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# **STRUCTURAL CHANGE IN AFRICAN AGRICULTURE**

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# I NTRODUCTION

**CHRISTOPHER L. DELGADO AND TSHIKALA B. TSHIBAKA**

Sub-Saharan Africa has been a major area of focus for IFPRI research during the past decade. There has been a growing consensus in both the policy and research communities that there is a need to promote structural change in agriculture through both price-mediated policy reforms and improved investment policies. However, the investment issues in particular involve especially complex questions of public-sector versus private-sector roles, priorities regarding regions, functions, and commodities, and choices concerning long-run development strategies.

Policy debates in Africa between donor assistance agencies and national governments, and within both these sets of organizations, have at times been especially heated concerning the appropriate means for promoting desired investment activity for growth, sustainability, and food security. Some participants have argued that the focus of policy reform under structural adjustment in Africa should be limited to preventing interference by governments in output and input markets, with the objective of creating an environment that will permit markets to shift productive resources among constantly changing opportunities. Others have argued that only direct state intervention can overcome structural market failures in key domains such as credit availability and high transport costs that affect the ability of the private sector to respond to price incentives.

The truth probably lies between these two extremes, as it does with most issues of this type in much of Africa. Thus, both sides largely agree on two points. First, detailed knowledge of facts and processes based on field-level observation of specific cases is central to devising an informed view of the realistic options available for achieving reform goals. Second, policy reform that increases incomes in agriculture is of crucial importance, because it is the area of policy most likely to affect the welfare of a very large number of poor people.

The briefs that follow present a view of IFPRI's approach to research on three sets of issues that are central to the debates on investment policies under structural adjustment in Africa.

The issues explored in the first set of briefs concern priorities for increasing the productivity of agricultural resources in Africa in the context of policy reform. The second set of briefs suggests that the current pace of macroeconomic adjustment necessarily will have a strong negative impact on food security in the immediate term. It points out the limitations of targeted food security policies in Africa under the economic austerity associated with macroeconomic adjustment policies. It confirms the need to approach food security issues directly through attention to the sources of income of poor people. This suggests either that the pace of macroeconomic adjustment must be slowed, or that a greater and more immediate effort must

be made in securing those productivity increases that bolster the incomes of the rural poor. The third set of briefs concerns the interactions between macroeconomic and trade policies and the allocation of resources to agriculture and within agriculture. It emphasizes the link between macroeconomic reform and the ability to successfully pursue productivity-increasing reforms along the lines of priorities discussed in the first set of briefs. Thus macroeconomic adjustment is necessary not just in terms of short-run balance-of-payments adjustment, but also in terms of securing the sustainable productivity increases central to the food security of the poor.

Taken together, the briefs underscore both the complexity of the problem of promoting growth and equity in both the short and long run and, more fundamentally, the central need for increasing the productivity of agricultural labor in Africa from the standpoint of both growth and equity. They also demonstrate the need for complex solutions based on solid knowledge of individual cases. Each of the briefs is based upon substantial in-depth research, most of it involving intensive collection of field-level data. The results are of interest for specific situations as well as for the insights they offer for approaching similar problems in other locations and time periods.

Tshibaka's overview for the first set of briefs stresses that raising the productivity of agricultural resources requires a tight set of priorities when the task is huge and resources few. He emphasizes the need to select a few key commodities in the areas with higher potential for productivity increase. He sees public investment as being the key to mobilizing private resources in these areas. The prime mover here must be domestic political will to promote technological change through scientific research, provide improved transportation infrastructure, and support extension services that will take productivity-increasing innovations into the farming population.

The case study of structural adjustment in The Gambia presented by Puetz and von Braun is supportive of the view that output price realignments are not enough to assure the development of processes favorable to growth in agricultural productivity. This result has been confirmed by other IFPRI research in Senegal. This situation is especially likely to exist in situations where failures in one market (for example, land) lead to failures in another (for example, credit). In both the Gambian and Senegalese cases, dismantling of monopolistic state support structures for agriculture (fertilizer provision, credit, and so on) were not followed by development of private initiatives to replace them. While private initiative is necessary for large-scale success, public investment in infrastructure and some support services may be necessary to provide the facilitating environment.

If pricing issues are best approached at the macroeconomic or sectoral level; public-investment issues need to be approached at the subsector level, underscoring the information-intensive nature of policy reform in this area. The briefs by Matlon (agricultural research), Jha (farm mechanization), Wanmali (rural service use), Svendsen and Meinzen-Dick (irrigation), and Desai and Gandhi (fertilizer) all explore subsectoral issues in the relatively higher potential areas for agriculture.

The final brief in this section, by Rohrbach on trade-offs in the development of maize and sorghum in Zimbabwe, implicitly raises the question of what can be done in the lower potential agricultural areas. These are typically drier zones that nevertheless account for a large share of Africa's overall population. Should these zones attempt to emulate the higher potential regions through agricultural intensification, albeit for more drought-resistant crops? Or is some other means of supporting growth in incomes in this area necessary?

The importance of the issue is acutely brought out in the overview by von Braun for the food security briefs. He points out that roughly one-quarter of the population of Sub-Saharan Africa does not consume enough food for healthy, active lives. Furthermore, as shown in the two briefs by von Braun and Kennedy and von Braun, Teklu, and Webb, the incidence of hunger and malnutrition is not evenly spread across the population, with rural people—especially children—in the less-favored areas being most at risk. Furthermore, as Kumar shows, the problem is also different at different times of the year.

Yet food security issues in Africa are not limited to rural areas. As Delgado and Reardon show, cereal consumption patterns in Africa are shifting towards increased dependence on imported grains such as wheat and rice, especially in the urban areas. Von Braun notes that the policy response has been threefold: attempts have been made to restrain rice and wheat consumption through price measures, the consumption of domestically produced coarse grains has been promoted, and increased emphasis has been put on nonfood exports to pay for imports. The first solution has received the most emphasis, particularly in West Africa, perhaps because of relatively modest success with the other solutions. As Reardon and Delgado show, the resulting higher grain prices have been borne disproportionately by the urban poor and generally have not been very effective at channeling demand towards domestically produced coarse grains.

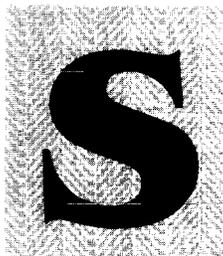
Thus, the pervasiveness of African food security problems, their inherent complexity, and the relative inaccessibility of those most at risk make targeted interventions especially problematic for dealing with food security issues. Both the series of intensive field studies reported on by von Braun and Kennedy and those reported on by Reardon and Reardon and Delgado support the position that households that have benefitted from better access to markets and technology have fared significantly better over time, even when controlling for other effects. Thus there is a happy congruence between those policies that enable rural people to be more productive, typically involving the provision of public goods such as roads and other infrastructure that are central to mobilizing private investment,

and those associated with improved food security at the household level. However, a necessary—even if clearly not a sufficient—condition of such private resource mobilization in Africa is an appropriate environment of intersectoral incentives that makes investment in smallholder agriculture appealing.

The links between macroeconomic and commercial policies and the net outcomes for relative agricultural prices is the subject of the third set of briefs. In his overview statement Valdés argues that the set of macroeconomic and sectoral policies pursued in many African countries from 1960 to 1984 had the effect of severely depressing relative incentives to invest in agricultural production, resulting in massive income and resource transfers out of agriculture during this period. The central point is that the indirect effects of economy-wide policies on the incentive structure of agriculture were frequently greater than the direct effect of agricultural incentive policies, a point that is forcefully demonstrated in the case study of Nigeria by Oyejide.

Since the view that the overall effects of development strategies in the region have been harmful to agriculture is now widely accepted, Valdés points out that the key set of policy issues concerns the question of how to deal with the operational problems of the transition to macroeconomic policies that are viable in the long run. At a minimum, this will involve improved synchronization of sectoral and macroeconomic policies. The brief by Pinckney, examining the specific issue of grain price stabilization in Kenya, illustrates how research can elucidate the trade-offs between the fiscal cost of policies and their results. In the specific case examined, a small increase in permitted price variability would vastly decrease the fiscal cost of stabilization stocks. In another brief, Valdés argues that the overall demand outlook for agricultural exports from Africa is not necessarily bad, and that the focus should be on increasing supply and developing new markets, together with export diversification.

The three briefs by Badiane and Koester, Delgado, and Badiane deal with the issue of developing new markets through exploration of the potential for increased regional trade in agricultural commodities in Africa. The myriad economic integration schemes in the region have all tended to have an industrial focus and to neglect the potential for efficiency gains from greater integration of agricultural markets. As the briefs by Badiane and Koester and Badiane show, this appears to have stemmed in large part from the erroneous perception that African agricultures are essentially similar and thus have little to gain from trading with each other. Delgado adds the point that the intensive concern with cereal self-sufficiency in inland areas such as the Sahel over the past 15 years, coupled with dumping of noncereal agricultural products by developed countries in African coastal markets of the same period, have tended to obscure the importance of agricultural trade between subregions with very different ecologies to development strategy in Africa. Ongoing, collaborative policy research at IFPRI will continue to focus on the trade issue as well as the topics covered by the other briefs.



# **SOME KEY ISSUES ON AGRICULTURAL PRODUCTIVITY GROWTH IN AFRICA: AN OVERVIEW**

**TSHIKALA B. TSHIBAKA**

## **MAJOR AGRICULTURAL TRENDS AND THEIR IMPLICATIONS FOR DEVELOPMENT**

A diagnosis of the agricultural situation in Sub-Saharan Africa during the last three decades reveals a number of disturbing trends, all of which have had serious implications for development. The growth of agricultural value added displayed a decreasing trend, so the increased use of imported inputs recorded during this period did not significantly add to the growth of agricultural output. The relative contribution of agriculture to gross domestic product (GDP) and foreign exchange declined rapidly without any substantial change in the structure of the Sub-Saharan economy. The food supply situation worsened as per capita food output declined. Rising food aid and imports (even after discounting for droughts and other natural disasters) did not help bridge the gap. The result has been widespread malnutrition and hunger.

These declining trends made it hard for the farm sector to contribute effectively to the development of the economy. IFPRI intersectoral growth linkage studies, comparing some areas of Africa and Asia, reveal that in these Sub-Saharan areas, agriculture displays weak backward and forward linkages, thus implying that its contribution to the overall growth process is constrained. The same studies clearly indicate that weak linkages are, to a large extent, due to poor development of the basic infrastructure, namely, road network, transport system, and markets. For example, in Zambia it was found that with a 1-kilometer increase in distance to the services from rural households, the per capita expenditures declined on purchased food by K 38.48, on nonfood consumer goods by K 1.70, on fuel and energy by K 3.22, on health by K 18.13, and on credit by K 3.22. For fertilizer and seeds the amounts spent declined by K 0.03 and by K 0.55 respectively.

These studies suggest that adequate development of basic infrastructure and services—in terms of their type, size, number, and location over a given region—is a prerequisite for agriculture in Sub-Saharan Africa to play its role as a main contributor to the overall growth process. Where infrastructure and services are relatively well developed, as in some cash-crop-growing areas (cocoa areas in Côte d'Ivoire, tea area in Kenya), agriculture has shown strong intersectoral growth linkages.

## **NEED TO REVERSE DECLINING TREND IN AGRICULTURAL PRODUCTIVITY GROWTH**

Since agriculture is the mainstay of the Sub-Saharan economy, the worsening of the agricultural situation constitutes the main factor in the economic crisis the region has been experiencing. The region has been left unable to meet its consumption, production, and investment needs. This unfortunate situation is a logical outcome of a declining trend in the growth of agricultural productivity.

The productivity of land has been declining in the region as a whole, as illustrated by the fact that land expansion was the dominant source of the modest growth in aggregate agricultural output achieved in the region during the last three decades. The demographic and environmental trends clearly indicate that land expansion as a major source of agricultural growth is not sustainable in the long run. Even now, in some areas, land expansion is no longer a feasible solution. The arable land/person ratio in 1989 was 0.30 hectares per capita for Malawi, 0.36 for Uganda, and 0.17 for Rwanda.

A sluggish growth in agricultural output, coupled with rapid growth in the farm labor force resulting from high population growth, has led to a declining growth in agricultural labor productivity. During the 1961-80 period, the per capita food output declined at an annual rate of 0.2 percent in West Africa and 0.5 percent in East and Southern Africa, but increased at an annual rate of 0.7 percent in Central Africa. The agricultural labor force grew during the same period at an annual rate of 1.7 percent in West Africa, 1.6 percent in Central Africa, and 1.7 percent in East and Southern Africa. This situation is particularly disturbing since labor is currently the main determinant of agricultural output in Africa.

A decreasing trend in the growth of agricultural income, resulting from a declining trend in the growth of land and labor productivity, constitutes a major constraint, not only to improved standards of living in the farm sector but also to the development of agriculture and the rest of the economy. The worsening of living conditions in the farm sector contributes to human capital transfer out of agriculture, which constrains the productive capacity of the farm sector. Furthermore, a declining trend in the growth of agricultural income also affects negatively the process of capital formation and limits the ability of the farm sector to invest in productivity-enhancing inputs and techniques.

The most vivid illustration of this situation is the observed deceleration in the growth rate of fertilizer consumption in the region. Even on a relatively small base, the growth rate of fertilizer consumption moved from 11.5 percent in the 1960s to 6.0 percent in the 1970s and 4.3 percent in the 1980s. Definitely, efforts have to be initiated to reverse the trends if the region is to meet its consumption, production, and investment needs.

## **MAIN CAUSES OF THE OBSERVED AGRICULTURAL PRODUCTIVITY STAGNATION**

As a result of deliberate macroeconomic and sectoral policies, the once dynamic agricultural sector has been turned into a contracting sector. Its productive capacity has been made to shrink over time, while the population continues to grow at an alarming rate. In parts of the region

hard-pressed by population increase, the use of traditional farming techniques has led to land degradation. Even in areas characterized by a relative abundance of land, population growth is bringing additional land under the slash-and-burn mode of production and shortening fallow periods—results that contribute to the depletion of forests and to ecological breakdown.

High rates of rural-urban migration of young and educated people has led the agricultural sector in most parts of the region to rely heavily on old people, most of whom are illiterate and exhibit poor health, low work capacity, and limited technical skills. Disregarding the movement of people related to political crises, droughts, and other natural calamities, it is widely established that the search for jobs, probably those paying much better than farming, is the major cause of the observed rural-urban migration in Sub-Saharan Africa. Furthermore, it is important to note that the few educated people who remain in rural areas tend to be primarily engaged in the nonfarm sector of the rural economy. The public investment and inward-looking incentive (trade, exchange rate, credit, tax, and price) policies that were followed during the last three decades, when most efforts were directed toward the urban sector of the economy, bear most of the blame. These policies stimulated off-farm migration and hence slowed the process of human capital formation in the agricultural and nonagricultural sectors of the rural economy.

The same policies have also encouraged the transfer of private material capital out of the farm sector and other sectors of the rural economy, slowing the process of material capital accumulation and technological transformation of the rural economy. Most farmers continue to rely on simple hand tools. Mechanized and oxen cultivation remain limited. The mechanization of postproduction farm operations (transport and processing) at the household level remains negligible for the region as a whole. In a few countries, however, some progress has been made in this regard. Overall, policymakers continue to pay little, if any, attention to this segment of farm activity.

Elsewhere in the developing world the technological package includes fertilizers, high-yielding seeds, pesticides, irrigation, and machinery, but in Sub-Saharan Africa this package is, for all practical purposes, limited to fertilizers and high-yielding varieties. Worse still, the use of these inputs is concentrated on large farms and a few crops, mostly export crops. With 20 percent of the arable and permanent cropland and 10 percent of the population of the developing world, the Sub-Saharan region accounts for only 2.3 percent of total fertilizer consumption. Despite some scientific breakthroughs, notably in maize, the use of high-yielding seeds is still very limited.

Besides this narrow resource base, the productive capacity of the agricultural sector in the region as a whole is seriously constrained by inadequate development of supporting infrastructure and institutions. Lopsided price, trade, exchange rate, and credit policies have also contributed to this situation.

## **CONCEPTUAL FRAMEWORK FOR LONG-TERM GROWTH IN AGRICULTURAL PRODUCTIVITY**

While there is a consensus on the need to reverse the situation, the controversies are on how to enhance, in a sustainable manner, the productivity of resources and,

consequently, agricultural income. This is clear from the current debate generated by structural adjustment programs and policies. Quite apart from the merits of these reforms, the real question related to agriculture is whether these programs and policies are based on a correct understanding of the forces that govern the agricultural growth process. What is even more frustrating when one examines closely the whole structural adjustment package is that its focus seems to be solely on the need to stabilize and reverse the declining trends in major macroeconomic equilibria, including balance of payments, debt burden, government budget deficit, and foreign exchange revenues. Without underestimating the need for an appropriate macroeconomic environment, the current structural adjustment programs and policies appear to have paid limited attention to the need for long-term growth in agricultural productivity.

While recognizing that structural adjustment programs and policies are currently a matter of serious debate in the region, this paper has chosen to concentrate on a more central issue of how to get the agricultural sector into a dynamic and sustainable growth path. Especially, the paper examines how to increase, in a cost-effective manner, agricultural productivity and how to keep the growth process moving.

Conceptually, increasing the productivity of agriculture involves two sets of related actions. The first set includes actions that lead to an upward shift in the agricultural production curve. This set of actions describes the process of technological transformation of the farm sector. This transformation process assumes a change in the structure of productive resources. The volume of productive resources increases and its structure changes and becomes more complex as the farm sector ceases to rely on simple tools, on-farm crop seeds, and household labor. Complex tools, equipment, machinery, improved seeds, fertilizers, pesticides, and irrigation form the bulk of capital input. The human capital content of the household labor force grows as more investments are made in health, nutrition, education, and training. The second set focuses on creating conditions that stimulate most farmers to operate efficiently within the available technological framework given their resource base. This will result, in the short-to-medium term, in increased resource productivity and reduced production cost.

The two sets of actions are in fact complementary, because for the increased growth in agricultural productivity to be sustainable in the long run, the process of technological change has to be cost-effective as well. Hence, the use of improved inputs requires efficient allocation of land and labor and sound conduct of farming. It would be counterproductive for Africa to build a farm sector based on a high-cost technological base.

This conceptual framework implies that two major issues should be addressed. First, there is a need to set a narrow set of priorities, along geographic, commodity, and functional lines, in order to improve the average productivity of farm resources. The history of development shows that rapid growth in smallholder food production has largely been due to an increased response to already favorable conditions for one or two crops (maize in Zimbabwe, rice in Punjab). Increasing agricultural productivity is a difficult and complex task. Therefore concerted efforts have to be focused on geographical areas where technical constraints are the lowest and on a few crops that present the potential

for greater success in a variety of ecological settings. Such areas and commodities exist in various parts of the region. Research efforts to guide policies must focus on identifying key constraints at various functional levels, including production, processing, storage, transport, marketing, consumption, and trade. In the past, most African countries have diffused their resources over all areas, primarily in response to political pressures. Research on commodities continues to be diffused and is still organized along problem areas such as soils, water, and pests, and not along commodity lines. This contrasts sharply with the Asian approach, where intensive research work evolved on two commodities (rice and wheat).

The second major issue is related to public investments. As suggested earlier, policymakers need to recognize that the provision of public goods to farm and nonfarm sectors of the rural economy is a prerequisite to fostering the process of private capital accumulation in rural areas. Put differently, the level of public capital accumulation in the agricultural sector constitutes one of the key ingredients of private agricultural capital accumulation.

## **ACTIONS NEEDED TO REVERSE THE TREND**

The history of the last three decades shows that efforts to structurally transform agriculture and the rest of the economy in Sub-Saharan Africa continue to rely heavily on foreign aid and borrowing. The domestic contribution to this process has remained less than adequate, partly as a result of low productivity of smallholder agriculture, the mainstay of the economy in the region. The current economic crisis, characterized, among other things, by massive foreign debt and increasing food imports, has severely limited the volume of investable resources available to the region. It is particularly urgent for countries in the region to examine ways and means of improving the productivity of agriculture in the near future, relying on available limited domestic resources and technology.

It should be emphatically stressed that this assertion does not deny the well-established fact that agricultural productivity growth has been impressive where substantive technological progress, resulting from major investment efforts, has been achieved. Neither does it overlook the pressing need for technological change in the Sub-Saharan region. However, it stresses the need to regard foreign assistance in the development process as an addition to domestic efforts—not the other way around.

In fact, attempts to increase the productivity of agriculture while relying on domestic resources and technology constitute a sensible short-term approach that will lay down a foundation for a domestically sustainable technological progress. The deceleration of the growth rate of fertilizer consumption in the region observed during the last three decades strongly suggests that such a foundation does not currently exist in most parts of the Sub-Saharan region.

Since many actions are required to develop such a foundation, the most important operational question to be addressed is that of the sequencing and timing of these efforts, in view of limited domestic resources, both public and private. The following sequencing of actions appears

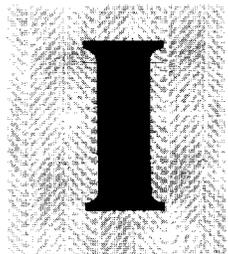
to be the most plausible way of proceeding.

As the first step, the governments in the region must demonstrate an explicit political will to enhance the growth of agriculture as the basis for overall development of the economy. Whatever the development strategy adopted, the second step should be—as IFPRI research suggests—the development of adequate basic infrastructure and institutions as well as consistent macroeconomic and sectoral policies. These include roads and transport networks, distribution and marketing channels for inputs and outputs, and credit, research, and extension services. Proper maintenance and location of infrastructure and services over a region constitute two crucial factors in improving their use and accessibility for the farming population. All these efforts are of a long-term nature and require an appropriate institutional framework and a macro-economic environment characterized by consistent investment, price, credit, trade, and exchange rate policies.

The third step is to see that farmers utilize their resources efficiently. The specific actions at this level include persuading farmers, through extension, to time farm operations appropriately; improving weather forecasting as a basis for sound timing of farm operations; developing research on relationships between crop productivity, weather conditions, and timing of farm operations; and finally, feeding the findings of this research into the extension system.

The fourth step embraces actions related to the introduction of improved inputs in the production process. Among these, fertilizers, high-yielding varieties, and irrigation deserve special attention. In view of the disappointing growth rate of fertilizer consumption that has characterized the region during the last three decades and the lack of consensus among policymakers and donors on identification of the most binding constraints to growth in fertilizer consumption, there is a pressing need for a comprehensive assessment of factors that have a bearing on the growth process of fertilizer consumption. These factors can be grouped into four sets of processes: those that influence the agronomic potential of fertilizer use, convert the potential into farmers' effective demand for fertilizers, determine the growth in fertilizer supply, and develop the fertilizer delivery system. A similar analysis is also to be undertaken for improved seeds. This analysis should include not only technical and economic aspects related to production and distribution of seeds, but also to nutritional, consumption, and commercial aspects of crops produced from these seeds.

As for irrigation, the experience with large-scale operations in the region has been very frustrating for a variety of reasons, including high development cost and poor supporting infrastructure and institutions. Small-scale and traditional irrigation systems that have been ignored until recently are, as indicated by recent IFPRI research, extremely important. This suggests the need to develop a coherent policy framework to promote the expansion and productivity of these systems as alternatives to direct investments in public, government-managed irrigation systems. Finally, it should be stressed that widespread diffusion of these improved agricultural inputs is a long-term endeavor that requires massive and consistent investment efforts.



# IMPACT OF STRUCTURAL ADJUSTMENT POLICIES ON AGRICULTURAL PRODUCTION IN THE GAMBIA

DETLEV PUETZ AND JOACHIM VON BRAUN

The Structural Adjustment Program (SAP) in The Gambia was initiated in 1985 when the economy was on the brink of collapse and foreign exchange resources were depleted. Declining agricultural production (the main cash crop, groundnuts, provides about 80 percent of official foreign export earnings), large imports of rice, and an overextended public service were largely responsible for the economic breakdown.

To reverse the trend in agriculture, the SAP set out to

- Improve price incentives for producers and reduce distortions in input and output markets,
- Transfer marketing responsibilities from parastatals to the private sector, and
- Reverse the costly overextension of government administration and parastatal agencies and increase their efficiency.

To what extent was the SAP able to turn around the declining trend in agricultural production and provide the incentives and means for the agricultural sector to increase aggregate production and investments? For this examination of the changes in the price and market conditions that the Gambian farmers encountered between 1984 and 1987, collaborative survey work by the Planning, Programming, and Monitoring Unit of the Ministry of Agriculture (PPMU) and IFPRI between 1985 and 1987 provides the basis for the observations. The study area is located in the center of The Gambia, 270 kilometers east of the country's capital, Banjul. Two distinct production systems are found in the area. Upland villages mostly rely on rainfed production of coarse grains (millet, maize) and groundnuts, while lowland villages place a much greater stress on rice grown in the river swamps.

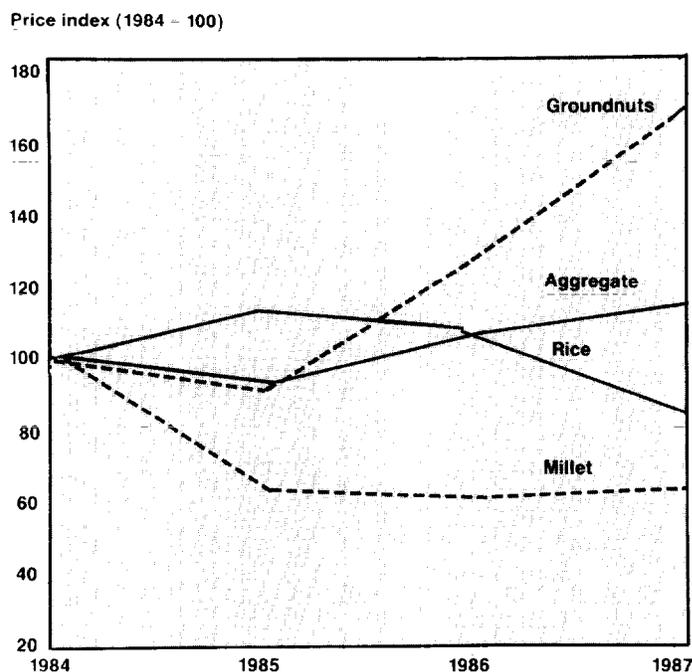
## PRICE INCENTIVES LOWER THAN EXPECTED

Impressive nominal price increases between 1984 and 1987 were largely offset by domestic inflation that increased production costs and eroded the purchasing power of producer income. Whereas relative prices shifted dramatically in favor of groundnuts and against cereals, the aggregate, weighted, output price index changed little (+17 percent between 1984 and 1987) (Figure 1). Moreover, the aggregate input price index (Figure 2) increased faster (+58 percent). Although fertilizer prices were an exception (up only 11 percent), providing an incentive for more intensive use, especially on groundnuts, unavailability of adequate fertilizer supplies actually prevented increased usage.

## THE RESPONSE: GROUNDNUTS UP, CEREALS DOWN

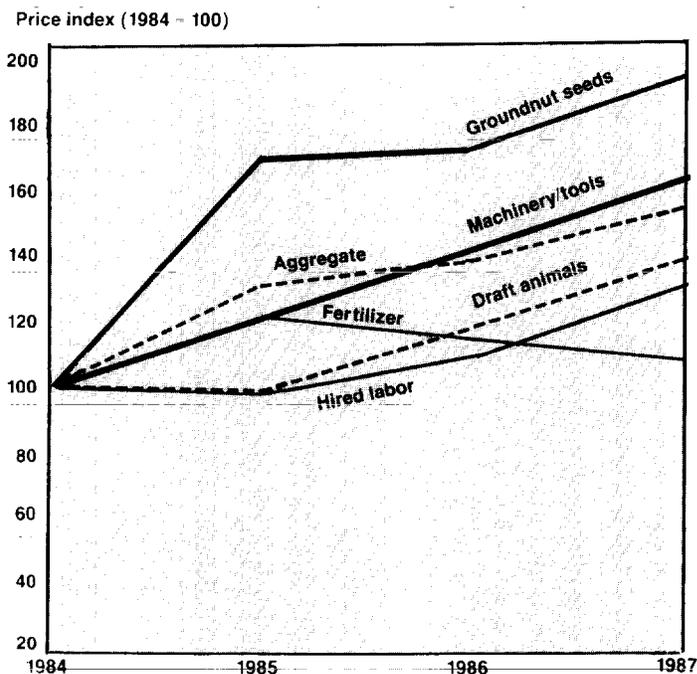
The change in relative output prices shifted cultivated area and production from cereals to groundnuts: for instance, in

Figure 1  
Output price index for major crops, 1984-87 (inflation adjusted, lagged one year)



Source: IFPRI and The Gambia, PPMU.

Figure 2  
Input price index, 1984-87 (inflation adjusted)



Source: IFPRI and The Gambia, PPMU

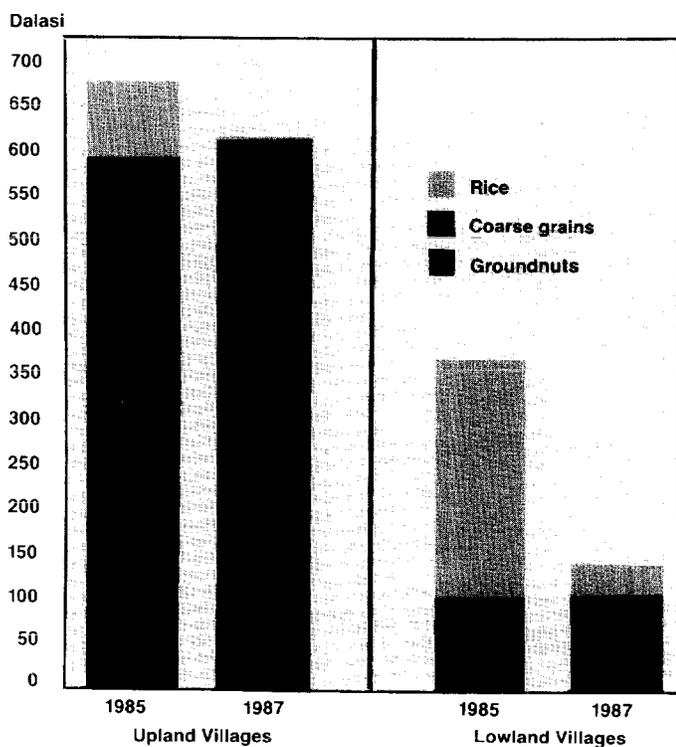
upland villages the share of area cultivated with groundnuts rose from 46.3 percent in 1984 to 60.4 percent in 1987 (with a brief dip to 40.7 percent in 1985). Similarly, the share of groundnuts in total production value rose from 56.4 percent to 75.0 percent. On the other hand, total crop production (including cereals) did not change much in these four years. Model results largely confirm the price-driven shift from cereals to groundnuts: with other factors held constant, a 10 percent increase in groundnut prices would lead to a 6.0 percent increase in production. However, due to substitution effects in area and labor, the net increase for total crop production is only 2.6 percent.

### EFFECTS ON REAL INCOME AND INVESTMENT

Upland villagers captured more of the groundnut price hike, particularly in 1986: their average per capita crop income (in constant prices) went up by 17 percent from 1985 to 1986, but down by 23 percent in 1987. In contrast, in the lowland villages surveyed, per capita income decreased by 14 percent in 1985/86 and by 54 percent in 1986/87. Declining cereal prices were aggravated in 1987 by low rice yields as a result of adverse climatic conditions and pests. Moreover, in lowland villages, farmers cannot easily expand their groundnut production. This leads to unequal distributional effects, favoring groundnut producers over cereal producers, upland farmers over lowland, and—in lowland villages—male farmers over female. Male farmers traditionally grow more groundnuts and female farmers more rice.

The price policy made farmers more vulnerable to sudden groundnut price changes or marketing problems: in upland villages, the share of income from groundnuts rose from 48 percent in 1985 to 76 percent in 1987, and even in lowland villages it grew from 19 percent to 61 percent (Figure 3).

Figure 3  
Per capita crop income, wet season, 1985 and 1987



Source: IFPRI and The Gambia, PPMU

Between 1985 and 1987, farmers made investments in draft animals, increasing their stock by 18 percent. But purchases of machinery actually declined in 1986/87, compared with the periods of 1982/83 and 1984/85. High prices for new machines, unavailability and poor quality of secondhand machines, and restrictive sales by the parastatal marketing system were major constraints. Thus, the price policy did not contribute substantially to the accumulation of production capital in agriculture, which could induce a longer-term response in output.

### FERTILIZER: A MARKET SHUNNED BY THE PRIVATE SECTOR

Between 1984 and 1987 fertilizer use in The Gambia declined by more than 75 percent, although research results consistently suggest high returns to fertilizer use. Most of the decline was the result of delivery failures (untimely fertilizer imports in 1985, for example), a restrictive distribution policy despite ample supplies in government stores, and the failure to involve private marketing.

The decline in overall fertilizer consumption disproportionately affected the poor. In tracing the development of fertilizer use in upland crops from 1984 to 1987, it can be seen that overall fertilizer use declined by more than 50 percent, and the share of low-income groups in total fertilizer consumption fell continuously. In 1984, the bottom half of income groups consumed 37 percent of all fertilizer, but by 1987 this figure had fallen to 25 percent. Some of this decline was also the consequence of limitations in credit access. Fertilizer cash purchases were lowest in the poorer income groups: 44 percent versus 57 percent in the upper groups.

### POLICY CONCLUSIONS

To some extent, the SAP price policy has succeeded in providing incentives for producers and turning around the negative trend in groundnut production, although at high subsidy costs. But other price policy goals have been reached to a lesser degree: first, previous distortions in favor of cereals have been replaced by distortions in favor of groundnuts (through subsidies). Second, although the outflow of groundnuts to Senegal was prevented in 1986/87, IFPRI-PPMU survey results show that in 1987/88, 53 percent of groundnuts produced were sold in Senegal, and national estimates for 1988/89 put this figure somewhere between 60 and 80 percent. Third, the removal of price subsidies and the reduction of public agricultural services led to reduced fiscal burdens, but they have yet to evolve into private sector participation. In the meantime, the availability of inputs and services at the farm level has seriously decreased.

# PRIORITIES FOR RICE RESEARCH IN WEST AFRICA

PETER MATLON

## RICE TRENDS AND TECHNOLOGICAL NEEDS

The West African rice sector faces a wide and growing imbalance between demand for rice and the supply produced by the region's farmers. Since 1970 regional demand has been expanding at an annual rate of approximately 8.4 percent, while production has risen at an annual rate of 3.3 percent. At this pace production barely exceeded population growth, and it has met less than half of the increments to demand. The widening gap is being met by imports, which have risen at the explosive annual rate of 28 percent since 1970.

Although favorable policy changes have an important complementary role to play, it is clear that lasting improvements can only be achieved by increasing productivity. Regional rice yields, which currently average less than 40 percent of the world mean, have been stagnant, rising at only 0.3 percent per year since 1970. Low yields are reflected in unit production costs, which remain among the highest in the world. Given limited technical opportunities for increasing yields, farmers seek to raise production by extending cultivated area, which has expanded at more than 0.3 percent a year over the last two decades. But in those subregions of West Africa where population pressures are highest, area expansion is occurring either onto soils that are poorly suited to rice or at the expense of fallow periods or both. Each of these processes threatens the sustainability of rice productivity and production.

## ENVIRONMENT AND ECOSYSTEM PRIORITIES

The constraints to rice production and needs for technical change vary according to the diverse environments and ecosystems in which rice is cultivated. The West Africa Rice Development Association (WARDA) has defined three priority rice-growing environments (Table 1).

The **upland/inland swamp continuum** has a priority position in rice production because its large area and farm population give it the greatest overall leverage on regional production. Up to 80 percent of rice farmers in the region cultivate rice on approximately 2 million hectares of continuum land. The continuum contains two distinct types of land, the uplands and the inland valley swamps, and a third less well defined type, the hydromorphic zone. At the upper end of the continuum the potential for impact on yields is moderate, but because of the considerable areas involved, the potential leverage on output is large, as even marginal growth in yields or cultivated area will translate into large production effects. Production systems tend to be extensive and returns to labor highly competitive with other enterprises. Issues of cropping sustainability are also most urgent in this portion of the continuum, since erosion and

Table 1  
Priority rice-growing environments in West Africa

Environment	Area (1,000 hectares)	Percentage of Total	Average Yield (tons/ hectare)	Potential Area Expansion	Potential Yield Increase
Continuum Upland/ hydro- morphic soils	1,539	57	1.0	++	+
Hydro- morphic soils/ swamp	513	21	2.8	+++	++
Sahel	135	6	2.8	+	+++
Mangrove	189	7	1.8	+	++

Source: WARD A

Notes: Area estimates are for 1980-84. Percentages do not sum to 100 due to the exclusion of low potential deepwater rice systems. + = marginal potential; ++ = medium potential; +++ = large potential

soil fertility degradation can be severe under continuous cultivation. At the lower end of the continuum the potential for impact on yields is substantial. However, the intensive production systems required to realize the potential may currently be inappropriate, except in areas of atypically high land pressure. Maintaining sustainable increases in productivity under continuous cropping generally poses few problems on typical lowland soils

**Sahelian irrigated rice** presents a markedly different environment and set of potentials and problems due to its organizational structure, management system, and proximity to the desert. Access to water control, generally within large government schemes, means that potential returns to high levels of variable inputs are greater than in other rice production systems and the risks of financial loss are less. In addition, at least two rice crops might be grown annually over much of this environment. Wide diurnal temperature variation, high pest pressures, and poor water management, however, make a second-season cultivation highly risky with current varieties and practices, and farmers generally prefer to grow cash crops such as vegetables during the off-season. Whether they would switch to rice if better-adapted varieties became available depends largely on the market and policy environment.

Although there is considerable technical potential for expansion of the Sahel's irrigated area, total cultivated area is likely to remain limited in the medium term. An irrigable area of nearly 2 million hectares is located along the Sahel's major rivers and in the Lake Chad basin, but only 5 percent of this was under irrigation in 1985. The recent completion of the Diama and Manantali dams in Senegal

and Mali makes an additional 375,000 hectares potentially available. Nevertheless, uneconomically high land development costs are likely to restrict exploitation to less than 10 percent of this potential by the year 2000. This will bring the total area under improved irrigation to only 155,000 hectares by the turn of the century.

**Mangrove swamps** constitute the third priority rice-growing environment in West Africa. The soils are generally more fertile and can sustain longer periods of continuous cultivation than in the other environments. However, they can also be characterized by high salinity and sulfate acidity, and these problems have been accentuated by lower regional rainfall during the last two decades. Rice cultivation is currently limited to less than 200,000 hectares of the approximately 1.2 million hectares of mangrove swamps in West Africa. The prospects for increasing this are limited due to the high financial costs and potential environmental damage of further land clearing.

### WARDA'S RESPONSE AND RESEARCH APPROACH

Two important lessons have been learned from past rice research in West Africa. First, rice technologies developed outside Africa are seldom directly transferable. West Africa must develop an indigenous capacity to generate new technologies. The high diversity of rice production systems means that national agricultural research programs must begin to carry a greater responsibility for both applied and basic research. The second lesson is that very few of the technologies developed on experimental stations have been broadly adopted. Levels of purchased inputs for many recommended packages are often inefficiently high, exceeding farmers' capital resources and their ability to absorb risk. Land-saving, yield-increasing technologies are not always the most appropriate. Labor-saving or yield-stabilizing technologies that lessen the need for purchased inputs are often more appropriate.

Building on these lessons, WARDA's **Medium-Term Plan** for the period 1990-1994 lays out a provisional set of

projects for each environmental program. The research agenda is based on four guiding principles: a clear problem-solving, constraints-based research orientation; interdisciplinary project orientation and management; full integration of on-farm and on-station research; and close collaboration with and strengthening of national research programs. Moreover, WARDA's research projects reflect the position that environmental and management factors, not germplasm, constitute the primary set of constraints to sustainable improvements in production. WARDA emphasizes research on crop and resource management to develop appropriate means of modifying production systems in ways that will in turn increase the demand for more responsive cultivars.

### SUSTAINABILITY ISSUES

Rice production in West Africa faces a range of direct and indirect threats to production sustainability (Table 2). WARDA has defined the following goals for technology development to ensure the long-term sustainability of new production techniques:

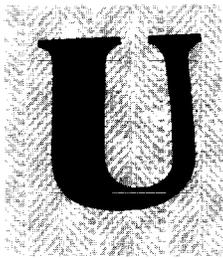
- **Technical sustainability**—maintenance or reduction of unit production costs over time within new production systems without incurring major negative externalities outside these systems.
- **Economic sustainability**—assurance of competitive net social returns, and of financial profitability given most probable future price and policy conditions.
- **Socioinstitutional sustainability**—assurance of institutional support required for the adoption of new technologies that demand neither radical modification of social behavior patterns (for example, on the farm or in the village) nor levels of administrative, managerial, or fiscal support that would be unrealistic for national programs to maintain over time.

WARDA is now incorporating these goals and guidelines in the design of its project activities and is defining measurable evaluation criteria.

Table 2  
Major sustainability problems in West Africa's principal rice-growing environments

Environment	Classes of Sustainability Problems				
	Direct	Technical	External	Economic	Socio-institutional
Continuum					
Upland	Erosion; declining fertility		Lowland silting		
Lowland	Toxicities related to drainage		Waterborne human diseases	Competition with other crops	Land tenure
Sahel, irrigated	Sodium and alkali build-up		Silting of structures; waterborne human diseases; agrochemical pollution	Subsidies; competition with other crops	Group action/water management
Mangrove swamp	Sulfate acidity buildup		Loss of wildlife habitats	Competition with other activities	

Source: WARDA



# USE OF ANIMAL TRACTION ON SMALLHOLDER FARMS IN EASTERN PROVINCE, ZAMBIA

DAYANATHA JHA

Extension of cultivated area is the dominant source of production growth in regions characterized by relative abundance of land. Yet, features of the forest and bush-fallow systems prevalent in many parts of Sub-Saharan Africa inhibit the adoption of mechanized cultivation. Prevalence of tse-tse flies is another ecological barrier to adoption of animal traction over large parts of the continent. This brief presents some evidence on adoption of oxen cultivation on smallholder farms in the Eastern Province of Zambia and raises some issues relevant for its spread in other areas. These data are based on a survey of 330 smallholder households in the province.

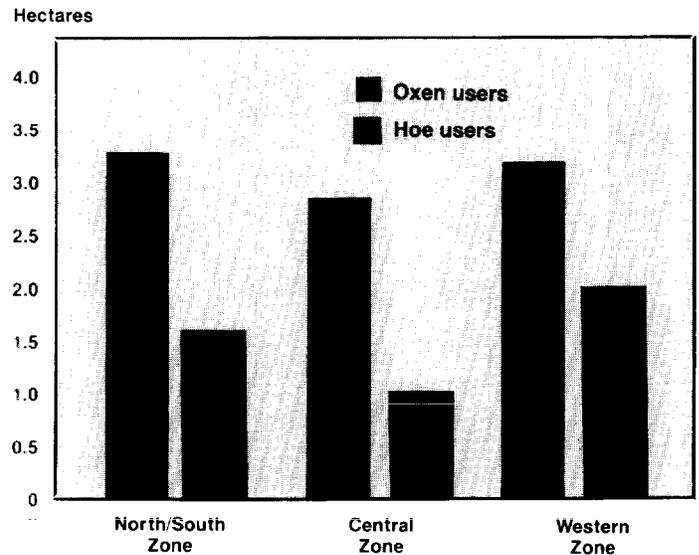
Eastern Province is a sparsely populated region. It has two distinct ecological zones—the plateau and the valley. The bulk of the population (83 percent) is concentrated in the plateau zone. Cattle population is also confined to this zone, though incidence of disease keeps stock levels fluctuating. Cattle population and use of animal traction varies between the three major agroecological zones of the plateau region—the North/South, the Central, and the Western.

The percentage of farmers owning oxen ranges from 25 percent in the Central plateau zone to 41 percent in the Western. These households account for 31 percent and 57 percent of the cultivated land in the two zones, respectively. Use of oxen for cultivation, however, is more pervasive. It varies from 28 percent of the households in the Central zone to 73 percent of the households in the North/South zone, and the area cultivated with the help of oxen ranges from 48 to 74 percent of the total cultivated area in different zones. A rental market for oxen services is prevalent, and cash rentals are common. As expected, owners use oxen for different operations, whereas 65 percent of those who rent, use oxen for a single operation only, usually for land preparation.

According to the 1985/86 survey, on average, oxen users cultivate 55-170 percent more area than hoe users. The average cultivated area ranged from 1.08 to 3.37 hectares per household (Figure 1). This is in line with other studies in different parts of Sub-Saharan Africa.

Oxen use is strongly related to farm size (Table 1). Only 17 percent of the households in the smallest size category owned oxen; only 26 percent of households in the smallest size category were oxen users. At the other extreme, about 77 percent of the households in the largest category owned oxen and 96 percent used oxen to cultivate their lands. Differential access to this technology could be contributing toward growing inequalities in land distribution in the plateau zone. In the valley, where animal traction is not used, land distribution is more equal. This tendency to inequality is exacerbated by the fact that oxen users are also more likely to adopt other yield-increasing technologies. For example, 51 percent of the oxen users grew hybrid maize, compared with 14 percent for hoe users. For

Figure 1  
Land cultivated with oxen, compared with hoe users, three zones of Eastern Province, Zambia, 1985/86



Source: IFPRI/RDSB/NFNC/EPAD Project Survey.

Table 1  
Size distribution of farms and adoption of oxen cultivation, plateau zone of Eastern Province, Zambia, 1985/86

Variables	Size of Farm in Hectares				
	Less than 1.00	1.00-1.99	2.00-2.99	3.00-4.99	More than 5.00
	(percent)				
<b>Farm size</b>					
Number of households	23.6	31.7	15.4	18.7	10.6
Percent of total area	5.7	18.6	14.7	28.1	32.9
<b>Oxen cultivation</b>					
Farmers using oxen	25.9	56.4	65.8	87.0	96.2
Farmers owning oxen	17.2	17.9	36.8	58.7	76.9
Area cultivated by oxen	18.4	46.0	58.4	70.3	93.2

Source: IFPRI/RDSB/NFNC/EPAD Project Survey.

fertilizer adoption, the corresponding figures were 73 percent and 66 percent, respectively.

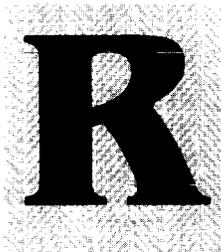
Finally, analysis of determinants of animal traction technology reveals that higher socioeconomic status, represented by larger area and membership in cooperatives, led to higher adoption. These variables also repre-

sent better capacity to invest in acquisition of oxen and implements in this capital-scarce setting. The knowledge variables, education and extension advice, also influenced adoption positively, as did improved infrastructure. Finally, ecological differences—in this case incidence of disease—play an important role in explaining differences in adoption.

Spread of animal traction in Eastern Province has contributed to significant growth in cultivated area and production. In order to foster this process and also to minimize the emergence of disparities among farms arising out of differential access to this technology, a number of steps are suggested.

- Higher priority to disease eradication and veterinary services within the plateau zone would facilitate the spread of animal traction in the province. It would encourage investment in cattle by reducing the high risks of mortality.

- Acquisition of oxen and implements involves significant cash outlays. Credit programs in the province are primarily oriented toward short-term production credit. There is a need to expand medium-term credit. The existing insistence on land as collateral is misplaced in this context because the use of oxen will enlarge the land base itself.
- Adequate supply of animal-drawn implements and repair facilities are also constraints. There is a need to develop these independently from the credit package.
- Output growth in the province has been driven by a favorable maize price policy, backed by the ability to increase surplus production. This has encouraged adoption of new technologies. There is a need to constantly monitor the incentive structure and expand it to cover other crops like groundnuts, soybeans, cotton, tobacco, and sunflower—all of which have excellent potential in the province.



# RURAL SERVICE USE IN EASTERN PROVINCE OF ZAMBIA

SUDHIR WANMALI

Generally, when referring to infrastructure, the research community is concerned with roads, telecommunications, electrification, and irrigation. Also necessary for the development of agriculture are various services such as transport, finance, veterinary, input distribution, and output marketing.

Infrastructure and people are "located" in towns and villages. Locating services properly over a region is a crucial factor in improving their accessibility for the farming population. Making these services available in distant towns is not of much help locally.

In the geographical studies on the spatial impact of development, it is recognized that access is directly related to income and social status and that it declines away from towns and cities. The analysis of such a center-and-periphery relationship, particularly involving infrastructure and people, is fast becoming a centerpiece in all current literature on regional development planning in the Third World.

Analysis of the determinants of service use at the household level attempts to address the broader policy issues of the effects of access to rural service infrastructure on household demand for services and on planning for the distribution of goods and services. In the rural Eastern Province of Zambia there are 10 main groups of services: health, communications, credit and finance, bus and other transport, agricultural implements, agricultural

inputs, veterinary, agricultural extension, agricultural marketing, and retail. The 10 communities jointly surveyed in 1986 by IFPRI and Zambian collaborators (Rural Development Studies Bureau, Eastern Province Agricultural Development Project, and National Food and Nutrition Commission) had access to these services at 13 locations.

## BASIC PATTERNS

For communities (groups of villages, called branches) studied in Eastern Province, there is a negative relationship between distance and the number of trips made and between travel time and the number of trips made. The correlation coefficients are -0.18 and -0.19, respectively, and are significant at the 0.001 level, although these simple linear relationships are weak.

This basic relationship also appears to be true for separate services: the more accessible a service is to a household, the more it is used. Thus, agricultural marketing, which is the most accessible of services, has the maximum use (Figure 1)

Various travel modes are used to reach services: 53.5 percent of the trips are by foot, 24.4 percent by bicycle, 10.0 percent by ox-cart, 6.3 percent by car or taxi, and the rest by bus, truck, motorcycle, boat, or canoe. The mode differs according to the purpose of the trip (Table 1).

Figure 1  
Trips and distance for average household using service in Eastern Province of Zambia, May 1986, by service type

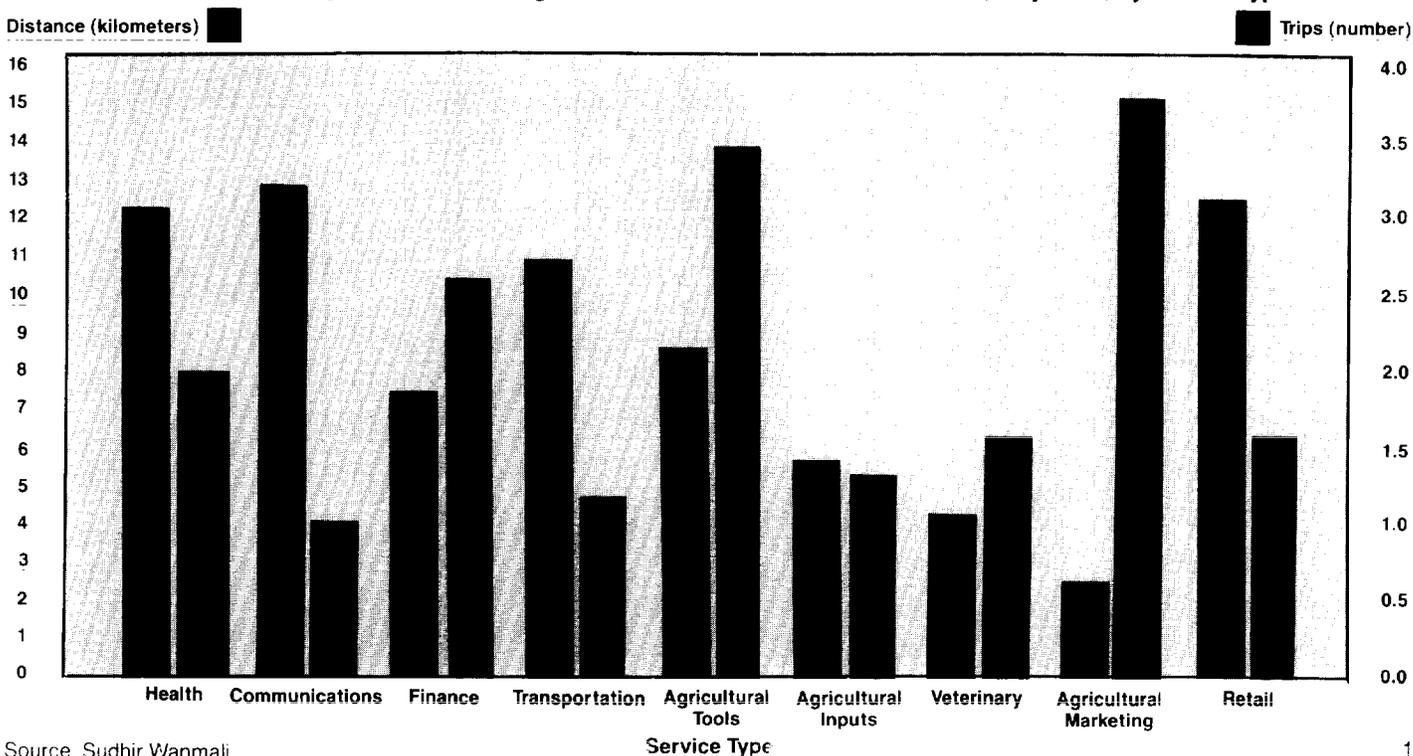


Table 1  
**Pattern of service use for aggregated sample**

Purpose of Trip	Number of Trips	Travel Time to Service (hours/trip)	Mode of Transport							
			Foot	Bicycle	Ox-Cart	Motor-cycle	Car or Taxi	Bus	Truck	Boat or Canoe
Health services	155	1.68	71.61	25.16	0.65	...	2.58	...	...	...
Postal communication services	34	1.55	52.94	41.18	...	...	5.88	...	...	...
Credit and finance services	87	1.11	50.57	28.74	16.09	...	4.60	...	...	...
Bus and other transport services	52	1.39	57.69	1.92	11.54	1.92	17.31	1.92	7.69	...
Agricultural tools—purchase	55	2.24	58.18	41.82	...	...	...	...	...	...
Agricultural tools—hire	11	1.17	54.55	9.09	36.36	...	...	...	...	...
Agricultural tools—repair	6	0.82	66.67	16.67	16.67	...	...	...	...	...
Agricultural input services	165	1.01	25.45	22.42	32.73	3.03	2.42	...	...	13.94
Veterinary services	5	1.72	100.00	...	...	...	...	...	...	...
Agricultural marketing services	228	0.54	42.98	26.75	15.35	...	...	...	...	14.91
Retail services	589	1.35	71.82	20.37	1.36	0.17	5.77	0.51	...	...

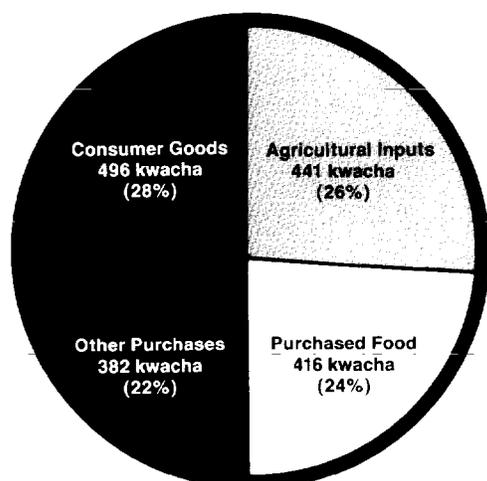
Source: IFPRI/RDSB/EPADP/NFNC Regional Service Use Survey, May 1986, Eastern Province, Zambia.

Note: Percentages may not add to 100 because of rounding.

### DETERMINANTS OF SERVICE USE

Expenditure on services can be influenced not only by the socioeconomic characteristics of the households but also by the distance between services and households. The three most important areas of household expenditure for the aggregated sample are (in kwacha) consumer goods (K496 or 28 percent of the total annual expenditure); agricultural inputs (K441 or 26 percent); and purchased food (K416 or 24 percent). Credit, transportation, building and construction, fuel and energy, health, postal communication, and education account for the remaining 22 percent of total annual expenditure (Figure 2).

Figure 2  
**Mean household purchase pattern for aggregated sample from Eastern Province of Zambia, 1986**



Source: Sudhir Wanmali

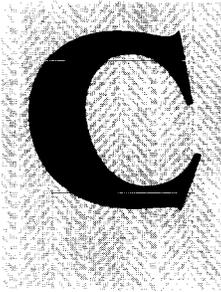
With an increase in actual distance, regression analysis shows statistically significant declines in the average expenditure on purchased food, consumer goods, fuel and energy, health, and credit services. Distance negatively influences demand for fertilizers and seeds and is statistically significant.

For example, with a 1-kilometer increase in distance to these services from households, the per capita expenditures decline on purchased food by K38.48, on consumer goods by K1.70, on fuel and energy by K3.22, on health by K18.13, and on credit by K3.22. For fertilizer and seeds the amounts spent decline by K0.03 and by K0.55, respectively.

### POLICY IMPLICATIONS AND RECOMMENDATIONS

Of course, what people consume and demand is greatly influenced by what is available and made available. Considering that in Zambia the supply of all services is almost entirely the responsibility of the government, the findings of this study have tremendous policy implications for the development of Eastern Province.

Access needs to be improved to individual groups of goods and services as well as to agriculture-related infrastructural services in Eastern Province. This has implications for improvement also in the distribution system of goods and services. Policy interventions in order to improve the efficiency of public expenditure form a major plank of the structural adjustment program in Zambia, and rural service infrastructure is one of the major areas of public expenditure there. Increased efficiency of these public investments in terms of their effective availability as well as better management will go some way in addressing the issues related to structural adjustment in this area of public expenditure.



# CHOICE OF IRRIGATION TECHNOLOGY IN ZIMBABWE

MARK SVENDSEN, RUTH MEINZEN-DICK, AND MANDIVAMBI RUKUNI

## IRRIGATION DEVELOPMENT IN SUB-SAHARAN AFRICA

Irrigation development in Sub-Saharan Africa (SSA), has lagged far behind similar development in Asia. While 31.6 percent of arable land in Asia is irrigated, only 3.7 percent of arable land in SSA is provided with controlled water supplies.<sup>1</sup> The difference in productivity of irrigated and unirrigated land in semiarid environments or where precipitation is highly variable is well established; and expanded irrigation has often been advanced as a solution to chronic problems of stagnant agricultural productivity, declining per capita production, and immense year-to-year variability in output which characterize SSA agriculture.

A number of reasons have been advanced to account for the modest extent of African irrigation development to date. These include high irrigation development costs, low population densities, highly weathered infertile soils, poor supporting infrastructure, lack of a tradition of irrigated agriculture, and the absence of extensive alluvial floodplains and deltas such as those of the Indus, Ganges, Yellow, and Mekong rivers in Asia.

Recent irrigation statistics indicate that small-scale and traditional irrigation (SS/T) systems are extremely important in SSA, serving 47 percent of the total irrigated area

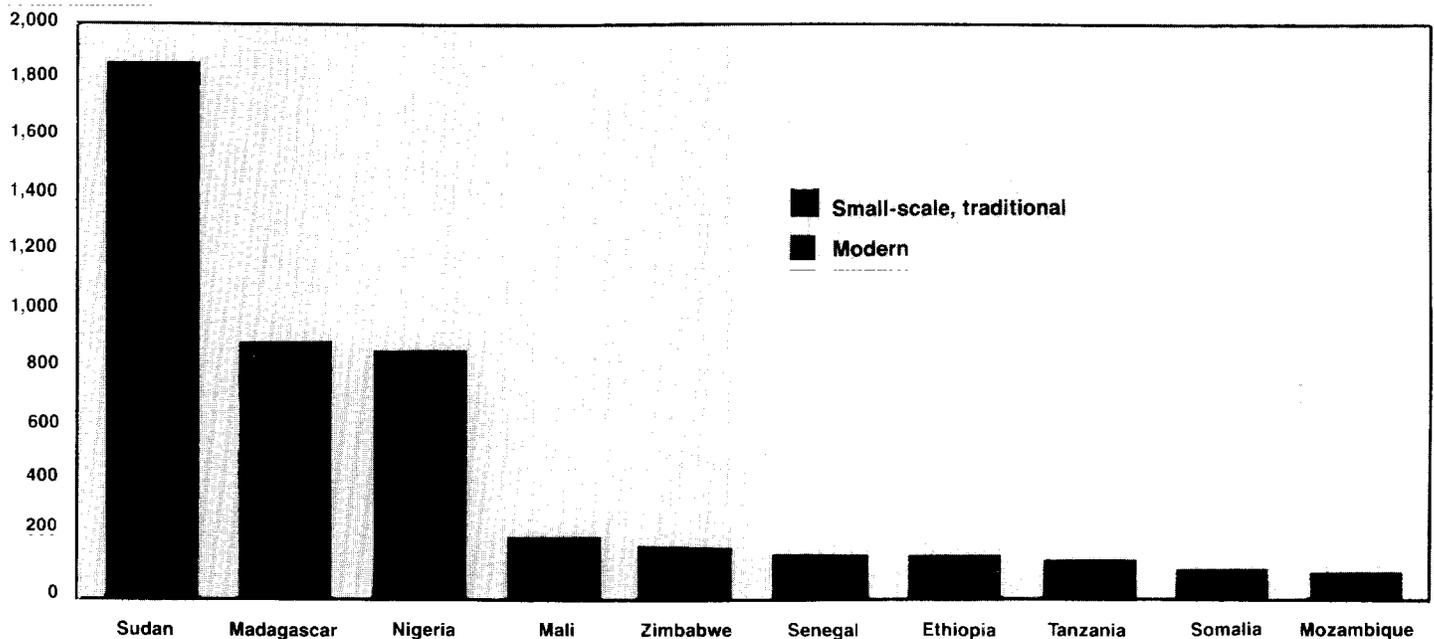
and a larger share of smallholders. Figure 1 presents 1987 data of the Food and Agriculture Organization of the United Nations on irrigated area for the 10 largest irrigating countries in SSA, broken out by type of irrigation. While somewhat subjective, the distinction between the two different modes of irrigation is based largely on system size, government involvement in management, and technology, with the SS/T systems typically being simple, small, and managed by individual farmers or groups of farmers.

Until 1985, the *FAO Production Yearbook*, the standard source of regional irrigated area data, seriously underreported area under irrigation in SSA, primarily because it ignored the bulk of the area under SS/T schemes. In that year a retroactive adjustment process was initiated, which raised reported levels of SSA irrigated area by about 37 percent (using 1982 as a reference year) to correct for this. However, some of the smallest and least organized types of schemes, such as the *dambo* gardens in Zimbabwe, are still uncounted. (*Dambo* gardens are small, intensively cultivated, privately controlled holdings on *dambo* landforms, which are shallow, seasonally waterlogged depressions at or near the head of a drainage network.) The underrecognized importance of the traditional irrigation sector, coupled with the often disappointing performance of modern irrigation projects in SSA, suggest development and consideration of policy options that promote expansion and increased productivity in traditional modes of irrigation

<sup>1</sup>For the purpose of this paper, Asia excludes Soviet Asia, and Sub-Saharan Africa excludes the Republic of South Africa.

Figure 1  
Net irrigated area, by traditional or modern irrigation, 1987

(1,000 hectares)



Source: FAO

as alternatives to direct public investment in larger-scale, government-managed projects. Zimbabwe provides an interesting example of the potential of this approach.

## IRRIGATION DEVELOPMENT IN ZIMBABWE

Irrigation in Zimbabwe spans a range of technology, management patterns, and modes of government intervention. Over 88 percent of the irrigated area comprises large-scale commercial farms and estates, and less than 12 percent of irrigation is available to smallholders (Table 1). The large-scale commercial sector includes estates run by the government parastatal (ARDA), private commercial estates, and individually owned commercial farms. Smallholder irrigation likewise includes systems run by a government agency (Agritex), communally managed systems, and *dambo* gardens under individual management.

Both technological sophistication and development costs of irrigation systems in the large-scale commercial sector are generally higher than in the smallholder sector. Per hectare costs are estimated at US\$3,000-4,000 for commercial systems, compared with US\$500-2,500 for smallholder systems, in part because of the greater use of overhead sprinklers and pumps in the former. Both of these figures are comparatively low by SSA standards.

Since independence, Zimbabwe has made concerted efforts to expand irrigation to meet objectives of increasing food security and raising rural incomes, with particular emphasis on smallholder irrigation. The 15 percent simple growth in irrigated area during the period 1980-88 has been achieved through a combination of direct government involvement, indirect government support, and private investment. *Direct government involvement* includes investment in dam construction (which may serve both commercial and smallholder irrigation, as well as municipal water supply and other purposes), irrigated estates (ARDA), and agency-managed smallholder schemes (Agritex).

The National Farm Irrigation Fund (NFIF), which makes available subsidized credit for irrigation development, provides *indirect government investment* in irrigation. Since 1985 approximately US\$9.75 million has been loaned through this fund. The advantage of this strategy is that it allows the state to assist farmers in developing

irrigation without assuming the full cost of construction or the recurrent burden of operating the systems. However, it has been much more successful in assisting commercial farms than in developing irrigation for smallholders. This is partly because of the greater experience of commercial farmers with irrigation, but the lending agency's difficulties in administering loans to smallholders and groups of smallholders, particularly where full ownership of the system and security of tenure are absent, has also limited its effectiveness among communal farmers.

*Private investment* by farmers has been a major source of irrigation development in Zimbabwe. While the most visible part of this occurs on large-scale commercial farms, smallholders have also made substantial investments in constructing and operating irrigated gardens. Just as most SS/I irrigation in Africa in general has been ignored until recently, gardens on *dambo* landforms continue to be overlooked in official statistics and policy, even though recent studies estimate that smallholders have developed as much as 20,000 hectares of such garden irrigation, using shallow wells with manual lifts or small pumps. These irrigated gardens can be extremely productive and have strong nutritional, drought insurance, and off-season employment benefits, yet questions over their environmental impact and a failure to recognize their importance and potential have led to stringent regulation and a near total absence of public assistance and support.

The general lesson here is that an effective program of support for irrigation development requires sector-wide planning and a diversity of approaches to expansion and improvement. Technologically led growth in irrigated agriculture does not demand that sophisticated systems be built new from the ground up or imported whole from Asia or the West. Traditional forms of resource exploitation can provide physical design models that can be enhanced selectively with improved technology. Likewise, traditional forms of irrigation organization can provide useful models for building sustainable local institutions to construct and manage new smallholder irrigation schemes. Required is a thorough and broad-ranging review of existing policies and practices and careful analysis of constraints and opportunities afforded by alternative policies and assistance modes.

Table 1  
Irrigated area and estimated development costs in Zimbabwe by type of farm, 1980-88

Year	Large-scale Commercial			Smallholder			Total
	ARDA Estates <sup>a</sup>	Private Estates <sup>b</sup>	Commercial Farms	Agritex	Communally Managed <sup>c</sup>	Dambo Gardens	
	(hectares)						
1980	8,446	30,230	124,576	3,612	282	20,000	187,146
1981	8,446	34,338	123,990	3,612	282	20,000	190,668
1982	10,696	31,547	133,858	3,612	282	20,000	199,995
1983	11,195	33,033	110,812	3,612	282	20,000	178,934
1984	11,534	33,157	102,440	3,685	282	20,000	171,098
1985	11,534	32,697	117,138	3,961	282	20,000	185,612
1986	12,304	n.a.	n.a.	4,061	282	20,000	n.a.
1987	12,364	32,697	140,339	4,227	282	20,000	209,909
1988	12,414	32,697	145,850	4,393	282	20,000	215,636
Estimated development costs (US\$/hectare)	3,250	n.a.	3,000-4,000	2,250	n.a.	500-2,500	

Source: Compiled from data from Agricultural and Rural Development Authority, Central Statistical Office, Commercial Farmers' Union, and Agritex.

<sup>a</sup> Figures refer to developed command area.

<sup>b</sup> Figures refer to irrigated area. The years 1985-88 were affected by drought.

<sup>c</sup> Time-series data not available. Assumes no expansion after 1985.

# **P**OLICY ISSUES IN GROWTH OF FERTILIZER USE IN SUB-SAHARAN AFRICA

**GUNVANT M. DESAI AND VASANT P. GANDHI**

Within the developing world, about one-fifth of the arable and permanent cropland and one-tenth of the population are in Sub-Saharan Africa (SSA). But SSA accounts for just 2.25 percent of the developing world's fertilizer consumption. Furthermore, SSA's share in fertilizer consumption has declined over time—it was nearly 4 percent in the early 1960s.

The need for rapid growth of fertilizer use in SSA is widely recognized. Several points need to be considered in view of the persistently low levels and slow growth of use: higher relative cost of area expansion than of yield increases; danger to fragile ecosystems from area expansion; present low soil fertility; and complementarity between fertilizer use and productivity of both land and labor.

According to the FAO, fertilizer consumption in SSA must increase by more than six times between 1979-81 and 2010 to raise agricultural production at 2.9 percent per year. This implies annual consumption of about 6 million tons by 2010 compared with 1.1 million tons in 1987.

## **DEBATE ON FERTILIZER POLICIES**

There is no unanimity on policies for rapid growth in fertilizer consumption. Currently, issues such as removal of fertilizer subsidies, privatization of the distribution system, and liberalization of fertilizer imports are debated in the context of the structural adjustment programs and policies. This discussion often seems simplistic because rapid growth in SSA's fertilizer use is also constrained by difficult agroclimatic environments, lack of major technological breakthroughs, inadequate infrastructure and institutional development, and deficiencies in overall agricultural development policies.

## **A FRAMEWORK TO IDENTIFY POLICY REQUIREMENTS**

Experiences of many countries suggest that long-term growth of fertilizer use may be viewed as an outcome of four types of processes—those that influence the agronomic potential for fertilizer use, convert the potential into farmers' effective demand for fertilizers, determine the growth of aggregate fertilizer supply, and develop the fertilizer distribution system. Three major elements in the operating environment that influence development of and interactions among these processes are prices, institutional setup, and macroeconomic conditions. Government policies affect growth in fertilizer use through their direct and indirect influence on these processes and the operating environment.

It seems more appropriate to consider growth of fertilizer use in SSA as an outcome of all the above processes operating in a dynamic setting rather than as the result solely of farmers' fertilizer demand in a setting where markets for outputs and inputs are fairly well-developed. This is because the constraining factors are varied and interrelated. Therefore, it is important to identify the *most binding* factors and constraining relationships and then to address policies to remove them.

## **AN OVERVIEW OF GROWTH IN SSA'S FERTILIZER CONSUMPTION**

Despite low levels of fertilizer use and poor growth, SSA's fertilizer scene has changed substantially since the early 1960s. Total consumption has increased from less than 200,000 tons to about 1 million tons in the mid-1980s. More important, this was an outcome of growth in all agro-ecological regions and in many countries. In the early 1960s, the western SSA region, with 37 percent of SSA's harvested area, had a share of just 8 percent in fertilizer consumption. By the mid-1980s, it had risen to 32 percent. Similarly, consumption exceeded 3 kilograms per hectare in 27 countries, compared with only 5 countries in the early 1960s, and nearly a dozen had levels above 10 kilograms per hectare.

But there are also some disturbing aspects. Over time there has been a deceleration in the growth rate of total consumption—11.5 percent in the 1960s, 6 percent in the 1970s, and 4.3 percent in the 1980s (until 1987). Also, growth that was fairly steady and continuous up to the mid-1970s has since become unstable and intermittent. Similarly, in all regions except western SSA there was a substantial setback to growth during the 1970s. The pace of growth dropped further and became statistically insignificant during the 1980s in the Sudano-Sahelian and southern regions. In the western region too, the growth rate dropped from above 15 percent in the 1960s and 1970s to 8 percent in the 1980s.

To invigorate the trends, it is crucial to identify the *most binding* constraints to rapid growth in fertilizer use. These may not be the same in different countries. Also, new constraints may emerge as consumption grows. Therefore, continuous diagnostic research on growth of fertilizer use is needed.

## **SOME REFLECTIONS ON POLICY THRUSTS**

The thrusts in policies needed to accelerate long-term growth in SSA's fertilizer use are outlined below. These reflections are based on exploratory research at IFPRI that

examines variations in the growth of fertilizer consumption among SSA countries.

- In countries where agricultural exports dominate foreign exchange earnings and government revenue, the bulk of fertilizer use generally has been on a few export crops, but its growth has been poor and unstable. This seems to be due to the long-term downward trends and high variability in the world prices of most agricultural exports. The output price policies are usually tied not only to the world market conditions but also to the needs for foreign exchange earnings as well as government revenue. Reforms in policies for export crops alone will not suffice to accelerate growth in fertilizer use. The crop-oriented base of fertilizer use needs to be broadened through new initiatives. To accomplish this, continuous enlargement of fertilizer supply and development of institutions that rapidly spread fertilizer use for nonexport crops may be more important than price incentives.
- Since food crops account for the bulk of cropland in most SSA countries, rapid growth in total fertilizer use critically depends on the pace of fertilizer diffusion among these crops. Countries with relatively high levels (and also those with impressive growth) of fertilizer use are also the ones where food crops have a high share in total fertilizer use. The diffusion of fertilizer use on food crops in SSA is, of course, constrained by the absence of major breakthroughs in crop varieties. Yet there appears to be considerable untapped potential for fertilizer use on food crops. Maize could be a lead crop because of its dominance and superior fertilizer response, but fertilizer use on maize is not widespread in most SSA countries. This seems to be due to numerous deficiencies in the agricultural research and

extension systems, inadequate development of fertilizer distribution and credit systems, and underdeveloped marketing systems for food crops, especially as all these systems relate to the smallholder sector.

- Debt burden appears to have been a major factor in slowing down the growth of fertilizer consumption in the 1980s. But in most countries, fertilizer imports are only a small fraction of the total import bill. Therefore, curtailing fertilizer imports contributes little to solving the debt problem. On the other hand, restrictions on the growth of fertilizer supply aggravate the dependence on food imports through adverse effects on the motivation and scale of efforts to spread fertilizer use on food crops.
- Finally, government commitment to agricultural development is vital for enhancing fertilizer use. To begin with, it is needed to develop processes (on both demand and supply sides) that tap the unexploited fertilizer potential, especially in food production by the smallholder sector. In this task, sustained growth in fertilizer supply plus many nonprice policies may be more important than signals of price incentives, particularly because of the constraints of underdeveloped markets and infrastructure. Rapid growth in fertilizer use over a long period also needs government commitment to agriculture, since it depends on raising fertilizer potential (through technological breakthroughs) and sound development of institutions and infrastructure, which allow agriculture to play its crucial role in economic development.

Merits and limitations of specific fertilizer policy reforms need to be discussed in the context of such development thrusts in policies for long-term rapid growth of fertilizer use in SSA.

# M

## MAIZE VERSUS SORGHUM PRODUCTION AND FOOD SECURITY IN ZIMBABWE

DAVID D. ROHRBACH

Maize accounts for roughly 70 percent of the crop area planted to cereals in Zimbabwe. Remarkably, during the first seven years of independence (since 1980), smallholder production of maize more than doubled. This brought a 60 percent increase in national maize supplies and more than a fourfold increase in the level of national maize stocks. Zimbabwe could mount extensive domestic drought-relief programs (based on maize) while exporting large quantities of grain, even in the midst of drought. Zimbabwe exported 40 percent of the 1987 drought-reduced market intake.

Despite these gains, the majority of Zimbabwe's small farmers remain subject to persistent food insecurity. Roughly two-thirds of the country's small farmers live in the three-quarters of smallholder farmland receiving less than 650 millimeters of rainfall. These semiarid areas are subject to frequent drought and severe mid-season dry spells. Most of these households tend to be food-deficit. They are unable to consistently produce enough grain to meet their family needs. These farm facilities are forced to rely on drought-relief programs and to allocate limited cash for food purchases. The post-independence growth in national maize production has facilitated the delivery of drought relief and fostered cheaper food purchases. Greater benefits could have been achieved, however, if advances had also occurred in the production of more drought-tolerant crops such as sorghum and millet. In sharp contrast to the gains in maize, per capita production of sorghum and millet declined.

### WHY MAIZE USE HAS RISEN

The recent growth in smallholder maize production in Zimbabwe can ultimately be attributed to the strong demand for this grain in urban and industrial markets. Prior to independence, large-scale commercial farmers sought improved maize technologies to produce grain to feed a large urban, mine, and farm labor force. In consequence, Zimbabwe was the first country, after the United States, to develop maize hybrids. Fertilizer and agricultural credit distribution broadly served the commercial sector. Product markets drew maize through a parastatal Grain Marketing Board to private millers with losses under 1 percent. Retail distributors of maize meal were ubiquitous.

Commercial interest in maize production brought improved seed varieties to the smallholder sector. Farmers in many drier regions became interested in growing maize as the availability of new varieties coincided with a period of unusually favorable rains during the late 1950s and early 1960s. Following independence, input delivery and product assembly systems rapidly expanded in the smallholder farming areas (particularly in regions of higher rainfall). Within six years, hybrid maize seed sales and fertilizer sales to the smallholder sector both increased fivefold.

Agricultural credit, virtually unavailable to smallholders before independence, quickly reached more than 70,000 small farmers. Average maize yields increased 75 percent. Area planted increased by 50 percent.

### WHY SORGHUM AND MILLET HAVE DECLINED

Farmer interest in maize was reinforced by strong industrial demand. All commercial mills in the country have been built to process maize or wheat. None mill sorghum or millet for retail sale. The stockfeed industry has been built around the availability of milling by-products and low-grade maize rejected by the milling industry. The only consistent source of demand for sorghum and millet has been from the opaque beer brewers. Yet this demand has remained small compared with the overall industry requirement for maize (less than 3 percent of total industrial demand for cereal grains). These needs have largely been met by a small group of large-scale commercial farmers using sorghum varieties developed outside the country (in South Africa and Tanzania). Effective farmer and industry demand for the development of a domestic sorghum and millet research program has been limited. As a result, virtually no technologies have been locally developed. A sorghum and millet breeding program was not even established until after independence.

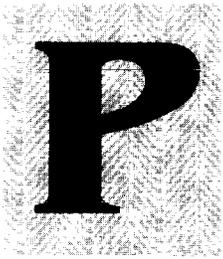
The limited commercial interest in sorghum and millet, and associated lack of improved technologies, has encouraged farmers throughout the semiarid regions to grow and consume maize. These farmers have quickly adopted new seed technologies. Virtually all maize growers now plant hybrid seed. Yield checks during the 1989 drought-affected harvest indicate many of these farmers are obtaining maize yields comparable to the low yields derived from sorghum and millet. Improved maize compares favorably with unimproved sorghum and millet—even in drought years. The question remains, how would maize compare with improved sorghum or millet? Most households in the semiarid regions continue to face persistent food deficits.

The recent gains in maize production were highly concentrated among the limited number of small farmers in the nation's high rainfall zones. Roughly three-quarters of the postindependence gains were contributed by only 10 percent of Zimbabwe's smallholders. Meanwhile, the majority of small farmers based in Zimbabwe's semiarid regions have become increasingly dependent on maize-based drought relief and maize meal purchases. Over 600,000 metric tons of maize have been distributed over the past eight years, or more than 1 metric ton of grain for each household in the semiarid regions. Recent survey evidence indicates a related dependence on maize meal purchases.

Poor rains during most of the 1980s have brought a renewed interest in sorghum and millet. However, structural changes have made it difficult to shift back to sorghum and millet production on both the demand and the supply side. On the demand side, survey results indicate that children have become accustomed to the taste of maize. An increasing opportunity cost of labor has led to a preference for more easily processed maize. On the supply side, several improved sorghum varieties were released two years ago. But only limited quantities of seed were made available because the nation's principal seed company has exhibited a strong commercial preference for maize hybrids, rather than open-pollinated sorghum varieties. No improved millet seed is available. In effect, the choices available to the majority of Zimbabwe's small

farmers remain limited.

In sum, national food supplies have increased since independence. Food security, measured in terms of national self-sufficiency or high grain stocks, has improved. In sharp contrast, the food security of the small farmers living in the nation's semiarid regions has remained limited. Most of these households continue to suffer persistent production deficits. These deficits have been reinforced by the maintenance of a technology development, input supply, and product market system primarily geared to the production and distribution of maize. However, increased attention to sorghum production, which is more drought-resistant, will require a complementary policy effort on utilization issues.



# PRODUCTION ISSUES OF IFPRI'S WORK ON HOUSEHOLD INCOME STRATEGIES AND AGRICULTURAL POLICY IN WEST AFRICA

THOMAS REARDON

This brief discusses a set of IFPRI projects entitled "Household Income Strategies and Agricultural Policy Impacts in the West African Semi-Arid Tropics," which includes case studies in Burkina Faso, Senegal, and Niger, each entailing a detailed household-level field survey in a variety of zones.

While the project includes both production and food security research, the aspects most relevant to the issues of farm productivity and sustainability are stressed here.

## MOTIVATION FOR THE RESEARCH

There is a tendency in debate on the development and sustainability of Sahelian agriculture to treat rural households solely as farm households. But households manage to feed themselves even during drought years and even in zones of the West African semiarid tropics where one would expect that hunger would abound—in the Sahelian zone, for example. They do so by purchasing substantial portions of their food. IFPRI research with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Burkina Faso found that a quarter to a half of food consumption in rural study zones was purchased during 1981-85.

A diversified income base financed these purchases. The research shows that household incomes were highest in the Sahelian zone, a low-potential zone for crops, and the Guinean zone, a high-potential zone. In these two zones, noncropping income constituted more than half of total income. The poorest study zone, the Sudanian or intermediate zone, had the least diversified income base. Because households were more dependent on cropping in a highly variable and risky environment, the incidence of hunger was much greater in the Sudanian zone.

These discoveries on the food security side led to the posing of some exciting but difficult questions on production and development strategy, which led to the income strategy projects in Senegal and Niger, as well as to a focus in the ongoing Burkina work on the consequences for cropping productivity of household income diversification.

The essence of the production-side issue of the project is this: in a situation where agriculture is highly risky—where both outputs and prices fluctuate greatly, and where households diversify incomes in order to compensate for these fluctuations—how can households be expected or encouraged to invest in cropping productivity increases and sustainability measures of the kind described in Tshibaka's overview? Concretely, would rural households buy fertilizer and animal traction equipment or build the bunds and terraces necessary for major increases in crop output under these circumstances?

Using Burkina data, IFPRI investigated the issue econo-

metrically and found that in the Guinean zone with higher potential, higher shares of income from noncropping sources were associated with more fertilizer purchased; this was not true in the Sahelian zone. In short, it appeared that households in the lower-potential zone were putting their off-farm cash into diversifying income and not conserving or increasing the fertility of their soils. Households in the higher-potential zone, however, were willing to use off-farm profits to develop their agriculture.

These results led to the asking of a broader set of questions and to the exploration of the issues empirically in a variety of case study zones. Work on these issues has been done in Kenya by Paul Collier and in Botswana by Allan Lowe, but there has been a dearth of such work in West Africa. The productivity issues addressed in Tshibaka's overview take on urgency in West Africa because the food problem is acute and agriculture is stagnating.

## THE RESEARCH QUESTIONS

The first two questions establish what household income and investment strategies are, how they are determined by net returns per crop in the cropping sector, and what are their relative returns over the cropping, livestock, and off-farm sectors. First, what are the multisectoral income strategies of rural households, how much do they earn by sector, and how do these patterns vary over zones and years?

Second, how do intersectoral opportunity costs—relative returns over economic sectors and, in the cropping sector, among crops—influence household income earning and investment strategies? Corollary questions are how do output and input policies, as well as infrastructure and trade policies, influence these relative returns? How does agricultural research influence these returns?

The third and fourth questions relate household strategies to outcomes that affect the supply of food and the productivity of Sahelian agriculture. Third, how do intersectoral opportunity costs and the consequent household income strategies influence short-run household decisions, such as what crops to produce, what crops to consume, how much fertilizer to buy, and how much output to sell?

Fourth, how do intersectoral opportunity costs and the consequent household income strategies influence long-run household decisions (longer run in the sense that they determine the dynamic of the cropping sector)? That is, how much do households invest in increasing productivity in the cropping sector (through investment in items such as animal traction, bunds, fertilizer, and seed)? How much do households invest in other sectors—livestock or off-farm, for example? Are these types of investment competitive? That is, do farmers put nonagricultural profits back into agriculture? What conditions favor this type of investment?

## **SIGNIFICANCE OF THE PROJECT FOR FORMULATION OF DEVELOPMENT AND RESEARCH STRATEGIES**

What significance for development and research strategies do these questions have? They concern research and policy priorities in terms of products and technologies.

To have a major impact on crop output, and given scarce fiscal and research resources, IFPRI has generally stressed the need for research and policy to focus on a limited set of crops and technologies with high potential for both production and demand. The income gains from this prioritized strategy lead to growth linkages. The product and sector priorities and the technology approaches that are appropriate to them will differ from zone to zone within a country and among countries.

The income strategy project contributes to an understanding of what these products and these technologies *can* and *should* be—*can* because it first examines what farmers are actually willing to do: where they earn income, where they invest, what crops and sectors they favor, and

then finds out why. It looks at how policy, agroclimatic, and infrastructural factors influence farmers' decisions, and what constrains these factors. Both the farmers' strategies and their constraints help identify the commodity priorities and technical options that meet the needs and demands of farmers in different zones. What the priorities *should* be is related to where the future potential for productivity growth and demand outlets lies.

## **OPERATIONS**

The Burkina work started in 1984; the income facet of the work will end in late 1990. It is a collaborative project between IFPRI and ICRISAT. The Niger work started in 1987 and will end in 1992. It is a collaborative project between IFPRI, the National Agronomic Research Institute of Niger (INRAN), and the ICRISAT Sahelian Center. The Senegal work started in 1988 and will end in 1992. It is a collaborative project between IFPRI and the Senegalese Agricultural Research Institute (ISRA).

# F

# OOD SECURITY CHALLENGES IN AFRICA UNDER STRUCTURAL CHANGE: AN OVERVIEW

JOACHIM VON BRAUN

## STRUCTURAL CHANGE FOR FOOD SECURITY

There is widening recognition that a macro policy of rapid structural adjustment can contract demand, causing severe hardship for the poor. Fundamental difficulties arise when an attempt is made to cure this macro policy problem by adopting micro projects, such as targeted food and nutrition projects, especially where public institutions are weak and under severe fiscal restraint. The appropriate policy response may not necessarily be to undertake projects that parallel the macro policy reform process, but to review and possibly adjust macro policy in light of its food security effects (see the brief by Oyejide and the overview by Valdés).

While paying attention to the current painful consequences of structural adjustments for food security, policy-makers must not lose sight of the fact that structural change is the desired outcome of a forward-looking development strategy. Elements of such a strategy are first, revitalized agricultural and rural growth, fostered by technological change, commercialization, and infrastructure buildup; and second, an improved human-capital base, for which education, health, and nutrition are key elements, which further support the rural growth strategy. Food security at the household level is both a desired *output* of successful development (with structural change) and a necessary *input* for development on a healthy human-capital basis, which permits accelerated technological change and specialization.

The concern for food security is a public policy concern that cuts across a range of issues. Central questions in this context are what role the public sector (versus the private) should play for food security, and at what scale. Food security is a basic element of social security. In the

absence of formal systems for social security, and because of their prohibitive costs, public policy action for food security is called for in a number of places. These include the need to check food price levels and to stabilize prices, to respond appropriately to rapid growth of consumption of imported cereals, and to foster beneficial effects of rapid technological change and commercialization on food consumption.

## TRENDS AND PROBLEMS

Africa's food security problem remains unsolved, and the 1980s have seen deterioration rather than improvement of food security in many parts of the continent. About one-fourth of the population does not obtain enough food to lead healthy and active lives. Rapid urbanization as well as a trend toward policy changes that cut preferential treatment of urban consumers have resulted in a rising urban food security problem. (The hunger problem in rural areas still predominates.)

IFPRI projections in the 1970s gave early warning of a rapidly **widening food gap** in Sub-Saharan Africa in the 1980s. A similar outlook for the year 2000 suggests that ever widening gaps will have to be filled by imports, including food aid. The gap is growing particularly rapidly in West Africa and in East and Southern Africa (Table 1). Extremely high population growth will remain a major challenge for food security policy in the long run. In view of high external debt and scarce foreign exchange, the rising food import bill will become increasingly difficult to pay.

**Famines** continue to be a recurrent problem in countries with poor resource bases, such as parts of Ethiopia and Sudan. They are aggravated by war, long-term effects of policy mistakes (such as the land tenure policy in Ethiopia and the mechanization policy in Sudan), neglect of the

Table 1  
Long-term trends in Africa's staple food consumption and production

Region	1961-65		1979-83		Projection to 2000 (million metric tons)
	Quantity (million metric tons)	Rate of Growth (percent)	Quantity (million metric tons)	Rate of Growth (percent)	
			<b>Consumption</b>		
Sub-Saharan Africa	53.9	2.5	83.5	3.5	161.3
West Africa	25.7	2.0	37.0	3.8	76.1
Central Africa	8.6	2.5	13.4	3.2	24.4
East/Southern Africa	19.6	2.9	33.1	3.2	60.8
			<b>Production</b>		
Sub-Saharan Africa	56.7	1.7	79.3	1.8	110.4
West Africa	28.1	1.1	35.0	1.0	42.0
Central Africa	8.8	2.0	13.2	2.0	19.2
East/Southern Africa	19.8	2.3	31.1	2.4	49.2

Source: J. von Braun, L. Paulino 1989.

rural economy as evidenced by antiagricultural policies and failure to build infrastructure, and lack of preparedness and political will to respond to crises. Food production performance and hunger remain tightly tied in the famine-prone countries because public institutions are weak and international and interregional trade have been hampered. The instruments that have been effectively implemented for famine prevention in India—expansion of public works, rationing, and an effective public role in expanding food availability in times of crisis—are largely lacking in Africa, as explained in the brief by von Braun, Teklu, and Webb.

## CRITICAL POLICY ISSUES

**Policy responses to consumption change.** While it is noteworthy that the share of noncereals, including roots, tubers, and plantains, in staple consumption remained at 42 percent between 1961-65 and 1979-83, the cereal composition of the African diet has been changing toward increased import dependence. The shares held by wheat and rice are increasing. In general terms, the policy response to the pressure for cereal consumption change can be addressed in three different ways (or a mix of them): first, by constraining consumption of the commodities through taxation or import restrictions (Nigeria's policy of banning wheat imports shows that this may involve high resource costs); second, by promoting use of traditional staples (by improving processing of coarse grains and cassava); and third, by promoting exports to pay for rising import bills. The latter two options have been underemphasized. Policies have centered on the first and disregarded the adverse effects on food security for the poor, whose demographic and work patterns, especially women's, make them more likely to be consumers of imported grain (see the briefs by Delgado and by Reardon and Delgado). Potential adverse effects for employment in the nonfood sector, resulting from drastic cereal price increases, need to be considered, too.

**Price stabilization.** The malnourished rural poor as well as the urban poor in Africa are largely net purchasers of food, at least during critical (high price) times of the year. Seasonal and interannual price fluctuations are a major cause of nutritional deterioration. When food prices tripled in Sudan in 1984/85, the prevalence of malnutrition among children more than doubled to about 20 percent, from already high levels. Ad hoc project-based interventions can do little to mitigate such shocks. Economically efficient price stabilization policies, appropriately employing stockholding and import options, have a key role to play for household food security, as discussed in the brief by Pinckney.

**Diversification of income and commercialization.** Food insecurity in Africa has complex poverty dimensions and regional and intertemporal diversity. Diversification of income sources can be an outcome of two different underlying forces. First, it is the outcome of households strategizing to cope with food security risks, that is, risks in the food and nonfood markets and in the off-farm labor market. This diversification of income sources for risk reduction is a symptom of poverty and comes at the cost of forgone gains from specialization, which could be captured in a situation where markets are more integrated. Second, it is the result of emerging rural growth linkages and thus a desired effect of an agriculture-driven rural growth process with increased specialization at household and farm levels. Nonagricultural income shares of the malnourished rural poor in Africa are already at a high 35-39 percent in four of the five cases in Table 2. Improved **infrastructure** is the key to tapping the potential gains from specialization and to moving swiftly from poverty-driven to growth-linkage-driven diversification (see the brief by Reardon and Delgado).

A typical feature of structural change is a declining share of the agricultural sector in a growing economy. The reverse also holds generally true: declining economies in Africa show growing agricultural sector shares (Table 3).

Table 2  
Income sources of the malnourished rural poor (calorie-deficient households) at selected survey sites in Africa (early and mid-1980s)

Source	The Gambia (South Bank)	Rwanda (Northwest)	Kenya (Southwest)	Burkina Faso (Mossi Plateau)	Sudan (Kordofan)
	(percent)				
Agriculture	83.8	40.9	52.0	61.5	64.9
Subsistence food	54.9	28.1	38.1	29.2	9.2
Marketed crops	26.8	10.8	11.7	<sup>a</sup>	24.8
Other agriculture <sup>b</sup>	2.1	2.0	2.2	32.3	30.9
Nonagriculture	16.2	59.1	48.0	38.5	35.1
Nonagricultural wages	1.7	24.6	13.8	17.4	24.8
Other nonagriculture <sup>c</sup>	14.5	34.5	34.2	21.0	10.3

Source: J. von Braun 1989.

<sup>a</sup>Included under subsistence.

<sup>b</sup>Includes livestock, agricultural wages.

<sup>c</sup>Includes craftwork, services, transfers, and remittances.

Table 3

**Growth, position and change of share of the agricultural sector and food insecurity: selected African countries, 1965-87**

Country	GDP per Capita, 1987 (US\$)	Economic Growth (GNP per capita), 1965-87 (percent)	Agriculture's Share in GDP, 1987 (percent)	Change in Agricultural Sector Share, 1965-87 (percentage points)	Food-Insecure Population, 1980s <sup>a</sup> (percent)
Ethiopia	130	0.1	42	-16	62
Zaire	150	-2.4	32	+11	19
Malawi	160	1.4	37	-13	27
Tanzania	180	-0.4	61	+15	34
Burkina Faso	190	1.6	38	-15	21
Madagascar	210	-1.8	43	+12	13
Zambia	250	-2.1	12	-2	33
Rwanda	300	1.6	37	-38	14
Kenya	330	1.9	31	-4	28
Sudan	330	-0.5	37	-17	35
Nigeria	370	1.1	30	-24	13
Ghana	390	-1.6	51	+7	30
Senegal	520	-0.6	22	-3	18
Zimbabwe	580	0.9	11	-7	n.a.
Côte d'Ivoire	740	1.0	36	-11	6
Cameroon	970	3.8	24	-9	7

Sources: World Bank.

<sup>a</sup>P. Svedberg and calculations based on various World Bank and FAO statistics (share of population deficient in calories).

There are, however, some important "perverse" cases. These are countries whose overall economic stagnation or deterioration is combined with declining agricultural-sector shares. Accelerated deterioration of the agricultural sector coincided with and probably fostered economic decline in this group, which includes Zambia, Sudan, Senegal, and Ethiopia—all of which are known to have particularly serious food security and nutrition problems. **Revitalized agricultural growth** is particularly urgent in these cases.

A key feature of structural change in rural Africa is commercialization of agriculture, that is, agriculture's increased market integration on the input and output side. There is much concern that potential gains from commercialization of agriculture would increase the food security risk of rural households. However, IFPRI research on the issue, summarized in the von Braun and Kennedy brief, shows that in none of the study settings were negative effects of commercialization on nutrition noted. Positive income effects of commercialization were found to effectively reduce food deficiencies.

**Health and sanitation.** Rapid income growth from agriculture or elsewhere goes a long way toward solving the food security (hunger) problem. The same cannot be said for the problem of malnutrition, which is a complex interaction of lack of food and morbidity. The symptoms are arrested growth in children and high prevalence of illness. Health and sanitation have to be promoted in tandem with agricultural development to assure that growth is translated into nutritional welfare effects and a solid human-capital base for rural growth. The necessary income streams for sustainable promotion of health and sanitation, however, again largely depend on accelerated (rural) income growth.

## CONCLUSIONS

Three sets of findings are emphasized here:

- Food security of the rural and urban poor in Africa cannot be protected in a situation of continued net-capital outflow, negative per capita income development, and unchecked price explosions. Targeted project measures may be successful at some locations, but wider coverage is frequently a problem. Adverse macro policy effects on food security can hardly be corrected by project measures alone.
- Agricultural growth (including food production growth), through direct and indirect employment and income generation, goes a long way toward improving food security in Africa. Technological change and an open trade regime, at least on a regional basis, are preconditions (see the briefs by Badiane and Badiane and Koester).
- In addition, the set of policy instruments for a household food security guarantee—tailored to specific country circumstances—needs to be deployed rapidly in the 1990s. This comprises public works (especially to build up rural infrastructure in the famine-prone countries); price stabilization (preventing explosive food price changes in the context of supply crises and exchange rate realignments); health and sanitation promotion (especially in rural areas providing access to respective services at low [time] costs for the poor); and institutional capacity to assess and respond to food insecurity (including institutions to monitor, design, and supervise implementation of food security policy modules). IFPRI and its partners in Africa have a key role to play in this respect.



# WHY IS RICE AND WHEAT CONSUMPTION INCREASING IN FRANCOPHONE WEST AFRICA?

CHRISTOPHER L. DELGADO AND THOMAS REARDON

## THE PROBLEM

Policy attention in West Africa has turned to the major imbalance between the *composition* of cereals consumption and that of production. Annual per capita rice and wheat consumption rose by more than 16 kilograms from the early 1960s to the early 1980s, whereas millet and sorghum consumption fell by more than 22 kilograms. Corn consumption increased by less than 1 kilogram over the same period. Besides the growing drain on foreign exchange, policymakers are concerned about the outlook for production of coarse grains. They account for four-fifths of cropped area in a Sahelian agricultural sector that continues to employ roughly three-quarters of the overall population. The prospects for decreasing unit production costs for coarse grains in West Africa appear good. However, Sahelian wheat production prospects remain poor, and rice production growth has lagged behind consumption growth (15 percent of cereals production in the early 1980s and 21 percent of consumption).

## IS IT A SUPPLY OR A DEMAND PROBLEM?

Some observers posit that the rise of rice and wheat consumption in West Africa during the 1970s and 1980s is the consequence of the declining domestic production of coarse grains. Excess demand was met by imports, and it is primarily rice and wheat that are available on international markets. By contrast, the changes in cereal consumption patterns have primarily been demand driven. Despite bumper harvests in the Sahel in 1985 and 1986, and a consequent fall in coarse grain prices to one-third to one-tenth their 1984 levels, commercial imports of wheat and rice continued at high levels. In Mali, for example, commercial rice and wheat imports still accounted for 8 percent of total imports in 1986, a year of bumper domestic stocks of coarse grains. Commercial rice and wheat imports in Burkina Faso over the past 20 years are not significantly correlated with coarse grain production.

## IF SUBSTITUTION IS DRIVEN BY DEMAND, WHAT IS THE ROLE OF PRICES?

Some observers believe that the changing cereals demand patterns are caused by relatively low rice and wheat prices. From 1970 to 1987, world cereals prices as a group fell about one-third relative to manufactures. However, rice prices fell one and one-half times as fast as coarse grain prices, implying that rice was getting cheaper relative to both coarse grains and manufactures on international markets. Similar trends could be observed in national rice and wheat prices relative to coarse grains and manufactures in most of francophone West Africa.

The same observers have tended to view relatively cheap rice and wheat on world markets as being a

temporary phenomenon induced by policy distortions in the OECD countries. Yet despite the temporary nature of the world price dip, many fear that low cereals prices in West Africa will induce agricultural resources to permanently leave the sector, as discussed in the brief prepared for the third session by Delgado. Therefore, given the view that changing relative prices have promoted past substitution in cereals consumption patterns and that the process could even be reversed if rice and wheat prices were raised, they have advocated commercial policies to increase domestic rice and wheat prices in West Africa relative to all other prices. Nigeria, for example, has attempted to ban all rice and wheat imports. The Club du Sahel has urged creation of a regional protected zone for cereals in West Africa, characterized by a high common external tariff for cereals imports from outside the region.

IFPRI collaborative research in Burkina Faso reported in the brief by Reardon and Delgado on urban consumption patterns suggests that relative prices may play only a minor role in driving rice consumption at the household level and that nonprice factors—such as income distribution, the need to eat away from home, and occupation—are more important. These household-level insights are consistent with the results from econometric modeling of annual national trends in the share of rice and wheat in total cereals use as food from 1966 to 1986 in Burkina Faso, Côte d'Ivoire, Mali, Niger, and Senegal.

The aggregate-level research found that the share of rice and wheat in total cereals consumption over years and across countries is only weakly related to movements in the prices of rice and wheat relative to the prices of millet and sorghum. The exception concerns wheat in Niger and Mali, where the degree of consumer subsidy has been especially high. The percentage increase in the share of rice in national cereals consumption associated with a 1.00 percent decrease in the urban retail price of rice (relative to the price of the principal traditional starchy staple) ranged from a high of 0.46 percent in Niger, to a low of 0.10 percent in Côte d'Ivoire.

While results using crude national-level aggregates are particularly shaky in the Sahel, it does seem fair to conclude that the national-level trends give no comfort to those who expect commercial policy for rice and wheat to reverse substitution trends. At face value, the trend in the most price-responsive case (Niger—where rice consumption averaged 3.50 percent of annual cereals consumption over the 1966-86 period) would at most serve to decrease the absolute share of rice in national cereals consumption by 0.16 percent. This implies a decrease in the quantity of rice consumed nationally of less than 5.00 percent from an already small base.

On the other hand, processes associated with urbanization appear to be major determinants of rice consumption. In the aggregate-level regressions for Burkina Faso over

the 1966-86 period, a 1.00 percent increase in the share of total population living in towns provoked a nearly 1.30 percent increase in rice consumption, even when price and national income effects are controlled for.

## **POLICY IMPLICATIONS AND CONCLUSIONS**

These results provide insights in three areas on rice and wheat pricing policy, particularly when the latter is used as an instrument to slow down substitution in consumption.

- First, the low sensitivity of rice and wheat consumption to relative prices suggests that **to be successful at reducing demand, price-based measures would need to raise rice and wheat prices very significantly** relative to coarse grains prices. Nor are these relative price changes likely to be mitigated greatly by increased domestic production of rice. Major consuming areas for rice in West Africa tend to be close to coastal ports, whereas the major producing areas tend to be inland. Transport typically needs to be done by truck, which means that internal transport costs for domestic rice are often of the same order of magnitude as total import costs at the point of consumption. A tariff high enough to prevent imports would have to be high enough to cover these transport costs plus the difference between the rice production costs of domestic and international suppliers. Rice prices in coastal cities could double. Therefore, effective quantitative or tariff restrictions on rice and wheat imports can be expected to significantly raise the prices for these items relative to coarse grains.
- **Second, policies that greatly increase rice prices need to be accompanied by measures to decrease the negative effect on the urban poor.** The collaborative study between the University of Ouagadougou and IFPRI reported on in the brief by Reardon and Delgado found that households in both the poorest and the richest income terciles obtained about one-third of their cereal-based calories from rice. For the poor, this accounted for one-half of their cash expenditures on cereals. The urban poor are important consumers of rice. Their consumption of rice is not especially responsive to changes in its relative price. Although conver-

tional wisdom suggests that urban people in West Africa are better off than rural people, field surveys by IFPRI, ICRISAT, and the University of Ouagadougou show that, in Burkina Faso at least, the richest third of the rural population in the better agricultural areas is distinctly better off than the poorest third of the population in the capital city.

- **Third, the long-run effect of large relative price changes on resource allocation and growth within West Africa is not well known.** Generally, rice and wheat import bans and tariffs will shift public and private resources out of unprotected sectors into rice production. Such shifts are not costless, either to farmers or to the countries as a whole, as explored further in the brief for Session III by Delgado.

In sum, four related sets of points are argued here. First, changes in cereals consumption patterns in francophone West Africa are demand-driven. Second, these changes are widespread. The urban poor in at least one Sahelian capital are major consumers of rice, mostly in cooked form outside the household. The rich eat substantial quantities of rice at home. Third, relative prices have not been the leading factor in promoting change in consumption habits. Nonprice factors, such as household income and employment patterns, are more important. Fourth, rice and wheat prices would have to increase quite substantially before consumption of these cereals would be choked off, and such price increases would have extremely negative welfare effects on the urban poor.

Three areas of policy emphasis are suggested. First, a careful assessment should be made of the best potential for decreasing unit production costs for different cereals. Coarse grains can soak up a large share of demand for rice for consumption in the home, but only if they are kept cheap relative to everything else. If rice production costs can be significantly and sustainably lowered, the problem ceases to exist. Second, even with progress in lowering coarse grains production costs, better processing technologies are required to permit coarse grains to better meet the needs of urban food consumers. Third, there needs to be a way to soften the impact of higher rice prices on the urban poor. Cheaper and easier-to-prepare coarse grains food dishes, from imports or own production, are likely to be a major component of any solution.

# T

## THE SCOPE FOR POLICY TO ALTER CEREALS CONSUMPTION PATTERNS IN THE SAHEL: THE CASE OF OUAGADOUGOU

THOMAS REARDON AND CHRISTOPHER L. DELGADO

As in the rest of the urban Sahel, the diet of consumers in Burkina Faso has changed rapidly over the last three decades, shifting from coarse grains—millet, sorghum, and corn—to rice and wheat, mostly imported. The annual rate of increase in cereals imports from 1970-72 to the present exceeds 9 percent per year in Burkina Faso. This has increased the trade deficit, which amounted to US\$36 per capita per year over the 1982-86 period and increased national dependence on imported cereals, which accounted for more than 20 percent of supply in 1982-86. A collaborative study between IFPRI and the University of Ouagadougou examined the substitution of rice and wheat for coarse grains in household consumption in Ouagadougou during 1984/85. The following substitution issues were addressed.

- **Who is involved?** Who is eating imported cereals? Who is eating coarse grains? Whose welfare would be most affected by policies that raise the prices of imported rice and wheat?
- **Can changes in relative cereals prices reverse substitution trends?** Is the quantity demanded of coarse grains sensitive to changes in the rice prices? To their own prices? To changes in household incomes? By what is rice and wheat consumption driven? Do the answers differ by income group?
- **To what extent is substitution due to factors other than cereals prices?** Do the demographic and employment characteristics of urban households influence their consumption of imported cereals? Why?

To answer these questions, data on monthly expenditure patterns were obtained from a sample of 125 households during the period from October 1984 through September 1985. These data came from a detailed, weekly household survey. Although most of the survey followed a poor harvest of coarse grains, relative prices of imported to domestic cereals fluctuated greatly over the survey year. The initial report was published in French by the University of Ouagadougou in June 1988. A more detailed econometric analysis will be published soon by IFPRI. Results are given for the whole sample and terciles based ex post on the observed distribution of income across households.

The main results are as follows. In physical terms, rice composed about a third of cereal consumption of all income groups. In money terms, rice was even more important for the poor: almost half of their expenditures on cereals went to rice. The rich and middle terciles only spent a third of their cereal budget on rice. Furthermore, cereals accounted for half of the food expenditures of the poor, compared with only about a third for the rich. The higher value share of rice in the cereal consumption of the poor is due to the larger share of prepared rice they purchase from street vendors.

By contrast, wheat products (mainly bread and noodles) were much more important in both physical and value terms in the diet of the rich: wheat products made up a third of the cereals consumed by the rich, versus only a twentieth for the poor.

The most striking regression result concerning price effects is that the cereals consumption patterns of the poor are much less sensitive to changes in prices than those of the overall sample.

When the price of rice rises, consumers in the overall sample decrease coarse grains expenditures. The increase in the price of rice absorbs purchasing power and decreases expenditure on the set of other basic staples. The estimated cross-price elasticity of -1.1 of coarse grains expenditure to the rice price implies that a 10 percent increase in the price of rice decreases coarse grains expenditure 11 percent.

Expenditure on all rice—uncooked (grain form) and prepared rice combined—by the overall sample rises with an increase in the price of rice (elasticity of 0.9). The own-price elasticity of calories from rice is only 0.1, however. The price of rice was found to have no significant effect on the total rice expenditure of the poor tercile. The motivation behind the rice consumption of the poor appears to lie in the form and not the price of the product. Because the poor buy half of their rice from street vendors, they appear to be less sensitive to price changes than the average household.

Millet/sorghum and corn, which have a cross-price elasticity of 0.6, are substitutes. Consumers were willing to substitute one coarse grain for another in local dishes. The real substitution is thus among the coarse grains and not between coarse grains and rice.

Other foods (such as tubers, pulses, and meats) are substitutes, albeit weak ones, for rice and coarse grains. Consumers are sensitive to the relative prices of nonstaples and want to diversify their diets.

Poor households have a relatively high proportion of women who work outside the home, mostly in petty commerce. They have little time for food preparation. Male heads of poor households are usually employed in manual labor or commerce—jobs that do not allow them to go home for lunch. These factors motivate the poor to purchase prepared rice from street vendors. Whereas half of the money spent on rice by the poor went to street vendors for prepared rice, only a tenth of that spent by the rich was for prepared rice. For roadside food sellers, the time and the energy costs of preparing rice are less than those for the traditional cereals, and the product is more easily marketed to customers with different cultural backgrounds. The preparation of coarse grains, on the other hand, is more labor-intensive, and traditional dishes are also specific to each ethnic group.

These results have important implications for Burkina­bé and Sahelian cereal policy. First, an increase in the price of rice would hurt the poor, at least in the short run. If tariffs are instituted (to raise the consumer price of rice), it is probable that spending on rice, and therefore, on imports will go down very little. What adjustment there is will come from the middle- and high-income groups who will shift to other food sources—most likely wheat, pulses, and tubers. The poor, who are less flexible, will absorb the cost of the price change because the amount of rice offered for a fixed-price plate of rice at roadside food sellers will be reduced.

Second, any policy aimed at the problem of rice expenditure must take into account the restaurant sector as well

as the cereal processing sector. The restaurant industry now accounts for a significant amount of informal sector activity in the Sahel. Food sellers require a tasty, filling dish that is easy to prepare in small increments from raw materials that can be purchased and stored in bulk.

Third, in both restaurant and home, food products from traditional cereals that are easier to prepare and store might be more attractive than rice and wheat in the long run. However, the absolute cost of the final product—in addition to its cost relative to rice and wheat—will be important to its success. Otherwise, consumers are likely to diversify into more preferred production—with higher-priced calories—such as yams, potatoes, and meat.

# I

## NCOME DIVERSIFICATION OF RURAL HOUSEHOLDS IN BURKINA FASO

THOMAS REARDON AND CHRISTOPHER L. DELGADO

There is a tendency in debate on the development and sustainability of Sahelian agriculture to treat rural households solely as farmers. Price incentives to produce more cereals and to invest in sustainability are thus seen as automatically compelling to economically rational households. Yet Sahelian households often do not behave in the way that policymakers expect. In Burkina Faso, farm-level investments in productivity and sustainability of cereals production have not increased much following an upward trend in real cereals prices.

Nevertheless, households are feeding themselves, even during drought years, and even in zones such as the Sahel where one would expect that hunger would abound. The reason is that rural households purchase a large part of their food. These purchases are financed by a diversified income base: Sahelian rural households are not merely farmers.

This brief presents evidence from Burkina Faso that the majority of income comes from noncropping sources in both the relatively arid northwest and the relatively well-watered southwest of Burkina Faso.

The results are from IFPRI/ICRISAT collaborative work using data from the ICRISAT baseline survey conducted by Peter Matlon. It covered four harvest-years, 1981/82 to 1984/85, which included a variety of good and poor harvests. It was conducted in three zones of the country: the Sahelian zone in the northwest (agroclimatically, a very poor zone, with low rainfall, poor soils, and extremely variable cropping outcomes); the Sudanian zone in the Mossi Plateau (a poor to intermediate zone, with low-

medium rainfall, poor soils, and moderately variable cropping outcomes); and the Guinean zone in the southwest (a moderately favored zone, with medium-high rainfall, good soils, and relatively stable cropping outcomes).

### INCOME LEVELS AND DISTRIBUTION

Table 1, which shows levels and composition of household income using 1981-85 averages, makes the following points:

- **Rural households are not always worse off than urban households.** The richest one-third of households in the Guinean zone had household income per adult equivalent of 95,000 CFA francs (about US\$185 per capita); the richest one-third in the Sahelian zone had income per capita of about US\$138. These figures are greater than the average income of the poorest tercile in Ouagadougou in 1984/85—about US\$135 per capita.
- **Household income is not closely related to the agroclimatic level of the zone.** The worst and the best zones have the highest incomes: the Sahel average income is CFAF 42,000 per adult equivalent, while that of the Guinean zone is CFAF 55,000. The Mossi Plateau's average is only CFAF 29,000 per adult equivalent. Despite greater purchasing power, much more food aid was targeted to the Sahelian zone as opposed to the Mossi Plateau in the 1984/85 drought year. The targeting was based on crop production outcomes, not purchasing power.

Table 1  
Income sources by zone and income stratum, 1981-85 averages

Zone/ Income Tercile	Crop Income	Livestock Income	Local Nonfarm Income	Migration Income	Food Aid	Other Transfers	Total Income
	(percent of total income)						(CFAF/adult equivalent)
Sahelian							
Poorest	66	17	6	5	3	4	22,566
Richest	36	17	35	9	1	1	70,545
Overall (N=45)	48	15	24	11	2	1	42,205
Sudanian							
Poorest	82	5	8	2	0	3	15,660
Richest	69	6	16	5	0	3	48,616
Overall (N=44)	74	6	14	3	0	3	29,295
Guinean							
Poorest	57	18	22	2	0	3	29,886
Richest	31	19	48	1	0	0	95,629
Overall (N=47)	43	17	38	1	0	1	55,261

Source: Thomas Reardon, Christopher Delgado, and Peter Matlon, forthcoming.

- **Income is not evenly distributed.** The Gini coefficient of income per adult equivalent is about 0.3 in the zones. Hence income distribution is unequal despite relatively easy access to land. This is more equal than income distribution in South Asia, but is fairly representative of rural West Africa.

## INCOME COMPOSITION

**Noncropping income is very important.** It constitutes 52 percent of income in the Sahelian zone and 57 percent in the Guinean zone. It is, however, only 26 percent of income in the Sudanian zone.

**In general, the higher the income, the lower the share of cropping in total household income.** The poorest zone (the Sudanian) relies the most on cropping. The poorest tercile in each zone relies the most on cropping. The authors have shown for the same period and zones that hunger increases as incomes decrease. Hence, those who are the most dependent on cropping—those with the least diversified incomes—are the hungriest. There is no necessary link between own-production and food security at the household level in the Sahel.

**Concerning intersectoral linkages, local nonfarm activities are most important in the zone with the best agriculture—the Guinean zone.** Local nonfarm income (food processing, cottage industry, commerce, and so forth) is highest in the Guinean zone—38 percent of income. These activities, which are closely tied to local agriculture, boost the income of women in this zone. This demonstrates the potential for intersectoral growth linkages to boost income. The other two zones also have a local nonfarm sector, but it is less important, and the poor participate in it less than they do in the Guinean zone.

**By contrast, the diversification of the Sahelian zone's income is much more externally based.** Eleven percent of Sahelian income is from migration versus 3 percent in the Sudanian zone and only 1 percent in the Guinean. The potential for intersectoral linkages in the Sahelian zone is reduced by the weaker and more variable agricultural base. Thus, the demand base for income diversification is local in the Guinean zone; it is much more external in the Sahelian zone.

**Off-farm income is used to compensate variation in cropping outcomes.** Table 2 shows by zone the coefficients of variation of four yearly averages (over households) of cropping income and of total income. Cropping

income is 2.6 times more variable than total income in the Sahelian zone; 1.7 times more in the Sudanian, and only 1.4 times more in the Guinean. Hence, the ratio of the variability in cropping income to total income decreases as the agroclimatic level increases. The riskier the cropping, the greater the gain from income diversification.

Table 2  
Interyear variation for 1981-85 in cropping income and total income—average over households

Zone	Cropping Income	Total Income	Variation of Cropping Income/ Variation of Total Income
			(Coefficient of variation of yearly averages over households)
Sahelian	0.45	0.17	2.6
Sudanian	0.22	0.13	1.7
Guinean	0.22	0.16	1.4

Source: Thomas Reardon, Christopher Delgado, and Peter Matlon, forthcoming.

These results raise important policy and research issues concerning the consequences of income diversification for the long-run development of agriculture in the Sahel.

**What are the consequences for sustainability?** Is the Sahelian household's interest in income diversification, which requires time and cash investment, at odds with its willingness or capacity to invest in the sustainability of agriculture (for example, to construct bunds)?

**What are the consequences for technology improvement?** Do Sahelian households want to use their noncropping income in the cropping sector—to buy animal traction equipment, fertilizer, and so forth? Or, do the more stable and possibly higher returns in the noncropping sectors attract and divert their cash? Does this delay the modernization of Sahelian agriculture?

**What are the effects on trade patterns,** both between the rest of the world and the Sahel, and between the coastal countries and the Sahel? Is risk aversion a major factor in consumption shifts toward imported rice? Toward Ghanaian corn?

**How can policy best use intersectoral growth linkages to raise rural incomes?** What are the roles of infrastructure and technology investments?

# C

# OMMERCIALIZATION OF AGRICULTURE AND HOUSEHOLD FOOD SECURITY: POLICY IMPLICATIONS OF PROGRAMS IN THE GAMBIA, RWANDA, AND KENYA

JOACHIM VON BRAUN AND EILEEN KENNEDY

Cash cropping remains important in many African countries' agriculture. In the mid-1980s, only 10 out of 35 African countries devoted less than 10 percent of their cultivated area to major cash crops (excluding basic staple foods), 15 had 10-30 percent of cropland under cash crops, and 10 had more than 30 percent. A longitudinal assessment of the relationship between basic food production and cash cropping shows that most of the countries either manage well a combination of cash cropping and food production or fail to manage either.

The current foreign exchange crisis and debt burdens of many developing countries provide further impetus for greater orientation of agriculture to exports. Expansion and improved efficiency of the agricultural export sector is a cornerstone of many structural adjustment programs for low-income countries. Many would argue that commercialization, by raising incomes, actually improves a nutritional situation that might have been worse otherwise. Theoretically, opposite outcomes can also be constructed.

IFPRI, in collaboration with other institutions, has conducted research in The Gambia, Kenya, and Rwanda at carefully selected program or project sites where farm households have recently undergone a change from semisubsistence staple food production to production of more crops for sale. This change often entails a switch from little use of external inputs to application of new inputs and technology.

## MAINTENANCE OF SUBSISTENCE FOOD

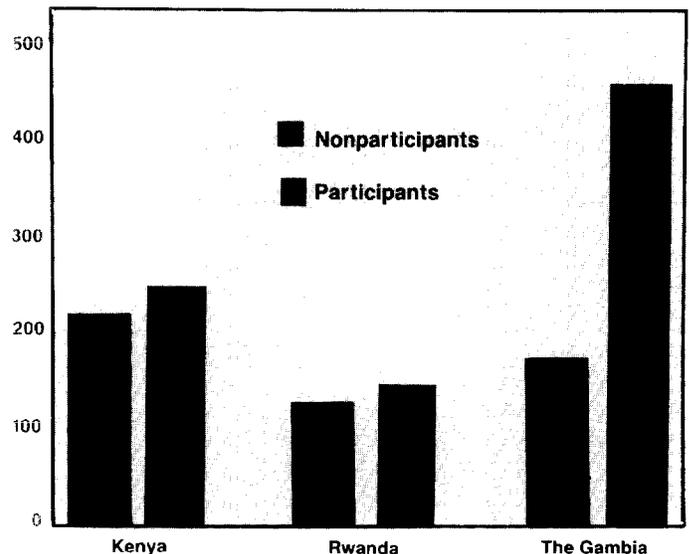
In settings in all three of the countries studied, smallholder producers make a conscious effort to maintain subsistence food production along with the new cash crops through increased yields or area expansion (Figure 1). While this is not surprising in The Gambia, where irrigation of rice has been introduced, it is noteworthy that farmers in Kenya and Rwanda continue to grow food crops despite higher returns to land and labor from cash crops. This reliance on food from own production is a response to market, employment, and production risks, and can be viewed as an insurance policy for farm households in a risky income environment. Theoretically, this strategy may be viewed as a second-best option for farm households, compared with full market integration, because related benefits of specialization are forgone. In view of the risk, agricultural policy can effectively support household food security by the promotion of technological change in staple (subsistence) foods.

## INCOME EFFECTS

In the study settings, commercialization generally had positive effects on income, but not necessarily for all households or for all components of the commercialization

Figure 1  
Staple food production per capita in farm households participating and not participating in cash cropping schemes

(kilograms/capita)



Source: J. von Braun, E. Kennedy, and M. Bouis 1989.

Note: Only households of similar farm size (middle tercile) are compared.

process. Although substantial, the net income gains in general were much less than the gross income from the new cash crops because of substantial substitution effects within agricultural production and between agriculture and off-farm employment. In The Gambia, for instance, an incremental dollar earned in double-cropped irrigated rice production came at the cost of 70 cents lost in upland crops (groundnuts and millets) because of withdrawn labor.

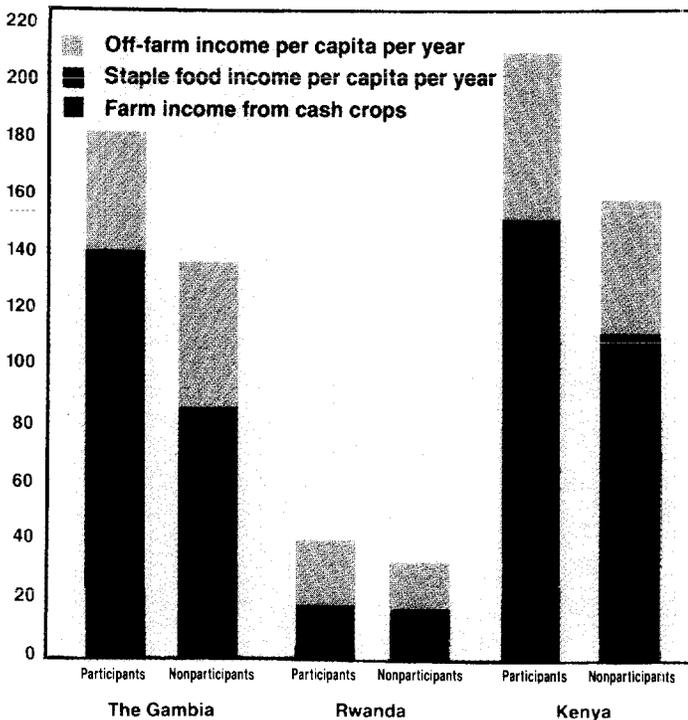
At least in the short run, some types of households had absolute income losses due to the schemes, mainly because there were constraints on land. General employment expansion cannot be relied upon to reach these groups in the short run. For example, some farm households in Rwanda were displaced by the tea factories in the area and not fully compensated. On average, however, these relocated households had a caloric consumption similar to other types of households. Entitlements to food were maintained despite the reduced landholdings via the off-farm employment that was available. The situation was different in Kenya; households who were relocated as a result of the sugarcane factory were worse off in terms of caloric intake (but not in terms of the nutritional status of

their children). In The Gambia, food aid was used to compensate for the temporary loss of access to swamp fields when irrigation infrastructure was put in place.

Off-farm nonagricultural rural income already plays an important role, providing 16 percent of total household income in The Gambia, 48 percent in Kenya, and 59 percent in Rwanda. Much of this is in local goods and services. In The Gambia—less densely populated than the other two—less off-farm income was available. Agricultural commercialization adds to income diversification in farms of similar size (Figure 2).

Figure 2  
Income and income sources of cash cropping scheme participants and nonparticipants

(US\$/capita)



Source: IFPRI.

Note: Only middle tercile farm size groups are represented in the graph to exclude farm size differences.

## CONSUMPTION AND NUTRITION

In all of the study settings with rising income from cash crops, the absolute spending for food consumption increased. The effects of commercialization on children's welfare are mediated in part through the income-consumption link, which is found to have favorable effects on child nutritional status. In the poorest households (those with a per capita income level of no more than \$100 per year), a 10 percent increase in income was found to lead to a 2.5 percent improvement in children's nutritional status (weight-for-age) in Rwanda and 1.9 percent in The Gambia. In Kenya, where the health situation was particularly bad, improvements in children's welfare as the result of increased income were not observed.

The net nutritional effect of incremental income is modest because the increased income does not decrease morbidity, at least in the short run. This suggests that health and sanitation improvements in rural areas have to be promoted in tandem with agricultural development. Increased income and increased food availability provide solutions to the hunger problem but not to the problem of malnutrition, which is a complex result of lack of food and morbidity.

## POLICY AND PROGRAM DESIGN

The following policy and program design issues are important to maximize potential benefits from agricultural commercialization and minimize potential damage:

- Promotion of technological change in food crops along with cash crop production for household food security;
- Improvement of market infrastructure for food, nonfood goods, and services, especially in remote areas where a change toward production of nonfoods may lead to a change in the net food import situation and thereby to drastic price changes;
- Attention to land tenure and resulting land allocation problems when net returns to land increase substantially;
- Establishment of effective rural financial institutions to generate savings and make credit available not only for scheme participants but for the community as a whole; and
- Development and promotion of community health and sanitation services in order to maximize the returns to health and nutrition from increased income.

# S

## EASONAL ASPECTS OF FOOD INSECURITY IN ZAMBIA, NIGER, AND ETHIOPIA

SHUBH K. KUMAR

The seasonality of weight loss in rural areas of predominantly agricultural communities is closely linked to the variations in work and food consumption relative to needs. Work is currently under way in several collaborative IFPRI studies to examine the extent to which household characteristics influence the seasonal dimensions of weight fluctuations and their economic significance.

Results from several case studies in Africa indicate that the primary factors in weight fluctuation are slightly different for children and adults. For adults, the main factors are variation in dietary calories and work loads, and, to some extent, acute infectious diseases such as malaria. For children, infections and dietary factors associated with both caloric adequacy and diet quality are found to be important, as well as variations in the work loads of adults—particularly women—who cannot devote as much time to childcare during peak work periods.

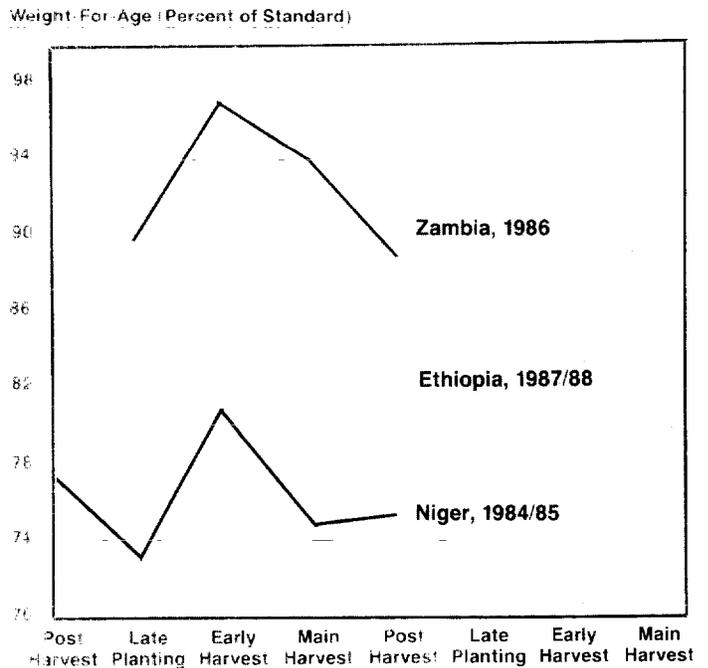
In each of the case studies of Zambia, Niger, and Ethiopia, there is one main growing season during which the bulk of the year's food supply is produced. Planting of crops commences with the onset of rains and continues well past the middle of the rainy season. Cereals, legumes, oilseeds, and cash crops are all sequenced in this planting period. Work loads are heavy during this period, and the ability to make an extra effort can influence crop output and yields.

For both children and adults, the time when nutritional status is poorest is during the late planting season. Households have just passed through a period of heavy work, disease is prevalent because of the onset of malaria, and food stocks are dwindling. With the start of the new harvest, diets and the nutritional status of all household members improve. However, there are indications that these fluctuations are not costless.

Children's growth falters markedly during the rainy season and is at its lowest level during the late planting period. The situation for the youngest children improves quickly during the early harvest period (Figure 1). This is seen in each of the three countries considered here. In Zambia, for instance, this improvement is due to the increased availability of fresh maize and legumes, as well as leafy, green vegetables from intercrops. The work load for women is also much lower than during the earlier planting and later harvesting periods. Similar dynamics are likely in the other two cases.

During and immediately following the main harvest period, when caloric availability in the household diet is usually found to be highest for the year, the nutritional situation of the youngest children does not continue to improve. This is because of deterioration in the diversity and quality of the diet, relative to the early harvest period, and also the heavier work load for women. For adults and older children, however, weight gain peaks following the main harvest.

Figure 1  
Seasonal fluctuations of children's nutrition in Zambia, Ethiopia, and Niger

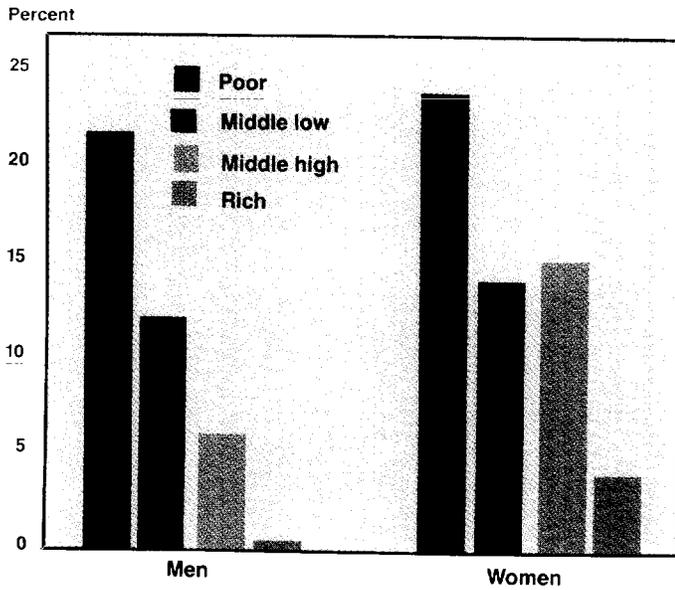


Source: IFPRI and E. Bianchi et al. 1989.

In most cases, children's weight gain during the early harvesting period does not appear to be adequate to enable them to fully catch up on the growth curve. As a result, in the following year, their nutrition is at an even lower level during the critical period, which leads to a higher probability of acute malnutrition and death. Progressive growth faltering of children thus seems to be the result of a combination of factors during the period of seasonal stress.

Adults in each of the case studies were found to have, on average, a 3-4 percent fluctuation in body weights between seasons. However, the range of individual fluctuation in body weight was two-to-three times higher than the group averages. Generally, the smaller the farm size, the lower the income level and the lower the level of food self-sufficiency. The extent of moderate-to-severe caloric deficiency, as reflected by low body weights, was also higher in these households (Figure 2). All three case studies found that both the absolute and percentage change in body weights for adults was higher in households where the level of nutrition was already low. The implications are therefore more critical for the poorer

Figure 2  
**Prevalence of moderate-to-severe caloric deficiency in different income groups in Ethiopia, December 1987**



Source: F. Branca et al. 1989.

households, as they are more likely to face severe nutritional stress at times when the work requirement in agriculture is the highest. In Ethiopia, where the overall levels of adult nutrition were the lowest of the three cases, the poorest households had a significantly higher seasonal weight loss than the higher income households. This may reflect their reduced ability to buffer seasonal food insecurity, as compared with the Niger and Zambia sample households. Factors expected to be important here are the extent of savings, disposable assets, and livestock, characteristics of the rural labor market, and other seasonal employment opportunities.

Rural works and other programs that generate rural employment have been controversial in much of Sub-Saharan Africa. The prevalent perception is that availability of such programs will draw workers away from agricultural production. It is still not appreciated that much of the rural work force faces severe nutritional stress primarily due to the inability to acquire sufficient food, and that this stress is greatest at the time that they are expected to provide most of the labor for agricultural production. Thus rural public works employment may have a beneficial effect on agricultural productivity, even in the short run. In the long run, if these programs are generating rural infrastructure, additional productivity gains could accrue.

# P

# OLICIES FOR FAMINE PREVENTION IN ETHIOPIA AND SUDAN

JOACHIM VON BRAUN, TESFAYE TEKLU, AND PATRICK WEBB

Famine has been a burden throughout human history. Today a consensus is building that even in resource-poor countries, famines are the result of national and international policy failures—that is, failure to give due priority to the conceptualization, implementation, and management of famine prevention. During the 1980s, severe famines were confined to Africa. Sudan and Ethiopia were the two major problem cases. In 1989/90 famine conditions are again emerging in large parts of both countries.

## FAMINES OF THE 1980s

Famine deaths in Ethiopia between 1983 and 1985 have been estimated at over 1 million, and those in Sudan in 1984/85 at about 200,000 in western Sudan alone, with an additional 200,000 deaths assumed in the second half of the 1980s in the war-stricken southern provinces. Infant mortality rates in parts of western Sudan increased to more than 300 per 1,000 in the famine year of 1985. The few nutritional surveys available from the crisis areas indicate severe child malnutrition affecting 20 to 30 percent of children in Sudan and over 50 percent in Ethiopia (Wollo), increasing from "normal" prevalence rates of 4 to 6 percent to those levels in a matter of a few months.

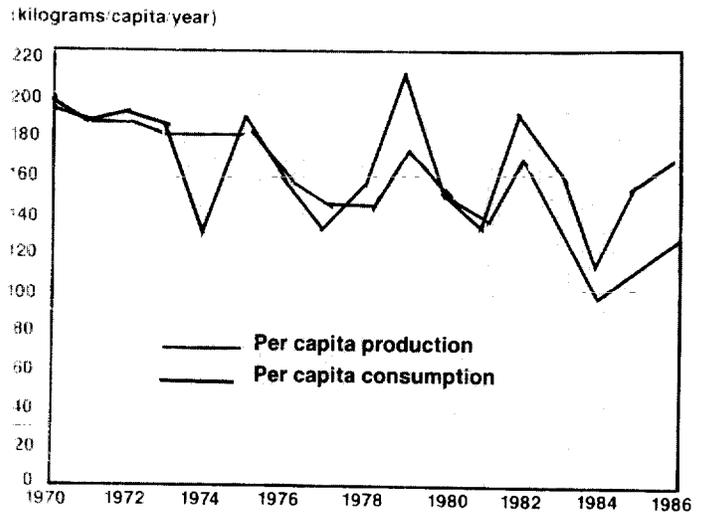
In both of these countries, it is tempting to point to continuing military conflicts as the chief cause of famine. It is true that the resource drain and economic disruption resulting from war are important factors. However, the causes of conflict are complex, and lie in part with underlying policies that led certain regions in both countries to be increasingly vulnerable to famine: weakened local government, underinvestment in rural infrastructure, urban bias in services and public employment, overtaxation and underinvestment in the agricultural sector, and concentration of scarce capital. Areas most severely affected by famine often have low agricultural resource bases: Eritrea, Tigre, and Wollo provinces in Ethiopia and Darfur, Kordofan, and Red Sea provinces in Sudan are cases in point. Population growth remains at high levels in both countries.

*Drought* and other unfavorable weather conditions remain a chief trigger of famine crises when public preparedness is lacking. Modeling results by IFPRI indicate that a 10 percent decline in long-term average rainfall results in an 8.4 percent drop in total cereal production in Ethiopia and a 5.0 percent drop in Sudan. Responses are larger for individual crops concentrated in drought-prone regions. For example, for sorghum, the average elasticity with respect to rainfall is much higher (16 percent in Ethiopia and 7 percent in Sudan). Local drought is a recurrent feature, triggering food crises on a small scale in different parts of each country almost continuously.

*Food production* in Ethiopia shows a disturbing downward trend, with production fluctuating excessively in both Ethiopia and Sudan. Production fluctuations have a direct

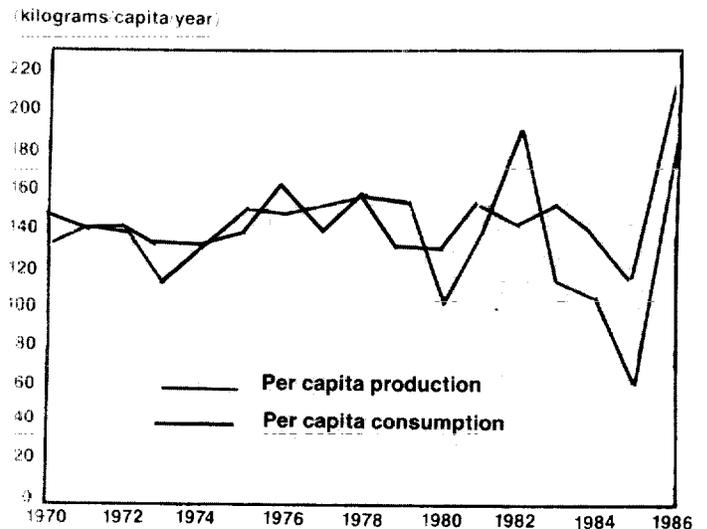
effect on food availability due to the countries' physical inability to move large amounts of food in a crisis. Limited foreign exchange and borrowing capacity pose additional constraints: in 1987, Ethiopia's external debt was equivalent to 46 percent of GNP; that of Sudan equaled 102 percent of GNP. Production and consumption remain tightly connected in both countries, particularly in Ethiopia (Figures 1 and 2). In the 1970s and 1980s, localized famines

Figure 1  
Per capita cereals production and consumption in Ethiopia, 1970-86



Source: Ethiopia, Central Statistics Authority.

Figure 2  
Per capita cereals production and consumption in Sudan, 1970-86



Source: Sudan, Ministry of Agriculture and Natural Resources.

occurred in both countries whenever national cereal production fell below 140 kilograms per capita, unless that poor crop year was preceded by an exceptionally good year. The most severe famine years have generally been preceded by two or three years of low rainfall and production.

In addition to the direct effect on availability, production crises causing famine conditions also have indirect effects on *prices, rural wages, and employment* in both farm and nonfarm rural economies. IFPRI analysis in Sudan shows that a 10 percent decline in production led to an approximately 20 percent increase in real cereal prices. In 1984/85, real food prices in Sudan tripled, and in Ethiopia they more than doubled in 1983/84. A critical factor in such price movements was the deterioration of livestock/cereal terms of trade. In western Sudan these increased from a ratio of 1:1 in 1980 to 1:8 in 1984/85, thus eroding the purchasing power of pastoralists. Given that in western Sudan household budget shares directed to food are normally about 70 percent, income elasticities of calorie consumption are 0.4-0.7, and price elasticities are -0.2 to -0.3, one cannot be surprised that starvation was widespread. In both countries, rural households dependent on livestock and wages and subsistence farmers in drought-stricken regions were affected the most. Among these, children, the elderly, and female-headed households were the hardest hit.

## **RELIEF AND FAMINE PREVENTION POLICY**

*Food aid* played a crucial role in both countries, reaching 1.2 million tons in 1985 in Ethiopia (and 1.3 millions tons in 1988), and 0.7 million tons in Sudan in 1984/85. Red (feed) sorghum was the principal relief food distributed in Sudan, which, because it is not a desired food according to local taste, may have been self-targeted to the truly needy. Wheat was widely distributed in Ethiopia, especially by nongovernmental organizations, which played a key role in managing emergency operations in both countries.

*Food-for-work* operations in both countries largely came to a standstill during the crisis mainly because of logistics problems and the more immediate demands of relief intervention. Both countries are a long way from effective utilization of public works during periods of decline in agricultural production and employment, a key instrument for famine prevention in India.

*Cash transfer schemes* in Ethiopia had mixed results. IFPRI surveys show that in one area cash recipients faced state-imposed interregional trade restrictions that curtailed long-distance food acquisition. Most people would therefore have preferred to receive food aid. However, at another more remote site, access to markets outside the drought zone was freer, and recipients were happy to have received cash rather than food.

Improvements in *agricultural technology* can play a key role in famine prevention, particularly by increasing production in high-potential areas. A case in point is the Jebel Marra area in Darfur, Sudan. The area benefits from a project where participants have access to improved technology that includes delivery of improved inputs, animal traction, and improved farming practices through extension networks. IFPRI's collaborative research with the Jebel Marra Development Project shows that households with access to technology coped better. They had less pressure for migration under stress: while only a few of the participating households had no male head during the drought year, 50 percent of the nonparticipating households had to manage without a male head.

While Ethiopia has a long-standing institution for famine prevention—the Relief and Rehabilitation Commission (RRC)—a similar institution was established in Sudan only after the 1985 crisis. *Early warning systems* were certainly not optimal in either country. Although technically well implemented, debate continues over the appropriateness of warning indicators used, and such systems are a poor substitute for a free press and effective local-central government interaction. Lack of early information was less of an issue than lack of early policy response. The central government declared western Sudan an "emergency zone" in August 1984—eight months after the governors of Darfur and Kordofan made an urgent appeal. Even longer response lags occurred in the Wollo and Tigre famines in Ethiopia in 1983/84.

While an effective relief operation has to be part of a famine prevention policy, relief is not a substitute for development-oriented measures that reduce the likelihood of crises. Famine in Sudan and Ethiopia has complex causes, which should be addressed through a complex set of instruments tailored to regional economic, social, and ecological environments. In this set, priority should be assigned to the following:

- Employment-generation schemes creating useful assets (such as infrastructure) that function under stress;
- Improvement of rural infrastructure to facilitate the movement of food, services, and labor;
- Liberalization of interregional trade in food stuffs;
- Promotion of agricultural technology to expand food output, increase productivity, and stabilize production in the stress-prone regions;
- Conservation and enhancement of the productive resource base (forests, soils, and water);
- Stabilization of prices through trade (including food import financing facilities and food aid) and stockholding; and
- Development of rural financial markets to help stabilize household consumption.

# K

## KEY TRADE AND MACROECONOMIC ADJUSTMENT ISSUES IN AFRICA: AN OVERVIEW

ALBERTO VALDES

The economic performance of Sub-Saharan African countries has been disappointing for many years, and it is generally agreed that domestic policies must change drastically in order to improve economic performance and eliminate the current disequilibrium in the countries' external accounts.

Structural adjustment programs, which promote export-led growth and a long-term, sustainable current account balance, are being promoted in a number of countries. However, there is considerable controversy among economists and politicians in the region about the type of policy reforms to be implemented, their timing and sequencing, and the potential external demand constraints that may arise if a jointly promoted export-led strategy resulted in world market price deterioration.

Structural adjustment programs comprise a mix of demand-side policies, supply-side policies, and policies to improve a country's international competitiveness. At the core of structural adjustment, one finds fiscal discipline, real exchange rate devaluation, and trade liberalization. This incentive-oriented type of adjustment is not based on getting relative prices right alone. Nonprice factors that enhance the effectiveness of incentive policies are also normally included in the package of reforms: for example, technological innovations, infrastructure to connect locations of production and consumption, availability of inputs, information network, and an institutional framework to provide credit and marketing services.

Six supporting briefs are included in this session, representing on-going work at IFPRI on various aspects of trade and price policy reform in Sub-Saharan Africa. Two of these aspects will be discussed here: first, some relevant findings from IFPRI's work on trade and macroeconomic policies will be highlighted, and second, transition problems will be identified as part of a new research program on structural reforms and agriculture.

### SOME RELEVANT FINDINGS

The evidence from IFPRI's work on the effects of sectoral and economy-wide price interventions in several countries in Asia, Sub-Saharan Africa, and Latin America for the period 1960-84 shows that there was a strong antitrade pattern in practically all the countries studied, and it was particularly high in Sub-Saharan Africa. At the official exchange rate, agricultural importables were protected and agricultural exportables were taxed. Furthermore, a striking general finding of the analysis is the importance of indirect price intervention to the structure of incentives in agriculture. These indirect interventions basically reflect the exchange rate misalignment and the effect of industrial protection on domestic relative prices. While sectoral

policies have an enormous range of effects on domestic incentives (for example, as measured by the nominal rates of protection), indirect intervention is consistently negative and high. In the countries analyzed in Sub-Saharan Africa, these indirect interventions reduce farm prices (relative to nonfarm prices) by 30 percent or more.

This implicit taxation of agriculture, which does not yield revenues to the government, is extraordinarily high. It reduces agricultural growth, farm income, and the competitiveness of agriculture directly through its effects on the cost of purchased (tradable) inputs, and indirectly through appreciation of the exchange rate and higher prices for protected tradables outside of agriculture. In the long-run, such a strategy accelerates the flow of labor and investment from agriculture to the rest of the economy. In countries where agriculture represents a major potential contribution to national income and to the balance of trade, the forced import substitution and the accompanying overvaluation of the exchange rate contribute powerfully to discouraging the production of agricultural tradables, particularly exports. This in turn results in a foreign exchange crisis and a drastic cut in imports. These solutions generally cause the exchange rate to be distorted even further.

Large increases in the indirect taxation of agriculture, relative to the 1970s, occurred during the early-1980s in Ghana, Zambia, and Côte d'Ivoire. Huge intersectoral income transfers took place between agriculture, the government, and the nonagricultural sector. Estimates for the same three African countries show total transfers out of agriculture of more than 50 percent of agricultural GDP, a fraction of which went to the governments.

### TRANSITION PROBLEMS

In most countries now there is general agreement concerning the need for policy reforms. There is, however, little experience in carrying out reforms of the magnitude and complexity of those that have been tried in some Latin American countries, rural China, some African countries, or those that are now being initiated in Poland, Hungary, and other centrally planned countries. Among the issues to be considered in guiding these new research projects are the following: How broad should the reforms be to be effective in reaching the desired objectives? Are the rules for reform general or should each reform process be considered a special case? Can a framework be developed that will permit policymakers to understand better where the major resistances to reforms are likely to arise? What about the issue of compensation?

Broadly, IFPRI's work in this area can be seen as an effort to develop a framework for defining a strategy for

agricultural reform. Such reforms cover many different aspects, and they are a potential area for an institute-wide effort. The Trade and Food Security Program proposes to emphasize the theme of synchronization between reforms in economy-wide and agricultural price interventions, their related implications for marketing and trading agencies, and their impact on agricultural output, trade flows, government budgets, and income of the poor. The first phase would concentrate on the following topics:

1. Interface between reforms in commodity-specific sectoral policies and economy-wide policies and the impact on incentives to produce agricultural tradables;
2. The possible conflict between reforms affecting farm prices and urban real wages;

3. The effects of reforms on the government budget;
4. Measures to make the agricultural output respond faster, including reforms in the nonagricultural sector that affect services, credit, and so forth; and
5. Policies to deal with price instability in the major staples.

There is no clear conceptual framework to deal with these issues. This is a new area, but one where IFPRI's previous work on the foreign trade and exchange rate regime and agriculture provides a solid intellectual basis for the proposed research. As a plan of action, it is proposed that the work begin with simultaneous studies of the experiences of some countries that have implemented broad reform programs in Latin America, Africa, and Asia.

# A

## AGRICULTURAL EXPORTS UNDER STRUCTURAL ADJUSTMENT IN AFRICA

ALBERTO VALDÉS

The development strategies after World War II in most developing countries, including those of Sub-Saharan Africa, grossly undervalued the potential contribution to economic development of agriculture in general, and of agricultural exports in particular. Policy analysts in developing countries, however, have begun to reassess the potential contribution of agriculture to development. As part of a development strategy, agricultural exports can play a critical role in stimulating agricultural growth, generating rural employment indirectly, and alleviating poverty, as well as contributing directly to foreign exchange earnings. Given the extraordinarily high taxation of agricultural exportables in most of Sub-Saharan Africa there is considerable scope for fostering incentives to expand the production of exportables.

Economists were pessimistic about the growth of external demand for exports and also skeptical about the dynamic influence of exports on the rest of the economy. This was particularly so for tropical products, which were assumed to face inelastic price and income demand. Despite their widespread pessimism, economists explicitly argued that in selecting a development strategy, trade should be considered as more than an exchange of goods. An outward orientation enables an economy to be more flexible and to adjust better to external shocks. More generally, it brings an economy closer to an optimum allocation of resources. In the developing countries, too much emphasis was put on the forces operating to limit the demand for primary products and far too little on those operating to open up new markets and products.

For several economies in Sub-Saharan Africa, the performance of their principal export commodities was below the world average. For example, whereas Ghana lost a substantial share of the cocoa market between 1961-63 and 1982-84, and Nigeria's and Zaire's shares of the palm oil market declined, Malaysia's share increased more than threefold (Table 1). Brazil increased its share and Côte d'Ivoire raised its share of the cocoa market from 9.3 percent to 26.3 percent during the same period. The decreasing market share for several Sub-Saharan African countries' major agricultural exports is an indication that external demand was not the main constraint: one should look for domestic factors behind the poor export performance.

### THE EXTENT OF THE BIAS AGAINST AGRICULTURAL EXPORTS

Until recently, economists paid scant attention to the significance of trade and macroeconomic policies in shaping the economic opportunities faced by agricultural producers. An import-substitution strategy leads to an overvalued domestic currency (relative to an equilibrium exchange rate at lower levels of protection), which leads to

Table 1  
Export market shares of cocoa and palm oil in selected developing countries, 1961-84

Commodity/Country	Export Market Shares	
	1961-63	1982-84
Cocoa		
Africa	80.0	64.1
Cameroon	6.8	6.9
Côte d'Ivoire	9.3	26.3
Ghana	40.1	14.4
Nigeria	18.0	11.2
Palm Oil		
Africa	55.8	1.9
Nigeria	23.3	0.2
Zaire	25.1	0.1
Asia	41.8	95.0
Indonesia	18.4	8.2
Malaysia	17.9	70.6

Source: MacBean 1989.

stagnant production of exports and nonprotected importables. This leads to a foreign exchange crisis, and attempts to avoid a crisis have generally caused the exchange rate to be distorted further. The resulting penalty on agriculture is inherent and will last as long as industry is highly protected; it cannot be eliminated by better management in other areas of economic policy.

A recent study applies a common methodology for 18 developing countries in Asia, Africa, and Latin America, resulting in a set of estimates of agricultural price interventions during the 1960-84 period. The direct, indirect, and total nominal protection rates are estimated from representative export crops. The study calculates the indirect effects adjusted for the exchange rate misalignment and for the change in the price of nonagricultural tradables due to industrial trade policies. The results for three Sub-Saharan African countries are presented in Table 2. It is evident that these countries adopted policies that resulted in the equivalent of extremely high export taxes. The net effect of direct and economy-wide policies during 1980-84 was that prices paid to producers in Côte d'Ivoire, Ghana, and Zambia were about half of what they would have been at a realistic exchange rate with no direct price intervention. This extremely large total negative protection adversely affected net agricultural exports and, consequently, foreign exchange earnings.

A need for government revenue was clearly an influential factor underlying the direct taxation of exports in many developing countries. But the most pervasive form of taxation came from misalignment of the exchange rate, which did not significantly generate government revenue. It is also worth noticing that Ghana, Côte d'Ivoire, and Zambia had the highest rates of total taxation on agricul-

Table 2

**Direct, indirect, and total nominal protection rates for exported products, selected African countries, 1975-79 and 1980-84**

Country	Product	1975-79			1980-84		
		Direct	Indirect	Total	Direct	Indirect	Total
(percent)							
Côte d'Ivoire	cocoa	-31	-33	-64	-21	-26	-47
Ghana	cocoa	26	-66	-40	34	-89	-55
Zambia	tobacco	1	-42	-41	7	-57	-50
Average		-11	-25	-36	-11	-29	-40

Source: Krueger, Schiff, and Valdés 1987.

Note: The direct nominal protection rate is defined as the difference between the total and the indirect nominal protection rates, equivalently, as the ratio of, first, the difference between the relative producer price and the relative border price, and, second, the relative adjusted border price measured at the equilibrium exchange rate and in the absence of all trade policies.

tural producers among the 18 developing countries examined. In addition to a lower rate of agricultural growth, this policy resulted in a substantial income transfer from agriculture to the government and to nonagricultural sectors.

## CURRENT CONCERNS

Concerns about several specific issues regarding the adoption of outward-oriented strategies for agriculture in Sub-Saharan Africa are being voiced today. Concerns about constraints in external demand have not disappeared, especially in the slow-growth environment of the 1980s. Domestic food security is also seen to be threatened if there is a trade-off between expanded agricultural exports and the availability of domestic food supplies. At

the local level, fears are also expressed about the nutritional effects on farm households of switching from production of food crops to export crops. Finally, sustained growth of a broad base of agricultural exports is dependent on an organizational framework and "trade infrastructure" that is not in place in some countries. Export growth is dependent on an efficient service sector including banking and communications; on a regulatory framework for trade; and on improved physical infrastructure. It takes several years to have these elements in place. There is much to be lost and little to be gained by waiting until the last moment if a case for economic reform can be made.

Each of these concerns has to be addressed in the context of the individual country. However, the external demand constraint has probably been overestimated. For countries in this region, the analysis noted previously reveals a loss in market share for most countries over time. Of course, exports from this region could be further stimulated if industrialized countries such as those of the European Community were to open up their markets to processed agricultural imports. Removing the present tariff escalations should help countries in Sub-Saharan Africa set up export-oriented, agricultural-processing industries to produce exports with higher unit value. There is, however, a real concern about products for which Sub-Saharan Africa's share in the world market is rather large—cocoa and coffee, the region's two chief agricultural export products. Significant expansion of their export would reduce world prices and perhaps marginal export revenues. The excessive emphasis on two or three export products could be misleading, however. Countries that have followed open trade regimes, such as Brazil, Chile, Thailand, and Turkey, have usually succeeded in diversifying their agricultural exports significantly over time. Furthermore, countries in Sub-Saharan Africa might face less severe external demand constraints if policy reforms were simultaneously implemented and were used to stimulate trade between developing countries.

# A

# GRICULTURAL INCENTIVES IN THE CONTEXT OF STRUCTURAL ADJUSTMENT IN NIGERIA

T. ADEMOLA OYEJIDE

## PRELUDE TO STRUCTURAL ADJUSTMENT

Nigeria's structural adjustment program (SAP) was preceded in the 1970s by an oil boom. The unexpected windfall associated with oil radically altered the structure of the economy and substantially biased the system of incentives against nonoil tradable sectors, particularly import-competing and exportable agriculture. In the process, the well diversified though basically agricultural economy of the 1960s was transformed into one heavily dependent on crude oil—now the major sector of the economy and the principal source of government revenue and export earnings.

The policy environment of the oil boom period exacerbated the adverse Dutch Disease effects of the boom. Because of a rigid and inappropriate exchange rate policy, the Nigerian currency became highly overvalued, and the real exchange rate appreciated by well over 70 percent between 1970 and 1984. High levels of industrial protection offered by the trade regime further penalized agricultural tradables. As a result of the prevailing agricultural marketing and pricing policy, which gave monopoly control of agricultural exporting to parastatal commodity boards, producers of the major agricultural commodities (cocoa, for example) received less than 60 percent of the export earnings generated by these commodities.

Under the combined effects of the oil boom and inappropriate macroeconomic policies, agriculture's share of the gross domestic product (GDP) fell sharply from about 60 percent in the 1960s to 25 percent in the early 1980s. Similarly, Nigeria's share of developing-country and world agricultural exports declined at annual rates of 5.7 percent and 7.1 percent, respectively, between the early 1970s and 1980s. Aggregate value of the country's agricultural exports fell by more than 55 percent in real terms between 1970 and 1982.

The slump in world oil markets from mid-1981 on had enduring negative effects on the Nigerian economy. Fiscal and current account deficits mounted, external debt rose sharply, and both GDP and living standards declined. Thus, growth of real GDP fell from an annual average rate of 3.7 percent in 1973-80 to -4.6 percent during 1980-85. As a result, GDP in 1985 was roughly 15 percent lower than it was in 1980, and real per capita GDP in 1985 was well below the levels achieved in the early 1970s. Average real income of rural households declined by 30 percent, while that of their urban counterparts fell even more sharply—by more than 50 percent—between 1980 and 1985.

The unsustainability of the prevailing imbalances motivated the adoption of a comprehensive incentive-oriented SAP in 1986.

## INCENTIVE-ORIENTED STRUCTURAL ADJUSTMENT POLICIES

Nigeria's SAP places high priority on stimulation of the agricultural sector through substantially improved incentives. This is based on the recognition that previous fiscal, trade, and exchange rate policies, which exacerbated price distortions in the economy, were major contributory factors to the poor performance of agriculture. Hence, the primary focus of agricultural policy, under SAP, is to restore and enhance agricultural incentives by removing the distortions. It is presumed that the abolition of the commodity boards coupled with the adoption of an appropriate exchange rate policy will provide improved price incentives. The scope for increasing agricultural incentives through a reform of trade and exchange rate policies was clearly demonstrated by the overvalued currency, which implicitly and substantially taxed agricultural tradables, and by the parastatal marketing arrangement that did the same explicitly.

Thus, the core of Nigeria's SAP is a radical reform of trade and exchange rate policies, combined with enhanced market liberalization and institutional changes aimed at creating a degree of economic flexibility, which is expected to improve the effectiveness of the incentive system.

Specific details of the reforms include the adoption of a largely market-determined floating exchange rate system, which became operational in September 1986. Next was the progressive liberalization of the trade regime, starting with the abolition of import and export licensing requirements and a sharp reduction from 74 to 16 in the number of commodities placed under import prohibition. Subsequently, the average (1981 trade-weighted) tariff rate was reduced to 25 percent, with most rates falling in the range of 10 to 30 percent. On the export side, nonoil exporters were granted unrestricted access to the foreign exchange market and the right to retain 100 percent of their export earnings. Finally, the six existing agricultural commodity boards were abolished in December 1986, thus opening up internal and external marketing and ensuring free-market determination of the prices of all agricultural commodities.

It should be noted, of course, that even after almost three years, the reforms remain incomplete in some areas, and there has been some backsliding in other areas. Thus, several key agricultural imports (wheat, rice, maize, and vegetable oils) remain under import prohibition; and various other food items have also been placed under export ban.

## EFFECTS OF POLICY REFORMS

The policy reforms were intended to have a direct and immediate effect upon agricultural incentives by raising

agricultural prices. Table 1 shows the trend of agricultural prices just before and after the reforms. In broad terms, export crop prices rose sharply soon after the policy reforms were adopted. By 1988, prices of some export commodities had increased more than twofold (for example, palm oil, palm kernel, and groundnuts) and five- to sixfold in other cases (cotton and cocoa). The behavior of food crop prices shows a different pattern. In these cases, prices actually fell sharply in 1986 and 1987, because the postreform period was one of good rains and good harvests. This good fortune did not continue, however, and food prices increased sharply in 1988.

Table 1  
Indexes of agricultural commodity prices, Nigeria, 1983-88

Crop	1983	1984	1985	1986	1987	1988
(1985 = 100)						
<b>Producer prices of export crops</b>						
Cocoa	88	94	100	219	469	688
Cotton	70	88	100	125	500	563
Groundnuts	60	87	100	133	277	300
Palm kernel	58	100	100	100	213	250
Palm oil	83	100	100	167	200	250
Rubber	92	100	100	92	77	115
<b>Retail prices of food crops</b>						
Maize	82	118	100	81	96	173
Millet	67	125	100	87	77	375
Sorghum	69	46	100	49	69	210
Gari	97	136	100	64	77	173
Beans	63	116	100	100	114	179
Rice	47	108	100	90	89	143
Yams	89	108	100	84	69	183

Source: Central Bank of Nigeria.

The immediate postreform period also coincided with a period of declining agricultural commodity prices in the world market. The index of average dollar prices of Nigeria's agricultural commodities fell by almost 40 percent between 1985 and 1988; a similar price index for cocoa, Nigeria's most important agricultural export commodity, declined by 55 percent during the same period. But because of the sharp and continuing depreciation of the local currency, the index of average c.i.f. prices in naira increased substantially, jumping from 100 to 451 in the case of cocoa and to 374 for all agricultural commodities between 1985 and 1988.

A major objective articulated for the agricultural sector in the context of structural adjustment is to increase production of exportable cash crops as a means of diversifying the economy's export base. The short-run response to policy reform in this respect is impressive (Table 2). Between 1985 and 1988, the quantity of agricultural exports more than doubled, whereas their value increased elevenfold. Furthermore, the contribution of agriculture to total export earnings increased steadily from 2.3 percent in 1985 to 9.1 percent in 1988.

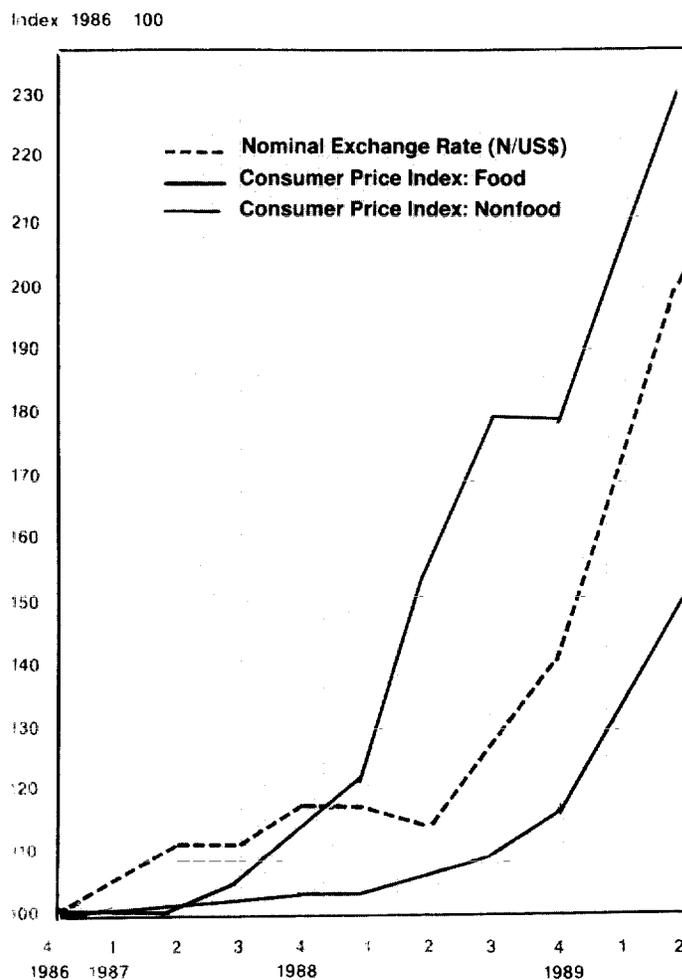
Table 2  
Volume and value of agricultural exports, 1983-88

Item	1983	1984	1985	1986	1987	1988
Index of value	100	80	100	157	728	1,171
Index of volume	173	96	100	146	200	210
Agricultural exports as a percentage of total exports	3.4	2.3	2.3	4.6	5.2	9.1

Source: Central Bank of Nigeria.

Domestic food supplies have not kept pace with demand since the policy reforms, partly because import restrictions remain on several food items. Moreover, the naira has continued to depreciate while urban retail food prices have risen sharply (see Figure 1). This consequence of current structural adjustment policies has a major adverse implication for food security, especially for vulnerable urban households, given the drastic decline in real income that has also accompanied the structural adjustment process.

Figure 1  
Nominal exchange rate and consumer prices, 1986-89



Source: Nigeria, Federal Office of Statistics.

# R

# REGIONAL INTEGRATION AND NATIONAL FOOD POLICIES IN THE CEAO AND SADCC COUNTRIES

OUSMANE BADIANE AND ULRICH KOESTER

Because it reduces the various barriers to regional trade, regional integration can be considered as an additional strategy toward improved national food security. As a source of food supply, employment, and foreign exchange earnings, agricultural production has played a key role in food security in Communauté Economique de l'Afrique de l'Ouest (CEAO) and Southern African Development Coordination Conference (SADCC) countries. Through its effects on the level and stability of activities in the food sector, integration of agricultural markets can help increase and stabilize national consumption levels.

## FOOD POLICIES AND THE REGIONAL STABILIZATION POTENTIAL

National food policies in CEAO and SADCC countries fall into three categories: trade and marketing measures to regulate cross-border commodity flows and the movement of goods between regions within a country; pricing measures to influence directly prices on consumer and producer markets; and commodity storage. Limited market information, as well as the multitude of cross-sector linkages on factor and product markets, makes these policies difficult to manage and undesired effects associated with them unavoidable.

Regional integration allows the use of commodity trade to partly substitute for national measures (for example, stockholding). As shown in Table 1, cereals production is much more stable at the regional level than in almost any single member country of CEAO or SADCC. The coefficients of variation used as indicators of production instability are much higher at the national level, compared with the regional average. Therefore, encouraging commodity exchanges between countries would help stabilize the national food markets. The first step to this end would be to reorient national policies toward the regional markets.

## INWARD-LOOKING VERSUS REGIONALLY ORIENTED NATIONAL POLICIES

The substantial divergences in the levels and ratios of national prices observed among SADCC and CEAO countries indicate the inward-looking nature of domestic policies. A review of research on intra-SADCC trade by Ulrich Koester shows price differences of 50-200 percent for maize in single years. In the case of CEAO, recent studies have revealed national price differences for maize in some years ranging from 40-50 percent between Mali and Côte d'Ivoire and 200 percent between Senegal and Mali. For millet and sorghum, national prices in Niger and Burkina Faso in some years exceed those in Mali by more than 75 percent. The inward-looking character of national policies is also reflected in the widespread adoption of panterritorial and panseasonal prices.

Table 1

Indexes of production instability and trade overlapping in  
CEAO and SADCC countries

Country	Instability of Cereals Production <sup>a</sup>	Overlapping of Trade
SADCC (1960-80)		
Angola	9.81	0.02
Botswana	68.85	0.04
Lesotho	19.65	0.33
Malawi	11.64	0.10
Mozambique	12.75	0.09
Swaziland	26.41	0.10
Tanzania	9.24	0.04
Zambia	12.66	0.10
Zimbabwe	22.32	0.00
Region	9.02	0.16
CEAO (1961-86)		
Burkina Faso	15.61	0.07
Côte d'Ivoire	8.07	0.03
Mali	14.28	0.02
Mauritania	34.60	0.00
Niger	17.70	0.14
Senegal	23.62	0.04
Region <sup>b</sup>	14.73	0.16

Sources: SADCC, Ulrich Koester; CEAO, Ousmane Badiane.

<sup>a</sup> The higher the indicator value, the more unstable is production.

<sup>b</sup> Regional figures are for all West African countries, not just the six countries shown above.

It may be inferred from these few examples that prevailing national food policies have not contributed to integrating agricultural markets and expanding trade among CEAO and SADCC countries.

## COMPARATIVE ADVANTAGE AND THE POTENTIAL TO EXPAND TRADE

The potential contribution of regional integration to food security hinges on the possibility of expanding trade at the regional level and, therefore, exploiting the differences in comparative advantages between countries. An economy's comparative advantage, that is, its competitiveness in the production of a single commodity within a given set of commodities, is determined by the endowment of the economy with resources, its opportunity to trade, its cumulated experience with production technologies, and its structure of domestic preferences. These factors differ among the countries of the two subgroups so that comparative advantages of the countries must necessarily differ. In fact, analysis of the historical patterns of trade and production have revealed that, in both regions, national economies have specialized differently over time.

A trade overlap index can be used to give an idea of the potential for expanding trade if national policies are adjusted and the various barriers to cross-border trade are

eliminated. The indicator values, which vary from 0 to 1, give the percentage of the revenue from exporting a good that is spent on imports of the same good by each country and country group. The figures in Table 1 show that, with the exception of Lesotho and Niger, national trade flows hardly overlap, whereas, on average, 16 percent of regional flows do. (The level of overlapping for Lesotho and Niger is probably explained by Lesotho's membership in the South African Customs Union and livestock re-export by Niger to Nigeria.) This means that some CEAO or SADC countries export certain commodities to extraregional markets, while some of their neighbors import the same commodities at the same time, also from extraregional sources. There may be many reasons for this bias, such as bias in trade regimes, higher transport costs within the region, and poor communication. However, the value of 16 percent indicates that, even with constant production

and consumption patterns, reducing those barriers would expand trade within the CEAO and SADC countries.

The trade overlap indicator is based on existing national patterns of production and consumption. However, integrating national agricultural sectors starts with harmonizing national food policies, which presently tend to be inward-looking. Resulting changes in relative prices induce adjustments in production patterns more in line with comparative advantages and thus expand the base for intraregional trade

## **CONCLUSIONS**

Regional integration can complement and partly substitute for national food policy measures. However, for regional trade to contribute to national food security and agricultural development objectives, today's inward-looking policies need to be reoriented toward the regional markets.

# L

## ESSONS IN PRICE STABILIZATION FROM KENYA

THOMAS C. PINCKNEY

The price and availability of the primary staple foods are of critical concern to all governments. Rapid increases in price or periods of unavailability can lead to calorie deprivation, real income declines, and political crises. Consequently, many governments in Africa and elsewhere take measures to moderate price fluctuations and to ensure supplies through some intervention in the market.

If the government is to have a beneficial impact on prices or availability during shortage, it is necessary to increase supplies reaching the market. This requires moving the commodity either from surplus to deficit regions, or from surplus to deficit time periods. The surplus "region" may be the world market, with imports enhancing domestic supply. Often governments or parastatal organizations store, transport, and import or export the staple food for these purposes.

Such activities are typically expensive for governments. Storage of foodgrains requires both a high capital cost up front in order to build proper facilities and high costs each year to hold the stock (typically 15 to 25 percent annually of the value of the stock). Importing and exporting the staple often results in financial losses if the government desires a domestic price that is more stable than the world price. Thus, there is a trade-off: governments can stabilize prices, but only at a cost that rapidly escalates as price variability moves toward zero.

Basic economic principles imply that prices should be stabilized until the benefits of added price stability are outweighed by the added cost. The statement is simple; defining and measuring the added security and added costs are quite complex. Moreover, the costs of achieving a given degree of price stability will vary depending on the way government chooses to intervene in the market. There may be much more efficient methods of achieving the same degree of price stability than the policies governments are pursuing at present.

### PRICE STABILIZATION IN KENYA

IFPRI has examined these issues in Kenya and Pakistan, with research continuing on Zambia, Zimbabwe, and Malawi. Kenya attempts to stabilize the price by authorizing its marketing board to buy all that is offered at its purchase price and to sell all that is demanded at its selling price. Purchase prices usually are announced prior to the planting season, while selling prices are announced shortly before harvest. Both prices are supposed to remain constant for a year after the announcement.

Such a system causes wide swings in cost from year to year, as official prices cannot respond to developments in the domestic or world markets. If the government does not give the parastatal sufficient fiscal resources to import and sell the staple in a bad year, or to buy and store or export in a good year, private market prices will swing widely. The

populace will be faced with all the problems of price instability even though there is a facade of official price stability.

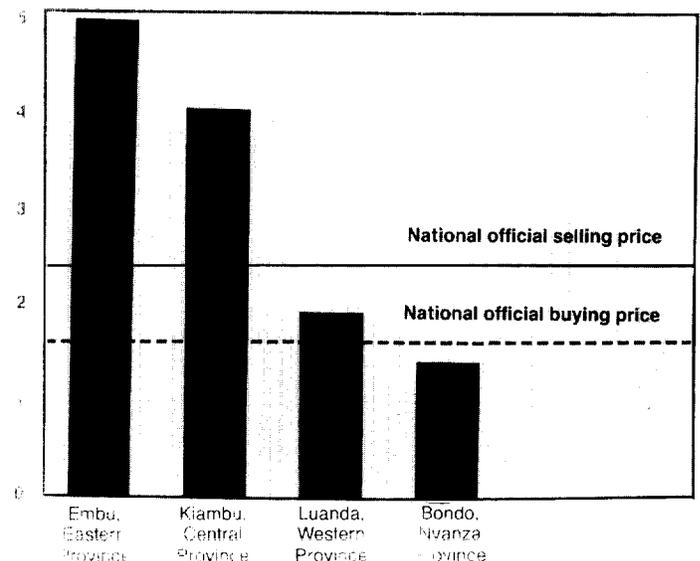
An example of this occurred in Kenya in 1984. The country experienced a major drought, and it failed to supply all that was demanded at the official price. Movement controls between regions exacerbated the problem. Figure 1 shows that by September, prices in some markets were almost double the national, official selling price, even while prices in other parts of the country were within the normal range.

Such problems highlight the need to design efficient policies for coping with extreme market conditions. The normal price band approach to price stabilization, which has been adopted by most countries that control food prices, is exceptionally costly in these extreme years.

So the Kenya research was conducted with two major goals: first, to measure trade-offs between government objectives, and second, to discover methods of designing policy in order to achieve a given degree of price stability at the lowest possible cost. Because there is a perceived quality difference between the domestically consumed white maize and the internationally traded yellow maize, the country has an objective of limiting imports in addition to the usual objectives of price stability and low fiscal cost.

Figure 1  
Private and official maize grain prices in Kenya, September 1984

Price (KSh/kilogram)



Source: Abstract for IFPRI Research Report 1

The trade-offs, as measured by the most efficient policies, are presented in Figure 2. Since there is no maximum or minimum price in these policies, only probabilistic statements about the range of possible prices can be made. Note also that the stated prices reflect the degree of variation in the official *producer* price. Official consumer prices are assumed to have a similar degree of variation.

The trade-off between cost and imports is read by following one set of bars from left to right. For each of the two levels of price variability shown, the total cost of implementing the policy more than doubles when expected imports over 10 years are reduced from 600,000 to 300,000 tons. These increases reflect higher storage costs and the opportunity costs of not exporting the grain.

The trade-off between cost and price stability can be read by comparing the two bars at each level of imports. Holding producer prices between US\$129 and US\$151 in 9 out of 10 years costs between US\$1 million and US\$1.5 million more annually than holding them between US\$125 and \$155.

### LESSONS FOR POLICY DESIGN

Efficient policies for price stabilization differ from the normal price band approach by allowing domestic prices to vary with market conditions. The *degree* of variability can be limited to any particular level desired by the government; it is the *correlation* between official prices and external

conditions that causes efficient policies to be less costly than price band policies.

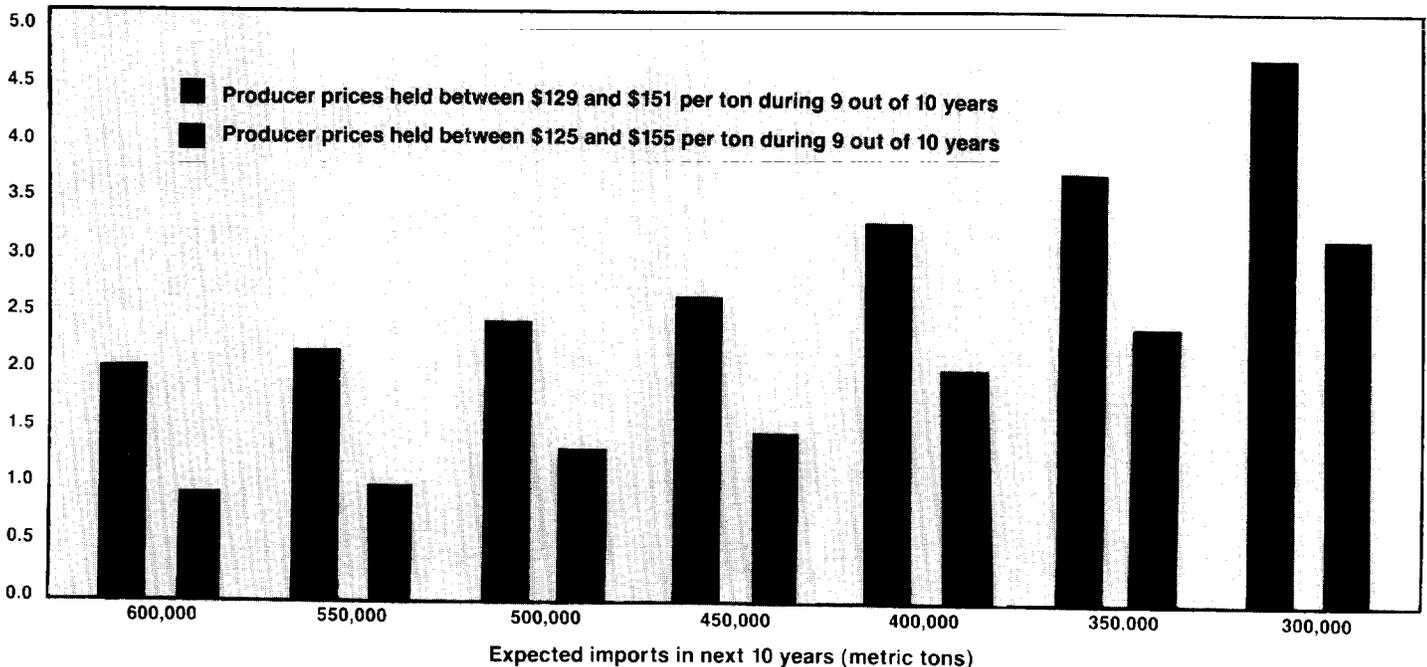
The change in policy with the largest potential impact is modifying the official price in response to the size of the domestic crop. In approximate order of importance, the other changes include lowering the maximum size of the food security reserve (and thus exporting more) when world prices rise; allowing the domestic price to reflect changes in the world price; and lowering the domestic price when government stocks are abundant.

There are several ways that these adjustments in prices could be built into the system. One possibility would be for the government to announce at planting time a price that would be efficient if the world price were to fall and production and closing stocks were to be large. This would be the minimum amount paid to farmers. Then, just before the major harvest, a "bonus payment" could be announced, based on the latest estimates of production, world price, and closing stocks. The total received by the farmer would be the sum of the bonus payment and the minimum price.

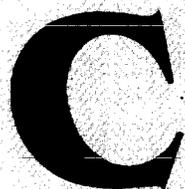
Such a scenario is only one possibility for applying the lessons in policy design to the real world. But two elements of any efficient policy clearly come out of this analysis. First, totally stable official prices are never efficient. Second, any changes in official prices should be correlated with changes in the world price, domestic production, and government stocks.

Figure 2  
Trade-offs between objectives

Average annual costs (US\$ million)



Source: Abstract for IFPRI Research Report 71



# CEREALS PROTECTION, COMPARATIVE ADVANTAGE, AND AGRICULTURAL DEVELOPMENT STRATEGY IN THE SAHEL

CHRISTOPHER L. DELGADO

## CEREALS PROTECTION AS A DEVELOPMENT STRATEGY

Cereals self-sufficiency has declined in the Sahelian countries over the past 20 years, as illustrated for Burkina Faso in Table 1. In West Africa as a whole, rice and wheat consumption increased on average by 16 kilograms per capita per year and millet-sorghum declined by 22 kilograms per capita per year over the 1960-83 period. Influential voices at the Club du Sahel/CILSS policy conferences at Mindelo in 1986 and Lomé in 1989 suggested that the visible stagnation of Sahelian agriculture and the rise of rice and wheat consumption in the Sahel are linked. They are seen as the joint outcome of discriminatory pricing policies against local cereals, the latter being implemented by cheap imports of "dumped" cereals at overvalued exchange rates. This led to the conclusion that higher cereals prices through protection of cereals alone, in the absence of other feasible options, is the key to revitalizing Sahelian smallholder development.

Table 1  
Sources of cereals consumption in Burkina Faso, 1969-86

Consumption Source	1969-72	1973-76	1979-82	1984-86
(percentage shares of national consumption)				
Domestic production	95	92	90	79
Commercial imports of rice and wheat (primarily nonAfrican sources)	2	2	4	7
Commercial imports of other cereals (primarily maize from the coastal countries)	...	2	2	6
Food aid	3	4	4	8

Sources: Computed from FAO production, trade, and food consumption data, and UN population estimates.

For cereals protection to be a viable development strategy in the Sahel the following five points must be valid.

- **Shifts in cereals consumption patterns are driven by relative prices between rice and coarse grains; such shifts can therefore easily be reversed by price policy alone.** Briefs for this conference by Delgado and Reardon suggest that this is not the case.
- **Major cereals price increases will improve both welfare and food security in most rural areas of the Sahel.** Reardon shows that this is not true in Burkina Faso; other work has shown that it is not true in Mali or Senegal either.
- **Coastal people in West Africa will provide an elastic market for periodic surpluses of millet and sorghum in the Sahel.** Unfortunately, consumption shifts in the coastal countries also suggest that this will not be the case. Furthermore, the rapid development of hybrid maize in these countries is providing a cheaper and more reliable alternative source of supply for coastal consumers and stockraisers

- **Raising the price of cereals relative to all other rural income sources does not raise production costs and reduce employment in other farm activities such as livestock production, artisanal activities, and cash crops.** Unfortunately, IFPRI research shows that people in semiarid West Africa typically spend 70-90 percent of total income on basic food staples. There is a close link between cereals prices and wage costs. A development strategy based on raising cereals prices relative to all other prices will discourage labor absorption outside cereals production.
- **Sahelian farmers do not have better alternatives for engaging in economically viable and environmentally sustainable activities to generate incomes and food entitlements than production of millet and sorghum for export.** Reardon's brief on food security in rural Burkina Faso shows that farmers are in fact heavily engaged in livestock, cash cropping, and non-agricultural activities. The issue then becomes whether these activities can provide a viable basis for agricultural growth if the demand prospects for millet and sorghum as a food crop are limited

## REGIONAL TRADE AND SAHELIAN SMALLHOLDER DEVELOPMENT

Historically, export flows from the Sahel consisted primarily of annual nonfood crops and their derivatives, such as cotton and groundnut oil exported outside the region, and livestock flows, consisting primarily of animals on the hoof, to the coastal countries. This trade expanded rapidly during the 1960s.

However, disruption of world commodity markets has led to pessimism in the Sahel about export-led agriculture. World cereals prices have been very low since the 1985 U.S. Farm Bill. And the West African coastal countries have been flooded since the mid-1970s with meat dumped first by Latin America and then by the European Community (EC), as well as milk products from the EC, cheap vegetable oil from Malaysia, and low world cotton prices after China's emergence as a major producer. Table 2 shows that in Côte d'Ivoire, for example, the Sahelian market share for meat has fallen from the historical mean of 85 percent to less than 40 percent. During 1984-87, Côte d'Ivoire imported about 2 kilograms per capita of meat and 6 kilograms per capita of liquid milk equivalents from the EC.

The competitiveness of Sahelian agriculture has been severely compromised over the past 15 years, a process strengthened by the progressive overvaluation of the CFA franc (currently estimated to be about 40 percent in several Sahelian countries). On a West African regional basis, the devaluation of the currencies of Ghana and Nigeria in the mid-1980s has left the Sahelian countries with high effective demand for imports but uncompetitive exports.

The CFA Franc Zone relative beef and starch prices in Mali

Table 2

**Sources of meat consumption in Côte d'Ivoire, 1969-87**

Consumption Source	Historical Trend 1969-1972	Drought 1973-1976	Recent Events 1984-1987
	(percentage shares of national consumption)		
Domestic production	11	15	38
Live animal imports (primarily from the Sahel)	85	70	37
Meat imports (primarily from EEC and Latin America)	3	15	25
Average annual meat consumption (kilograms)	7.6	6.3	11.4

Sources: 1969-76: John Staatz. 1984-87: *Afrique Agriculture*, June 1989.

and Côte d'Ivoire are a case in point. The real returns to beef production in Mali in terms of cereals increased in the 1970s and fell sharply in the 1980s. In Abidjan, non-African frozen beef sold for almost the same price in *nominal* CFA francs in 1986 and 1987 as it did in 1974-76, though the local consumer price index (CPI) increased threefold. In Mali between 1974-76 and 1984-85 (two drought periods), local beef prices increased by roughly 75 percent, while the CPI increased by 125 percent and the price of rice increased by more than 130 percent. In Burkina Faso, the real price of a basket of food consumed by low-income people increased by nearly 90 percent between 1967-69 and 1984-86. However, real local beef prices increased by less than one-third over the same period. The supply-side problem of higher labor costs compounds the demand problem of competition from non-African sources.

Ecologically, virtually every technological recommendation for maintaining or improving soil fertility in the Sahel emphasizes the need to increase the organic content of soils through mixed farming practices. The latter have been considerably hindered by the unfavorable price trends for livestock products relative to cereals. Furthermore, the present situation is an incentive to grow cereals in fragile livestock areas and to decrease off-take from seminomadic herds on the common range. Both of these phenomena have been increasingly observed in the Sahel and are environmentally destructive.

It is striking that West Africa is virtually the only region of the world where cattle can live that does not have a viable local dairy industry. Even in Bamako, where notable progress has been made in this regard, 80 percent of milk consumed is imported, despite an estimated national dairy herd of roughly one milk cow per three inhabitants.

The demand prospects for Sahelian exports to the coast have been further hurt by the debt crisis affecting the richer coastal countries. It is testimony to the extraordinary market potential for livestock products in Côte d'Ivoire that meat consumption per capita has nearly doubled over the last decade, despite the difficult economic situation (Table 2). This is consistent with IFPRI research that estimated expenditure elasticities for the late 1970s in a community of rural Northern Nigeria of 1.32 for fresh beef, 1.52 for milk, 1.83 for eggs, and 2.82 for butter. CGIAR analyses of FAO data show that West Africans consume fewer calories from livestock products (about 3 percent) than people in all other developing countries (more than 6 percent). This situation appears to be changing rapidly.

Livestock products still accounted for 3 percent of the total value of imports to Nigeria and 7 percent to Côte

d'Ivoire in the depressed period from 1980 to 1985. In Nigeria, this accounted for more than US\$400 million annually in 1980 dollars—a sum similar to the agricultural GDP of its northern neighbor, Niger, during the same period. Actual—as opposed to recorded—Nigerian imports were probably substantially larger. Imports of vegetable oils—another commodity for which income elasticities are high on the coast—are growing rapidly. Both Ghana and Nigeria now import cotton.

Ghana and Nigeria now appear to be on solid growth tracks that will change their structure of demand. They are also investing heavily in their own agricultural and livestock sectors: in particular, productivity in hybrid maize is increasing rapidly in the Middle Belt. It is striking in Table 1 that commercial exports of cereals from the coastal countries to Burkina Faso during the drought in the 1980s were almost as important a source of consumption as non-African food aid. The Sahel has the potential to become an increasingly important market for the products of the northern parts of the coastal countries, provided that the Sahelians have purchasing power from their own exports.

Both Côte d'Ivoire and Ghana have embarked on ambitious programs to increase national livestock production. However, this has not been without cost to their own development. Technically, increased livestock production in the coastal countries, which are tse-tse fly zones, has been made easier by the abnormally dry series of years this decade. However, a recurrence of historical rainfall patterns could greatly increase animal mortality. Second, increasing population density in the coastal countries is leading to severe confrontations between herders and farmers. Third, as the Middle Belt regions develop a comparative advantage in cereals production, they also develop, by definition, an increasing interest in obtaining their feeder cattle from further north.

The conditions that depressed both domestic demand and coastal outlets for Sahelian livestock are rapidly changing. The EC "meat mountain" stemming from the slaughter of the dairy herd appears to be gone. The "milk lake" has dried up, which suggests that the urban dairies in West Africa will be weaned from reconstituted milk. As demand conditions improve, much will depend upon the capacity of technological change in grain production in the Sahel to alleviate the feed constraint with low price grain and by-products, and to prevent labor costs rising even further relative to output prices.

## CONCLUSIONS

Events in world markets since the late 1970s for the traditional exportables of the Sahel, especially livestock, oilseeds, and cotton, have been devastating to long-run growth. This has been much more serious than the case for cereals, which tend to be importables. The greatest likelihood for the Sahel to be able to resolve their problem of access to export markets in the long run is at the regional level. However, progress will depend upon lowering the cost of labor through technological change in foodgrain production, which will also directly assist the livestock sector through feed for dairy cattle. Even so, these prospects will probably not be realizable unless the CFA franc is substantially devalued vis-à-vis the Sahel's coastal trading partners, especially Nigeria and Ghana, at least for the purposes of agricultural trade. The worst policy for both growth and food security in most rural and urban areas of the Sahel would be to implement policies that raise cereal prices relative to other prices.

# A

# GRICULTURAL TRADE AND SPECIALIZATION IN WEST AFRICA

OUSMANE BADIANE

Recent debates on economic integration and the role of regional agricultural trade in long-term development strategies in West Africa emphasize the need to reorient inward-looking national policies toward regional markets, first, to stabilize domestic food markets, and second, to exploit the potential for improving efficiency in national agricultural sectors. To what extent regional integration can yield the expected gains depends upon the distribution of output fluctuation among the countries and the possibilities for expanding trade among them. The distribution of production fluctuation is analyzed in the brief for this seminar by Badiane and Koester. The possibilities for trade expansion are determined by the existing degree of complementarity between national production and trade patterns and the potential for further specialization among the individual economies.

## CROSS-COUNTRY SPECIALIZATION

To analyze the structure of national specialization in the region, the historical patterns of production and trade of agricultural commodities by individual countries are compared. Comparisons are based on indicators showing the degree of similarity between the patterns of export—the Export Similarity Index (ESI)—of any pair of 14 West African countries. The ESI covers the major agricultural commodities during two periods, 1961-65 and 1981-85. The higher (lower) the ESI value between two countries, the more similar (dissimilar) are their export structures. An ESI of about 50 (50 percent similarity between export patterns)

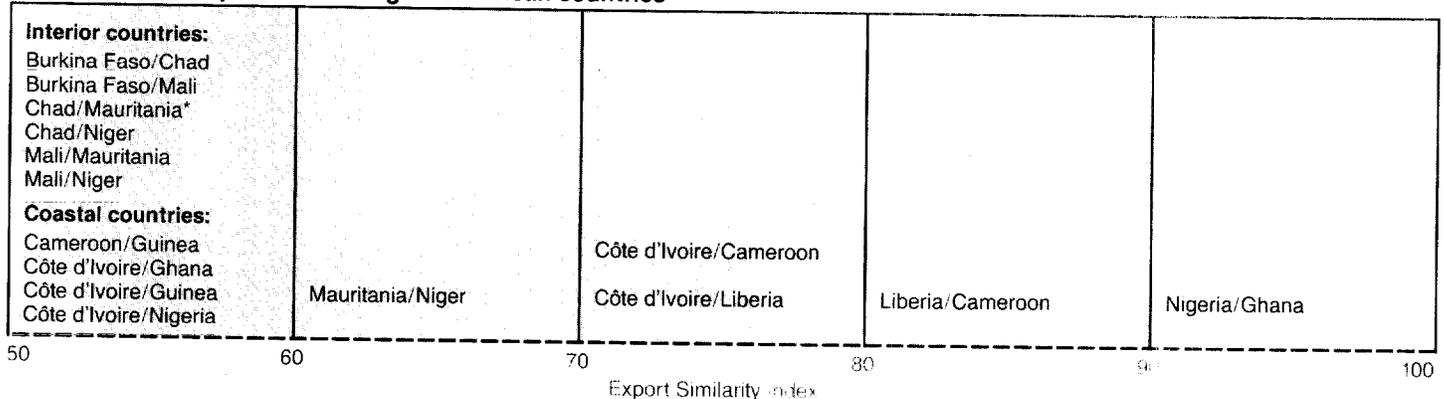
is interpreted as having a degree of specialization compatible with higher levels of exchange between two countries.

Figure 1 presents the pairs with ESI values greater than 50. Values of more than 60 are obtained for only five pairs: Niger/Mauritania; Côte d'Ivoire/Cameroon; Côte d'Ivoire/Liberia; Cameroon/Liberia; and Nigeria/Ghana. It is interesting to note that for the majority of cases where countries from the same subregion—coastal or interior—are paired, ESI values lie between 50 and 60. The numerous pairs not presented in Figure 1 mostly compare interior with coastal countries, and, as expected, ESIs are significantly lower than 50, which suggests that national trade patterns are more complementary than similar for those countries.

Another indicator, the Production Similarity Index (PSI), is used to compare national production patterns. It yields a significantly higher number of cases with coefficients above 50. PSI indexes for interior countries lie between 70 and 90, and those for coastal countries lie between 70 and 80. Within the subgroup of coastal countries, indexes are the highest between Cameroon and Togo, between Guinea, Guinea Bissau, and Liberia, and between Nigeria and Togo. Production structures are quite dissimilar between the groups of interior and coastal countries, yielding PSIs of less than 50.

The calculated indicators point to diverging patterns of specialization between the semi-arid Sahelian and humid coastal zones of West Africa and, to a lesser degree, within the group of coastal countries. This is best documented by looking at the patterns of sectoral specialization of single countries.

Figure 1  
Similarity of trade patterns among West African countries



Source: Ousmane Badiane

\*Mauritania is a Sahelian but not an interior country

## SECTORAL SPECIALIZATION

Indicators of comparative production performance (CPP) and of comparative export performance (CEP) are used to single out leading sectors in production and trade of individual countries during 1961-65 and 1981-85. The CPP and CEP indicators compare the relative weights of single sectors in national production and trade, as compared with the world average. The higher the indexes for a given commodity the more important it is for the considered country.

The products with the highest indicator values for each country are presented in Table 1. Again, the differences in the set of commodities across countries show the patterns of specialization between interior and coastal countries. With the exception of pulses in Niger and cotton in Mali, livestock and cereals are the most important commodities in the interior countries. Production and trade at the coast are dominated by coffee, cacao, and palm oil. The predominance of export crops in coastal countries is a real source of regional trade because it creates the demand for Sahelian products, especially livestock. The emerging production of coastal maize (see Ghana and Togo) is a real source of exports to Sahelian countries, which can be used to stabilize their cereals markets. The differences in commodity rankings across countries are also important; they can be a real source of intrasectoral trade, as already observed in regional markets for cotton and vegetable oils

## EMERGING CHANGES IN TRADE AND THEIR IMPLICATIONS

Livestock has played a dominant role in regional agricultural trade in West Africa, both in terms of volumes and rate of growth. The results presented above point to two underlying factors: the strength of the interior countries in livestock production, and the stronger economic growth of coastal countries, based on export agriculture. However, ongoing discussions about agricultural markets and regional integration in West Africa tend to focus on cereals markets and to shift emphasis away from these factors, which explain many of the trade problems facing the region. First, diminishing competitiveness of major coastal exporters on international markets has reduced demand for Sahelian exports. Second, decreasing competitiveness of regional livestock exports vis-à-vis dumped supplies from Latin America and the European Community has shifted demand in favor of extraregional sources. The dwindling competitiveness of regional supplies on both regional and international markets is due to generally low productivity increases in agriculture, especially in livestock and export sectors, and progressive overvaluation of the major currencies, particularly the naira and the cedi but also the CFA franc (see the brief by Delgado).

Ongoing reforms are expected to halt economic decline in the coastal countries. However, unless interior countries adjust to such reforms—for example, by devaluing the CFA franc to cope with progressive devaluation in Ghana and Nigeria—they will not be able to improve the competitiveness of their exports in these markets.

The patterns of specialization between the coastal and interior West African countries are more distinct than those between countries from the same group. The patterns of specialization identified above suggest that the livestock-exporting interior countries can play a significant role in coastal markets, where demand for livestock and other noncereal agricultural products have expanded rapidly with growing incomes. Long-term agricultural development policies in the Sahel should not ignore this potential market.

Agricultural trade between these two zones has suffered from generally decreasing competitiveness of the agricultural sectors and reduced economic growth in coastal countries. This underlines the need for technological change to lower the costs of production in agriculture and changes in the policy environment to raise the competitiveness of regional exports on regional and outsider markets.

Table 1  
Ranking of products according to production and export performance indexes, West African countries

Country	Highest Ranked Products
Benin	Cotton, palm oil, maize
Burkina Faso	Cotton, cattle, cereals, pulses
Cameroon	Cacao, coffee, cotton, fruits and vegetables
Cape Verde	Fruits and vegetables, pulses
Chad	Cattle, cotton, cereals
Côte d'Ivoire	Cacao, coffee, palm oil, fruits and vegetables
The Gambia	Groundnuts, oilcakes, cereals
Ghana	Cacao, palm oil, fruits and vegetables
Guinea	Cattle, palm oil, coffee, rice, fruits and vegetables
Liberia	Cacao, palm oil, coffee, rice, fruits and vegetables
Mali	Cotton, cattle, cereals, groundnuts
Mauritania	Cattle, cereals
Niger	Cattle, pulses, cereals, groundnuts
Nigeria	Cacao, palm oil, cereals, cotton
Senegal	Groundnuts, fertilizers, cereals
Togo	Fertilizers, cacao, palm oil, cereals, coffee, maize

Source: Ousmane Badiane.

Note: Cereals are millet and sorghum.