling charges were 160 cedis per seat, or 5.0 percent of processors' total operating cost per seat volume. They were quick to add that increases are not arbitrary, but are collectively set by the millers' association in conjunction with representatives from processors' groups. Because entry into the milling business is limited only by equipment cost, it is unlikely that

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[2]The mill's owner, a contemporary of Togbui Kordah, at one time operated a center. However, the Kumasi City Council condemned the activity yard to make way for an access road. This points to the problem of land acquisition in an urban setting.

mill owners exert undue economic pressure on processors. This is certainly the case in Anloga-Kumasi, which has the highest concentration of mills per processor in the city. Moreover, processors own their cassava and gari; they have control over both cassava supply and gari marketing channels, independent of the mill owner. Thus, at least in the case study centers, specialization seems to have struck a balance beneficial to both processor and mill owner.

Impact on Employment. However, a problem could arise if more steps of the process were mechanized. The processors were unanimous in their praise for the mechanized roaster and cassava peeler. But if such improvements were made available, they would almost certainly be priced above the reach of the processor. Thus, such machines would doubtless become incorporated into the services provided by the mill. The danger, of course, is that processors would at some future time be reduced to wage earners. As long as processors retain the right of ownership of cassava--in short, maintain the system currently in effect--this is not likely to occur.

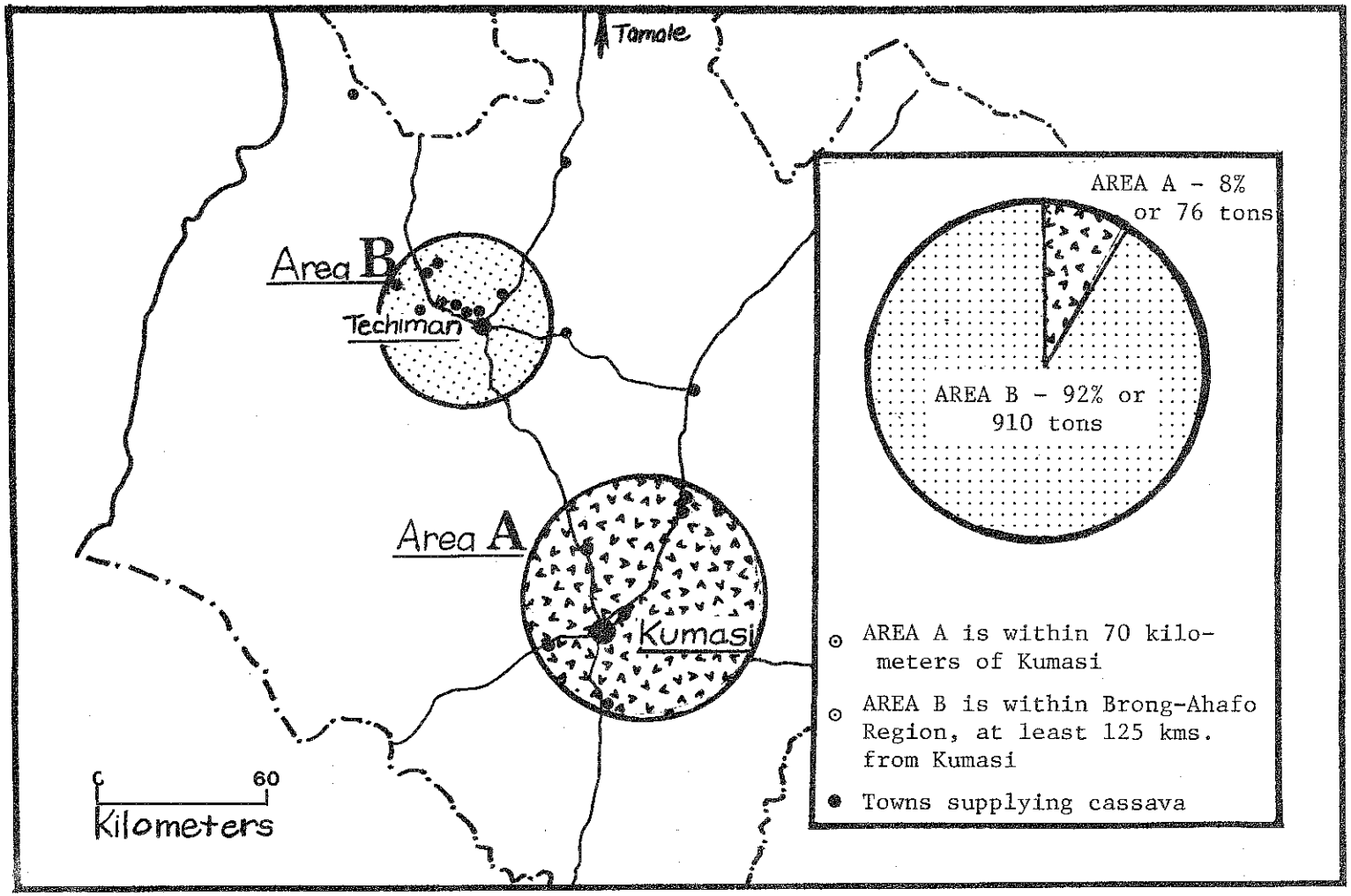
Supply of Cassava to Unit

A surprising feature of the Anloga-Kumasi marketing chain is that the bulk of cassava comes from beyond the Kumasi subregion. Map 6.1 shows that over 92 percent of the supply delivered to Anloga-Kumasi processors originated in Brong-Ahafo, a distance of at least 120 kilometers. No immediate explanation for this pattern presents itself, other than perhaps that contractors find it relatively difficult to assemble marketable quantities within the Kumasi subregion and the Techiman area has more transport available for hauling cassava than Kumasi. Perhaps it is related to the processor's expressed preference for large tubers which are common in the comparatively fertile soils of Brong-Ahafo.

History of the Supply Area

The current system of farm-to-center delivery has developed over the past several years. According to processors, the supply area was originally confined to farmland within close proximity to Anloga. At that time, processors accompanied farmers to uproot and carry the cassava back to their sites--a system not unlike that of Akua, the Ayigya processor. In their view this system was inefficient and time-consuming; they were not able to devote their full energies to processing. Anloga-Kumasi processors in large part became high-volume processors because the function of assembling and delivering cassava was assumed by another person: the cassava contractor.

MAP 6.1. SUPPLY AREA AND PERCENTAGE CONTRIBUTION OF CASSAVA DESTINED FOR SELECTED ANLOGA-KUMASI PROCESSORS, JULY-NOVEMBER 1985



The Cassava Contractor: Connecting Farmer with Processor

The key person in connecting farmer with processor is the cassava contractor. For the gari centers of Anloga-Kumasi, this position tends to be a full-time job. In the context of Anloga-Kumasi, contracting is a male-dominated profession, with only one woman among the group of 23 contractors. Entry into cassava contracting is unrestricted, although contractors suggested that operating capital of 10,000 to 15,000 cedis was essential during periods when credit is tight. For those with enough capital to speculate, cassava contracting can be lucrative. Nevertheless, it is a high-risk business which requires a good measure of both skill and luck.

The Delivery System: A Description

Data for the cassava marketing channel were collected (August-September 1985) on ten separate trips accompanying contractors to the supply area. Without exception, they were most forthcoming and helpful in sharing the details of their operations with the research team. Having participated in the cycle from start to finish, one is struck by the amount of time, effort, and coordination required for a successful trip.

Tasks to Perform. From the start of the cassava assembling process in Brong-Ahafo to delivery in Anloga-Kumasi, three to five days will have elapsed. During this period several tasks must be performed: the cassava farms must be identified; price negotiated with farmer; agreement struck with farmer and villagers on labor charges for uprooting and carrying cassava; the truck loaded at the farm gate; and movement from farm gate to feeder road to Kumasi. Of course, the speed with which these tasks are performed is a function of weather and condition of the truck. Because cassava is extremely perishable and a premium is placed upon freshness, the contractor works against the clock to ensure delivery of reasonably fresh cassava.

Source of Cassava. Identifying adequate sources of cassava is perhaps the first priority. Contractors stated emphatically that they do not want to negotiate for several small lots of cassava. The preferred arrangement yields a truckload of packed cassava at one stop. To do otherwise results in unnecessary delays, and, in the rainy season, may increase the chance of the truck becoming bogged down. This implies additional costs for labor and tractor fees, and more time for the tuber to deteriorate. During the research period at least ten trucks had to be unloaded, the cassava carried to a tractor, and the truck pushed free of the muck. In five journeys the contractors could not reach Anloga-Kumasi because of mechanical breakdowns, and had to have the cassava hastily prepared as konkonte. And, on one occasion mechanical failure resulted in complete loss of the cassava. Although these examples do not by any means represent the bulk of cassava moving to gari centers, they suggest the difficulty inherent in the trade.

In an effort to expedite assembly of tubers, many contractors maintain contacts, who live in the village(s) and monitor the size and availability of tubers and condition of roads leading to the village and farms. Their primary function is to liaise between contractors and farmers. These rural assemblers work as commission agents, and are a feature of the long-distance wholesale trade of farm commodities. Nyanteng and Van Apeldorn, in their study of foodstuff marketing in Mampong and Attebubu districts of Brong-Ahafo, suggest that these agents may use their experience to become independent wholesalers (37, p. 41). At least two of the informant contractors began in this manner; however, the more common route to contracting was through truck driving. Thus, maintenance of the improved marketing channel is a team effort, involving contractor, village agent, driver, and driver's assistants. Plates 1-3 illustrate the important features of the cassava delivery system.

Contribution of System. The contribution of the improved marketing system is significant. It is another example of specialization which has improved the overall productivity of gari processors in Anloga-Kumasi. By not concerning themselves with supplying their own cassava, the processors are freed to focus on gari production. That gari processors generally feel the arrangement is beneficial to their operations is revealed by the fact they do not perceive themselves as being exploited by the contractors. Although cassava costs are high, so are the costs of transportation and the attendant risks (36, pp. 3-4). For the gari processors the bottom line is a dependable and large supply of tubers; and this is precisely the contractor's business.

Risk: Borne By the Contractor

The risk of cassava spoilage, for whatever reason, is borne by the contractor. Should the truck break down en route to Anloga-Kumasi, the contractor shoulders the entire burden, and will not be reimbursed by the transport owner. As mentioned in Chapter V, the condition of cassava must meet with the approval of the gari center secretaries. This assurance of quality for a perishable crop places additional burden on the contractor. However, this portion of risk is spread back down the marketing chain to the farmer. Thus, the contractor demands that all cassava placed onto the truck meet with his approval. If, however, spoilage is a result of delays and not field-damaged tubers, the contractor must bear the loss.

Analysis of Marketing Costs

The wholesale price of cassava in Anloga-Kumasi is comprised of four major categories: transportation, producer's price, contractor's net margin, and farm labor:

Item	Percent Share, Anloga Wholesale Price
Transport	42
Farm Price Cassava	28
Farm Labor	12
Contractor's Net Margin	18
TOTAL	100

Transportation costs comprise the largest percentage share of the wholesale price. At 42 percent, transportation costs are more than twice the percentage contribution of the contractor's net margin, and over 50 percent greater than the producer's price for cassava.

Transportation. Of the factors influencing transportation cost, the more important are: weight of consignment, distance shipped, and condition of the roads. Despite legislated weight restrictions and the need for truck maintenance, the limiting factor in determining the size of load is volume, not weight. Thus, a seven ton truck has a capacity of 10 seats, which equates to more weight than prudence alone would indicate. Distance travelled varied with each shipment. In a typical trip the contractor made three visits from Techiman to the farm before loading cassava and continuing to Kumasi. The average round trip distance was 294 kilometers. However, arguably the most important factor is condition of roads. Some of the feeder roads plied by cassava trucks would scarcely be considered motorable. It is understandable, therefore, that vehicle owners charge high rates, in effect achieving a quicker depreciation rate for their vehicles to compensate for the risk of lost revenues through breakdowns. Lack of competitiveness may also contribute to unusually high transportation costs. Gore, in his study of an urban supply system in Southern Ghana, suggests that competition was least on the poorest roads within the supply area of Koforidua, Eastern Region (20, p. 313). Certainly the feeder roads of Brong-Ahafo are comparatively worse than those of the Eastern Region around Koforidua. Furthermore, the demands for alternative uses placed upon the available transportation would be particularly high in Techiman, because of its strategic marketing location. Thus, relative transportation costs are likely to remain high, and can be expected to fall only if feeder roads are improved and the numbers of long haulage trucks are increased. Also needed are improved availabilities of spare parts.

Producer's Price. The tabulation shows that 28 percent of wholesale price goes to the cassava farmer. This value is considerably lower than values recorded by Gore for cassava, 47-74 percent, and Nyanteng for yams, 50-60 percent (20, pp. 321-322; 36, pp. 3-4). However, the percentage share may be underestimated for Techiman area cassava farmers. For example, if the farm labor share, 12 percent, is added to producer's share, the total is 40 percent. The lumping together of the two is justified because producer's share represents the price paid for a load of cassava exclusive of harvesting costs. In this marketing system the contractor must then either pay to have the

cassava harvested and assembled, or provide his own labor. Only in three of the 35 sample trips did the contractor provide labor.[3] Thus, in 91 percent of the cases farm labor costs accrued to the farmer, increasing the producer's share to almost 40 percent of Anloga-Kumasi wholesale price.

Contractor's Net Margin. According to Jones (1972), the net margin of the trader represents returns to labor, management, entrepreneurship, capital, and unpaid family labor (30 pp. 117-118). In addition to these, Nyanteng (1978) lists unofficial road tolls and the opportunity cost of the contractor's time spent in locating supplies in the off-season (36, p. 5). Figure 6.1 shows that contractors received a mean net income of 2,916 cedis per trip--median net income was 2,900 cedis--for a net margin of 18.3 percent of Anloga-Kumasi wholesale price. Assuming six trips per month, the monthly net income for a contractor would average 17,496 cedis. Notice, too, that on four of 35 sample trips contractors lost money. If it were not for the practice of gari processors giving contractors an "incentive" of 1,000-1,400 cedis per trip, another ten would operate at or near a loss. Thus, cassava contracting is a risky business--at least from the evidence obtained during the rainy season. It is reasonable to expect a higher and more even distribution of net income during the comparatively dry months of December through May.

Transfer of Ownership: Contractor to Processor

A description of cassava price negotiation between contractor and secretary is contained in Chapter V. During the research period the price per "Techiman Seat" of cassava fluctuated between a high of 3,600 cedis and a low of 2,800 cedis.[4] The bargaining point is not so much price, which is set by the contractor, as volume, over which the contractor and secretary haggle to discover price per truckload. Plate 3 shows price negotiation in progress. Behind the well stacked, enormous tubers seen in the photograph is a truckload of variable, poorly stacked cassava. The secretary inspects the load and decides by how many seats she will reduce the total. One secretary confided that during periods of glut, she arbitrarily reduces the number of seats by one. If the contractor is a recent entrant, or the cassava isn't fresh (i.e., more than three days uprooted), the secretary is likely to ask for yet a further reduction. In the words of another secretary, "can he take it back to Brong-Ahafo?" On the other hand, during the dry season contractors command the number of seats and the price they demand. What keeps this method of price negotiation from becoming

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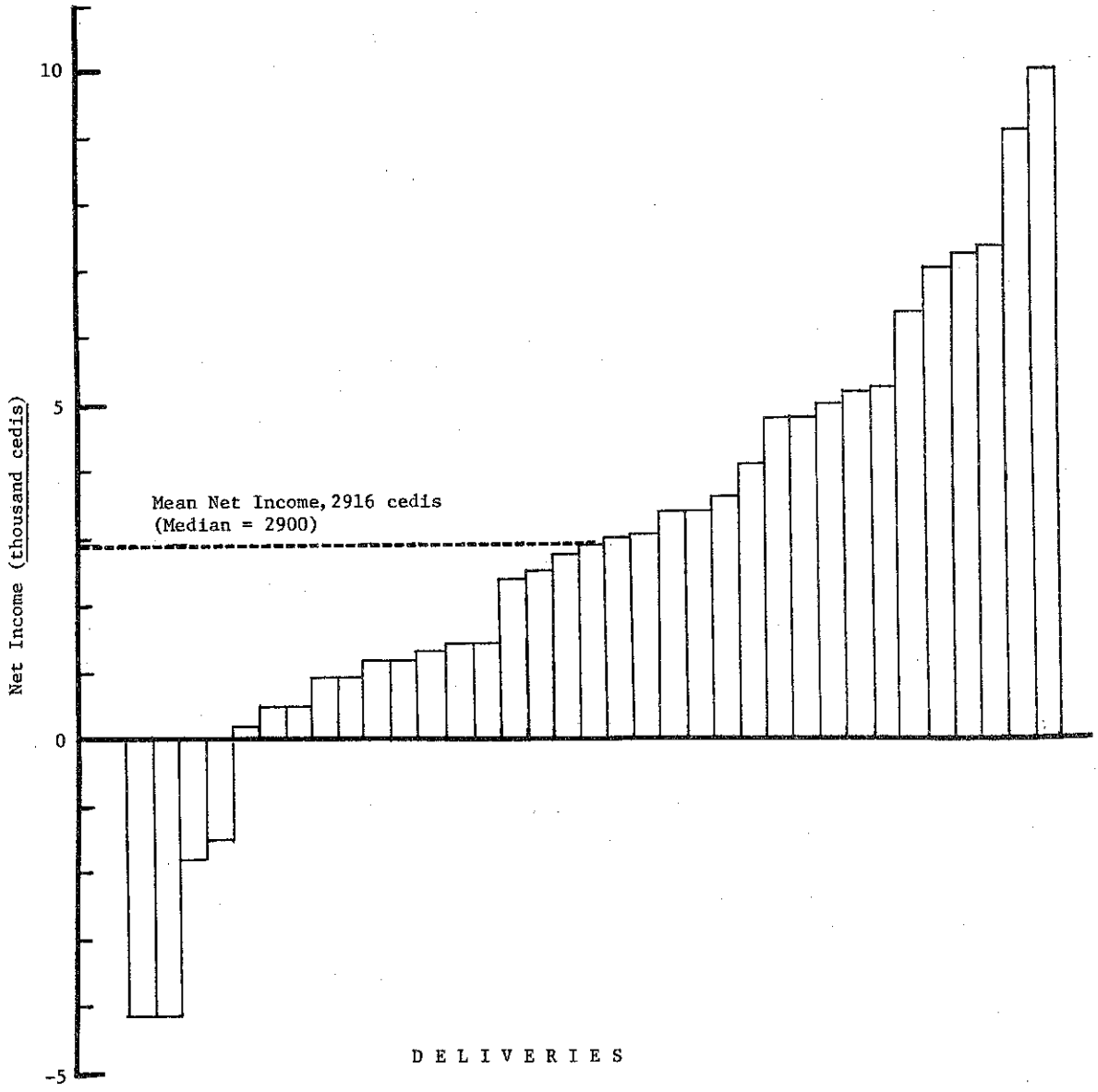
[3]A common practice was for a group of farmers to share in harvesting and assembling their cassava farms.

[4]The "Techiman Seat" describes the volume of a seat from a seven or eight ton truck. This is distinct from the volume of a three ton truck which contains approximately 3/4 as much as a "Techiman Seat."

FIGURE 6.1. VARIATION OF CONTRACTORS' NET INCOME FOR 35 CASSAVA DELIVERIES TO ANLOGA-KUMASI, 11 JULY-30 SEPTEMBER 1985



pernicious is the realization by both parties that it is in their best interests to maintain good relations and promote high-volume trade. To this end informal agreements between contractor and secretary have evolved. For example, contractors are told by the secretaries to return with cassava by a certain date; however, the processors are free to purchase from other contractors. This protects both parties in the event the contractor cannot return by the agreed-upon date. The prospect of losing service prevents secretaries from taking undue advantage of contractors.

Credit System: At All Levels

Trade at all levels of the marketing chain from farmer to gari retailer is facilitated by credit. The three basic linkages are: farmer to contractor, contractor to processor, and processor to wholesaler/retailer. Contractors extend credit equal to the cost of one truckload (approximately 25,000 cedis), from one delivery to the next. In fact, delivery of the next load may be contingent upon repayment. According to the processors, full payment is always expected during the dry season because retail sales of gari are brisk. Farmers may extend credit to contractors, especially if the farmer has agreed to supply a large consignment of cassava. Conversely, farmers expect cash payment for cassava uprooted in the dry season. The processors regularly extend credit to gari wholesalers and retailers, although it, too, is a function of demand. Thus, the high-volume trade of Anloga-Kumasi processors is to an extent dependent on credit. Credit oils the mechanism that facilitates trade. This system of credit from farmer to processor is not developed among the case study traditional and transitional processors, in large part because they are not organized to demand a continuous supply of cassava.

The provision of credit has also expanded the gari industry in Brong-Ahafo. Long distance trade in gari is built upon informal agreements between suppliers and intermediaries. Regular customers and suppliers allow the gari intermediaries to handle a larger volume than would otherwise obtain. Higher volume, made possible through technical improvements, in turn encourages other processors to adopt improved processing technology. Thus, credit and development of the gari industry are inextricably bound.

Development of Gari Industry in Techiman

High prices for gari in Techiman Market during the food crisis of 1983 attracted many farmers to gari processing. As set forth in Chapter IV, there is an ever-increasing number of independent processors working in villages surrounding Techiman. This section examines the level of technology and business organization among Techiman area gari processors, and speculates on the future course of development of the gari industry.

Tuobodom and Asuoyi: Two Organized Processing Centers

Map 4.2 indicates the location of Tuobodom and Asuoyi, two villages in the Techiman area where the concept of the processing center has taken root. Over the past 20 years Tuobodom has become a virtual suburb of Techiman. A recently resurfaced section of the highway connecting Techiman with Tamale runs through Tuobodom; by public transportation the trip from Techiman to Tuobodom takes 10 minutes. Asuoyi lies at the end of a feeder road several kilometers off the Wenchi road. Once a town of prosperous cocoa farmers, Asuoyi's economic position has declined over the past 15 years along with cocoa production in the area. Building upon an abundance of cassava and the ready market for gari provided by Techiman, the two towns have become noted processing centers.

Tuobodom: An Established Center

That Tuobodom is an important gari center is evidenced by the fact that Techiman's largest volume gari market is named after the largest supplier of gari: Tuobodom. Mechanized cassava grating has been a feature of Tuobodom gari since 1973. The original machine was manufactured in Accra, and has been in continuous operation. At the time of this study, Tuobodom had three mills, the other two manufactured locally by Alhaji Beba, a carpenter, bricklayer, mechanic, and, most recently, gari entrepreneur.

Owner and Manufacturer. Alhaji Beba is proud that he not only built the mill house and roasting sheds, but also fabricated the grater and roasting pans. He is generally supported in his claim to have introduced the idea of group processing to Tuobodom. Perhaps the striking organizational difference between Alhaji's center and those of Anloga-Kumasi is in ownership of cassava. In Tuobodom the processors do not always own the cassava they process. During the peak gari season, Alhaji prefers to hire processors on a commission basis; however, in slack periods (August-September) he rents the facilities to processors. Thus, although the concept has taken root, it has not yet evolved into full-time activity.

In terms of technology employed, Tuobodom is ahead of villages not supplied with mechanical graters. However, nowhere in Tuobodom is the manual screw press in evidence. Alhaji Beba has seen the press in action in Anloga-Kumasi, and had placed an order for one in September 1985. He was particularly optimistic about the press because it could increase throughput of gari. Beba has fabricated 32 cassava graters over the past 12 years. By engineering standards, his machines are poorly constructed, yet they achieve the purpose of grating cassava and thereby increasing labor productivity. At this stage of development the emphasis is on number of machines, not quality. The bushings and shafts of his drum graters are machined in Suame Magazine, Kumasi. Beba mounts the shaft assembly in a simple wooden superstructure not unlike a box. Two types of rasping surface are offered: a stippled

sheet of galvanized tin, or band saw blades set horizontally in the drum. He suggested that choice of two surfaces provided the customer flexibility, that the comparatively low maintenance sheet surface was more suited for remote locations, while the band saw was for towns where wayside mechanics could make repairs. Beba himself offers a repair service for graters in his area.

Asuoyi: A Center in the Planning Stages

Estimates by the owner of a cassava grater place the number of part-time Asuoyi gari roasters at 200, a high figure suggesting a concentration of processing activity. The bulk of Asuoyi gari is sent by the processors to the Tuobodom gari section of Techiman Market. An atypical feature of Asuoyi's gari industry is that men (perhaps 10 percent of total processors) have entered into the trade. Their entry is to a large extent a result of the availability of mechanized grating in Asuoyi.

Owner and Teacher. Kwame Mensah set up his milling operation last year when he returned from Nigeria. Until then he had been a secondary school teacher in Lagos. With savings deposited in a foreign currency account in London, Kwame purchased a diesel engine and corn mill from India. His cassava mill was fabricated in Tuobodom by Alhaji Beba. Although his mill had been in operation for only four months, he was optimistic the investment would prove sound, especially in view of the demand from northern markets. Mensah has also begun construction of roasting sheds based on the Tuobodom model, and hopes to start a processing center by January 1986. Whether or not Mensah's center develops along the lines of those in Anloga-Kumasi depends primarily on ownership of cassava. At this juncture, however, he envisions providing milling services for a fee, and not hiring processors on a commission basis. In his view, processors will work diligently only if they work for themselves.

Good Prospects for Techiman Gari Industry

For the following reasons, prospects are good for expansion of Techiman's gari industry: processing equipment is manufactured locally; the gari market is large and well organized; cassava is abundant; and Techiman has a strategic geographic location.

Beginnings of Local Manufacturing Capability. The Tuobodom workshop supplies grating machines, and will continue to respond to the demand for equipment. It is likely that if demand outstrips Alhaji Beba's capacity, the mechanics' shops in Techiman's informal area will step in and fabricate graters. Although simple in design, the screw press is more problematic because it must be milled on a lathe; by October 1985, Techiman's mechanics were not equipped with lathes. However, the numerous machine shops of Kumasi could provide the presses, leaving repairs to Techiman's wayside mechanics. The

important point is that local sales and service are available and will probably expand.

Strategic Market and Abundant Supply of Cassava. The Tuobodom and Buoyam gari sections of Techiman Market bring together scores of buyers and sellers each market cycle. Recent expansion of the Tuobodom section indicates that producers are responsive to increases in demand. The demand area for Techiman gari is extensive, with penetration evident in most northern markets where food production and security are uncertain, as well as in coastal urban markets where demand for cassava products is high. This is a consequence of Techiman's geographic location in the transition zone on the major highway linking the northern savanna with the forest and coastal plain of the south. That cassava production in Brong-Ahafo is relatively high is indisputable. Revised Ministry of Agriculture production figures for 1980-82, disaggregated to the regional level, indicate Brong-Ahafo led Ghana in production of cassava.[5] Thus, supply and price of cassava cannot be considered constraints to development of a gari industry. Given the large percentage of Anloga-Kumasi wholesale cassava price accruing to transportation costs, it is understandable that Techiman area gari is less expensive than Kumasi gari. Moreover, at least for northern markets, Techiman gari would enjoy a price advantage over other areas because of comparatively lower cassava and transportation costs. In order to penetrate the Kumasi Market, Techiman processors would have to improve gari quality. As the market expands there is every reason to expect that Techiman gari will find acceptance in Kumasi and other markets.

Direction of Change: Mechanized and Organized

Assuming expansion of Techiman's gari industry, the question remains how and in what direction the change will occur? The change can be expected in equipment and organizational structure. As long as the price differential remains attractive, cassava farmers will process some cassava into gari. The number of these traditional technology processors will probably increase. However, the trend in mechanization is likely to continue, with more villages following the example of Tuobodom and Asuoyi. In villages with cassava mills, processors will become specialized to the extent that all or most of their time is spent preparing gari. The next stage entails changes in business organization. Scattered independent processors would group together at village processing centers. These loosely knit groups would eventually demand truck and tractor loads of cassava and take an active interest in the gari market. The key to development of the gari industry in Brong-Ahafo, as in Anloga-Kumasi, is entrepreneurial spirit. Mill owners, gari processors, cassava and gari contractors, and transport

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[5]Data provided by Economic Research and Planning Service, Ministry of Agriculture, Accra. Data for 1982 and 1983 suggest devastating effects of bushfire and drought on even cassava production.

owners provide the entrepreneurial ability to improve the marketing and processing chain, and thereby transform the gari industry.

The Impact of Technology on Traditional and New Markets

The marketing task of assembling commercial lots of gari varies from small quantities offered by widely dispersed farmers connected by poor roads, to large quantities regularly supplied by concentrated groups of gari specialists operating in the urban area. Data on the organization of selected southern gari markets were collected 15 August through 6 October 1985; data from northern markets are based on a field trip by research assistant, Sam Nyarko, 15 October - 15 November 1985. The data for Accra gari markets reflect a spot survey carried out over a 24-hour period. Thus, they at best present a glimpse of gari marketing at specific points in time, and cannot with any degree of confidence be taken to suggest a trend.

The impact of technical improvements on gari marketing is evident in a comparatively new market. In Techiman, for example, the rapidly expanding Tuobodom gari section is clearly the result of mechanized processing technology. In 1983, the demand for increased quantities of gari was met to a large extent by processors using mechanized graters. However, the impact of technology is less clear with respect to traditional markets, such as Kumasi and Accra. But, if the percentage of mechanized gari is compared to the total quantity available, it is then possible to gain a clearer understanding of technology's contribution.

Techiman Market: A Large Growing Supplier of Distant Markets

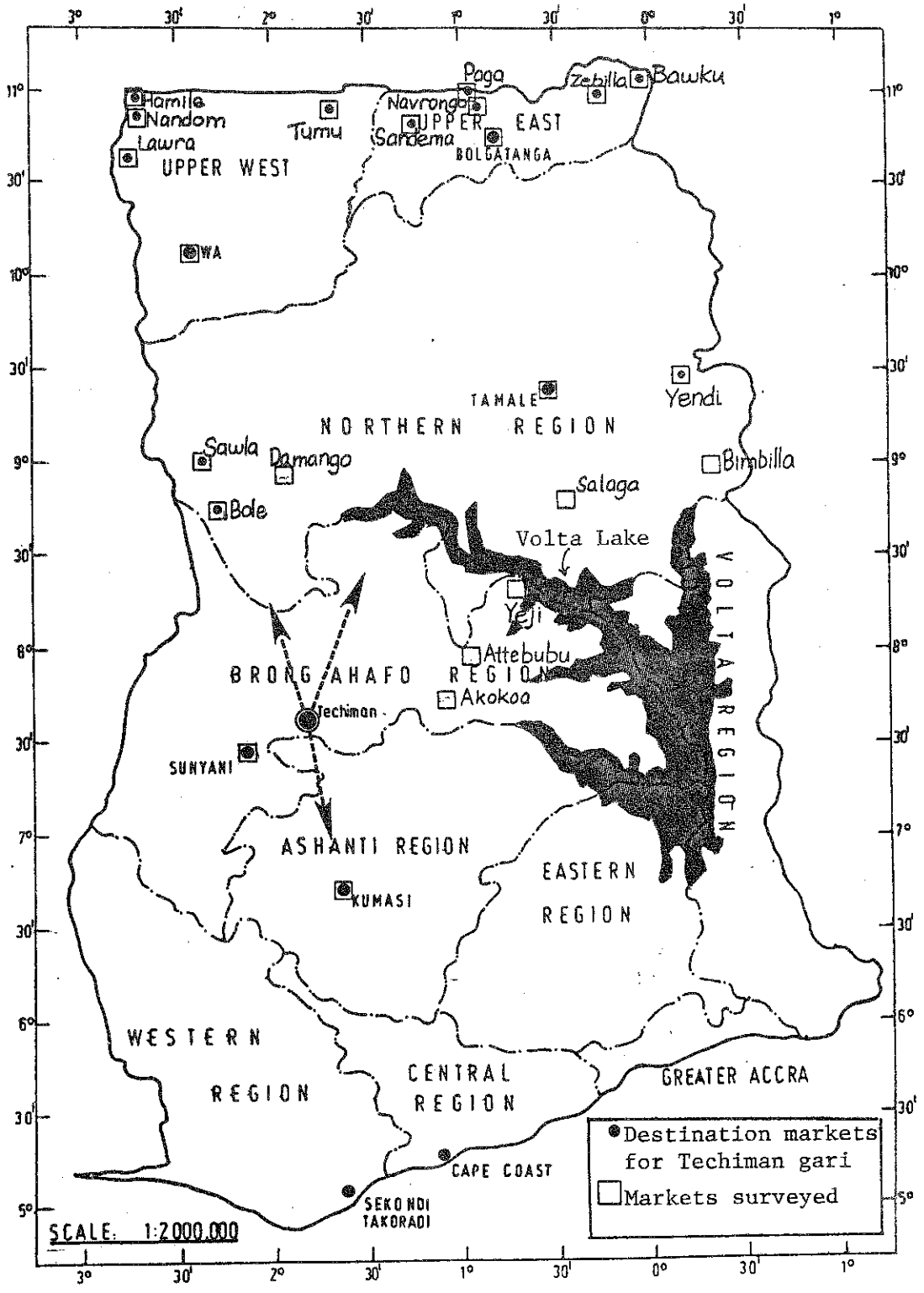
In Techiman's sprawling periodic market, large quantities of staple commodities are assembled for shipment throughout Ghana. One of the growth areas in Techiman Market has been the gari section, which is divided into two geographically separate areas. They are named Buoyam and Tuobodom, and refer to the outlying villages from which come most of the gari sellers. The original gari market, Buoyam, was established by Ewe processors in the mid-1960s; Tuobodom came into its own at the start of 1985 in response to the growing number of Bono cassava processors whose entry into business coincided with the 1983 food crisis. By the time of this survey (August-September 1985), Tuobodom Market had become the dominant supplier of gari. A comparison of the two is easily drawn. The Buoyam area is spread out under several trees, whereas Tuobodom is concentrated on a raised platform protected by a galvanized tin roof. To ensure maintenance and provide for expansion, each Tuobodom seller must contribute 1,000 cedis for membership. According to the market manager, 135 sellers have become members, although perhaps half of that number were in evidence during the research period. Buoyam gari sellers were approximately 20 in number.

Unlike Kumasi, retail gari in Techiman is sorted into various grades which attract different prices. However, the only retail market of any account was Buoyam. When asked why, the Buoyam market manager stated that Ewe gari is superior to that produced by the Bono, and therefore should be priced accordingly. While it may have been of better quality, there was no evidence to support price difference based upon quality. Quite to the contrary, the wholesale (cocoa sack) price of Tuobodom gari was at least that of Buoyam gari, if not actually a little higher. Thus, at the wholesale level, price is irrespective of quality; however, at the retail level the comparatively superior Buoyam gari attracts a higher price than Tuobodom gari. Its existence may be seen as a convenience service for discriminating consumers who buy small lots of the olonka or margarine tin measure. Almost all Tuobodom gari leaves market in bulk shipments.

Sellers are Processors. Techiman market brings together a large number of buyers and sellers. Most Tuobodom and Buoyam gari sellers are also processors. They either meet their processing needs from own production or by supplementing it with cassava from a relative's farm. Buyers include: large-scale food contractors, who own transport and regularly exchange commodities with Techiman; small-scale, independent contractors who may enter the gari trade only when margins are high; representatives of secondary schools; students on school holiday; and assorted other types. It is a diverse group. Apparently there is also a growing number of producer-processors (Auntie Grace, Chapter IV) who are eliminating the intermediaries and selling their gari in northern markets. The variety of intermediaries in the gari trade would suggest that risk is relatively low and margins high.

Destinations Far Afield. Destinations for Techiman gari include the following: in the north, Bawku, Tamale, Navrongo, Bolgatanga, Wa and Hamile; and, in the south, Kumasi, Takoradi and Cape Coast (Map 6.2). As would be expected, there is close integration of producer, intermediary, and consumer in the trade of both gari and cassava between Techiman and northern destinations. Contractors typically maintain regular customers (e.g., canteen operators and market women) and gari suppliers. According to contractors operating in the north considerable quantities of gari are sent from Hamile, Navrongo, and Bawku to Burkina Faso, and even to Mali and Niger. Further investigation would have to bear this out, but given the traditional pattern of trade in foodstuffs between Ghana and her northern neighbors, there is no reason to doubt that some of the gari (and konkonte) is in turn transshipped to Burkina Faso. This scenario would be particularly likely to occur during the season preceding the millet harvest in September-October. In a survey of 19 markets in the Northern, Upper East, and Upper West regions, gari originating from Techiman Market featured prominently in each market (Map 6.2). This is perhaps surprising given to local preference for millets and yam; however, it is apparent that gari has become readily available throughout the year in the savanna, in large part due to the fact that many areas suffer chronic food deficits. Despite comparatively good harvests in 1984 and 1985, the demand for gari has remained strong in the markets surveyed.

MAP 6.2. DESTINATIONS OF TECHIMAN GARI, SEPTEMBER-NOVEMBER 1985



According to market traders, the demand for gari falls slightly during the period immediately following harvest, October-December, but by January rises and remains high until the next harvest. At least two factors contribute to this situation: 1) some farmers would have exhausted their grain stocks either by own consumption or through sales to meet cash demands (e.g., school fees); and 2) others would prefer to gradually release stocks in an effort to improve overall income for the cropping season. In either case, a strategy relying on gari would tend to achieve the objective while supplying the diet with the cheapest source of calories available. Further monitoring would reveal whether gari has assumed an important position in terms of volume of trade among foodstuffs exchanged with the north (e.g., millet, sorghum, and rice for plantain, maize, cassava, and fruit).

Accra Markets: Distant Suppliers and Discriminating Consumers

As may be seen from Map 6.3, gari destined for Accra is drawn from an extensive supply area. The percentage contribution of mechanized gari provides a rough measure of the extent to which improvements have taken place in the gari industry. Fully 83 percent of gari held in the surveyed markets was processed using improved technology. While this may not accurately represent the percentage of all gari processed, it at least indicates a preference for improvements (mechanical grater and screw press) among producers supplying commercial channels such as Accra. Moreover, the wide spatial distribution of gari production centers suggests that improved technology is similarly dispersed.

As would be expected of Ghana's largest urban area, Accra exerts tremendous influence on gari processing and marketing. Accra is blanketed with small retailers offering quantities of one headpan or less; however, there are several areas where gari marketing is concentrated. Four prominent gari markets were surveyed 5 October, to determine quantity, origin, technology of processing, and price of gari offered for sale.[6]

Accra is by Ghanaian standards a wealthy and heterogeneous city. A feature of the gari markets is that consumers distinguish between grades of gari. Accra's markets were the most discriminating for gari, with retail prices for the olonka pegged to quality and varying between 50 cedis and 70 cedis. Retail prices in Accra markets were 40-50 percent higher per volume than for similar volumes in Kumasi; and, Kumasi prices in turn were 20-30 percent higher than Techiman's at the retail level. Whether this differentiation is likely to be emulated in other parts of the country as their gari markets develop remains to be seen.

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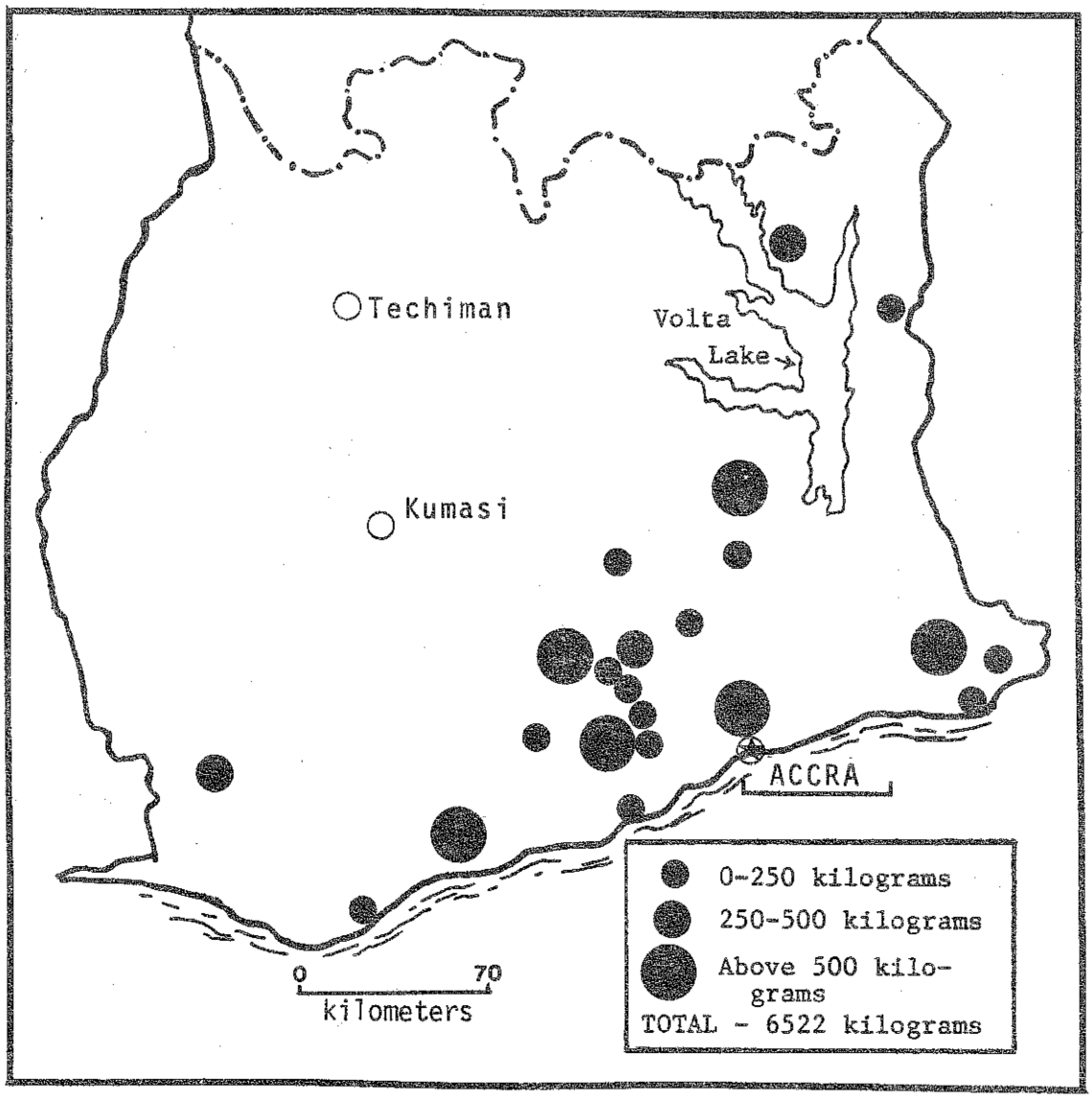
[6]The markets surveyed were: Makola #2, Rawlings Park, Railway Station, and Kaneshie.

MAP 6.3. ORIGIN OF GARI DESTINED FOR SELECTED ACCRA MARKETS, 5 OCTOBER 1985



Source: Market survey conducted 5 October 1985 with Sam Nyarko, FRI. Markets surveyed included: Makola #2, Rawlings Park, Kaneshie Market, and Railway Station.

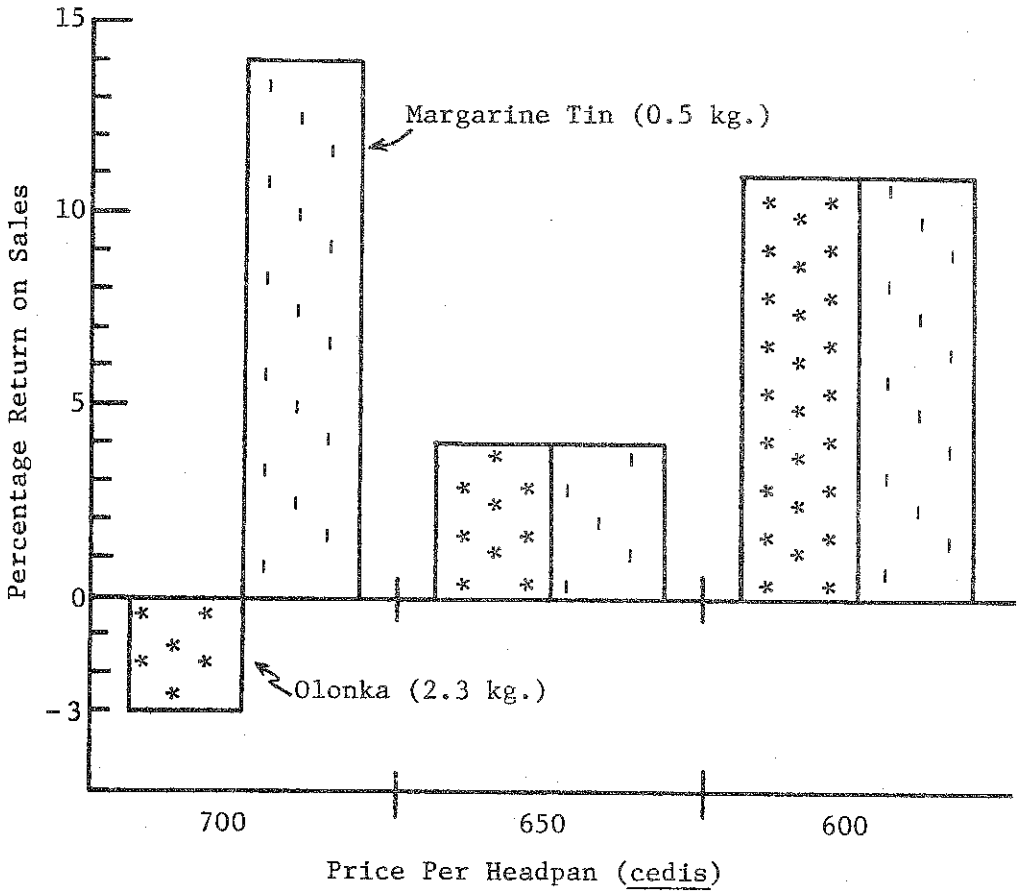
Impact of New Technology on Marketing Returns

Retailers Have a Lower Margin Than Processors

The markets mentioned in the previous section are characterized by many retailers. It is perhaps understandable that consumers prefer to buy relatively small quantities of gari, usually 2.3 kilogram and 0.5 kilogram measures. However, it is not clear what the economic returns are to retailing gari. The following section examines the economic position of retailers in Kumasi, 11 July - 31 August, 1985.

Gari retailers have a different cost structure from processors. Figure 6.2 presents return on sales for three different wholesale purchase prices (600, 650, and 700 cedis per headpan). Retail sales are in two units of measure, the olonka and margarine tin. Because the olonka is larger than the margarine tin, one would expect a lower margin than that for the margarine tin. The percentage marketing margins were derived from actual prices paid by gari retailers during the research period. Retailers were indeed comparatively better off selling margarine tin lots, especially when gari was priced at 700 cedis. Although on appearance it may seem counterintuitive, when the headpan price dropped from 700 to 650 cedis the profit fell from 98 cedis to 26 cedis. As Figure 6.2 shows, this is a decline in the profit margin from 14 percent to 4 percent. This is directly attributable to the larger percentage drop in price per margarine tin (17 percent). Nevertheless, the subsequent drop in price from 650 to 600 cedis resulted in an increase in profit to 11 percent by volume. Ten cedis per margarine tin apparently was the floor price for gari for the period. Assuming a weekly volume of four 600-cedi headpans and a margin of 11 percent, a retailer would earn net weekly income of 320 cedis, the equivalent of two days wages for a farm laborer. This is contrasted with the margin for gari processors, which was 27 percent. That traders engage in retail gari despite the comparatively low returns per week may indicate that they derive benefits other than cash; among these are free consumption of gari and social interaction with other traders. An economic analysis of roadside food sellers in Accra, undertaken by Ghana's Food Research Institute in the late 1960s, revealed that income in the form of food for family and social benefit were more important than net monetary income in determining whether hawkers remained in business. This is also true of food hawkers in Southeast Asia (34, pp. 81-82). As can be seen from Figure 4.1, the marketing chain can be either abrupt, with consumers purchasing gari at the processing center, or lengthy, with several intermediaries involved in the trade. Because volume is essential to a successful gari business, the processor establishes agreements with retailers and wholesalers that promote high volume trade. Occasionally, the opportunity presents itself for processors to perform the function of intermediaries, such as Auntie Grace in Brong-Ahafo (Chapter IV). This is also true of Anloga-Kumasi processors who send their children to retail gari in Kumasi Central Market. Then, there are small-scale processors, like Akua of Ayigya (case study C), who improve their profit margins six to seven percentage points by retailing small lots which they

FIGURE 6.2. RETURN ON SALES FOR KUMASI GARI RETAILERS, JULY-NOVEMBER 1985



produce at their processing sites. The high-volume processors of Anloga-Kumasi, however, cannot both maintain production and retail small amounts, and therefore tend to dispose of their gari in wholesale lots. Thus, the marketing of gari is dynamic, adjusting to changes in demand.

Technical change has had tremendous impact on the marketing chain. Improvements in processing technology (such as the mechanized grater) gave rise to the concept of group organization embodied in the processing centers of Anloga-Kumasi. In turn, the demand created by these centers gave rise to the long-distance cassava delivery system. That this impact is widespread is evidenced by the development of the incipient gari industry in Techiman, and the high proportion of gari processed by improved technology available in the surveyed Accra markets. To encourage adoption of technical improvements, the equipment must be made available, and this is the domain of the small-scale manufacturer. Chapter VII explores the contribution of small-scale manufacturers in supplying improved processing equipment.

CHAPTER VII
TRANSFORMATION OF THE GARI INDUSTRY: IMPACT OF NEW TECHNOLOGY ON SMALL-SCALE EQUIPMENT MANUFACTURERS

This chapter examines the contribution of small-scale equipment manufacturers to the development of Ghana's gari industry. Data for this chapter were collected June-October 1985, in Kumasi's three large informal industrial areas: Suame Magazine, Anloga Light Industrial Area, and Asafo (Map 3.3). Characteristics of firms specializing in the manufacture of food processing equipment are presented for comparative purposes. Chapter VII concludes with a projection of the future of small-scale agricultural equipment manufacturing in Kumasi.

Workshops of Equipment Manufacturers

Suame Magazine

The largest informal industrial area in Kumasi, and Ghana, is Suame Magazine. Most of the food processing equipment manufacturing workshops are located in Suame. A 1971 survey conducted by the Technology Consultancy Centre (TCC) of the University of Science and Technology indicated that the magazine covered an estimated 40 hectares and quartered over 1,600 businesses in almost 1,100 workshops, employing approximately 5,500 people. Ten years later the Suame Mechanical Association claimed a membership in excess of 27,000 (41, p. 1). In 1985, a follow-up survey found the magazine had grown to include over 40,000 workers.

Emphasis on Vehicle Maintenance

Suame ("carry me," in Akan) began as the precinct inhabited by the Asantehene's palanquin carriers.[1] It is perhaps fitting that transportation is still the primary occupation of Suame's population. The 1971 survey indicated that 50 percent were involved directly in vehicle repair, and another 37 percent were involved in trading or engineering activities related to vehicle repair. John Powell, the director of the TCC, suggests that the relative proportions have not changed in the last 15 years. This points to the fact that activity in Suame is primarily concerned with vehicle repair and maintenance, and involved in manufacturing production only to limited extent. In fact, Aryee in a study of Kumasi's informal sector reported only 20 percent of all manufacturing enterprises in Kumasi were involved in metal working, of which equipment manufacturing would be a small proportion.

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[1]Asantehene is the King of the Asante ethnic group.

Survey of Equipment Manufacturers

Our survey of food processing equipment manufacturers, conducted August-September 1985, revealed that in all of Suame Magazine only ten workshops specialize in some form of food processing equipment. Other workshops occasionally produced the screw press, but only on special order and not as a part of their inventory. These ten workshops are located in the same area of Suame, within 300 meters of each other. Three workshop proprietors are related to each other.

Characteristics of the entrepreneur. Table 7.1 compares the ten small-scale equipment manufacturers. A distinctive feature of this group, and Kumasi entrepreneurs in general, is their comparatively high level of formal education. Six of the ten proprietors have ten years of education (middle school certificate) or more. Aryee (1981) cites comparable proportions for Kumasi's informal sector population as a whole. As expected, the older entrepreneurs are the least educated.

All proprietors received training prior to establishing their enterprises, either through technical and vocational school, or through experience gained in the apprenticeship system. The two youngest owners had both formal training and experience as apprentices. Nine of the ten were apprentices before starting their businesses, while the tenth (H) was a master mechanic before switching to equipment manufacture. Thus, the apprenticeship system appears to have been instrumental in transferring both technical and business skills.

Characteristics of the Enterprise. Most of the Suame workshops surveyed were housed in small wooden structures, in which were stored machine tools and other valuable materials. The actual business of manufacturing is done in the open yard. To the untrained eye these workshops appear highly disorganized and untidy: the yard is littered with machines-in-progress, finished products, and piles of valuable scrap (i.e., raw materials). According to the owners and their apprentices, everything is in its place. This untidy appearance prompted government officials in 1985 to consider bulldozing Suame and starting anew. In large part Suame's chaotic appearance is the result of Kumasi City Council (KCC) policy and neglect. For example, provision of support facilities such as electricity and water has not kept up with the swelling number of workshops; and KCC policy prevents the construction of permanent structures in Suame (4, p. 92).

Labor. Table 7.1 shows that the surveyed workshops employ from two to eight apprentices, with seven workshops employing either two or three apprentices. In workshops A and I the number of apprentices is positively related to product diversity. Workshops A and I employ seven and eight apprentices, and manufacture seven and eight different machines, respectively. The one exception appears to be workshop D, with eight machines and only three apprentices; however, D actually borrows labor from I, who is his brother and is located across the lane some 20 meters. Apart from this one example shared labor is not common.

TABLE 7.1. COMPARISON OF CHARACTERISTICS, PRODUCTS, AND EQUIPMENT OF SMALL-SCALE EQUIPMENT MANUFACTURERS

Suame:	Characteristics Of Entrepreneurs							Products											Equipment: Machine Tools													Equipment: Hand Tools		
	Age	Years in Business	Former Apprentice	Years at present location	Education	Number of employees: Journeymen/Apprentices	Keep records	Corn/rice huller	Palmnut cracker	Cassava grater	Corn mill	Fish mill	Poultry feed mixer	Pepper mill	Corn grinding plates	Palm oil extractor	Cassava cracker	Wingnut screw press	Power hacksaw	Table lathe (small)	Capstan lathe	Centre lathe	Milling machine	Table drill press	Electric grinder (hand)	Grinder (table)	Welding machine	Electric hand drill	Shaping machine	Sanding machine	Hammers	Chisels	Hacksaw
A	45	10	Yes	5	Prim. Sch.	1/7	No	X	X	X	X	X	X				X								1		1	1		1	3	3	2
B	46	26	Yes	5	Sec. Sch.	/6	No	X	X	X	X	X									2	1	1	1	1	1	1	1			2	3	1
C	33	10	Yes	6	Mid. Sch.	3/	Yes	X	X	X	X			X				X							1		1				2	3	1
D	27	7	Yes	7	Sec.+ Voca.	/3	Yes	X	X	X	X	X	X	X		X									1		1	1			1	3	1
E	24	2	Yes	2	Tech. Sch.	2	Yes									X				1					1		2				1	2	1
F	35	17	Yes	2	Mid. Sch.	/2	No							X													1				1	2	1
G	42	30	Yes	12	None	/2	No	X		X	X														1		1				1	2	1
H	68	25	No	21	None	3	No	X		X	X						X								1		1				1	3	1
I	35	21	Yes	7	Mid. Sch.	2/8	Yes	X	X	X	X	X	X	X		X						1[b]		1[b]	1	1	1				3	3	2
J	46	17	Yes	2	None	2	Yes								X																2	2	
Asafo Kwanu	64	48	Yes	10	None	4/12	No	X	X	X	X					X		X			1		1	1	1		1	1		1	5	4	4
Anloga S I S	39/37	16/12		13	Univ. a/	6/8	Yes	X	X	X	X	X	X			X	X	X	1		1	4	2	1	1	1	2	1	1	1	4	4	2

a/ Engineering/Accounting

b/ Equipment not in operating order.

It should not be concluded from the preceding that apprentices specialize in only one type of machine, and that workshops offering an expanded product line require more specialists. In fact, at some point during the process all or most of the apprentices may work on any one machine; however, an apprentice will never construct the entire machine by himself. The tasks of welding, cutting, and assembling are spread among the apprentices.

The system of apprenticed labor is a distinguishing characteristic of Kumasi's informal sector. Moreover, the system is mutually beneficial to both apprentice and workshop owner. For the apprentice, the system offers knowledge and skills training at a low cost; and, for the owner, it increases the amount of labor while reducing the capital cost per worker. Thus, the apprenticeship system generates high levels of income and employment, and contributes to capital formation in the form of skills (4, p. 100).

Product Selection. These owners indicated that selection of product is based solely on perceived demand of customers. When asked why they chose to specialize in food processing equipment, the owners stated that profit was their guiding motive. Prior to 1980, the corn mill and rice/corn huller were the most important sources of revenue. Since the food crisis of 1982-84, the cassava grater has joined the corn mill as one of their most requested machines. However, demand for the rice/maize huller has outstripped that of these two machines. It is the only product workshop owners regularly keep in stock; all others are usually manufactured on a commission basis. At three workshops owners indicated that product selection also depends upon season. A few additional rice hullers and corn mills are made in advance of the harvest.

Typically, these machines are sold for cash and the proceeds reinvested in materials and equipment. For these workshops cash flow is maintained through repair service. Owners estimated that repairs comprised 20-30 percent of their business revenues. Although the profit on repairs is much less than that from manufacturing equipment, the owners stated it helped foster good customer relations and kept the firm in "chop money" (i.e., enough cash to buy food).

Method of Pricing and Payment. Generally, all machines must be ordered on a commission basis. The standard deposit ranges from 50 to 75 percent of total cost, paid at the time of ordering. It was observed that the price of cassava graters and corn mills varied widely among shops. There was a direct, positive relationship between price and quality of machine. Oddly, owners claimed they rarely tried to match the price of a competitor, stating that the quality of their machine warranted the difference in price. For most workshops, the procedure of price negotiation was straightforward and included the following steps: determine cost of bearings, bolts and nuts; assess cost and availability of sheet and angle iron; ask cost of welding rods based on that needed to weld the available scrap; ask price of milling the shaft; estimate labor costs of "chop money" per worker per day for

the duration of the project; and add a certain amount for profit and maintenance of tools. Seven owners claimed net income per machine was small, that manufacturing is a "hand to mouth business." However, the others admitted to adding 20-30 percent to their costs. Thus, a cassava grater that retailed for 30,000 cedis would represent a net profit of 5,000 cedis and a margin of about 17 percent.

Record Keeping. Half the workshop owners did not keep records. There does not seem to be a correlation between education and record keeping. However, because these entrepreneurs are averse to taxation, it is perhaps understandable that they would not keep records of income. The government's efforts to register equipment manufacturers were viewed with suspicion. Rather than benefit from the effort, they suggested the action would probably drive them out of business.

Fabricators with Simple Tools. The survey workshops may be characterized as fabricators using simple tools. With the exception of workshop B, all Suame workshops fabricate their products by cutting and welding parts by hand. Machined parts such as shafts are contracted to lathe turners within Suame Magazine. Table 7.1 presents the machine and hand tool endowment of each workshop. It is apparent that apart from hand tools (hacksaw, chisels, and hammers), the most frequently owned machine tool is the electric welding machine, followed by the electric hand grinder. Given these comparatively simple tools, workshop personnel can produce any of the food processing items listed in Table 7.1. The superior machine tool endowment of workshop B was in large part made possible through the assistance of the Technology Consultancy Centre.

Products Are Copies of Imports. Only one of the 10 firms claimed to design equipment. As in most developing countries, the prototype machine is built without resorting to scale drawings (7, p. 2). The vast majority of machines in Suame are copies or adaptations of either imported or locally manufactured models. Thus, at least the basic design is sound. Given the proximity of processing equipment workshops in Suame, one would expect that design improvements advanced by one firm would tend to be passed along to others. This is what has happened in the design of the grating mechanism of the cassava grater. Improvements made by one workshop (I) spread quickly to six other workshops. Modification of the design for a machine usually is the result of a collaborative effort between entrepreneur and customer.

Bottlenecks to Production

All workshop owners were forthcoming about their problems, and listed supply of materials, access to credit, and cancelled orders as their primary constraints.

Supply of Materials. All ten enterprises purchased raw materials and spare parts from Suame retailers. High cost and scarcity were mentioned as constraints to production. The bulk of raw materials are

scrap sheet metal and angle iron of various gauges, most of which derive from machine shop off-casts from the large state-run gold mines (Plate 8). Thus, there is an indirect backward linkage to the formal sector.

To a great extent the supply of materials depends upon what is available from the formal sector machine shops. During the survey period the temporary lack of one-quarter inch sheet metal and angle iron resulted in increased equipment prices. The manufacturers had no alternative but to substitute two-inch angle iron. If a scrap piece cannot be adapted to the required function, two or more pieces must be welded to create the desired size. This, of course, implies extra labor and equipment costs in the form of welding rods. For these reasons, the workshop owners suggest a price range for their equipment, and quote a firm price only after materials have been costed.

Credit. All Suame workshops listed access to credit as their major constraint. However, it appeared that limited access to formal lines of credit was a barrier only to the purchase of additional equipment. Eight of the ten owners indicated they would purchase center lathes and other machine tools if they were able to obtain loans. With a center lathe, each workshop would have the capability of producing all components of a cassava grater without sub-contracting for the shaft. Because the center lathe is an extremely versatile and fundamental machine tool Suame could easily absorb these eight additional units.

During 1985, Ghana's customs and excise service launched a campaign to register all workshops in Kumasi. One justification for the drive was that once registered a workshop would be eligible for machine tools and raw materials at heavily subsidized prices. However, as of October 1985, such machine tools and materials as were available were unsubsidized and very expensive. It remains to be seen whether the market price will come down, or the Ghana Government will be able to provide scarce supplies at subsidized prices.

Sales: Cancelled Orders. Virtually 100 percent of the enterprises sold their output directly to households or individuals. Marketing, as such, was not perceived as a problem. Perhaps because of the comparatively high cost and lengthy production time of each unit, the involvement of intermediaries was unknown. Traders simply were not interested in the prospects of tying up 50 percent of the cost of a piece of machinery for three to five weeks before they would enjoy a return. The principal complaint was that customers at times cancelled orders and demanded deposit refunds after fabrication had begun and capital tied up in materials.

Case Study: Kwa Kwanu

The Entrepreneur

Kwa Kwanu operates a workshop in Asafo, a residential borough on the other side of town from Suame Magazine (Map 3.3). Like Suame, Asafo supports an informal industrial area comprised largely of vehicle repairmen. Unlike Suame, Asafo is small and cannot expand.

Kwanu is the proprietor of a large workshop employing 12 apprentices and four master technicians. Mr. Kwanu, aged 64, had been in business almost 50 years at the time of the survey. As is typical of Kumasi workshop owners, Kwanu himself was an apprentice and worked his way up through the ranks. He describes himself a "jack of all trades," although he was trained as a blacksmith.

In Ghana, entrepreneurs such as Kwanu who choose to pursue a career in manufacturing are comparatively few, in large part due to low return on investment. An investment in a productive enterprise, such as food processing equipment manufacturing, has to offer a competitive rate of return. Because of Ghana's high rate of inflation and pattern of price controls, few enterprises can compete with the handsome returns to investment from trading. However, just as there are entrepreneurs in gari processing who have chosen productive over non-productive activities, so too are there entrepreneurs involved with equipment manufacturing. Kwanu has demonstrated a commitment to food processing equipment for most of his 50 years as a manufacturer. Judging from the number of his employees and his excellent equipment endowment, one would conclude that Kwanu has a successful enterprise. However, it was not possible to determine his economic position.

Characteristics of The Enterprise

Labor. Kwanu's workshop is very much a family affair, comprised of sons, nephews, grandchildren, and brothers-in-law. Two of the four masters (i.e., salaried positions) are close relatives. One of the two is the son of Togbui Kordah (Chapter VI). Together Kwanu and Togbui made the cassava grater for the first Anloga-Kumasi processing center.

A glance at Table 7.1 shows that Kwanu enjoys an enviable labor position among the workshops listed. What is not revealed is that unlike the masters and apprentices of Suame workshops, those working with Kwanu are better educated. They have at least completed Middle School and in most cases have attended vocational technical courses.

Product Selection. Kwanu makes many of the same products as the Suame workshops (Table 7.1). In addition to the standard processing equipment, Kwanu offers a rather complete line of forged or welded

tools and implements.[2] The shift of emphasis to food processing equipment was the result of customer demand. He stated that since 1981 orders for cassava graters have risen dramatically; and since 1983, the number of screw presses leaving the shop has been higher still. Unfortunately, Kwanu does not keep records and found it difficult to speculate on numbers--a result no doubt of fear of taxation.

Bottlenecks to Production

Supply of Materials. Cost and supply of appropriate raw materials were Mr. Kwanu's major constraints. He explained that although lack of machines was high on the list, it does not surpass scarcity of materials. According to Kwanu, in the absence of machine tools one can always use manpower to fabricate an order; but without raw materials, there is no business. In addition to the scrap suppliers in Suame, Kwanu is supplied by jobbers who specialize in locating hard to find materials. These services are expensive.

Credit. Kwanu did not specifically mention credit. He has used cash and no-interest loans from relatives to purchase machine and hand tools. Kwanu has a comparatively better tool endowment than nine of the ten Suame workshop owners, but less than that of SIS (Table 7.1). Unlike entrepreneur B, Kwanu did not receive assistance in acquiring his major machine tools. Kwanu's tool endowment is the result of personal investment accumulated over decades of business.

Sales. All orders are on commission basis, with a 50 percent cash advance paid the day of ordering. As is typical of the processing equipment industry, sales are to individuals or households. Intermediaries are rarely customers. Kwanu's only complaint was that customers occasionally cancel orders after the deposit has been tied up in materials. This presents a cash-flow problem, and is a complaint common to the survey workshops.

Case Study: SIS, Engineering, Ltd.

History of the Firm

From its inception in 1969, SIS has grown into perhaps the premier small-scale equipment manufacturing firm in Kumasi. The Technology Consultancy Centre has influenced the growth and development of SIS from the early years. TCC assisted SIS in procuring several machine tools and in identifying product lines. In terms of both product quality and business organization, SIS stands out among the survey workshops. This growth has been measured and gradual, as would be expected of a productive enterprise working within the context of an

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[2]For example, hoe blades, charcoal pots and bedlocks. He also makes his own hand tools and workbenches.

uncertain economic environment. However, through good management and a reputation for quality backed by service, SIS grew from a manufacturer of physics laboratory equipment operating out of a garage, to a limited liability company (1983) employing 15 people. It is located in the light industrial area of Anloga-Kumasi.

Employees Well Educated

The Directors of SIS are brothers. By Kumasi workshop standards they are extremely well educated: the managing director has the equivalent of a university degree in engineering, and the director, a university degree in accounting (Table 7.1). In addition to his responsibilities at SIS, the managing director is also an administrator and instructor at the Kumasi Polytechnic Institute. The other senior staff have either completed or were attending the Kumasi Polytechnic Institute or Kumasi Technical Institute. Thus, SIS and Kwanu both have a comparatively better educated staff than the Suame workshops. SIS, however, has the advantage in technically trained apprentices, with four of the eight attending Kumasi Technical Institute. Therefore, the quality of SIS products is in large part attributed to the emphasis on education and qualified supervision.

Product Selection

Like the other workshops surveyed, SIS's current product line reflects consumer demand. Initially SIS manufactured wooden products such as resistance boxes, soap molds, and weaving looms. Diversification into metal products followed in the mid-1970s. The decision to shift product focus was primarily economic, and based on the comparatively high cost of skilled carpentry labor and storage space for lumber and finished products. One of the first metal products was a saw bench.

Until SIS began manufacturing it, the saw bench, an import, was available only through retail shops, and was priced beyond the means of all but a few carpentry workshops. The saw bench proved enormously successful. For Anloga workshops the saw bench increased both labor productivity and timber utilization. For example, veneer-log cores of primary export species could then be sawn into boards, from which are made high quality furniture. Prior to the widespread availability of the saw bench, these log cores were converted to charcoal--a tremendous loss of potential revenue and employment. SIS estimated that by October 1985 over 100 saw benches had been sold. The benches have been informally exported to Ivory Coast, Togo, Burkina Faso, and Nigeria. The departure from wooden to metal products transformed SIS.

Food Processing Equipment

The first food processing equipment manufactured by SIS was a corn mill in 1974. Demand for the corn mill has remained strong: it is the only machine SIS routinely manufactures in advance of orders. In this respect SIS is similar to the other workshops surveyed. The array of food processing equipment has grown over the years. It is apparent Kumasi workshops produce a range of equipment. The only specialist is proprietor F who makes only pepper/tomato mills. Proprietors J and E have only recently set up their shops, and J is primarily a foundryman and not a fabricator.

Gari Equipment: Grater. SIS produced its first cassava grater in 1975 for a gari processor. It was a drum grater and was based on an imported model. Over the years design modifications have been made. The prototype drum grater has given way to a disc grater. Aside from appearing more streamlined and compact than the drum, the disc grater was designed to make it easier to operate. For example, cassava is simply dumped into the hopper and is fed across the rasping surface by gravity. However, operation of the drum grater requires more effort. SIS also claims the rasper of the disc grater is easier to replace than that of the drum.

Gari Equipment: Screw press. The demand for the screw press has remained strong since the first was made in 1983. SIS estimated that from September 1984 to September 1985, over 130 screw presses were turned out--all by SIS apprentices (Plate 9). The directors of SIS use the screw press as an incentive to encourage income earning among the apprentices. It is a simple machine with a high profit margin. SIS provides free access to equipment; the apprentices are free to take as many orders as they can on the condition that they work on the presses only during off hours, and supply their own raw materials (iron bar, wood and welding rods). All revenues from the sale of the screw presses accrue to the apprentice. During the survey period, a press cost 800-1,200 cedis, depending on diameter of bar used. Net profit ranged from 250-400 cedis. Thus, the incentive program had the three pronged effect of improving the availability of processing equipment, increasing the apprentices' skills, and providing apprentices income which was dependent on their own initiative and at a low cost to SIS.

Growth in Demand For Food Processing Equipment

According to SIS directors, the growth in demand for food processing equipment stems from the 1982-84 food crisis. At that time high prices attracted investors and people were eager to invest in food processing equipment. As expected, the sale of gari equipment and corn mills was brisk. Many new entrants were not prepared for the comparatively low profit margin and long daily work routine required for the processing industry. As soon as the food supply situation began to improve in late 1984, the interest in food processing began to wane. For SIS this decline meant cancellation of orders. However, the

director was quick to point out that this fall in interest was probably among the group of entrants who were not prepared to invest hard work and effort along with their money. The message was clear: only the strong survive.

In an effort to help chart the course for entrants into small-scale businesses, the director has written a manual titled, "Growing from a Small Beginning," which provides advice on all aspects of setting up and managing a business (2). This manual was prompted by the experience SIS had with customers who subsequently failed in business. One of the more memorable experiences involved a customer who ordered a medium-scale gari factory. SIS designed and fabricated a mechanized system complete with graters, roasters and gari graders. The system was technically more advanced than anything found in Anloga-Kumasi. The owner had adequate capital and owned a three-ton truck and pickup truck. However, he abandoned gari processing, claiming there was not enough money in it. Excuses given ranged from inability to organize a steady supply of cassava to low margin of profit. According to SIS, the problem was that the man wanted quick profit without devoting attention to daily business operations--in short, a lack of entrepreneurial ability.

SIS: Characteristics of Success

SIS prides itself on the consistently high quality of its products. Three characteristics were cited by the directors as contributing to their firm's success: economy of design, development of labor potential, and after-sales service.

Design. Although most processing equipment is based on imported models, the technical challenge of modifying the design of a product in Ghana is extremely great. To a large extent all Kumasi workshops must modify designs to make use of the available scrap material. However, no firm does this as well as SIS. Some of their designs are improvements on imported models. Over the years, the trend in design at SIS has been from bulky to streamlined. This is the area in which the managing director's skills as an engineer are put to use. As he put it, SIS is striving for the "Japanese model," i.e., a well engineered machine. Plate 9 shows the managing director making a template for a manual grater he designed. That these designs are successful is evidenced by the fact they have met with customer approval. Customer complaints quickly bring to the workshop's attention any design or construction faults. During the study period repairs were made only on equipment made at other workshops.

Two features of an SIS product are the shaft, and the bearing housing assembly and pulley. The managing director stated that there is more to a cassava grater than sturdy appearance. The shaft on which the grating disc (or drum) is affixed must be true. Otherwise the grater will break apart. The only way to ensure trueness is to mill the shaft on a lathe. However, the machines used in gari processing,

and basic food processing in general, are not of high precision and therefore allow a comparatively wide tolerance. In an effort to cut costs, some workshop owners use poorly milled shafts. These usually don't present problems until after the machine has been in use at the site. One shaft brought to SIS for repair was unmilled and had been joined from two pieces--it was irreparable. The managing director suggested that customers must become more quality conscious before such practices and low standards are eliminated.

The other feature is the bearing house assembly and pulley. Either bearings or bushings are used to reduce friction of the rotating shaft. SIS prefers bearings because they are relatively easy to replace. In the other workshops surveyed the bearing housing is fabricated from scrap and welded to the machine; the pulley is salvaged from other machines. At SIS the housing is milled and fitted with countersunk screw caps to facilitate removal of worn bearings. The pulley is milled as well. In four of the cassava graters examined during the research period, access to the bearings had not been provided, and the graters would have to be broken apart to replace worn bearings. How, then, does a poorly designed, poorly fabricated machine find a market? Obviously the demand for machines outstrips supply. It is likely that SIS's commitment to high standards will spread through the apprentices who leave to set up their own workshops. However, until economic conditions improve, the irregular supply situation will encourage poor design and therefore poor machine performance.

Development of Labor Potential. The commitment to training apprentices is clearly in evidence at SIS. Compared with the other workshops, SIS is in a superior position with respect to machine tools. Therefore, apprentices and master technicians alike are able to develop technical competence in a wide range of workshop tasks. Interviews with the apprentices revealed two reasons for their decision to apprentice with SIS: the superior equipment endowment, and quality of on-the-job training. The apprentices indicated that friends who had apprenticed elsewhere were less busy and relatively unchallenged. At SIS, they stated, the master technicians and directors always had work for them. In large part, the flurry of activity at both SIS and Kwanu's workshop is a result of their capability to machine and fabricate--in short, to make equipment under one roof. The Suame workshops, with one exception, had to send out their orders for shafts and pulleys.

The notion of quality control is instilled in apprentices early on. Whether they are training as machinists or fabricators, their work is inspected by the appropriate master technician. Unless the workmanship meets with their high standards, it does not leave the shop. The same adherence to high standards is not observed at all workshops. It follows that most apprentices will develop their skills only to the extent that they must meet with the master's approval. Beyond a certain level, skill is unnecessary because processing machinery is inconsistent, lacking a standard of quality. For this reason almost any machine can be sold, regardless of appearance or mechanical

efficiency. If the machine breaks down the customer simply brings it back to the shop for repairs. Thus, the quality control standards of SIS are indeed unusual for the industry of Kumasi.

After-Sales Service. Like workshops I and B, SIS provides after-sales service. Free installation of equipment is included if within the Kumasi metropolitan area. This helps to ensure that customers will know how to properly operate and maintain their equipment. SIS is in a better position than other workshops to offer these services because both directors have automobiles.

Constraints to Production

Raw Materials. SIS procures its materials from many of the same scrap jobbers used by the other survey workshops. Uncertainty of materials and consumables such as welding rods is a primary constraint. From a business perspective one wants to maintain a constant, reliable source of materials; but, in Ghana, the economic situation encourages impulse buying of scarce materials and supplies, and thus wreaks havoc on business planning.

Pricing Policy. The common policy of 50 percent deposit has evolved as a hedge against inflation. Problems arise when customers do not return on the agreed upon date to pay the balance and take delivery of their machine. This, of course, places demands on storage space, and, if the customer is very late, results in the loss, in real terms, of net income. SIS manages this by holding the finished equipment for only so many weeks after the due date before selling it to the next customer. This maintains cash flow and keeps the shop free of equipment. On one occasion during the survey, an irate customer demanded his cassava grater, after being delinquent more than 15 months. During that time, inflation in Ghana had proceeded apace at 87-100 percent, and the cost of the grater had increased by 45 percent. This person took delivery of another grater the next week; he paid the balance due at the old rate. Thus, customer irresponsibility can be a problem. SIS has attempted to lessen their risk by interviewing the customer carefully before accepting the deposit.

Looking Into The Future

Kumasi's small-scale equipment manufacturers have responded to the demand for food processing equipment. Despite a scarcity of raw materials and machine tools they have turned out equipment that increases the availability of processed food. The gari processing equipment is a case in point. The workshops have demonstrated their ability to adapt the design of imported models to utilize locally available materials.

Improved Design of Equipment

SIS is an example of a workshop actively seeking to improve the design of machines for gari processing. In addition to the disc cassava grater and manual screw press, SIS has developed improved versions of a manual roaster and a manual grater. They have also provided consultative services to entrepreneurs and village associations interested in setting up gari businesses.[3] In part, their ability to provide these services is a result of an exceptionally well educated staff equipped with a comparatively superior endowment of machine tools.

Access to Machine Tools

For the other workshops in Kumasi to achieve SIS's level of attainment they must have access to machine tools. However, as the owners indicated, these tools are beyond their means and credit is not readily available. Organizations such as the Technology Consultancy Center can help selected entrepreneurs acquire these machines, but resources are limited and only a few can be assisted. More than any other cause, the inability of the small-scale industrialist to obtain capital equipment thwarts growth and development.

Access to Spares and Raw Materials

All workshops need access to assured supplies of raw materials and spare parts. In this regard, they are on equal terms. From SIS down to the least sophisticated workshop, the scarcity of materials weighs against them. Thus, for workshops to continue to meet the demands of small-scale food processors, they need assistance in procuring spare parts and materials. As of October 1985, the private retail shops and governmental stores were beginning to stock these supplies; however, the cost was high. Until private enterprise can fill the demand, the government could ameliorate the situation by importing standard sizes of sheet metal and angle iron. Small-scale manufacturers could then focus on workmanship rather than on procurement of materials.

Standard of Excellence

Given its commitment to product quality and apprentice training, SIS stands as an example for other small-scale entrepreneurs in the Kumasi area. The extent to which other workshops are able to emulate SIS depends on their access to machine tools. Although the processing equipment produced in Suame and Asafo may not operate at the same

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[3]SIS was a consultant to an International Labor Organization project in Antoa, Ashanti Region, and Damango, Northern Region. Both sites have chosen gari processing as target activity.

efficiency as SIS or imported models, they help to satisfy the demand for equipment and conserve foreign exchange. In Ghana the emphasis has been on numbers of machines, not on whether the machine operated as efficiently, or was as presentable as the imported model. As long as the price was favorable there was a market for it. With SIS, a local standard of excellence has been introduced. Improvements in design and construction technology developed at SIS will probably spread to Kumasi's other workshops. It is likely that area workshops will improve as labor becomes better trained and access to machine tools increases. Clearly, the basis for local productive capability has been laid.

CHAPTER VIII
THE GOVERNMENT'S ROLE IN PROMOTING SMALL-SCALE ENTREPRENEURSHIP

The importance of government policy reform in agriculture became evident during the African Food Crisis of the early 1980s. Among the commonly recommended changes have been adjustments in pricing policy for both exchange rates and agricultural producer prices, transfer of some public sector responsibilities to the private sector (e.g., bulk commodity hauling), and reform of taxation and administrative controls to provide more equitable treatment to small-scale businesses. The experience in Ghana suggests that individuals can and will innovate in response to price incentives. High prices for both cassava and gari in 1982-84 stimulated interest throughout the marketing chain, from producer to processor to equipment manufacturer. The examples of the Anloga-Kumasi and Techiman gari industries indicate that entrepreneurs can contribute to agricultural development even with only minimal government encouragement. It has been suggested that the best encouragement is a neutral policy environment that minimizes harassment and regulation of small-scale businesses (53, pp. 34-40; 10, pp. 24-30; 38, pp. 27-39).

This chapter examines the role of government in promoting entrepreneurship. The advantages of improved technology are discussed in view of likely trends in demand for gari. High cost of improved processing equipment is considered along with its impact on ownership, group organization, and employment. The chapter presents a list of recommendations to guide formulation of government policy, and concludes with a brief description of the Technology Consultancy Centre's (TCC) approach to developing entrepreneurship. It is suggested that this could form the basis of an effective national strategy for promoting technological change at the grassroots level.

The Advantages of Improved Processing Technology

Improved technology is characterized by high volume output. For gari, improvements in processing technology imply increases in the amount of gari produced per person per unit time. Enhanced availabilities of calories certainly are necessary to feed Ghana's rapidly growing urban areas. The approach of focusing on processing and marketing rather than on increasing production is eminently sensible. However, these additional calories must be made available at the lowest possible cost. In this regard, the appropriate scale of technology must be assessed carefully.

For the processor the obvious advantage is time freed for other activities. In the case of full-time urban processors, the additional time was invested in increasing gari output and therefore net income. Rural based part-time roasters would have more time for gari marketing or farming activities. For certain villages the adoption of improved

technology would mean that some proportion of part-time roasters would become full-time gari processors.

Future Demand for Improved Technology.

Gari Demand. Demand for technical improvements in gari processing is in large part dependent upon consumer demand for gari. The food crisis of 1983 encouraged speculation and growth in the gari industry. This demand undoubtedly will be sustained in view of Ghana's natural population increase and rapid urbanization. The World Bank projection for average annual population growth in Ghana for the period 1980-2000 is 3.5 percent. The urban centers, with almost 40 percent of total population, are and will remain the major growth area for gari demand (55, pp. 210-216). It is unlikely that the urban poor will be able to command a more expensive diet than that based on cassava and cassava products. Food security problems in the northern regions of Ghana will also maintain the demand for gari at high levels. Unless food production and distribution can recover the ground lost from 1974-85, it is probable that demand for gari will increase throughout Ghana. Consequently, the indicators suggest that future demand for gari will justify improvements in processing technology.

The Likely Technology for Diffusion. Increased demand for gari does not necessarily lead to improvements in technology. Cost of equipment is also a primary consideration. Firms such as SIS, in Kumasi, and AGRICO, in Accra, possess the capability of manufacturing almost any scale of processing system, from motorized grater and screw press to a mostly mechanized eight machine system.[1] Both have the engineering capability to design even more sophisticated gari plants. Nevertheless, it is likely that diffusion of the comparatively simple technology of mechanical graters and manual screw presses will have the greatest impact on gari availabilities in Ghana in the foreseeable future. This is attributable to the high capital cost of the AGRICO System, more than ten times that of the motorized grater and screw press system. Moreover, as Plate 5 illustrates, labor for gari processing is relatively cheap, coming from younger children who contribute significantly to daily production. Also, maintenance of the screw press and motorized grater is comparatively simple.

Ownership of Improvements. As the Anloga-Kumasi case studies reveal, ownership of mechanized improvements such as cassava graters is usually not in the hands of processors. Moreover, when mechanical power is introduced, men enter the traditionally female dominated industry. This trend cannot entirely be explained by the high cost of mechanized equipment, or, as Williams states in her study of gari innovations in Nigeria, by the male tendency to seek out improved

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[1]The AGRICO System includes a motorized peeler and gari sorter. In 1985 the system cost 750,000 cedis. It has a suggested daily production rate of 20 cocoa sacks of gari. See Chapter 5.

income-earning opportunities (51, pp. 255-256). Rather, it is probably a combination of these and other factors. At issue here is whether ownership by someone other than the processor is a desirable condition.

One conclusion of Chapter VI was that under certain circumstances separate ownership is beneficial to both processors and owners--it is an example of business specialization. In exchange for a flat milling fee, the processors are assured of uninterrupted milling service. It was also suggested that ownership of cassava and marketing access are perhaps more important in terms of processor's income than ownership of machinery. Furthermore, all processors owned the simple, yet efficient, manual screw press. This is why the level of technology employed by Anloga-Kumasi case studies seems most appropriate for widespread diffusion: the equipment manufacturing base is broadening; the technology is comparatively simple and easily adapted to local conditions; and processors find part of the improved equipment affordable.

Group Organization. In order for mechanization to pay acceptable returns to owners, machine utilization must be high. One way to encourage high utilization is to locate the cassava grater in a concentration of gari processors. However, location alone is probably not enough. Group organization is arguably a necessary concomitant for maximum use of machines. In this regard the example of Anloga-Kumasi processing centers is instructive. Under the leadership of the secretary, the group achieves comparatively high labor productivity by commanding a constant and large supply of cassava which they process with mechanical grater and manual screw presses. The gari processing groups are assisted in their efforts by the cassava contractor, who perhaps constitutes the sine qua non of urban-based gari production. Thus, these processors demonstrate how joining forces ensures a regular supply of cassava and a ready market for gari.

The question remains, however, why these groups have not pooled their resources to purchase mechanical graters. The cultural argument that mechanization is men's work holds only partially; one grater in Anloga is owned by a woman, although she is not a gari processor. In Anloga, the constraint to group ownership appears to be lack of access to land on which to establish a processing center. Although the mechanical graters in Tuobodom and Asuoyi were owned by nonprocessors (men in both cases), there is no reason other rural groups of processors would not jointly invest in improved technology. Thus, one could expect widespread adoption of technical improvements, at least at the level of technology described by mechanical grater and manual screw press.

Impact on Employment. The danger of technical improvements is that in achieving the goal of increased labor productivity, job displacement and unemployment may result. However, as Jones and Akinrele state in their survey of improvements in cassava processing in Nigeria, the danger of displacement is greatly reduced when "increased productivity leads to increased output of product rather than to

reduced inputs of labor" (31; p. 30). Clearly, the processing centers of Anloga-Kumasi greatly increase both overall availabilities of gari and per person productivity. Moreover, assuming an increase in gari consumption no greater than projected population growth rate (3.5 percent per year), it is highly unlikely that the availability of even the comparatively mechanized AGRICO gari system would result in much labor displacement. This is because the AGRICO system is very expensive and the adoption rate likely to be low. Thus, mechanization of gari processing in Ghana should on balance lead to increased inputs of labor.

Government's Role in Encouraging Improved Technology

In an effort to address the sadly deteriorating economic conditions in Ghana, the government in 1983 embarked on the Economic Recovery Program (ERP). The principal focus of the ERP has been self-sufficiency in basic foodstuffs in the medium term. Included in the 1985 Budget and Food Policy statement is a call for improved storage and processing facilities. This is where small-scale entrepreneurs can and will be expected to contribute. The response of farmers, food processors, and food processing equipment manufacturers to the increased demand for gari during 1982-84 came about largely without government support. It was encouraged by the government only to the extent that the price of gari was not officially controlled--at most a passive encouragement. However, Ghana has clearly set food self-sufficiency as a national priority, and the government has indicated a willingness to strengthen the processing subsector (19, p. 22). The question is what should be the role of government in stimulating local capacity to process food and encouraging improved technology? The following considerations are intended to help guide formulation of policy.

Assisting the Producer

Production of agricultural commodities is basic to national development. With respect to cassava production, government has only begun to assist the producer. Improved, disease resistent cultivars have been introduced on a limited scale. However, such intervention takes time. Perhaps the more direct approach of providing effective extension services would benefit those farmers who produce surplus quantities for processing and for market. Of course, incentives must include provision for improved transportation facilities.

Deterioration of Ghana's transport system has handicapped the distribution of production inputs and the marketing of bulky foodstuffs such as cassava (14, pp. 87-89). The extremely high transportation share (42 percent) of the wholesale cassava price reported in Chapter VI indicates that transportation is inadequate. deWilde, in his analysis of marketing problems in Ghana, states that in 1979 the Ghana Private Road Transport Union claimed more than half its vehicles were

inoperable. This situation had probably improved by the end of 1985, although by how much is not known. Government should therefore encourage the transportation sector by either permitting private importation of spare parts and farm vehicles at low duty, or bringing them in through official channels.

Vehicles will remain in service to the extent that both farm and feeder roads are maintained. Attention must be given to road maintenance. At independence, Ghana's extensive endowment of surfaced roads was the envy of Africa. Through neglect and mismanagement the highway system deteriorated badly. Only recently has the government begun to maintain and extend the existing system. Although strides have been made in connecting producing areas with feeder roads, continued work can only improve the situation. More marketed cassava translates into more gari.

Pricing policies have not discriminated against cassava producers. Farm prices reflect the supply and demand situation, and are not controlled by government. This hands-off approach should be continued.

Assisting the Processor

Government will have to determine how best to encourage processors. It has to balance the need to generate tax revenue with the need to promote agricultural development. The present weakened condition of Ghana's cocoa industry is in large part the result of excessive taxation at the producer level. Clearly the campaign to "educate" the processors on the proposed 12,000 cedi flat tax was a failure. It was perceived as a threat and production simply dropped. Small-scale enterprises are encouraged to develop when government regulation and harassment are minimized (38, p. 37).

In order to increase production, government should examine how to encourage group effort; however, it is rather doubtful that cooperative organization would succeed among these individualists. The benefits of group effort are evident in the Anloga-Kumasi case studies. At the very least, the processors will benefit from improvements resulting in cheaper equipment and cheaper cassava. A rational policy of encouraging these entrepreneurs will have a significant impact on the agricultural sector.

Assisting the Manufacturer

It is obvious that it is in Ghana's best interests to encourage the small-scale, informal sector industrialists. Local capacity can be stimulated by importing standardized raw materials, spare parts, and basic machine tools, rather than by importing foreign-made processing equipment.

Occasionally processors may demand imported equipment. Imported cassava graters and integrated gari processing plants were available during the study period. To encourage growth of manufacturing the government should weigh carefully any decision to import equipment which could be made locally. Some cassava graters in Kumasi retail shops were imported privately, and will probably remain unsold because comparable quality is available for less in Anloga-Kumasi. The larger scale processing plants of AGRICO were another matter. Produced in pieces in India and assembled in Ghana, they were imported by the government as part of the Economic Recovery Program. These machines could have been fabricated by certain Kumasi workshops if they had had access to raw materials. At least with respect to the comparatively simple cassava processing equipment, the government should follow an import policy which treats local manufacturers equitably.

The government will have to closely examine the excise tax laws as they pertain to small-scale manufacturers. Incentives should be given to producers of agricultural processing equipment, but at what level? Perhaps the first order of business would be to demonstrate that there is some benefit from paying excise tax. Part of the problem is that small-scale manufacturers are usually too small or poorly organized to deal effectively with government bureaucracies, and therefore find it difficult to obtain supplies linked to payment of tax. During the research period Excise officers attempted to enforce the 25 percent excise tax on equipment produced by manufacturers. The immediate impact of this effort was for manufacturers to withdraw their equipment. They reasoned that because government had not helped them secure loans or procure control-priced materials, they should not have to pay excise tax. In fact, they suggested that small-scale agricultural processing equipment should be tax-free. This seems a sensible argument. In the event government implemented an allocative mechanism for stocking certain raw materials, taxes could be reconsidered but probably along the lines of an income tax.

The informal industrialists want basic machine tools, materials and spare parts. Their counterparts in the gari industry desire improved equipment at affordable prices. Part of the dilemma facing the government and private financial institutions is allocative in nature: with scarce resources how does one decide who gets what? One possible answer would be to focus attention on those who demonstrate entrepreneurial ability; another would be to develop this entrepreneurial ability. The experience of the University of Science and Technology's Technology Consultancy Centre (TCC) holds promise for developing a national strategy to promote technical change at the grassroots level.

Promoting Entrepreneurs: TCC

The TCC was founded in January 1972, with the mandate to promote industrial development in Ghana by making available the resources and experience of the university. Over the years TCC has become synonymous

with the intermediate technology approach to grassroots development. Its main emphasis is on the promotion of small-scale industry by establishing contacts with entrepreneurs interested in investing in intermediate technologies. The approach has been to demonstrate and diffuse improved techniques.

In all its efforts TCC has maintained a commitment to encourage and upgrade the skills of small-scale entrepreneurs. Successful manufacturing firms such as SIS and Suame workshop B have had a long association with TCC. Both are clients of TCC and have benefitted from procurement of machine tools and advice on business management. The other Suame workshops surveyed in this study have been reluctant to approach TCC, in large part because they are skeptical of its affiliation with the university. Thus, the workshops are ignorant of how TCC might benefit their businesses. For its part, TCC prefers to have entrepreneurs approach it, rather than the opposite. This practice apparently separates the serious from the nonserious inquiries. However, as the study drew to a close, a representative of TCC visited the survey workshops to explain the services and facilities they offer. Two features of TCC's approach are the Pilot Project and the Intermediate Technology Transfer Unit (ITTU).

The Pilot Project Approach. The objective of the pilot project is to determine the appropriate degree of smallness for a target industry under actual commercial conditions. This is accomplished by reducing the scale of industrial production techniques (both organizational and technical) to the point they remain competitive with large-scale industry. Once the process is worked out, it serves as a model for diffusion to interested entrepreneurs. An example of a pilot project which has benefited nearly all manufacturing workshops is equipment for small-scale soap making plants. This equipment has been copied and fabricated by eight of the ten workshops.

Intermediate Technology Transfer Unit (ITTU). The TCC established the first ITTU at Suame Magazine in August 1980. According to Director John Powell, it was the first of its kind in the world. The second, at Tamale, Northern Region, had not yet come on line by the end of the study period. The ITTU is the extension arm of TCC and consists of several workshops and production units demonstrating technologies developed or adapted to local conditions by the TCC. Among these technologies are steel bolt and nut manufacture, plant construction (welding and steel fabrication, e.g., soap making units), and ferrous and nonferrous metal casting.

The purpose of the ITTU is to stimulate the diffusion of both new and proven manufacturing processes and products. This is accomplished by providing advice on technical and economic aspects of business, on-the-job training, access to hire machine tools and equipment for those entrepreneurs who have not yet acquired them, and access to purchase machine tools and equipment. It is perhaps the last point which most interests the Suame workshops.

Plate 8 shows Yao Atinga (Suame workshop J) casting a corn grinding plate. Metal casting is an example of a technology TCC earmarked for development. Until selected by TCC, grinding plates were either imported (and priced exorbitantly) or locally cast and consistently poor in quality. Mr. Atinga, a traditional metal caster from northern Ghana, availed himself of the ITTU's technical expertise and production facilities. The result was a quality grinding plate priced below imports. By the end of 1985, Atinga had set up his own production facility in Suame.

Although the scale of this project is small, the potential for metal casting is enormous. Casting is a prerequisite of industrial development. This is just one example of the TCC/ITTU approach to a demonstration pilot project that increases local manufacturing capability and conserves foreign exchange. Over the years, the TCC has had considerable impact on productive capacity in Kumasi's small-scale industrial sector. For example, from 1972 to 1983, TCC brought 21 lathes and 44 other machine tools to Kumasi (41, pp. 2-4). The ITTU engineering workshops established by TCC have produced a variety of equipment and basic plant that previously could only be obtained through imports. Thus, TCC has a wealth of experience in promoting small-scale productive enterprises. It seems sensible, given its success, to encourage a direct linkage between the ITTU and governmental effort to bring about economic development from the ground up.

The Link Between TCC and GOG

A national strategy of small-scale industrial promotion involving TCC would place a tremendous burden on its existing resources. Therefore, in the medium and long-term, additional ITTUs should be established. In the interim, however, TCC and the ITTUs should continue identifying and developing economically viable small-scale technologies, such as the ferrous foundry. These technical processes should then be adapted to the specific needs of small-scale entrepreneurs, such as metal caster Yao Atinga. Thus, the current structure of the TCC could be expanded to reach greater numbers of entrepreneurs.

Those involved in or considering the processing industry should receive advice on business organization and selection of technology. It is conceivable that the TCC Client's Association could develop into a business advisory board in its own right. Hopefully, the SIS manual "Growing From a Small Beginning" is indicative of the support forthcoming from fellow entrepreneurs.

For the Suame entrepreneurs engaged in processing equipment technology, the appeal of assistance would derive from obtaining machine tools. These small-scale industrialists stated flatly that they did not require technical or business assistance; what they needed were machine tools. In this regard they are probably typical of the majority of workshop fabricators throughout Ghana. The problem lies in deciding who has the greatest potential for utilizing the productive

capacity of an imported machine tool and thus merits assistance. A TCC-GOG board could help screen applicants for government-procured machines or bank loans, to ensure that scarce resources are used productively.

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Entrepreneurs in Ghana's food processing subsector have begun to transform the gari industry. Technical change has resulted in both increased labor productivity and increased gari output, as well as improved employment and income opportunities for gari processors, equipment manufacturers, and the principals involved in cassava marketing. These entrepreneurs have demonstrated that the urban informal sector has an impact on agricultural development and on increased availabilities of calories to urban centers. The government should be at pains to help rather than hamper them.

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APPENDIX
RESEARCH METHODOLOGY

The focus of this study was the impact of technical innovations on the gari processing and marketing channels in and around Kumasi, Ghana. Of special interest was the role of entrepreneurship in bringing about technical change. This study examined the roles of the principal figures involved in the cassava marketing and processing: cassava farmers, intermediaries, processors, retailers, and processing equipment manufacturers. The research period was from 6 June - 9 October 1985; certain projects were continued by research assistants through the end of November 1985. Funding for the study was provided by the Postharvest Institute for Perishables, University of Idaho, Moscow, Idaho.

Daily activities of gari processors were followed closely throughout the research period. Case studies were made of four high-volume processors in Anloga-Kumasi. These women use the technological improvements of the motorized cassava grater and the manual screw press. Three of the women were leaders (secretaries) of large, organized processing units. The fourth was an independent, but had been a secretary in the past. The independent was included to determine if independent status had an effect on production. The case studies were distributed spatially throughout the borough of Anloga. This was done to see if location had an impact on volume of cassava delivered to site. The findings indicated it had none. One surprising finding was that the supply area for Anloga extended for over 125 kilometers, and was not limited to the cassava belt surrounding Kumasi.

Another Kumasi gari processor was followed to see if choice of technology had an impact on gari business. This processor did not use the manual screw press. She was identified as a transitional technology processor. Also, she was an independent processor. Business organization proved an important factor in gari production, especially the delivery of cassava to the processing site. A study was made of a processor who used only manual equipment--the traditional method. Data for this processor were recorded for only four weeks.

In the case studies of Kumasi processors, daily visits were made by the author and three enumerators to each site. At least five hours each day were spent in Anloga-Kumasi observing and discussing with processors the gari operations underway. Interviews were in English and in Ewe (through the enumerators) and in Asante Twi. After my departure, 9 October 1985, daily production data for the Kumasi-based processors were collected by research assistant Albert Pappoe, Dept. of Housing and Planning, University of Science and Technology.

To gain a clearer understanding of the cassava delivery system supplying the case study processors, ten field trips of five days each were made with intermediaries (cassava contractors) to the supply area

of Brong-Ahafo. The author accompanied two enumerators on one such trip. During these trips interviews were conducted with cassava farmers, gari processors, market retailers, bulk assemblers, transport owners, village chiefs and Ministry of Agriculture officials.

Interview questionnaires were administered to cassava farmers in their villages and in the Techiman Market, from 15 August - 25 September 1985. Questionnaires were also given to gari intermediaries involved in the long-distance trade with northern markets. The findings indicated that Techiman gari (a relatively recent and growing phenomenon) penetrated many of Ghana's northern markets, and even Burkina Faso. Therefore, research assistant Sam Nyarko, Principal Technical Officer, Food Research Institute, Ghana, was sent on a survey of markets throughout northern Ghana, 15 October - 15 November 1985. His findings corroborated what the assemblers and other intermediaries had said: Techiman gari is found in most markets. Nyarko also reported that cassava is being grown across Ghana's Northern Region and in some isolated areas of the Upper West Region. In short, the range of cassava has extended northward.

Villages in the Techiman area were visited where gari is becoming a commercial concern. Interviews were held with mill owners, processors, and in one instance, an equipment manufacturer. These visits form the basis of the projection that Techiman area is a growing supplier of distant consumers.

To gain a better understanding of the role of equipment manufacturers a survey was made of Suame Magazine workshops. Ten workshops were found to produce food processing equipment. Interviews (with questionnaires) were conducted with each workshop owner. Interviews were in English and Asante Twi. The author and an enumerator made several return visits to each workshop throughout the study period.

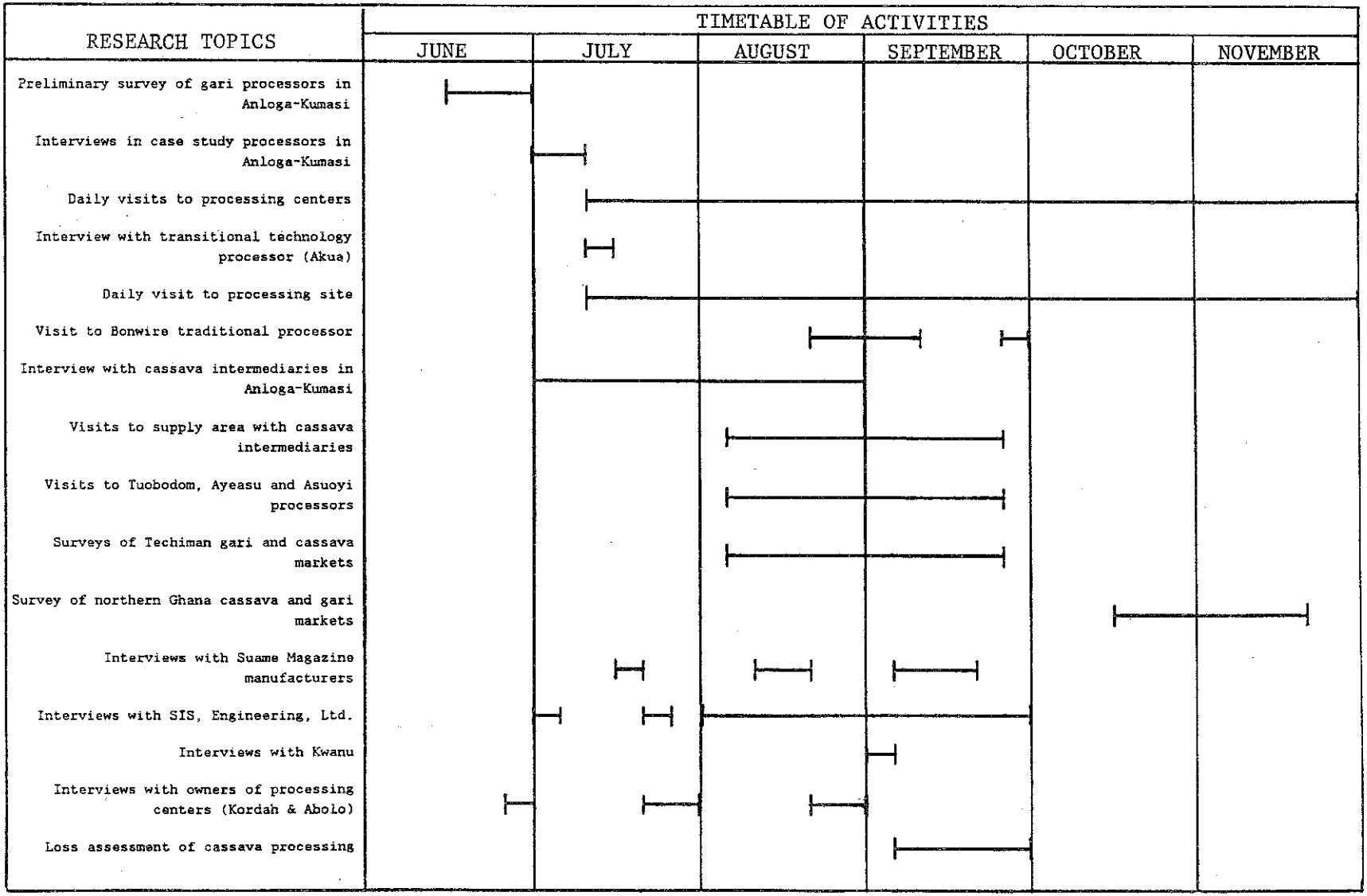
One Anloga-Kumasi workshop was selected as a case study. Daily visits were made to the workshop. Interviews were conducted in English with the workshop Directors and staff. Visits were made with the Director to install equipment and to consult with villagers on gari processing equipment.

Surveys were made of cassava and gari markets in Techiman, Kumasi, and Accra. These were informal checks of supply on hand, origin, and method of processing (for gari). The survey of Kumasi Central Market was undertaken by an enumerator who spent the entire day in the Asawasi cassava section from 15 to 27 September 1985.

An assessment of loss of cassava at the various steps of the marketing and processing chain was made by Sam Nyarko, FRI, from 4-30 September 1985. All weights were measured with Salter 30- and 45-kilogram spring scales.

The following is a subject reference and timetable of how the research period was apportioned:

APPENDIX A. RESEARCH SUBJECT REFERENCE AND TIMETABLE, 1985



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