African Rural Social Sciences Research Networks

# Issues in African Rural Development 1991: Summaries

Winrock International Institute for Agricultural Development
1993

**African Rural Social Sciences Research Networks**



Winrock International Institute
for Agricultural Development
1611 N. Kent Street, Suite 600
Arlington, VA 22209, USA

Reprints of the papers summarized in this volume can be obtained by writing to the above address.

ISBN# 0-933-595-87-5

B

## FORWARD

This collection of summaries represents research from the first two rounds of the African Rural Social Sciences Research Networks program sponsored by Winrock International and funded by the Ford Foundation and the US Agency for International Development. The research was conducted by African social scientists under a small grants program designated for the study of African rural development issues and problems.

The program has served to establish networks of African scholars in the rural social sciences and provides a mechanism for peer review and professional refereeing. The published results have been disseminated to policy making institutions, universities, libraries and other relevant organizations in Africa, Europe and the United States.

The studies were published in full in *Issues In African Rural Development 1991*, edited by Cheryl Doss and Carol Olson, Winrock International 1991. The summaries of the studies have been selected and organized in this volume according to country. They represent a wide range of social science fields and topics, all with policy relevance.

A serious concern in Africa is the large gap between research and the real needs of the rural farmer or household. The studies in this collection reflect efforts by African scholars to close that gap by tackling problems that are relevant to the needs of rural development as well as intellectually stimulating and challenging.

Publications from the Third and Fourth rounds of the African Rural Social Sciences Research Networks will appear as subsequent volumes to the series of *Issues* books. Studies from the francophone countries will be included. The summaries contained in this volume represent the first of a continuing collection of studies in African rural development.

Winrock International is grateful to the Ford Foundation and the US agency for International Development for their support of the African Rural Social Sciences Research Networks and their dedication to excellence in African research and human resource development through African participation.

## TABLE OF CONTENTS

# SOCIAL ACCOUNTS OF THREE ETHIOPIAN VILLAGES: A STUDY OF INSTITUTIONS AND POLICY

Taye Mengistae
Addis Ababa University, Ethiopia

Following the introduction of land reforms in 1975, the Ethiopian government developed a package of agrarian policies to mobilize resources from the countryside for public investment in the socialist industrialization of the economy. The package *wolbanized* village farming and nationalized rural trade and credit. *Wolbanization* is the organization of rural households into units of village-level communal farming known as *wolbas*. As a program of institutional transformation, it has been pursued by giving *wolbas* preferential treatment in credit, agricultural extension, taxation, and marketing. In addition, government policy has attempted to render smallholders economically marginal. The program for nationalizing rural trade has been limited to a 10-year-old scheme of compelling grain delivery at government-fixed prices that are well below those offered in local free markets.

The government has announced that it intends to abandon the compulsory grain-delivery scheme and the smallholder-marginalization policy. This action is a belated response to widespread criticism that its marketing policy has drained too many resources from the countryside and, together with *wolbanization*, has dampened activities and investment in villages. This paper attempts to assess the magnitude of resources in the Ethiopian countryside that have been affected by government policy.

The paper is based on a case study of three villages conducted over the 1988-89 crop year. These villages differed little in natural-resource endowment, traditional farming technology, ethnic or religious composition, or proximity to urban areas. However, they differed substantially from one another in degree of *wolbanization*.

Traditional farming technology in all three villages consisted of the grain-plow culture that characterizes the so-called grain-surplus areas of Ethiopia. The villages share a territory extending for some 12 km along both sides of what is probably the busiest highway in Ethiopia; that highway links them to six major urban centers within a radius of 60 km. Thus, the commercial relationship of the villages to private-sector units of the urban economy was stronger than that of most farming villages in the country as was the enforcement of postreform agrarian policy.

Survey data collected in the three villages was used along with data from weekly activities and transaction sheets of selected households to piece together the 1988-89 social accounts matrix of each village. According to these accounts, both smallholders and the *wolba* in each village have been subject to a net

drain of resources to the public sector, although the drain is much greater for smallholders. For every EB 1 of services the government provided to smallholders; the government took out four times as much, mainly through transfers implicit in the grain-delivery scheme. On a per-household basis, village *wolbas* have received twice the amount of government services that smallholders received, buy they too lost EB 1.7 for every EB 1 of services received.

Smallholder net transfers to the public sector stood at about 90% of their investment expenditure and 150% of their spending on consumer goods and services of urban origin. Net transfers from village *wolbas* to the public sector were a quarter of *wolba* investment and 135% of members' spending on urban consumer goods and services. Final demand spending of villagers would have been much smaller, and transfer rates to the public sector correspondingly higher, if it were not for favorable conditions in the local free market for grain. The prices of marketable village products have been pulled above their opportunity costs as measured by accounting prices until villagers have more than made up for their loss to the public sector.

Net transfer figures as read from the 1988-89 accounts fail to capture the full impact of government policy on the village economy. To measure the full opportunity cost of the net transfers, it was necessary to calculate what the levels of village activities and incomes would have been if the government had put back into the villages the exact amount of resources it took out. Each village lost at least EB 2.5 in foregone incomes for every EB 1 of net transfers.

The opportunity cost of net transfers to the public sector was much higher for smallholders than for *wolbas*. It was also higher in villages that were less *wolbanized*. Thus *wolbanization* complements the compulsory grain-delivery scheme in keeping down village activity and income levels by allocating village and government resources to relatively inefficient economic organizations. Although current policy favors the *wolba* in access to village farmland, agricultural extension services, and public credit, income per household is much higher for smallholders than for *wolbas*. The official justification for the policy of *wolbanization*—that it raises the rural populations's average propensity to save—has yet to be demonstrated. The accounts showed that the savings ratio of village *wolbas* was higher than that of smallholders. But smallholders have been forced to finance a large share of *wolba* investment and have been subject to a greater net drain of resources to the public sector. Without these factors, their savings ratio might have been well above that of the *wolba*.

A corollary of these findings is that the villages would have been much better off with a policy revision aimed at a more balanced flow of resources between villages and the public sector and a greater mobility of farm resources within each village. The recent announcement of planned government policy changes may signal such a shift. However, the new policy must be instituted before its effect on the economics of villages can be evaluated.

# THE EFFECTS OF DOMESTIC POLICIES ON EXPORTABLE PRIMARY COMMODITIES: THE CASE OF GHANA AND COCOA

W. Asenso-Okyere
University of Ghana

Over the past few decades developing countries have struggled to raise domestic living standards by experimenting with policies aimed at improving economic growth and stability. Policies pursued over this period have had mixed and often disappointing results. Instead of increased prosperity, many developing countries have been plagued with high foreign debt and balance of trade deficits, stagnating or declining export markets for their primary products, high rates of domestic inflation, an overvalued currency, and an overdependence on foreign imports. Much of the blame for the disappointing rate of economic progress has been placed on the deteriorating terms of trade between developed and developing countries in the exchange of manufactured items for primary products. As a result, solutions to developing nations' economic growth and trade problems have often focused on schemes to either enhance their trade position through creation of cartels or a new international economic order, or insulation from the world market through import substitution policies or formation of preferential trading communities.

This paper argues that it is not just international market problems, but also the misguided and conflicting domestic economic policies of developing countries that are responsible for the economic difficulties which these nations face. Steps such as formation of preferential trading communities or a new international economic order will not suffice to restore or safeguard the economic progress of developing nations until their domestic economic policies are, themselves, in order.

This paper illustrates the strong connections between a developing country's domestic economic policies and the well-being of its export sector by focusing on a historical analysis of Ghana's domestic economic policies and its principal export industry, cocoa.

Cocoa farming was introduced into Ghana in 1895 and rapidly became the mainstay of Ghana's economy. By 1911, Ghana had become the world's leading cocoa producer, exporting about 23,000 tons of the product annually. Ghanaian cocoa production rose to more than 200,000 tons per year by 1947, peaking at 572,000 tons in 1965. This increase was followed by a period of dramatic decline. Production fell by 72% over the next 20 years, to a low of about 159,000 tons in 1984. Ghana's lead in cocoa production was taken over by Côte d'Ivoire and Brazil, and Ghana's share of the cocoa market fell from about 33% to less than 10%.

The dramatic decline in Ghana's cocoa export production between 1965 and 1984 is attributed to low and declining real producer prices for cocoa, the declining price paid for cocoa relative to other crops, the low and declining price of cocoa relative to prices in neighboring countries, the overvaluation of Ghana's currency, labor shortages in cocoa farming areas, and the inadequate marketing infrastructure and limited supply of inputs available to cocoa farmers. Historical data shows that these problems in the cocoa sector arose largely as a result of domestic policies that were first implemented in the 1960s and 1970s.

Policies of the 1960's and 1970's that sought economic growth through rapid industrialization tended, in practice, to overtax the cocoa sector while inducing rural laborers to migrate to better-paying jobs in industrializing areas. They also resulted in the concentration of capital improvements in the urban-industrial sector at the expense of needed transportation, marketing and production improvements in cocoa farming areas. These problems were compounded by policies that increased the value of other crops relative to cocoa and that allowed the accumulation of large domestic and foreign debts, which were then financed by increased cocoa taxes and money creation. In addition, balance of trade deficits led to currency overvaluation, which made imports and merchandise trade more attractive than the production of tradable commodities.

The importance of real producer prices in determining cocoa output is supported by the results of a time-series regression analysis in which Ghanaian cocoa output is estimated as a function of the producer price of cocoa lagged one year and variables representing smuggling incentives, insecticide use, the opportunity cost of farm labor, and the real effective exchange rate of Ghanaian currency. Although only the lagged price variable is found to be significant, the model has a high explanatory power (adjusted correlation coefficient = 0.85) which supports the premise that real producer prices are a key determinant of primary commodity output, even in the short term.

Changes initiated in Ghana's domestic economic policies in the 1980's signal a hopeful trend in the Ghanaian economy. Overvaluation of the currency has been significantly reduced, economic growth as measured by gross domestic product has increased, the rate of inflation has decreased, and real prices received by cocoa producers have increased. Surveys conducted in 1987 indicate that as a result of these positive trends, acreage devoted to new cocoa plantings has risen substantially.

Much progress has yet to be made, however. Ghana is still faced with serious economic handicaps such as a high debt-servicing burden, a lower than desirable economic growth rate per capita, and dependence on a single primary commodity for most of its foreign-exchange earnings. Clearly, there are no quick or easy solutions to these or many other serious economic problems confronting developing countries today. As shown in the case of Ghana, however, developing countries can move a long way toward resolving international trade crises by careful examination and adjustment of domestic economic policies.

# THE ECONOMIC FEASIBILITY OF USING LOCAL FEED INGREDIENTS IN THE LIBERIAN SWINE INDUSTRY

Ernest G. Asante and George W. Cooper
University of Liberia

Current price trends indicate that Liberia's swine industry is in jeopardy unless a practical alternative is found to relying upon expensive imported pig feed. Although some research has examined the feasibility of feeding pigs locally produced feedstuffs, none has emphasized identifying a locally derived pig feed that is both nutritionally complete and less expensive than imported feed.

Local feedstuffs that have potential as pig-feed ingredients include cassava flour, rice bran, fish scraps, brewer's spent malt, corn bran, wheat bran, rubber seeds, blood meal, coffee husks, cassava leaf power, and tropical kudzu leaf powder. After an initial screening, the first six of these ingredients were selected for nutritional analysis. The diet worksheet method was used to determine a low-cost feed comprising these local ingredients that would meet the nutrient requirements of pigs. The results indicated that one such feed would include about 55% rice bran, 20% cassava flour,15% brewer's spent malt, 10% fish meal, a vitamin premix, and salt at a total cost of about $30.90 per 100 kg.

Feeding trials were conducted in 1987 to test the performance of this feed relative to that of imported feed. Twelve male Segher pigs, which were about 3 months old, were divided into six groups of two pigs each. Each group was randomly assigned a different feed combination ranging from 100% local feed to 100% imported commercial feed. At the end of 20 weeks the pigs were slaughtered, and average live weights, dressed weights, dressed weights, and backfat thicknesses were compared.

The lower cost of the locally derived feed contributed to higher gross margins for the pigs that were fed rations consisting of at least 60% local feed. Pigs fed 100% local feed had the highest gross margins at $63.57 for live weight and $77.02 for dressed weight. The lower protein and higher energy content of the locally derived feed resulted in greater average backfat thickness than did the imported feed. Therefore, locally derived feeds such as the one investigated, should be used for finishing only, and grower pigs should be fed a higher-protein ration—such as 60% locally compounded feed and 40% imported commercial feed—for the first 8 wk to 10 wk.

Additional research is needed in Liberia to identify and perfect potential feedstuffs that are, or could be available in sufficient quantities to support a growing swine industry. The results of the feeding trials indicated that the information and technology are available for analyzing the nutrient contents of local

feedstuffs and compounding nutritionally balanced diet for pigs from these feedstuffs that are comparable in performance to imported feeds but are cheaper.

# A CASE STUDY OF TENANCY ARRANGEMENTS ON PRIVATE BURLEY TOBACCO ESTATES IN MALAWI

J. Sinoya Nankumba
University of Malawi

Tenant farming and tobacco production were introduced into Malawi by the British in the early 1900s while Malawi (then Nyasaland was a British protectorate. Since independence in 1964, tobacco has continued to be one of Malawi's principal export crops and tenant farming has remained the predominant land-tenure system in tobacco-growing areas. Despite the importance of the tobacco subsector to the Malawian economy, little research has been conducted on the types of contractual arrangements in force on tobacco estates.

This paper investigates the nature of land-tenure arrangements on Malawian tobacco estates by analyzing the history of the tenant-farming system in Malawi and by surveying 330 tenant farmers and the estate managers of 17 privately owned, burley tobacco estates in Malawi's Kasungu Zone. Special attention is focused on (1) the reasons labor and management choose to enter into tenant-farming agreements, (2) the terms of contractual arrangements, and (3) tenant/management performance, to determine what improvements can be made in the tenant-farming system.

The tenant-farming system evolved in Malawi as a result of the over-privatization of land by the British and the need for cheap labor on British tobacco plantations. Africans with little or no land were encouraged, or forced by economic circumstances, to produce tobacco for plantation owners in return for a place to live, a small share in the sales value of the crop, and a plot on which to grow food.

Today, most of the socioeconomic and legal aspects of tenant farming are still patterned after the British system; the major differences are that most tobacco estates are now owned by native Malawians and managed by hired managers, and tobacco prices paid to tenants are now set by the government rather than estate owners.

It was found that tenant farming appeals principally to Malawians who have some farm background but who desire access to estate land, credit, and production inputs in an effort to raise their standard of living

to subsistence level or above. Estate managers prefer tenant labor over wage labor because tenant farmers (1) bear most of the risk associated with crop failure, (2) are assumed to be more dedicated and reliable workers than wage laborers, and (3) typically have wives and children who add to the labor force available to the estate.

Most tenant-farming contracts are oral; only one estate was found to use a written contract. In both cases, contracts were found to be vague and largely unenforceable by the tenant. No system of impartial arbitration of management/labor disputes is currently available to tenants.

In assessing tenant/management performance under the current system of contractual arrangements, it was found that tenants' 1987 net returns compared favorably with the estimated annual income of an unskilled laborer earning the minimum wage. Nevertheless, tenants surveyed voiced many grievances and their lengths of tenure indicated a high rate of tenant turnover on all but one of the estates surveyed. Notably, the Kanongo/Agra estate has a low rate of tenant turnover, the highest average 1987 tobacco yield, the best housing and provision of social services, and no record of complaints by either tenants or management.

Tenants at other estates complained of unfairness in the marketing of their tobacco, vagueness of contract provisions, and lack of social service amenities such as permanent housing and access to medical facilities and schools. Management at these estates complained principally of high tenant turnover rates which result in lower average tobacco yields and the need to spend more management time in recruitment and training efforts.

It is concluded that the basic terms of the tenant farming contract are beneficial to both tenants and landowners, but that the benefits are skewed in favor of the landowners. Tenants provide most of the labor and bear most of the risk in the production of the tobacco crop, and yet they receive only a fraction of the auction floor sale price, have no job security, are typically provided with poor housing and few social service amenities, and have little leverage in negotiating or enforcing their contracts.

Improving the provisions and enforceability of tenant contracts is justified in the interest of fairness alone, but it will also lower tenant turnover rates and increase yields and profits on burley tobacco estates. For these reasons, the Ministry of Agriculture, which licenses estates to produce specialty crops such as tobacco, is encouraged to pursue an active role in the regulation and oversight of contractual arrangements on tenant-farming estates in Malawi's burley tobacco sector.

It is specifically recommended that the form and content of tenant-farming contracts be improved by making contract provisions more complete, precise, equitable, and enforceable. These improvements will ensure that tenants are

- charged fairly for necessary production inputs and consumer items provided by the estate (no more than cost incurred plus transportation)
- paid fairly for their crop and any other services they provide to the estate
- provided with adequate food, or land upon which to grow food, for family consumption
- provided with adequately sized, permanent housing; ideally iron roofed (financed through loans to the estate, if necessary)
- provided with the means to transport family members to medical facilities
- provided with other social services such as schools, recreation facilities, and on-site emergency medical assistance as practicable

# AN ECONOMIC EVALUATION OF SMALLHOLDER FARMING SYSTEMS IN CHINGULUWE SETTLEMENT SCHEME, MALAWI

Chimimba David Phiri
University of Malawi

---

Agriculture is the backbone of Malawi's economy. Ninety percent of the rural population depends on smallholder agriculture for survival. Agriculture's share of Malawi's gross domestic product was 36% in 1987 (having declined from 55% in 1964 and 46% in 1976). Agriculture contributed 88% of Malawi's total export earnings, although smallholder agriculture contributed only about 30%.

Malawi is divided into eight Agricultural Development Divisions. Salima division has remained the second poorest despite a long history of development projects in the area.

The Chinguluwe settlement scheme in Salima is noteworthy because it includes settlers as well as local farmers. The settlers include Malawi Young Pioneers (MYPs), blind settlers, and migrant settlers. It has been assumed that the MYPs and the blind settlers, who received agricultural training prior to entering the settlement scheme, would act as examples to other farmers within and outside the scheme.

This study compared the performance of the four groups of farmers in the settlement scheme—MYPs, blind settlers, migrant settlers, and local farmers—with respect to resource-use efficiency for the three main crops of the area: maize, cotton, groundnuts. Gross margins per hectare of land were the primary tool used to compare farmer efficiency. The gross margins were calculated as the total value of the crop minus the costs of variable inputs.

The blind settlers and local farmers were significantly more efficient than the MYPs and migrant settlers in maize production. During the survey year, rainfall was poor. However, the extremely poor performance of MYPs and migrant settlers could not be attributed entirely to poor rainfall. The use of expensive fertilizer needed to produce the improved varieties of maize reduced the gross margins. Both MYPs and migrant settlers emphasized cotton production, thus investment in cotton might have taken resources away from other crops.

In cotton production, the gross margins of MYPs, blind settlers, and local farmers were not significantly different. However, the migrant settlers had a significantly higher gross margin than the other three groups. The high gross margins of the migrant settlers could be attributed to good management and to the fact that they favored cash crops (cotton) over subsistence crops (maize).

In producing groundnuts, each of the groups of farmers differed in its resource-use efficiency. It was surprising that the difference among farmers was so large considering that groundnuts require few inputs. However, competition for labor between cotton and groundnuts may have contributed to the poor performances, especially of MYPs and migrant settlers; as with maize, the groundnut crop might have been neglected by these two groups to concentrate on cotton production.

Overall, the gross margins of the blind settlers, migrant settlers, and local farmers did not differ significantly; however, the gross margins of the MYPs were significantly lower than those of the other groups. There was also no significant difference between the performance all of the settlers combined and the local farmers, whether measured by gross margin per variable capital or the gross margins per worker day.

The actual performance in Chinguluwe scheme was compared to the Agricultural Development Division estimates for the entire project of Salima. The blind farmers, migrant settlers, and local farmers matched or exceeded the estimates for groundnuts and cotton. The MYPs were consistently below the estimates, especially for maize and groundnuts.

Although the MYPs had the lowest performance of any farmers in the settlement scheme and surrounding area, the myth that they were excellent farmers remained. This myth may have worked to their disadvantage, since it may have prevented them from implementing extension advice. MYPs could

improve their efficiency if extension workers worked closely with them to ensure that recommended practices were implemented.

Rising fertilizer prices and the eroding profitability of improved maize meant that farmers in the scheme would have been better off abandoning improved maize varieties and concentrating on local maize for subsistence and cotton and groundnuts for cash. Labor released from improved maize production could relieve the labor constraint in cotton and groundnut production. The area released from improved maize production could have been allocated to cotton for MYPs and migrant settlers, to groundnuts for blind settlers, and to both cotton and groundnuts for local farmers.

## FARM ENTERPRISE COMBINATION AND RESOURCE USE AMONG SMALLHOLDER FARMERS IN IJEBU, NIGERIA

A. A. Adesimi
Obafemi Awolowo University, Nigeria

---

Policy makers need a better understanding of the technical and managerial constraints facing smallholder farmers if they are to achieve the crucial objective of increasing the production and sales of staple food crops in Nigeria. Toward this end, survey information was obtained over the course of the 1987 crop year from a total of 60 smallholder farmers who were randomly selected from 4 villages in Ijebu North Local Government Area of Ogun State, Nigeria.

All of the farmers surveyed were married men with children. Most were over the age of 50 and had little or no formal schooling. Farmers relied on traditional tools and cropping practices to produce subsistence food crops on farms which ranged from 0.1 ha to 4.0 ha in size, with a mean farm size of 1.5 ha. Farming practices did not include the use of hired labor, borrowed capital, or mechanized farm equipment.

Farmland cultivated during the study period was devoted to 10 different combinations of 5 staple food crops; cassava, maize, melon, yam, and cocoyam. About 69% of the cropland was intercropped, while the remainder was devoted to segregated stands of cassava or maize. Maize, cassava, or both were planted solely or in combination with other crops on all but 4% of the land cultivated.

A budgetary analysis of per-hectare crop yields, costs and revenues reveals that enterprises which included melon, yam, or both, required the highest fixed and variable cost outlays and provided the highest gross returns and gross margins. Conversely, whether intercropped or grown in segregated stands, maize and cassava required the lowest-cost outlays and provided the lowest gross returns, per hectare. The lowest gross and net returns per hectare resulted from the sole cropping of maize. The fact that farmers did not devote proportionately more of their land to the crops that resulted in the highest per-hectare profits suggests that other considerations, such as food security and the availability and cost of inputs, play a significant role in production decisions.

Linear programming results suggest that one of the most critical constraints to increased farm production is a seasonal shortage of farm labor. Such shortages could be averted by programs which enable smallholder farmers to hire seasonal workers or which facilitate the adoption of labor-saving technologies.

Current farm policy encouraging farmers to adopt sole-cropping practices appears to be misdirected. This study's survey results and budgetary and linear programming analyses add to the growing body of evidence that suggests the intercropping of subsistence food crops is more profitable, efficient, and practical than the cultivation of food crops in segregated stands. It follows that agricultural research should be refocused to center on improving the efficiency and output of mixed cropping practices.

Finally, least-squares analysis of smallholder farmer's allocation of crop output between home consumption and market sales reveals that household income and product prices are key policy variables that could be used to elicit an increased marketed surplus of staple food crops.

## HIRED LABOR ON SMALLHOLDER FARMS IN SOUTHEASTERN NIGERIA

S.A.N.D. Chidebelu
University of Nigeria

---

Nigeria has set the goal of becoming self-sufficient in food production by the year 2000. However, the demand for food has been increasing at a rate of 4% to 5% since the 1970s, while agricultural output has been increasing by only about 2%. Thus, agricultural output must be significantly increased to meet Nigeria's goal.

Lack of labor is the most important constraint to increased agricultural output in southeastern Nigeria. Smallholder farmers used to rely on family members and other unpaid laborers. However, due to the increasing monetization of the economy, decreasing family size, increasing rural-to-urban migration, and increasing schooling of children, smallholder farmers have become dependent upon hired labor.

This study surveyed smallholder farmers and hired laborers. Their socioeconomic characteristics were compared; the current labor situation on the farms with respect to the types of labor used and managerial concerns was determined; and the welfare and living conditions of hired laborers were investigated.

At the time of the survey, 90% of the smallholder farmers that were interviewed used hired labor. Most said they would increase the size of their farms if more laborers were available for hire.

Many hired laborers were working part time while they attended school or a training program. The hired laborers were younger than the smallholders, on the average. The most important reasons people gave for working as hired laborers were that no other jobs were available and they wanted to earn additional money. All of the hired laborers owned farms on which they produced food for subsistence; however, they said their farms were too small to supply all of the food and cash needs of their families. Working as a hired laborer was a means of earning cash. The vast majority of hired laborers said they would rather neither themselves nor their children had to work as hired laborers.

The hired laborers walked long distances to the fields, shared rooms with others, and bought most of their meals from itinerant food vendors. Their wages varied according to the type of work they were doing. Building mounds for yam-based crop mixtures paid more than twice as much as building mounds for cocoyam-based crop mixtures. The laborers complained that the wages were too low, whereas smallholder farmers claimed that they had to pay high wages to hired laborers.

The division between men's jobs and women's jobs has been eroding in Nigeria. Some tasks, such as mound making, still are generally done by men, just as some jobs, such as carrying and harvesting, continue to be done primarily by women. However, many tasks that were formerly considered men's jobs, such as yam tying and yam-barn building, are now being done by both men and women.

Many of the new technologies being introduced into Nigerian agriculture are labor intensive. For example, applying fertilizer not only requires labor to apply the fertilizer but also results in additional labor being needed for weeding. These technologies are being evaluated on the basis of their ability to increase output per hectare. However, since more land is available than labor, these technologies should be evaluated on the basis of output per worker hour.

# EFFICIENCY OF AGRICULTURAL PRODUCTION IN SMALL-AND MEDIUM-SCALE IRRIGATION IN NIGERIA

Saa Dittoh
University of Ibadan

Irrigated agriculture has the potential to relieve many of Nigeria's constraints to agricultural production. Past attempts to develop irrigation have generally been unsuccessful in Nigeria and in most parts of sub-Saharan Africa. Therefore, a deeper understanding of irrigated agriculture is called for. This study compared irrigation systems in two middle-belt states of Nigeria to identify opportunities to increase agricultural production and the productivity of irrigation projects.

Survey data was collected from irrigators—some who were not participating in formal, government schemes and some who were—in seven areas of the two Nigerian states. From each irrigator, information was collected on general socioeconomic characteristics; production activities, including resource use, costs, output, and returns; receipt of technical and credit assistance; and marketing practices and problems.

The results of the study showed that horticultural crops were grown on small irrigated farms averaging 0.82 ha in informal systems and 0.44 in formal systems. The area under informal irrigation in Niger and Kaduna states of Nigeria appeared to be at least 12 times greater than that under formal irrigation: The area under informal irrigation during the 1987-88 season was about 22,200 ha, while the area under formal irrigation was about 1,846 ha. The main problem in informal systems was that they had access only to small pumps that could be used only along the banks of rivers; thus, the area that could be irrigated was limited. Problems in the formal systems included frequent breakdowns of water pumps, farmer's lack of freedom to choose which crops to cultivate, and discrimination by government officials.

The relative economic efficiency of the systems was analyzed using a restricted unit profit function approach, which made it possible to determine the relative efficiencies of different farm sizes, technologies, and scales of operation. The study also examined variations in farmers' success in maximizing profits. Input and output prices also differed in the study area because sources of input procurement, transportation costs, and times of purchase and sale varied.

The estimates of the Cobb-Douglas profit function for the four sets of farm groups indicated that

- Small and large farms were economically efficient to the same degree.

- Informal irrigation systems were more economically efficient than formal irrigation systems.

- Economic efficiency did not differ for small-scale and medium-scale irrigation technologies (as distinct from farm size) in the study area.

Factor demand functions were used to test for relative price efficiencies. There was a significant difference in the price efficiency of hired labor between the small and large farm groups using informal irrigation. Small farms were relatively more wage price efficient than the larger farms. There were, however, no significant differences in price efficiency for irrigation water and fertilizer.

In comparing small and large farm groups using formal irrigation, small farms were more wage price efficient, while large farms were more fertilizer price efficient.

In comparing informal and formal irrigation farm groups, all of the variable factor price efficiencies were significantly different. Wage price and irrigation water price efficiencies were higher in informal irrigation; fertilizer price efficiency was higher in formal irrigation.

In comparing small-scale and medium-scale formal farm groups, the variable factor price efficiencies were not significantly different. All three factors were equally price efficient, irrespective of the scale of the irrigation scheme.

Absolute price efficiencies were determined by testing whether the calculated coefficients for the factors were equal to the factor prices. Separate calculations were made for small and large farm groups. Both sets of hypotheses were rejected at the 5% level of significance. This implied that neither small farms nor large farms were maximizing profits.

The conclusions were similar for the informal farm group, the formal farm group, the small-scale farm group, and the medium-scale farm group. None of the groups equated the marginal value products of all variable factors to the marginal factor costs (prices). This implied that, if the goal of production is profit, resources could and would have to be used more efficiently.

One approach to addressing Nigeria's irrigation needs would be to integrate formal and informal irrigation systems. The relative price efficiency analysis indicated that labor was being used inefficiently on large farms and fertilizer was being used inefficiently on small farms. It also indicated that labor and irrigation water were being used more judiciously by informal irrigators than by formal irrigators. These indications support the need to integrate informal and formal irrigation to take advantage of the strengths of each system.

# MULTIOBJECTIVE FARM PLANNING FOR SMALL-SCALE FARMERS IN OGUN STATE, NIGERIA

Bamidele O. Durojaiye
Ogun State University, Nigeria

Small-scale farmers account for most of the food production in Nigeria and other African nations. If agricultural policy is to help them use their resources efficiently, optimum farm plans should be formulated for them by regions or locality. Unfortunately, the few farm-planning models currently available in many of these countries are not useful.

A survey of 51 farm households in Ijebu-North local Government Area of Ogun State, Nigeria, was conducted in 1988 to obtain the information necessary to formulate a farm plan for the representative farm household in the study area. The average farm household had five family members, and the typical farmer interviewed was male, married, and 48 years old and had a primary-level education. Interplanting cassava/maize/cocoyams, interplanting cassava/maize, and cultivating maize in segregated stands accounted for 74% of total crop-production activities. The average farm size was 2.8 ha; most fields were less than 2 ha. Farm operations relied primarily on household labor and traditional farming practices. Operating capital averaged only ₦500, and none of the farmers used borrowed funds.

All of the farmers surveyed had more than one production objective. Using the method of paired comparisons, these objectives were ranked in descending order of importance as follows: maximizing gross margin, satisfying family food requirements, maximizing revenue, and minimizing out-of-pocket expenses. Only the difference in preference between satisfying family food requirements and maximizing gross revenue was statistically significant at the 5% level.

A farm budget was generated to reflect the average land, labor, and capital resources of the farm households surveyed. Yields and prices were also derived from the 1988 survey data. This information was incorporated into standard linear-programming models, which were used to elicit the optimal, feasible values for three of the production objectives, subject to the additional constraint that minimum family food requirements of 2,000 kg of food grain be met. The resulting payoff matrix showed that the maximum gross margin and revenue attainable, ₦9,953 and ₦10,453, respectively, required the entire ₦500 available to the farmer for out-of-pocket expenses. Conversely, if out-of-pocket expenses were minimized subject to the predetermined constraints, gross margin fell to ₦2,394 and revenue dropped to ₦2,579.

The trade-off curves between the competing objectives were estimated by first generating the set of nondominated solutions to the farm-planning problem using the noninferior set estimation method. The slopes of the resulting trade-off curves indicated the opportunity costs of furthering one competing objective at the expense of the other. The goal-programming approach was then used to solve the multiobjective farm-planning problem for the optimal, nondominated solution.

Three variants of goal programming have been defined in the literature, differing primarily in their approaches to minimizing the deviation of objectives from their target levels. Due to limited resources for research, only the preemptive-weights version of goal programming was pursued in this study. According to this method, the objectives were iteratively optimized in the order of their predetermined priority. Using this technique, the garget level for each objective was met or surpassed, with the exception of the cash-expenditure target. The solution suggested that the typical farmer in the study area should devote 2.47 ha. of land to producing cassava/maize/cocoyams invest ₦500 in out-of-pocket expenses, and supplement family labor with 30 days of hired labor.

When the possibility of borrowing capital was incorporated into the analysis, the solution values for gross margin and revenue increased by ₦1,250 and ₦1,408, respectively; the recommended level of hired labor increased; and all of the household's farmland was devoted to producing cassava/maize/cocoyams. At the margin, ₦1 in borrowed capital could yield up to ₦11 in additional farm income.

Sensitivity analysis revealed that the solutions reached through preemptive-weights goal programming were highly sensitive to the order in which competing objectives were optimized. Therefore, in cases where objectives are competitive and near equal in rank, it may be advantageous to use an alternate method of goal programming that allows for assigning nonpreemptive weights to the production objectives.

The farm-planning solution generated by this study indicated that the income of a representative farmer in the study area could be increased by about 50% under existing management practices without borrowing funds and without jeopardizing family food supplies. The use of as little as ₦134 in borrowed funds could raise the typical farmer's income by as much as 70%. These results offer strong evidence of the benefits that farm planning and credit availability could provide in raising the incomes and production of small-scale farmers.

# THE IMPACT OF THE LARGE-SCALE ACQUISITION OF LAND ON SMALLHOLDER FARMERS IN NIGERIA

A.C. Nwosu
Nigerian Institute of Social and Economic Research, Nigeria

Restricted access to land can be a major constraint to accelerated agricultural development. In recent years, restricted access has emerged as a key problem in the southern part of Nigeria. Customary land-tenure systems are breaking down under the impact of cash cropping, population pressure, and the land-consolidation policies of the government. Individuals, corporations, and the government have been acquiring large tracts of rural lands for agricultural and nonagricultural purposes.

Three of Nigeria's communities in which the government has acquired large tracts of land were examined to determine the impact these acquisitions have had on smallholder farms. The government acquired the tracts for an airport, an army barracks, and a university.

Traditionally, farmers have had access to both personal and communal lands. They usually obtained their first plots of land through inheritance. If they needed more land, they could acquire it by receiving it as a pledge, by borrowing it, or by renting it. The government's land acquisitions have interfered with this system.

The results of this study indicated that the large-scale acquisition of land has resulted in an 11% reduction of the aggregate landholdings of the sampled households in the three communities. Additionally, dependence on personal and rented land is increasing and dependence on communal and borrowed land is decreasing.

Despite the apparent shortage of land, however, when the effect of inflation was considered, the large-scale acquisition of land had not resulted in significant increases in the sale or rental prices of land.

While farm size has been significantly reduced following the large-scale acquisition of land in the university project area, similar reductions have not been observed in relation to the army barracks project or the airport project. However, the effect in the airport project area may not become evident until the government effectively occupies the land and the farmers' access to the land is curtailed. At the time of the survey, the farmers continued to plant crops in spite of government prohibitions.

The expropriation of large tracts of land appears to have intensified the use of land and increased the use of improved inputs. The fallow period appears to have been reduced, and more farmers had begun to apply fertilizers. Despite the intensification, the small farms—which will become smaller as the population grows—cannot meet the food and fiber needs of Nigeria in the next decade. Farm size must be expanded. Moreover, because tropical soil breaks down after about 5 years of continuous cultivation and productivity then falls, farming systems affected by land-acquisition projects may not be viable in the long term.

Landlessness has not emerged in the study area. Where farmers have lost all of their land to a government project, they have been able to rent farmland. However, landlessness probably will emerge when the land in the airport project area is occupied. The relocated households have had difficulty renting land from neighbors to supplement what is left of their own farmland. The situation is bound to become worse when the affected communities completely lose access to the acquired lands.

The increasing dependence on rented land and the escalating nominal rental fees and the cash available at the beginning of the cropping season. For smallholders whose cash incomes are low, high rental fees could mean renting less land. The cumulative result could be an enormous loss in production since most households rent supplementary farmland each year.

The increasing dependence on rented land may also interfere with agricultural development. Rented lands are not available for the long term investment and development of farm structures required for agricultural growth. Thus, even though renting facilitates access to land, it cannot form the basis for developing commercial agriculture.

Therefore, the government must be cautious and selective in acquiring rural lands. The cost to the rural people who own the land should be carefully considered. It is not enough to make cash payments to compensate for the loss of houses and tree crops; the government should provide alternative lands and build houses for those affected. At present, unaffected communities do not want to alienate their lands permanently and so do not make them available for the displaced communities to settle. Every large-scale land-redistribution program should enable those who lose land to a project to gain land from their neighbors—placing a small burden on every member of the community rather than a large burden on a few individuals.

# DETERMINANTS OF ADOPTION OF IMPROVED-PALM PRODUCTION TECHNOLOGIES IN IMO STATE, NIGERIA

Jude E. Njoku
Federal University of Technology, Nigeria

Oil palm is one of Nigeria's most important food and cash crops. Most of Nigeria's palm oil is produced by smallholders who own small, wild groves. The trees receive no maintenance and their yields are low. To reverse the decline in oil-palm production, the Nigerian government instituted the Oil Palm Rehabilitation Project to enable smallholders to replant old groves with high-yielding, disease-resistant varieties of oil palm to use improved inputs and production technologies.

Six improved technologies are recommended by the Nigerian Institute for Oil Palm Research: improved seed varieties, fertilizers, insecticides, herbicides, triangular spacing, and pruning.

Smallholders in six villages were questioned about their use of the improved technologies. Their levels and rates of technology adoption were low. All of the farmers had adopted at least one of the improved technologies, with the average being 2.9 technologies per farmer. A farmer was regarded as having adopted a technology if it was used on the farm to any extent.

The adoption rate was defined as the number of farmers using the technology as a percentage of the total number of survey farmers. Pruning had the highest adoption rate. The use of triangular spacing and improved seed varieties also had high adoption rates. Slightly over half of the farmers used fertilizer. Many farmers did not believe that fertilizer use was necessary after the trees were two to three years old. In addition, fertilizer application is labor intensive, thus its use was constrained by the acute labor shortage in the area. Few farmers adopted the use of insecticides and herbicides. These technologies were expensive because, unlike improved seed varieties and fertilizers, their prices were not subsidized by the government.

A regression was run to determine which factors influenced technology adoption. Tenurial status, cooperative membership, the amount of loan received, and the intensity of extension service were all found to be significant determinants of the level of adoption of improved technologies for oil-palm production. Farm size, age, formal education, and household size were not significant.

The results of the study showed that the greatest constraint to the adoption of improved technologies was the farmers' perception that their use was complex; for instance, smallholders did not know what types of insecticides and herbicides to use, how much to use, or how to apply them.

Another set of constraints was the high cost of labor, insecticides, and herbicides. Many of the new technologies require intensive labor use, which contrasts greatly with the limited amount of labor expended in the traditional, wild oil-palm groves. Smallholders must hire expensive labor to implement the improved technologies.

For improved technologies to be adopted and properly used, the farmers must be supported by extension services. Currently, Nigeria has no extension workers who specialize in oil palm production. The farmers also must be able to afford the technologies, and the inputs must be available at the time of year that they are needed.

Since institutional factors, such as tenurial status, cooperative membership, loan amount, and extension service intensity, are the major determinants of improved technology adoption, policies that influence the institutional environment may have more impact than those that influence the technical environment. Policies would encourage ownership of land and membership in cooperative societies. Credit programs that reach rural smallholder farmers must be implemented and extension services must be expanded and improved.

## THE ROLE OF WOMEN'S TRADITIONAL SAVINGS AND CREDIT COOPERATIVES IN SMALL-FARM DEVELOPMENT

Noble J. Nweze
University of Nigeria

---

The official cooperative movement in Nigeria has had limited success. Although it was introduced over 50 years ago, it has proven unsuccessful at incorporating the majority of rural Nigerians, especially rural women. Yet unofficial indigenous cooperatives continue to thrive.

This study examines women's savings and credit cooperatives in two Nigerian states, Anambra and Benue. Interviews conducted with 150 women members revealed that these cooperatives could help to improve smallholder farming.

The cooperatives' main economic activity was mobilizing members' savings. The average amount saved per cooperative in 1987 was ₦6,833 in Anambra and ₦ 4,838 in Benue. Most members spent their savings to meet farm expenses, some to meet nonfarm expenses (such as school fees), and only a few to acquire consumer or durable goods. Although farming was an important economic activity in the areas surveyed, about 65% of the respondents combined farming activities with other occupations.

The members said their accumulated savings were moderately sufficient to meet their needs. Most of the women were satisfied with their access to their savings, especially since it is usually available during the peak labor period when it was needed. A high proportion believed the cooperative was managing their savings well.

Of the 150 members surveyed, 35 borrowed money from their cooperative in 1987, which indicates that extending credit to members was an important secondary economic function for the cooperatives. The loans were used primarily for investments both on and off the farm—farm investments accounted for 61%. The major problem reported by borrowers was that loan amounts were inadequate.

In 1987, 570 loans were disbursed by 28 of the 30 cooperatives. Interest rates charged ranged from 10% to 50% for members and from 50% and 100% for nonmembers. Members did not consider the cost of borrowing a problem. Most loans were disbursed at the beginning of the cropping season, and most were repaid during the harvest period.

In 17 of the 30 cooperatives, work groups were organized to provide farm labor to members, in rotation, during peak periods of labor demand. The members said the availability of cheap, efficient labor through the work groups allowed them to utilize increased farm land.

Participants had high opinions of their group-based savings and credit cooperatives. They said the cooperatives are particularly effective in making loans available, allowing a long time for repayment, offering moderate interest rates, and keeping the loan-transaction process simple.

It was clear that despite some problems, members plan to continue patronizing their cooperatives even if banks are established in their areas.

# NUTRITIONAL CONCERNS IN AGRICULTURAL RESEARCH IN NIGERIA

Lily A. Ohiorhenuan
University of Ibadan, Nigeria

The failure of traditional agricultural research to produce tangible improvements in human health and nutrition in most developing countries has resulted in a call for research institutions to reevaluate their research methods and priorities and to incorporate nutritional goals into their research more explicitly. The need for establishing more effective approaches to solving hunger and nutrition problems is particularly obvious in Nigeria, where malnutrition remains widespread despite the efforts of research institutes to develop improved food production technologies.

A review of the literature on nutrition in agricultural research provides insights into why traditional agricultural research has had little success in alleviating malnutrition in developing countries such as Nigeria, and offers proposals for ways in which nutritional concerns can be more effectively incorporated into agricultural research efforts.

It was found that both structural limitations and conceptual deficiencies have reduced the effectiveness of agricultural research in developing countries. The most significant structural limitations are researchers' limited control over project funding and over the application of their research results. Research priorities and objectives are often determined by outside funding sources, which in the case of many developing countries had led to a research emphasis on export crops and other programs and objectives that have little direct bearing on nutrition. Researchers typically have had even less control over whether and how their research results are implemented. For example, wide-spread farmer adoption of new agricultural technologies has sometimes been hampered by inadequate credit, input subsidy, or price support provisions, or by inadequate market infrastructure.

The principal conceptual deficiency in past agricultural research has been its failure to recognize and address the root causes of malnutrition. Malnutrition has been conceived of as being essentially a problem of insufficient supply, when it is actually the result of poverty, and therefore primarily a problem of ineffective demand. New yield-enhancing technologies are irrelevant to subsistence farmers who have limited access to land, credit, production inputs, and market opportunities, and who cannot afford to purchase additional food, should it become locally available. Yet these are the farmers who produce the bulk of Nigeria's food and whose families are most at risk of suffering from malnutrition. This failure to consider the needs and resource constraints of small-scale farmers has led to misplaced research priorities and the development of inappropriate technologies, and has been singled out as a major reason

for the failure of agricultural programs to increase food production and reduce the incidence of malnutrition in developing countries.

Agricultural research also suffers from a lack of reliable comprehensive data on the specific nutritional needs of Nigeria's population subgroups. Most nutritional studies rely on food balance sheets which compare estimated aggregate food supplies with estimated aggregate food demand, both on a per-capita daily basis. But food balance sheet estimates differ substantially according to the assumptions used in their derivation, and also cannot provide information on how the food supply is distributed geographically, seasonally, within localities, or among adults, infants, and children.

The issue of more effectively addressing nutritional concerns in agricultural research surfaced during a series of meetings held in Nigeria and around the globe in the late 1970s and the 1980s. The general consensus of these meetings was that agricultural researchers and program analysts needed to place greater emphasis on the explicit, ex ante consideration of nutritional objectives in their programs. The need for agricultural research institutes to cooperate with nutritionists and others in the collection of necessary nutritional data and in the development of appropriate analytical methodologies was recognized. Specific recommendations made at the meetings pertained to the need for agricultural research institutes to develop technologies which are appropriate to the needs and environments of those who are nutritionally at risk. In particular, the need was identified for improving food storage capabilities and emphasizing farming systems which protect soil resources and provide food throughout the year. Other studies pointed to the importance of lowering the cost of crop production to low-income farmers, and of considering local consumer tastes and preferences in the development of new food crop varieties and crop technologies.

To determine the extent to which nutritional concerns are being incorporated into agricultural research in Nigeria, this study examined the programs conducted by three agricultural research institutes between 1981 and 1985. One national institute, the International Institute for Tropical Agriculture in Ibadan, and two national institutes, the Agricultural Research and Training Institute in Ibadan and the National Root Crops Research Institute in Umudike, were included in the study.

It was found that all three institutes have made progress in addressing nutritional concerns in the design and execution of their projects. There has been increased emphasis on farming systems programs, and projects aimed at improving the nutritional and storage qualities of seed and crops. Intercropping techniques which make optimal use of soil nutrients and provide food throughout the year are being investigated, particularly at the National Root Crops Research Institute. All three institutes have been involved in the Nigerian government's various efforts to increase food production, including efforts to boost the production on small-scale farms.

Despite these encouraging signs, very few of the research projects conducted by these institutes were directly related to nutrition. Increasing food-crop yields remained the primary objective. Nutritional benefits were expected to accrue indirectly and automatically in the form of increased food availability.

It is argued that more explicit consideration of nutritional objectives in the institutes' research has been limited by

- the short lapse of time the institutes have had since the issue surfaced to restructure research programs and develop appropriate data bases and methodologies
- the difficulty of implementing the general recommendations which have been made for incorporating nutritional concerns in agricultural research
- the institutes' dependency on outside funding which limits their role in the determination of research priorities and objectives
- the lack of direct communication and working relationships between agricultural researchers and nutritionists

What is required is a team approach. In particular, it is recommended that agricultural scientists and nutritionists collaborate within a nutrition planning framework. Using linear programming techniques, the required amounts of calories, proteins, and micronutrients to satisfy local diets can be translated into specific food production targets geared to meet the needs and preferences of local populations. Using this approach, food crops that are the most generous and economical suppliers of certain limiting nutrients in regional diets can be determined and promoted. The approach helps to evaluate the nutritional goals of current agricultural research and to identify those areas where research priorities need to be reordered.

# INCREASING RICE OUTPUT THROUGH TRACTOR USE IN ANAMBRA STATE, NIGERIA

O. Okereke
University of Nigeria

As Nigeria struggles to provide adequate food for its rapidly growing population, increasing the production of rice has become an important goal. One means of increasing rice output is to use tractors on the rice farms. Currently, only a limited number of farmers use tractors.

This study is based on a survey of 60 rice farmers in Anambra State, Nigeria. It estimates and compares the rice output from traditional farms using only manual labor and that from farms using tractors. It also estimates labor input and the costs and returns of production in both systems of farming.

There was no significant difference between the socioeconomic characteristics of farmers who used only manual labor and those who used tractors. The only difference was that 72% of the tractor users had attended an agricultural training program organized by the Ministry of Agriculture and Natural Resources.

Tractors were used only for clearing land, plowing, and harrowing. In fields where tractors were used, these tasks plus transplanting were begun and completed in July. On farms where the work was done manually, these tasks plus transplanting were begun in May but were not completed until August. Thus, farmers who used tractors were able to complete the subsequent operations one month earlier than farmers who did not use tractors.

Farmers tended to be aware of the benefits of using tractors. One of the most important constraints they faced was that tractors were not readily available, in spite of the existence of private and government tractor-hire services. The government tractors were frequently in need of repair.

The value of most of the farm inputs used in rice production did not vary significantly based on whether or not the farmer used a tractor. Tractor users applied more herbicides and insecticides, which they were able to get at a lower price than were the manual farmers because of the Ministry of Agriculture and Natural Resources provided these goods at subsidized prices to farmers who adopted modern technologies.

The requirements for and distribution of labor, however, were significantly different for farmers who used tractors. Some of the labor formerly used to prepare land for rice production could be used in other

crop enterprises. However, using tractors may increase labor needs on the farm at later stages in the growing season: Weeding and harvesting may demand more labor if using tractors increases production.

To prepare a hectare of land for a rice farm, the survey results indicated that it was less expensive to use a tractor than to use manual labor. A traditional farmer would pay ₦345 for clearing land and ₦450 for manually tilling a hectare; whereas a tractor user would pay only ₦250 a hectare for the tractor and ₦60 for the supervisory labor.

Labor costs were the most important production expenses, since they accounted for 82% to 91% of the total costs per hectare. By reducing the amount of labor needed, tractors helped to reduce the total cost of production.

The net return per hectare, defined as the difference between gross return and total cost of production per hectare, was significantly higher for farmers that used tractors. For tractor users, the gross return was ₦6,231 a hectare, and the total cost was ₦3,060 a hectare. Thus, the net return was ₦3,171 a hectare. For farms that relied exclusively on manual labor, the gross return was ₦4,616 a hectare, and the total cost was ₦3,465 a hectare. Thus, if tractors were not used, the net return was ₦1,151 a hectare.

A regression analysis was run to determine the effects of four variables on the total output of rice. For farmers using tractors, the tractor-hire charges and capital depreciation and labor input were significant and positive variables; the cost of variable inputs was significant but negative. Farm size was not significant. For farmers not using tractors, labor input was significant and negative and the cost of variable inputs was significant and positive. Neither the tractor-hire charges and capital depreciation nor labor input was significant.

The results of this study indicate that using tractors is profitable under some circumstances and confirm that tractor use ensures timely preparation of land to take advantage of the early rains.

Government policies should ensure that tractors are available to farmers. The government tractor service has been unreliable; farmers rely instead on private tractor services. The institutional framework must be developed to expand the availability of tractors and spare parts. Tractor use will become more profitable if it is expanded to minimize labor bottlenecks during harvesting and threshing.

# RURAL BANKING IN NIGERIA: DETERMINING APPROPRIATE POLICY VARIABLES

Aja Okorie
University of Nigeria

Ten years after the establishment of the Rural Banking Scheme in Nigeria, there are clear indications that the problems and issues that led to the scheme are still prevalent. These include a low level of rural savings mobilization, inadequate use of banking services, and the lack of credit for the rural people. This paper examines the central assumption of the Rural Banking Scheme that increasing the physical proximity of banks to rural people enhances rural savings mobilization and, in turn, increases the flow of funds to the rural sector. A variety of approaches to encourage rural banking have been tried in developing countries. These include quasi-cooperative banks, development banks, independent rural banks, and quasi-commercial banks. The latter are the type established in Nigeria, through legislation requiring commercial banks to open branches in rural areas.

Rural residents and rural bank branches were surveyed to determine which variables played a factor in determining rural bank use. Discriminant analysis determined that four variables were significant in discriminating between rural bank users and nonusers. These variables were household income, years of formal education, gender of respondent, and the awareness of the existence of the rural bank branch. The proximity of the bank to the respondent's residence was not a significant determining variable.

The data collected from the respondents who used rural banks was used in a regression analysis to determine which factors influenced the savings behavior of rural residents. Sixty-seven percent of the amount deposited in rural banks was explained by the variables of annual income, proximity of rural banks to residential homes, level of education, household size, and efficiency of bank workers. However, 80% of this explanation was accounted for by annual income.

A number of variables that were expected to be important were not. These included occupation, leadership position, age, the interest level paid on savings accounts, and membership in other savings associations including isusu clubs (traditional rotating savings and credit societies), cooperatives, and age-grade societies.

Orthodox urban-based banking is capital intensive and capital biased. The Nigerian rural banking system is merely an extension of the urban banking system. It was not designed to meet the needs of the rural people. In the rural banks, the rich and the poor pay different prices to obtain the same level of service or to transact the same business. Therefore, the rich tend to use the banking services, while the poor and

the illiterate prefer to patronize traditional savings and credit systems where they obtain better, faster, and cheaper services.

A continuation of the emphasis on a banking system with a capital and urban bias will certainly benefit the rich, and perhaps the middle class, but not the rural poor. Such policies will continue to deny the majority of Nigerians access to banking services, even when the physical distances between the people and the bank branches are reduced.

Thus, a new strategy must focus not only on the development of the physical banking environment, but also on the institutional infrastructures which will reduce the socioeconomic distance between the rural poor and the banks. The rural people must be a part of the rural bank ownership and management. The bank staff must adopt a more flexible approach in their operations to make their services more competitive and attractive. Finally, policies should be designed to increase and redistribute income to the rural poor.

## EFFICIENCY OF RESOURCE USE IN RICE PRODUCTION SYSTEMS IN ANAMBRA STATE, NIGERIA

Macaulay A. Olagoke
University of Nigeria

---

Chronic rice shortages have developed in Nigeria due to a domestic demand for rice that has outpaced the supply from domestic producers, coupled with a national ban on rice imports. Agriculturalists have been challenged to find ways to boost Nigeria's rice production to meet the growing domestic demand.

A study was conducted of resource use among smallholder rice farmers in the Uzso-Uwani Local government Area of Anambra State, Nigeria, over the 1987-88 crop year to determine ways in which rice production might be increased through more efficient use of farming resources. A total of 45 rice farmers was randomly selected for the study, in such a way as to include an equal number of irrigated, swamp, and upland rice farmers. The production inputs and yield of one rice field per farmer were carefully monitored through field observations and farmer surveys.

Survey results indicate that land scarcity, financial constraints, unfavorable rainfall patterns, and the inefficient distribution of irrigation water limited the production of rice during the survey period.

A comparison of production costs, resource use, and returns by type of rice production system revealed that swamp rice fields netted the highest average return per hectare. Irrigated fields averaged the highest yields and the highest production costs per hectare, resulting in the second-highest, average net return per hectare. Lower yields and lower paddy prices caused upland rice to net the lowest average return per hectare. Despite these apparent differences, the only statistically significant difference in net returns revealed by the data was between swamp and upland rice fields.

To derive the marginal product of selected rice production inputs for the survey year, a rice production function was estimated using ordinary least squares. The dependent variable, paddy rice yield per hectare, was specified as a semi-logarithmic function of three independent variables: (1) man-hours of household plus hired labor per hectare, (2) seed input per hectare, and (3) all other capital operating expenditures per hectare. Regression results using the pooled data indicate that 55% of the variations in yield among the sample fields are explained by the factor inputs included in the model. The signs of the coefficients estimated using the pooled data were all positive and significant at the 10% level or above. However, not all of the estimated coefficients were found to be statistically significant when individual regressions were conducted by type of rice production system. For example, the estimated coefficient for seed input was not significant for irrigated rice fields, possibly due to insignificant variation in the quantity of seed used per hectare. Similarly, the estimated coefficients for capital were not significant for swamp and upland rice production, possibly reflecting the uniformly low level of capital expenditures typical of these rice production systems.

Marginal physical products and marginal value products were calculated for each variable input for which a statistically significant coefficient was estimated. The marginal value products for each input were then divided by the input's unit price to determine whether the input was being used at efficient levels. All resulting ratios were greater than unity, indicating that these resources were underused on the sample fields during the survey year.

The finding that farm resources were underused is consistent with surveyed farmers' reports of being unable to obtain desired levels of financing. Most farmers reported that they would devote more land and resources to rice production if suitable land and financing were available at affordable rates. It is recommended, therefore, that the rural banking scheme and the credit delivery system be improved to accommodate smallholder farmers with varying credit needs, credit system knowledge, and literacy skills.

Study results also indicate the need for improved maintenance of irrigation pumps and canals, and the prevention of water hoarding by farmers whose plots are close to the distribution canals. Rice production on irrigation projects might also be enhanced by improving soil fertility through the use of rotation crops.

Similarly, more land suitable for irrigation should be developed to allow for the selective fallowing of rice fields with relatively low soil fertility.

The relatively high net returns of swamp rice fields, and the fact that no statistically significant difference was found between the net returns of irrigated and nonirrigated rice fields, suggests the continuing importance and viability of nonirrigated rice production. Accordingly, researchers should not neglect this area of study. Among other research concerns, efforts are needed to develop fast-maturing and high-yielding rice varieties that are drought and disease resistant, acceptable to consumers, and affordable by smallholder farmers.

## CAPTURE FISHERIES AND AQUACULTURE IN NIGERIA: A COMPARATIVE ECONOMIC ANALYSIS

Ade Olomola
Nigerian Institute of Social and Economic Research

Nigeria has great potential to increase the availability of fish by supporting and expanding its capture fisheries and aquaculture. In 1984, less than 30% of the potential of the country's coastal fisheries was being attained. This study compared capture fisheries with aquaculture (fish farming) in Ondo State, Nigeria, to determine how efficiently the systems were utilizing resources and how production could be economically increased.

In the capture fisheries, the fishermen were largely illiterate, but had an average of 30 years of experience in fishing in the Atlantic ocean. when larger, twin-engine boats are used, the operation in known as Double Engine Canoe Fishery (DECF); when smaller boats are used, it is called Single Engine Canoe Fishery (SECF).

Commercial aquaculture is a recent venture in Ondo State; 55% of the farmers interviewed had only about 2 years of experience, and 45% had about 6 years of experience. The inexperienced farmers were a little younger and better educated that their more experienced counterparts. They also had larger farms and invested more funds in constructing fish ponds. However, the experienced farmers used nondurable factor inputs (fingerlings, feed, fertilizer, and labor) more intensively than the inexperienced farmers.

To determine the efficiency of resource use, factor productivity, and returns to scale, production functions were estimated. For capture fisheries, estimates were made for both DECF and SECF in both wet and

dry seasons; fish farmers were categorized as experienced or inexperienced. The higher level of resource endowment associated with DECF did not result in higher productivity of factor inputs. For instance, the marginal products of fuel and hired labor for DECF were less than those for SECF. Only with respect to fishing assets was DECF more productive than SECF. The factor inputs, except for fuel, tended to be more productive in the wet season than in the dry season. The production function for DECF exhibited increasing returns to scale, whereas SECF was associated with decreasing returns to scale. Indeed, in terms of resource-use efficiency, hired labor, family labor, and fixed capital were inefficiently used in DECF. The use of hired labor and fixed capital in DECF was excessive. In SECF, the use of fuel was below the economic optimum. Fuel was underutilized during the dry season and used excessively during the wet season. An increase in the use of all the fishing inputs except for hired labor would lower rather than increase profits during the wet season under the prevailing prices and weather conditions.

The aquaculture production functions exhibited increasing returns to scale for the experienced fish farmers and decreasing returns to scale for the inexperienced fish farmers. Based on the magnitudes of the marginal value productivities, the experienced farmers used their fingerlings, fertilizer, feed, and fixed capital more productively than the inexperienced farmers. In terms of allocative efficiency, however, both the experienced and inexperienced farmers were efficient in the use of inputs.

An evaluation of the cost structures in capture fisheries and aquaculture revealed that aquaculture was more capital intensive. The share of the variable (cash) costs in aquaculture was 46% of total production cost and fixed costs constituted 46%. In the capture fisheries, the share of fixed costs was no more than 21%. Fuel costs were the largest component of operating expenses, constituting about 52% of total operating expenses under all conditions. In aquaculture, fingerlings were the largest component of operating expenses (47%), followed by feed (29%) and hired labor (21%).

Of the various components of production costs, only family labor was higher in capture fisheries than in aquaculture. Operating expenses, fixed costs, and total production costs were higher in aquaculture than in capture fisheries. Nonetheless, the short-term profitability of aquaculture is more promising than that of the capture fisheries. The operating profit associated with aquaculture exceeded that of capture fisheries by 99%.

Net profit was negative in both systems. In each system the returns generated were not sufficient to cover the fixed costs of production. This explains why investments in capture fisheries and especially in aquaculture were minimal in the study area.

If the fishing industries are to be viable, the government will have to institute policies that reduce the impact of the high cost of inputs. Inputs for fishing must be available at reasonable prices if fish production is to increase.

# THE CONTRIBUTION OF RURAL NONFARM ENTERPRISES TO RURAL EMPLOYMENT IN SOUTHWEST NIGERIA

Olufemi Oludimu
Obafemi Awolowo University, Nigeria

Small, rural nonfarm enterprises have typically received scant attention from policy-makers in developing countries such as Nigeria. Recent evidence supplied by this and other studies suggests that economic development policies that ignore or impede the growth of the rural nonfarm sector may be misguided.

Nonfarm occupations are a primary source of income for much of the rural labor force in most countries and provide important secondary sources of earnings for smallholder and landless farmers. Available evidence suggests that most of those employed in Nigeria's rural sector work at least part time in nonfarm occupations. Such occupations are diverse, ranging from manufacturing, trading, and repairing farm tools and consumer goods to processing and marketing agricultural products.

A survey was conducted in southwest Nigeria to examine the contribution of nonfarm enterprises tot he local rural economy. Twenty-five entrepreneurs from each of four rural villages were interviewed from July to October 1987. Each of the 100 respondents was asked specific questions regarding his or her business, household characteristics, and the adequacy of local resources and social and economic infrastructure. Most of the randomly sampled entrepreneurs were married men between the ages of 20 and 50 and had one spouse and more than one child. Just over half of the respondents had received some formal education, compared to about 20% of the local farm population. More than two-thirds of those surveyed had more than 10 years of experience in nonfarm occupations, and half of those surveyed had more than 20 years' experience in their stated business. While some had begun their current occupations as youths, others turned to nonfarm occupations to supplement or replace low or fluctuating agricultural incomes.

One-third of those interviewed were engaged in trade. Smoking fish, carpentry, and bricklaying each occupied another 11% to 16% of respondents. The remaining 26% of respondents were employed in tailoring, painting, grinding, teaching, baking, or welding and tinkering. Most of the businesses were inherited or started with nominal financial investments. Only one of the 100 businesses had ever been granted a bank loan. The rest relied on personal savings, informal loans, and assistance from friends and relatives.

These small-scale, rural nonfarm businesses relied on hand tools and apprentice labor. Ninety-seven of the 100 respondents reported employing only one or two additional workers, and at least half of these

workers were unpaid apprentices at the time of the survey. Less than one-fourth of those surveyed used power-driven machines, and only a few businesses relied upon electricity from the national grid.

The four villages offered some, through not all, of the physical and social infrastructure desired by local residents. Respondents complained about a shortage of storage and transportation facilities, poor road and waterway systems, a lack of social and recreational facilities, poor access to bank credit and business development funds, and an inconsistent supply of electricity from the national grid. Other problems mentioned included a shortage of affordable skilled workers and scarcity and high cost of improved tools and raw materials. The lack of infrastructure, high paying jobs, and adequate social amenities in Nigeria's rural areas is blamed for the steady migration of young rural workers to urban areas.

Despite these obstacles, most of the respondents appeared to be receiving a reasonable return for their efforts. Nearly half of those interviewed estimated that they grossed more than ₦5,000 in 1986, while a few that operated on a consistently large scale earned more than ₦10,000 in gross revenues—the equivalent of a university lecturer's annual salary in Nigeria. In addition to enhancing rural income levels, nonfarm industries help to stabilize the rural economy by providing consumer goods and services to the rural populace, producing inexpensive farm tools and equipment, transporting goods between rural and urban markets, storing and processing farm products, and providing jobs and training for the rural population.

Principal component analysis and stepwise, variable-inclusion, multiple regression analysis techniques were used to gauge the relationship between various factors measured in the field study and the size and success of nonfarm enterprises. The availability of funding sources and electrical energy were positively linked with the size of enterprises' physical production; trade-group membership was more closely associated with firms that had a smaller output. The availability of electricity was also positively associated with the 1986 financial returns of nonfarm enterprises. The cost of equipment was negatively tied to that year's financial returns, which reflected, in part, the scarcity and high cost of improved tools, equipment, and spare parts needed for some nonfarm operations.

The findings of this study support the argument that further development of the nonfarm sector would increase rural income levels and living standards and thus reduce interregional inequalities in income and opportunities. Because of the role of off-farm employment in stabilizing and enhancing the rural economy, any future policies aimed at food security and rural development must consider rural nonfarm enterprises. Therefore,

- Rural, nonfarm firms—particularly those that assist agriculture by providing necessary farm tools, services, or markets for farm products—should be encouraged to grow and develop.

- Adequate social, physical, and economic infrastructure should be provided in rural areas.
- Nonfarm firms should form cooperatives to facilitate the extension of credit.
- Banks and lending institutions should provide capital to small, rural nonfarm businesses.

## PRODUCTION PERFORMANCE OF SMALL RUMINANTS IN SOUTHEASTERN NIGERIA

Daniel S. Ugwu
University of Nigeria

Nigeria is facing a shortage of animal protein. Although cattle, pigs, and poultry are produced in Nigeria, small ruminants, especially sheep and goats, have the greatest potential to meet Nigeria's protein needs. Sheep and goats are particularly suited to the environment of southeastern Nigeria. In the absence of low-cost feed, they can be fed materials that would otherwise go to waste.

A survey of 100 sheep and goat farmers was carried out in six areas of Anambra State, Nigeria, in 1988. The results indicated that sheep and goat farmers also engaged in crop production and other economic activities such as hunting, crafts, trading, and tailoring. They also raised poultry, pigs, and rabbits.

About 13% of these farmers used extensive production systems to raise sheep and goats; the remainder used semi-intensive systems. The major reasons the farmers gave for raising small ruminants were that the animals could be sold for income, consumed directly, and used in ceremonies and that owning them conferred prestige. The problems the farmers cited concerned disease, feeding, accommodation, veterinary services, and management.

A multiple regression analysis showed that two biological variables—initial herd size and age at first parturition—were consistently significant and positively influenced the total herd size of small ruminants. For sheep, litter size was also a significant variable.

A separate regression analysis examined socioeconomic factors influencing herd size. Among the socioeconomic factors, family size and cash expenditure were consistent and outstanding in their positive influence on small-ruminant production in terms of total herd size.

The results of gross margin analysis showed that sheep and goat production was profitable under the traditional management system. The gross margin of the average farmer was ₦ 67.37 for sheep and ₦ 104.07 for goats in 1988.

To improve the performance and increase the output of farmers engaged in small-ruminant production in southeastern Nigeria, a number of steps should be taken. Veterinary clinics should be established to alleviate the problems with small-ruminant diseases. The extension network should be expanded and improved to teach technical skills to farmers. Credit should be made available to farmers and pastures should be provided at token cost. Further research on genetic improvements will also benefit small-ruminant farmers.

## THE ROLE OF RURAL WOMEN AS FARMERS IN EASTERN NIGERIA

Chuku T. Uwakah, Adaoha C. Uwaegbute and Michael C. Madukwe
University of Nigeria

Agriculture has a crucial role to play in the social and economic development of Nigeria. In recent years, however, productivity in the agricultural sector has not satisfied the nation's requirements for food, fiber, and other raw materials. This situation calls for the immediate reappraisal of rural education systems, notions of agricultural development, and plans for achieving the national goal of self-sufficiency in food and fiber production.

This study investigated the roles of rural women as farmers in four states of eastern Nigeria. A total of 880 women from 220 rural villages were interviewed. The main objectives were to analyze the farming activities performed by rural women; to identify the women's problems; and to suggest measures for improving the productive capacity of farm women in the region.

The average age of the women farmers was 42 years, and 88% of the women farmed full time. The older the rural woman was, the more likely it was that she was a full-time farmer.

To document changes in farm-labor patterns, the surveyed women were asked to report which farming operations they performed before 1970 and which they performed in 1987. The results showed that women have become increasingly involved in producing tree crops, food crops, and livestock since the

end of the Nigerian civil war in 1970. Shortages of male labor and the high cost of hiring farm hands pushed rural women to assume additional farming duties.

One-third of the women now take part in clearing and preparing land; one-tenth reported that they did so before 1970. About 20% of the farm women did not consider any farming operation to be only a man's task or too strenuous for a women to perform. Rural women continued to perform such tasks as removing burned sticks; planting crops; weeding; harvesting; and transporting, processing, and marketing farm produce.

Most of the women said they liked farming; however, 82% said that, given the opportunity, they would choose nonfarm occupations.

Although over two-thirds of the surveyed women did not know the agricultural station or office nearest to them and 83% had never contacted the extension office for advice, the women had a moderately favorable attitude toward the Ministry of Agriculture. Their involvement and participation in organized agricultural extension and rural development programs was poor. Only 7.5% participated in the homemaker programs designed for rural women. This suggests that the agricultural extension program in the eastern region has been ineffective at reaching women. Two-thirds of the nonparticipants, however, indicated that they would like to take part in at least one of the programs. Only 18% of the surveyed women—mostly the older, uneducated women—said they were not interested in the programs. This suggests that if extension programs were directed at women in these rural areas, the women would be eager to participate.

When asked about constraints to their productivity, 85% of the women said lack of capital was the most limiting factor. This concern was echoed when the women were asked to suggest ways to reduce the constraints—37% of the women said small loans and credit should be granted to their families. Others said that farm inputs should be made available at subsidized prices. This also indicated that capital was limited.

An additional constraint that the surveyed women mentioned was that the Ministry of Agriculture's male extension workers did not work with women. The women suggested that the Ministry of Agriculture design separate extension programs for rural women.

Thus, the systems of the rural education and training, including the agricultural extension services, have not taken into account the importance of women in agriculture. Women's productivity has remained static, while men have benefitted from extension programs that have provided them with modern techniques for growing cash crops. Future development will be enhanced by recognizing the role of women in rural farm labor and agricultural production and by making women more productive in these capacities.

# ECONOMIC ASSESSMENT OF TRACTOR USE IN SUBSISTENCE AGRICULTURE: MOROGORO REGION, TANZANIA

Sylvery L.B. Ishuza
Sokoine University, Tanzania

Tractors have been introduced in parts of many Asian, African, and Latin American countries in recent decades, in an attempt to increase agricultural productivity in areas typically farmed with draft animals or hand hoes. In general, the results have been disappointing. Past studies have typically found that tractor use has reduced labor demand per hectare, increased production costs, and had no noticeable effect on yields. Differences in productivity which have occurred have usually been attributed to other yield-enhancing factors such as the use of fertilizers, insecticides, improved seeds, and water control.

Poor tractor management has been cited as a principal reason for the high costs and lower than expected yields associated with tractor use. Studies have found that tractor use experiments have been plagued with (1) poor record keeping, (2) lack of adherence to efficient land preparation schedules, (3) lack of spare parts and fuel, (4) inappropriate pricing policies, (5) high costs of tractor use relative to the value of crops cultivated, (6) favoritism and a lack of commitment on the part of some tractor owners and hired drivers, and (7) a poor record of tractor loan repayment. In many areas, tractor cultivation has also been hampered because tractors must travel long distances between farm plots that are small, awkwardly shaped, and badly cleared.

Tanzania has made several attempts at improving agricultural productivity by the provision of tractors to areas traditionally cultivated by hand hoe. Experience from past failures and the urgent need for increased agricultural output led the government, in 1985, to organize a tractor pilot project in Morogoro region. Under this project, private individuals, villages, and cooperatives have been allowed to own tractors on a credit basis by making a downpayment equal to at least half the value of the tractor. Tractor owners are then required to send their tractors to assigned sites in designated crop production zones where farmers come to hire tractor services for land preparation prior to planting.

Survey data was obtained for the 1986-87 growing season from a sample of farmers in two zones of Morogoro region's Morogoro District. A total of 47 farmers who used tractors for land preparation and 32 farmers who relied on hand hoes were interviewed for the study.
It was found that, on average, farmers who hired tractors were holder, had more farmland, and had slightly larger households than farmers who did not hire tractors. Both categories of farmers farmed

small, scattered plots and the majority of farmers in both categories hired farm labor to supplement family labor sometime during the season. Most farmers did not use fertilizers or insecticides.

No statistically significant difference in maize yields per hectare was found between household that did and did not use tractors for the 1986-87 season. However, 57% of the surveyed farmers who used tractors reported that they did not receive tractor services in time to meet optimal planting schedules, and other indications of poor tractor management were detected.

Most farmers surveyed practiced monocropping, regardless of their method of cultivation. However, a comparison of the 1985-86 season with the 1986-87 season reveals a substantial increase in the practice of monocropping by farmers who relied on hoes. This suggests tractor use may be linked to the shift from mixed cropping to monocropping, which is consistent with government policy, but contrary to traditional methods of minimizing farming risks.

Survey results indicate that the use of tractors for land preparation reduced labor requirements by nearly 46.2 man-days per hectare. Therefore, in areas where labor is abundant and wage rates are low, using tractors to clear land is not justified. However, in situations where labor for clearing land is scarce and timely planting is critical, the use of tractors may be essential to enable farm expansions and ensure timely planting.

Tractor cultivation can only improve the timing and efficiency of farm operations in Tanzania to the extent that the tractors are well managed and efficiently organized. The following recommendations are made toward this end:

- Records should be kept that enable cost-effective use of the tractors, and individual tractor ownership should be encouraged to ensure that the individuals have a personal stake in managing the tractors efficiently.

- Land clearing schedules should be devised and followed that ensure timely planting with a minimum of unproductive travel time.

- Tractors should be regularly serviced, and spare parts and fuel should be made available at reasonable costs.

- Farmers' fields should be free of stumps, and farmers' landholdings and tenure arrangements should be reorganized, where feasible, to consolidate small plots into larger fields for more efficient tractor cultivation.

- Tractor use should not be restricted to clearing land if there are other tasks for which tractors can be profitably used that do not compete with land clearing operations.

- Tractor hire charges should be responsive to local economic conditions and should not be restricted to a particular hire rate.

Proper tractor management alone will not suffice to increase agricultural productivity. Many factors interweave to influence farm decisions and determine crop output and yields. Essential inputs such as fertilizers and insecticides need to be made available on a timely and affordable basis. Extension agents must assist farmers to maintain proper crop husbandry practices. Necessary infrastructure, such as roads, market centers, and lending institutions must be available to farmers to facilitate market production and sales. Finally, to avoid extensive use of parallel markets and the resultant distortion of crop output data, the government should offer attractive producer prices.

Accordingly, it is recommended that the decision to promote tractor use be made cautiously, as part of an evaluation of a locality's need for a whole range of farm inputs and infrastructure, and that any such decision take into account the locality's demand and supply of land and labor, and its incentive and ability to manage the tractors efficiently.

## AN ECONOMIC EVALUATION OF THE MOBILE SAWMILLING INDUSTRY IN TANZANIA

Godwin S. Kowero
Sokoine University, Tanzania

---

The forestry sector in Tanzania has been underutilized in promoting national development. The government owns large timber plantations that have not been fully harvested due, in part, to a lack of processing capacity. In the early 1980's, the Tanzanian government introduced five mobile sawmills to utilize the surplus of small-dimension timber from its overstocked plantations. These mobile sawmills have proven themselves to be both financially and economically profitable in Tanzania's unstable economy.

A financial and economic evaluation of the mobile sawmilling industry in Tanzania was undertaken to evaluate the factors that influence the profitability of the industry. Data was collected on the costs and revenues of the sawmills since their operation was initiated.

When using small-dimension timber, the mobile sawmills have a higher recovery rate than large sawmills. When using prime timber, the recovery rates for the mobile sawmills are between 40% and 50%, which is comparable to the range obtained by large sawmills. However, very few of the mobile sawmills utilize even 50% of their capacity, which suggests that more efforts should be directed towards full capacity utilization by these mills. As the workers have become more skilled with the machinery, the productivities of the mills have increased.

Because of better cost control and increased productivity, unit production costs, at constant prices, have declined over time. Costs could be further decreased through better management and by negotiating for lower royalty rates for plantation wood. Even at low levels of capacity utilization, these sawmills have been profitable. Projections based on current inflation rates indicate that the mills will continue to be profitable, even though the sale price for the sawn wood is increasing at a lower rate than the price of inputs.

The mobile sawmills have economic benefits in addition to the financial ones. They provide employment in areas where the unemployment rate is high. In addition, they distribute wealth to rural areas of the country. However, their economic benefits are constrained by the high level of foreign exchange that is used by the mills for capital equipment, fuel, and spare parts.

Both the financial and the economic results indicate that the mobile sawmills should be continued. The mobile sawmills were profitable during the first years of operation even when there were few skilled workers. This profitability, together with the mills' relatively small capital investment requirements and their flexible operational skills, supports the conclusion that mobile sawmills should be widely adopted by both the public and private sectors.

## VILLAGE FORESTRY IN TANZANIAN AGROPASTORAL VILLAGES

Aaron S.M. Mgeni
Sokoine University, Tanzania

---

Tanzania has been experiencing rapid deforestation. The consumption of fuelwood is greater than the sustainable yield. Although Tanzania has a long history of forestry projects, none have been able to mobilize the village populations to plant enough trees to meet their needs.

In 1967-68, the central government of Tanzania initiated the Village Afforestation Program to distribute seedlings to villages for planting around homes and schools and in communal woodlots. However, the program has been only marginally successful. Studies have examined the reasons that villagers have not implemented the program; however, they have concentrated only on the characteristics of the villagers and the system, not on the characteristics of the innovations themselves.

This study of six agropastoral villages in Karatu Division of Tanzania describes and characterizes villagers' uses of and approaches toward forest products. During 1988, 213 villagers were interviewed. In addition, the village leaders were interviewed.

Villagers were aware of the importance of the forests. The products they obtained from the forests included fuel, poles for building houses, wild fruits and vegetables, meat, honey, and fodder. Wood remained the most important source of energy for cooking and heating water.

However, the opinions of village households and leaders differed on several forestry issues. The villagers were concerned about the presence of snakes and wild animals in woody areas around the villages. The leadership did not share this concern. The leaders said the constraints to planting trees were drought, termites, and lack of seedlings. The villagers listed these constraints plus inadequate land, and poor organization, maintenance, and timing of forestry projects.

Many forestry projects have introduced new species of trees into the area; however, the villagers preferred 40 indigenous species because of those species' advantages: As building poles, they last two to six times longer than the introduced species, and they are used in tribal ceremonies and medicines. Because of the villagers preferences, forestry projects that simply introduce new species will be ineffective.

Forestry-related development problems were rated as less important by villagers than the scarcity of land for grazing and farming, the high prices of agricultural inputs, and the scarcity of water. Therefore, forestry projects should be components of development programs that address all of the concerns of the villagers.

# FACTORS AFFECTING AGRICULTURAL MARKETABLE SURPLUS IN TANZANIA: THE CASE FOR MAIZE

Isaac J. Minde
Sokoine University, Tanzania

Tanzania's agricultural sector provides over 40% of the gross domestic product, 75% of total export earnings, and 85% of the nation's employment, but has not always been able to produce enough food to keep up with the nation's increasing demands. The sector grew at a dismal rate of 1.8% between 1975 and 1986, compared to an estimated annual population growth rate of 3.4%. The general consensus is that the achievement of food security in Tanzania will require substantial increases in the marketed surplus of agricultural commodities.

Using historical analysis and survey methods, this study identifies and analyzes factors that affect the quantity of subsistence food crops marketed in Tanzania. In particular, the study focuses on socioeconomic and institutional factors that influence the amount of maize marketed by small farmers. Maize is examined because it is the staple food for the majority of Tanzanians and because it is grown widely by small farmers in many parts of the country.

State intervention in the agricultural sector preceded independence. A government grain purchasing monopoly was established in 1946, which set high producer prices to encourage grain production. Excessive grain surpluses and financial losses led to the establishment of a free market in grain in 1957. In 1962, drought-induced supply shortages led Tanzania's newly independent government to enact the Agricultural Products Control and Marketing Act to control and regulate the pricing and marketing of agricultural products. Government intervention in the production and marketing of agricultural products has continued, to varying degrees, from 1962 to the present.

Government control of food production tightened after the Arusha Declaration of 1967, which led to the nationalization of major grain milling companies and the relocation of many farmers into communal farming villages. Low real producer prices for staple grain cops such as maize, marketing restrictions and inefficiencies, and dislocations resulting from the villigization experiment resulted in lowered marketed output of maize. Much of the maize that was marketed was sold through the parallel market where the prevailing free-market prices were substantially higher than official prices.

In 1984, following a reevaluation of past agricultural policies, the government liberalized its policies on agricultural production and marketing by reintroducing market incentives. In particular, policy measures were adopted which sought to

- raise real producer prices by 5% per year to correct for historical price declines
- eliminate consumer food subsidies
- reduce regulations on the transport of produce by private traders
- remove agricultural input subsidies and revert to producer price incentives to encourage farmer adoption of improved crop husbandry techniques

The implementation of these measures, combined with good weather conditions from 1985 to 1987, dramatically increased supplies of maize marketed through official channels. By 1987 government stocks of maize reached record levels. Given the current situation—grain stocks are not moving, world commodity markets are weak, storage costs are high, and bank credit ceilings are stringent—the government's new challenge is to continue to honor its commitment to maintain guaranteed prices to farmers.

To test the role of various household, market, and institutional factors in the determination of the amount of maize marketed, a survey of maize producers was undertaken in Tanzania's Moshi and Morogoro districts in 1987. Thirty-one and 33 smallholder farmers were interviewed from major maize-growing villages in each district, respectively. Survey results support the findings of other recorded studies which indicate that a complex web of economic, social, institutional, and environmental factors interweave to determine the amount of maize marketed.

At the household level, key factors apart from weather include area planted to maize, total maize output, family consumption requirements, household storage capacity, cash requirements, effective use of advanced technologies, and higher education. The role of family size was found to be somewhat ambiguous. It is suggested that instead of family size, studies should focus on household consumption requirements and effective household labor supply. Survey results also indicate that the farming of cash crops such as coffee can compliment and augment the production of subsistence crops such as maize. Cash cropping need not interfere with maize land and labor requirements and can provide income for the purchasing of maize production inputs.

Across the farm gate, economic and institutional factors shown to influence the amount of maize marketed include pricing and marketing policies, local availability of consumer goods, timely local availability of credit and production inputs, and adequate marketing infrastructure such as transportation and storage.

Although producer price incentives have been shown to be a key determinant of the amount of maize produced and marketed, they can only be effective when combined with sufficient investment in supportive infrastructure. The production of surplus maize is a necessary, but not a sufficient, condition

for the realization of market sales. An effective integration of the market from primary producers to final consumers is necessary to achieve market efficiency and increased product sales. In particular there is a need for improved rural roads and transportation facilities, and rural grain storage facilities to ensure timely provision of production inputs and to facilitate the sale of surplus produce.