POLICY OPTIONS FOR AGRICULTURAL DEVELOPMENT IN SUB-SAHARAN AFRICA

CASIN/SAA/GLOBAL 2000



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EDITORS Nathan C. Russell and Christopher R. Dowswell

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Abstract: This publication provides a record of the sixth in a series of workshops that have examined measures for helping countries in sub-Saharan Africa achieve greater food security as well as other topics related to the continent's development. The papers presented here cover a wide range of issues, including approaches in the development and transfer of agricultural technology, macroeconomic policy, interventions (such as fertilizer subsidies and price stabilization) that are concerned specifically with agriculture, rural capitalization strategies, and prospects for diversification of agricultural exports.

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PREFACE

Jean F. Freymond*

In an effort to demonstrate the possibilities for making more rapid progress toward food security in sub-Saharan Africa, the SAA and Global 2000 have undertaken agricultural programs in seven countries of the region since 1986. Working closely with ministries of agriculture, the Sasakawa-Global 2000 (SG 2000) Projects have concentrated mainly on improving the capacity of national extension services to transfer seed-fertilizer technology. From the outset, though, the projects have been predicated on the assumption that the speed with which this technology can be disseminated among small-scale farmers depends heavily on government policy. We have pursued two, complementary approaches for encouraging our host countries to create a more favorable policy environment for the intensification of food production.

One has been to build pressure at the grass roots level (chiefly through large-scale technology demonstration) for improvements in the conditions that have a direct bearing on farmers' access and incentives to adopt new technology. Though some years ago this approach would rightly have been considered an exercise in futility, it seems somewhat more feasible now that democracy movements throughout the continent are giving rural people more of a voice in national affairs. The second approach has been to establish an ongoing dialogue with government officials, involving various kinds of contacts, including a series of workshops. These proceedings provide a record of the sixth such gathering.

Since the early 1980s, the major policy theme in Africa and other regions of the developing world has been structural adjustment. While exerting positive effects on economic growth in many countries, this strategy has fallen short of expectations, as note both its critics and proponents. A central question now is what else governments and donors must do (within the more solid macroeconomic framework created by structural adjustment) to alleviate poverty and stimulate growth in agriculture and other sectors. To provide African government ministers with an opportunity to review some of the options was the main purpose of this meeting.

The success of any workshop is the result of the effort and dedication of numerous people working behind the stage. In concluding, therefore, I would like to express my gratitude to Mesdames Gertrude Monnet and Sarah Petitpierre and to Mr. Patrick Orr, among others. My heartfelt thanks also to Mr. Douglas Larson, director of Airlie Foundation, and his team, whose friendship was much appreciated by our staff and contributed importantly to the smooth running of this workshop.

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WORKSHOP SUMMARY

Nathan C. Russell*

In their introductory remarks to this workshop, former US president Jimmy Carter and Sasakawa Foundation president Yohei Sasakawa both make a plea for cooperation, and in doing so both use the term "partner" (Carter calls for "a new partnership in African development"). As leaders of the SG 2000 Projects, their immediate concern, of course, is to muster additional support for these projects specifically and to encourage wider application of the approach they embody, either independently or in concert with SAA and Global 2000.

But the plea also has broader significance, as is evident from Carter's comments. The partnership he envisions is one that would feature a greater degree of "teamwork" across the whole range of development challenges, based on a greater recognition of "the intricate connections" between them. The first step toward establishing such a relationship among the national and international institutions concerned is to begin searching for a common ground with respect to policies and approaches.

That, in essence, was the central purpose of this workshop, which brought together government ministers from countries that have hosted SG 2000 Projects with SAA and Global 2000 staff and experts on a number of key policy issues. Each of the seven main sessions was devoted to a different set of issues, on which two speakers presented divergent viewpoints or at least examined the topic from distinct perspectives. The purpose of this summary is to define the issues briefly and try to identify the common ground between different opinions about them. Though agriculture may have "fallen from grace," as G. Edward Schuh laments in his discussion of macroeconomic policy, even the institutions responsible for its fall maintain that their actions were necessary for agriculture's eventual salvation. The

The first step is to begin searching for a common ground with respect to policies and approaches.

difference of opinion here is not about ends but about means. Few would disagree with Kevin Cleaver, of the World Bank, that to develop agriculture is the most promising means of alleviating hunger and poverty in Africa, nor with the additional point that real progress toward these goals will make it easier to deal with the continent's many other problems.

THE TECHNOLOGY DEBATE

It also seems self-evident that the introduction of new technology is a prerequisite for improving agricultural production. But what sort of technology? Some argue (staff of the SG 2000 Projects among them) that a suitable approach for Africa is one centered on modern varieties and inorganic fertilizers, a combination whose bestknown and most dramatic results have been registered in Asia and Latin America. An important aim of this approach is to intensify production in the more favored environments and thus reduce pressure on marginal lands. Opponents of that strategy

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prefer to emphasize technology that requires few, if any, external inputs and consists rather of modifications in farmers' traditional practice that permit more efficient use of resources available on the farm. These two approaches represent contrasting views about what is most relevant and practical in Africa and to some degree more subjective differences of opinion about what is best for traditional societies and the agroecologies they occupy.

In examining the choice between these options, Francis Idachaba (vice-chancellor of Nigeria's University of Agriculture) concentrates, not so much on the merits of one approach or the other, as on the conditions that complicate agricultural development in Africa, regardless of the strategy for technological change. The continent's situation, he says, is "unprecedented in world history." What other region has needed to accomplish so much so fast-to reduce environmental degradation, feed a rapidly growing population, and alleviate poverty-under such difficult economic and other circumstances? Not the least of Africa's problems in agriculture are the fragility of some of its soils, unreliable rainfall over large areas, and generally inadequate infrastucture.

By emphasizing the uniqueness of these conditions, Idachaba casts doubt on the possibilities for a rapid, easy transfer to African farmers of modern technologies like the ones that have succeeded in many parts of Asia and Latin America. A major obstacle to wide acceptance of these innovations, he suggests, is the risk they entail, which arises from various sources. One is heavy public sector involvement in "fertilizer procurement and distribution, tasks in which it is notoriously inefficient." In support of this point, he cites just a few of many cases documented in the Nigerian press during 1992 of "glaring deficiencies" in the government's handling of its responsibilities as the main supplier of fertilizer. Against this background, Idachaba concludes, Africans "are faced with a clear choice: they must either look inward and develop agriculture on the basis of their own natural resource endowments, with emphasis on extensive agriculture, or they must reorder their priorities" in such a way as to make modern inputs more widely available.

While advocating the use of external inputs, Derek Byerlee and Paul Heisy, agricultural economists with the International Maize and Wheat Improvement Center (CIMMYT), do not view the choice between this and other technology options strictly as an either/or proposition. What they support is a compromise, in which the so-called "high-payoff input model" figures very importantly but which also calls for more efficient use of internal sources of inputs, such as green manure crops. They argue this case, first, in a discussion of rainfed, small-scale food production generally and, then, with particular reference to maize in Africa.

Their argument that the seed-fertilizer strategy is relevant to this region rests on a sizable collection of evidence that such technology has already been accepted in many rainfed environments of moderate or high potential-a trend to which Africa is no exception. The resulting changes have been "more evolutionary than revolutionary," however, involving more limited yield increases than in irrigated areas and requiring that research and extension make special efforts to adjust new technology to the more variable conditions of rainfed environments. In response to concerns about the possible environmental hazards of this technology, Byerlee and Heisey note that, "given the low levels at which [fertilizers] are applied in African agriculture, the hazard of pollution resulting from their use will in the foreseeable future remain minor," a view in which Idachaba concurs.

In addition to maintaining that the seedfertilizer strategy is relevant to Africa, Byerlee and Heisy argue that it is necessary. Particularly in view of the continent's high rate of population growth, "farmers probably have little choice but to depend heavily on external sources of nutrients." As for low-input systems, "it is unlikely," the authors assert, "that [they] will be sufficient for achieving rapid growth in food production." What place is there for these systems, then, in the balanced approach that Byerlee and Heisey recommend? Their role will be the important one of increasing the efficiency with which inorganic fertilizer is used (and thus the profitability of this practice) and ensuring that increased levels of productivity can be maintained over the long term (largely by preventing soil degradation).

Thus, the central issue of the technology debate, according to the CIMMYT economists, is not a choice between high- and low-input options. It is the much tougher question of how agricultural leaders and producers in Africa can deal effectively with the difficulties that stand in the way of technical change on this continent. Just to pursue the seed-fertilizer strategy will require further research (aimed at generating more appropriate germplasm and shaping the technology more closely to farmers' requirements), more effective approaches for technology transfer, and greater efforts to establish systems of input supply. To incorporate into this strategy practices that make better use of internal sources of inputs will further increase the demands on research and extension organizations-not to mention farmers, who will need new knowledge and skills.

STRATEGIES FOR TECHNOLOGY TRANSFER

Two approaches to transferring technology were described in the workshop, one by Kevin Cleaver, chief of the Agriculture Division of the Africa Technical Department at the World Bank, and the other by Christopher Dowswell, director for program coordination with SAA. Since the differences between them lack the almost ideological character of the technology debate, it should be even easier to find a common ground. Conceivably, national extension services could apply a combination of the two and decide, on the basis of experience, which elements of each to retain.

The World Bank has applied the training and visit (T & V) system, developed by Daniel Benor, in 37 countries of Africa in an effort to increase the efficiency of national extension systems. This approach includes regular training of extension agents, who deliver technical messages through a program of periodic visits to "contact groups" of farmers and by means of on-farm technology demonstrations. Another important task of extension staff is to ascertain farmers' technology needs and to convey this information to researchers, along with feedback about the technical messages already disseminated. To ensure that these functions are carried out effectively, the T & V approach features heavy emphasis on improved management of field activities.

According to recent studies, this system has had considerable impact in some countries. In Kenya, for example, where it was implemented in 1982, "the rates of return to increased investment in extension were found to exceed 100%." The T & V approach has proved successful in Cote d'Ivoire as well, where new practices have been widely accepted and contributed to increased yields of various crops (e.g., 15% for maize and 25% for coffee). In promoting this system, the World Bank is apparently making considerable efforts to keep it from becoming static and routine and to resolve shortcomings, as these become apparent. Among other things, the Bank is promoting increased participation by farmer groups and stronger efforts to meet the special information needs of women.

On the need to revitalize national extension organizations, improve their management, provide regular practical training to extension workers, and bring them into more frequent and fruitful contact with farmers (including groups), the staff of the SG 2000 Projects entirely concur with proponents of the T & V system. Their differences have to do primarily with the form in which technology should be transferred.

The main feature of the T & V system to which Dowswell takes exception is its reliance on messages as a means of encouraging technical change. In contrast, under the SG 2000 Projects, extension staff provide cooperating farmers with practical training in new technology and loan them sufficient quantities of inputs (mainly seed and fertilizer) to apply the technology in large plots (0.25 to 0.5 ha). This somewhat controversial tactic reflects a key assumption underlying the work of these projects: that farmers can best be convinced of the value of new technology if they have the opportunity to test it themselves under realistic circumstances. In most cases they can do so only if extension officers ensure that inputs are available to participants in the demonstration program. To avoid creating dependency on the program and reinforce the realism of the test, participating farmers are expected to repay extension for the inputs received on loan. Since the ability of farmers to pay depends on successful application of the improved technology, extension staff have a

compelling motive to provide effective training in crop management.

The danger, of course, is that of making what is essentially an approach to training into a substitute for input distributors and credit agencies. In response to this criticism, Dowswell cautions that inputs must be supplied "on a loan basis only to farmers taking part in the program, only for limited periods to each cooperator, and only as a means of training them in the use of new technology."

These two approaches "are not inherently incompatible," as Dowswell remarks, and both show obvious merit. Thus, as in the technology debate, the central issue in considering strategies for transferring new practices is not so much whether to employ this or that approach but how national governments can work with donors and other institutions (including NGOs and the private sector) to "[give] farmers what they evidently want," as Dowswell puts it, using the combination of tools that experience indicates is most effective.

THE MACROECONOMIC FRAMEWORK

Much past experience in Africa has shown how efforts in research and extension can be frustrated by macroeconomic policies that discriminate against agriculture. By maintaining overvalued exchange rates, for example, many governments in the region have in effect placed a heavy tax on export commodities (such as cocoa) and subsidized imported food, much to the detriment of domestic producers. Under these circumstances, farmers are discouraged from investing in new practices to increase the efficiency of production, and the consequent low rates of technology adoption make it hard for research and extension organizations to justify their existence.

In order for these institutions to thrive and for farmers to benefit from their activities, it is thus essential that African governments adopt sound macroeconomic policies, as indeed many have started to do over the last decade or so. Along with more flexible exchange rates, these policies

The combination of sound macroeconomic and science policies is an extremely powerful instrument for achieving economic development.

include reduced barriers to trade, privatization of parastatals, and less government intervention in the economy. This is one part of the policy prescription outlined by G. Edward Schuh, dean and professor at the University of Minnesota.

The effectiveness of sound macroeconomic policy is much diminished, however, unless it is accompanied by a complementary policy of supporting the generation and dissemination of improved technology. In other words, it does little good to provide farmers with "the proper incentives to use their resources efficiently" if they are not simultaneously given better "access to technical innovations" that make this possible.

The combination of sound macroeconomic and science policies is an extremely powerful instrument for achieving economic development, particularly if investments in research are focused on the improvement of a country's major food crop. As new technology spreads and production increases, the price of this commodity eventually declines. "That is the point," Schuh says, "at which the real benefits of developing agriculture ... come to the fore." Lower prices for a major commodity have the effect of increasing the income of all members of society whose diet is dependent on it. This is particularly advantageous for the poor, since they spend a large share of their earnings on food. Further benefits accrue throughout the economy, as farmers channel their increased savings into other productive investments and as consumers use the money they would have spent on food to purchase other goods and services.

This, of course, is the happy ending to a sound policy prescription. What is actually occurring in many African countries is another matter, as we learn from Uma Lele (professor and director of international studies) and postdoctoral fellow Kofi Adu-Nyako at the University of Florida. By and large, governments are following through on the macroeconomic side, the authors explain, but without the measures that contribute to more efficient agricultural production.

In reforming their macroeconomic policies, many developing countries have received assistance from the World Bank and International Monetary Fund (IMF) in the form of so-called "structural adjustment" loans. Without doubt, this approach has contributed to economic development generally (though to a lesser degree in Africa) and to growth in this region's agriculture, particularly in the production of certain export commodities. Nonetheless, point out Lele and Adu-Nyako, recent trends in per capita production of food are alarming; the region has at best maintained 1984 levels. Meanwhile, commercial cereal imports have dropped, partly because currency devaluation has increased the price, and many African countries have become more dependent on food aid. The amounts reaching African consumers, though, are well below those needed to satisfy calorie requirements, "suggesting that there must be considerable malnutrition in the region." Trends in per capita

growth in GDP and in savings and investment are equally disturbing.

These problems, suggest Lele and Adu-Nyako, are part of the price African countries have paid for their attempts to achieve fiscal balance. As a decline in the international terms of trade has caused their export earnings to drop (in spite of greater volumes of exports), they have had to rely more heavily on spending cuts to reduce their budget deficits as part of structural adjustment. Lower government expenditures, in combination with declining per capita income and other factors, have resulted in reduced rates of investment, both in agriculture directly and in other areas, such as transportation and education, which strongly influence this sector. The problem has been aggravated by "shifts in donor resources away from agriculture toward structural adjustment and other sectors" (what Schuh refers to as agriculture's "fall from grace").

Not surprisingly, explain Lele and Adu-Nyako, decreased investment has been accompanied by significant deterioration in Africa's infrastructure, and budget cuts have "taken a heavy toll on agricultural research systems for export crops," in addition to reducing the capacity of many countries to obtain agricultural inputs. As a consequence, while currency devaluations and accompanying measures may have given farmers stronger incentives to produce more efficiently, other trends have made it increasingly difficult for them to respond. Chief among these are higher prices for imported inputs (to which devaluation has contributed) and more limited access to technology and markets (the result of declining investment in research and infrastructure).

At the national level, the outcome of these developments is a downward spiral: declining terms of trade and reduced earnings necessitate budget cuts, which in turn limit the government's ability to carry out effective agricultural research and extension; and since those are precisely the activities that help producers keep pace with technological change in other countries, the nation loses what Schuh calls its "best . . . defense against a decline in the external terms of trade." The solution, suggest Lele and Adu-Nyako, is not for governments and donors just to increase their investments in agriculture, but to enhance the "quality of those expenditures and the capacity of African countries to absorb them."

INPUT AND OUTPUT PRICES

In addition to adopting sound macroeconomic policies and making better investments in research and extension, what else can governments do to increase farmers' access to new technology and heighten their incentives to adopt it?

One alternative is to subsidize major inputs, particularly fertilizer. Though many countries in sub-Saharan Africa and other regions have done so, they are now being advised to abandon this practice, partly because of its effects in distorting the pattern of fertilizer use. Already, implicit subsidies in the form of high currency exchange rates have come down considerably. The question posed by Per Pinstrup-Andersen, director general of the International Food Policy Research Institute (IFPRI), is whether governments should also cut out explicit subsidies paid for directly or indirectly with public resources. To eliminate these will inevitably lead, at least in the near term, to reduced demand for fertilizer and lower crop production. But to leave subsidies in place may constitute an unacceptable burden on the limited fiscal resources of African countries. Are there better ways in which these resources could be deployed to make fertilizer more accessible and to benefit agriculture generally?

In answering this question, Pinstrup-Andersen calls our attention to the various reasons that governments opted for subsidies in the first place. An important one is that "the price African farmers pay for fertilizer, relative to the price they receive for their output, is . . . much higher than in Asia." What accounts for this are the small volumes of fertilizer imported by African countries and the high cost of distributing it on this continent. The latter, in turn, is a consequence of the public sector's inefficiency in handling fertilizer distribution and of high transportation costs.

Though "there is a place for fertilizer subsidies to compensate for the various factors that result in very high prices," Pinstrup-Andersen says, he argues that they should be considered a short-term measure only and not a permanent "alternative to longer term efforts to deal with the problems that keep prices high." Among the solutions he proposes are: 1) "regional cooperation in international fertilizer procurement," which would enable African countries to command better prices and lower the costs of shipping; 2) increased investment in rural infrastructure, especially roads, to reduce transportation costs; and 3) elimination of the many barriers to privatizing fertilizer procurement and distribution, together with positive measures that would contribute to this end.

Of course, none of these steps will be easy. Improving rural infrastructure, for example, requires much more capital than is currently available for this purpose (either from donors or in national budgets), and experience so far in privatizing the distribution of inputs is not particularly encouraging. But then, again, as Pinstrup-Andersen points out, these are long-term imperatives. Economist Peter Timmer of Harvard University makes a case for another measure—food price stabilization—that complements those described in the presentations summarized above. Timmer's arguments draw on experience in Southeast Asia, where the high priority placed by governments on agriculture has contributed importantly to vigorous economic growth, drawing now to a large extent on manufactured exports. The question he poses is whether the model that succeeded so spectacularly in Asia can be applied to good effect in sub-Saharan Africa.

The bulk of Timmer's paper is devoted to explaining what that model is and why it worked in Asia's rice-based agricultural economies. Two features are especially important. One is a set of macroeconomic policies that help producers remain competitive in agricultural exports. The second is a determined program for providing both rural and urban consumers with food security. A key policy tool by which Asian governments achieved this latter goal was to stabilize the price of rice (at levels more or less corresponding to those in international markets); this measure proved effective, largely because it was applied in combination with efforts to increase rice productivity.

The favorable effects of food price stabilization, Timmer explains, were exerted at different levels. Farmers, for example, since they had some assurance of reasonable returns, were more inclined to spend their savings on a wide range of productivityenhancing improvements; for much the same reason, the private sector was encouraged to invest in marketing infrastructure. Among urban consumers, the absence of sharp increases in the price of food contributed to "a higher level of social welfare" and to "a more stable political economy, with its attendant positive impact on investors' expectations."

Whatever doubts Timmer may have about the relevance of this model to Africa stem from notable differences between the agricultural economies of the two regions. The heavy dependence of Southeast Asia on a single cereal produced largely under irrigation simplified somewhat the tasks of 1) intensifying production through heavy investment in rural infrastructure and research and 2) using markets to increase farmers' incentives to take advantage of the opportunities created by these investments. In contrast, sub-Saharan Africa relies on various staple foods, which are mostly intercropped in complex farming systems and are commonly subjected to severe environmental stresses, especially drought. All of this greatly complicates the task of modernizing agriculture, "not only at the farm level, but also at the level of marketing inputs and output."

Another distinguishing feature of Africa's food economy is its heavy reliance on imported cereals, which it pays for to a large extent with earnings from agricultural exports. Since the income from those commodities is harder to stabilize than the price of food, it is difficult to imagine, Timmer says, how the region can "improve food security as well as stimulate economic growth" without a "switch in priority away from export crops toward domestic production of food crops." To achieve this will require stronger emphasis on research and rural infrastructure and a reorientation of incentives toward food production through price stabilization. These are, of course, costly measures. But the price of neglecting them could be even higher. Dealing successfully with the issue of food security, Timmer notes, forced Asian governments to "learn how to play their role in a market economy." This is an experience that A frican countries cannot afford to bypass on the road to sustainable economic growth.

RURAL CAPITALIZATION

If making the sizable investments required to reach that goal depended entirely on funds provided by governments and donors, then Africa's future prospects would indeed be bleak. Fortunately, there appears to be another option-what Joachim von Braun (director of the Food Consumption and Nutrition Division at IFPRI) and Douglas Graham (professor at The Ohio State University) refer to as the "mobilization" of domestic resources. Contrary to widespread perceptions about low-income rural people, explains von Braun, recent experience demonstrates that they have "substantial savings potential," which could provide a sound basis for creating rural financial markets.

Past efforts to develop such institutions have collapsed, largely because they counted on the generosity of the domestic and foreign public sector instead of building on the financial prudence of rural communities. The almost exclusive concern of these institutions with extending credit to stimulate production gave rise to careless practices (including poor evaluation and collection of loans), which quickly got them into financial trouble. As a result, notes Graham, "the landscape of sub-Saharan Africa is littered with the skeletons of development banks done in by supply-led credit schemes."

In the wake of these failures, says von Braun, researchers have paid closer attention to "indigenous ..., arrangements for savings and credit." What they have discovered is the "heterogeneous world of informal finance in Africa," as Graham puts it, consisting of "individual operators" (including merchants, family, and friends) as well as different types of groups. These appear to be quite effective in providing a wide range of financial services, and they are relatively free of the problems (such as high transaction costs and frequent default on loans) that handicap formal systems.

The crux of von Braun's message is that governments and donors can encourage the mobilization of domestic resources by supporting projects that build upon the strengths of the informal sector. This is an important part of the remedy for Africa's "severely undercapitalized" rural economy. If successful those projects could help generate investment in rural infrastructure and enable farmers to channel increased capital into new technology for crop and livestock production. A further benefit would be to provide low-income families with "an important means of insuring against anticipated or unexpected interruptions in the food supply." Particularly if complemented by the long-term policy of price stabilization suggested by Timmer, savings mobilization could thus contribute importantly to food security.

While noting that "there is no blueprint for the development of rural financial markets in sub-Saharan Africa," von Braun describes innovative programs in several countries of the region, which suggest that the task is by no means impossible. "The most prominent trait" of these projects "is their voluntary or mandatory savings schemes." They are also characterized by low transactions costs, achieved by "leaving management to volunteers at the village level." On the strength of these and other useful features, von Braun concludes, "savings and credit programs can provide sustainable services to savers and borrowers of limited means."

Graham concurs with von Braun's favorable assessment of informal finance but also points out its limitations, mainly an inability to provide sizable, long-term loans and to intermediate between savers and borrowers over long distances. Thus, even though projects based on this approach represent a great improvement over "the default-ridden, borrowerdominated development bank model," they are less than "ideal vehicles for mobilizing deposits to be reallocated through investment." By themselves they can go only so far in creating flows of capital into rural development. For precisely that reason von Braun suggests that "any effort to build rural financial markets from the bottom up, based on informal institutions, must eventually create links between them."

In pursuing this possibility further, Graham describes several "institutional paths" for reaching a compromise in the development of rural financial systems. The resulting arrangements would "emulate some of the virtues of informal finance" and at the same time "incorporate some of the organizational features of more formal finance." One possibility is to restructure development banks in such a way that domestic deposits are gradually substituted for government or donor funding. Where those institutions are already defunct, another approach is to involve private commercial banks more fully in servicing the "large wholesalerimporter of agricultural inputs. The wholesalers in turn can service the downstream network of retail operators in their marketing chain with sales on credit or consignment." A final option is to merge the numerous small units that constitute the informal sector "into broader based, village-level savings and credit associations," which could "pool a much larger volume of savings into larger loans for slightly longer periods." These approaches are somewhat more ambitious than the innovative projects described by von Braun but offer vital opportunities "to meet the challenge of marrying domestic deposit mobilization to domestic investment in rural Africa."

AGRICULTURAL EXPORTS AND AGRIBUSINESS

There is much room for doubt about the wisdom of a development strategy for sub-Saharan Africa that relies heavily on improvement in the region's traditional export commodities, such as cocoa, coffee, and tea. Various authors of papers included in these proceedings imply or argue explicitly that to intensify domestic food production is both more urgent for alleviating hunger and poverty and more promising as a means of stimulating economic development. One participant, Adebayo Adedeji (whose views are summarized below), goes so far as to suggest that, given the declining terms of trade in international markets for Africa's principal commodities, working for further gains in the efficiency of production is essentially futile and that the effort would be better spent on improving food production.

In discussing the prospects for traditional and other agricultural exports, Ronald Duncan (chief of the World Bank's International Trade Division), says much that seems to confirm those views and much that does not. Without doubt, major trends in the region's agricultural exports during the 1980s-declining real prices, expanding world production, and the growing markets shares of countries in Southeast Asia-have all meant bad news for African producers. The message contained in Duncan's review of the future outlook is no brighter; while noting some possibilities for improvement in the terms of trade (connected with slower growth in supply and lower real interest rates in the industrialized countries), he suggests that "producers should act as though the change is permanent."

Moreover, in discussing policy options, Duncan admits that measures taken by individual African countries to improve their export position can fall short of expectations or even make matters worse (if not for themselves, then for other producers). As a result of structural adjustment policies implemented in Ghana, for example, "cocoa production recovered significantly" and "economic welfare increased substantially." But the resulting drop in cocoa prices has meant "welfare losses" for other countries. Even

Once countries have learned to compete in one commodity, they can then apply the lessons learned to other export markets.

so, Duncan points out, Ghana really had no choice; if its government had continued along the path it was travelling, the consequences would have been much worse. And one can say much the same thing about other African countries undergoing structural adjustment. Though the accompanying changes in policy may have the effect of depressing export prices, this "must be accepted as unavoidable, and countries have to compete within the kind of market that develops."

The operative term in this statement is "compete." Even "in the face of a so-called cost-price squeeze," Duncan says, countries can still produce agricultural commodities profitably, if they concentrate on improving efficiency through efforts to raise productivity and lower production costs. Once countries have learned to compete in one commodity, they can then apply the lessons learned to other export markets. The point here, explains Duncan, is that new markets are not a refuge for countries that are being driven out of the traditional ones, but a further challenge for producers that have learned to compete in exports for which they have a comparative advantage.

For many reasons the challenge is a formidable one. To gain a toehold in these new markets, countries must create "pricing, distribution, and marketing channels for the new goods or services" and acquire the "requisite skills and knowledge" for "getting new activities going." In taking up these tasks, African producers face a number of barriers, which account for their fairly poor performance in market diversification so far. One is that the competition in nontraditional commodities is already tough. Moreover, "government policy and expenditures appear to have been biased in favor of traditional crops and to the detriment of new ones."

How much effort should African governments make to overcome these obstacles? As with various other issues discussed in these proceedings, the answer is not an either/or proposition. Though arguably domestic food production in this region demands higher priority than export commodities, it would be folly for African countries to allow their shares of international markets for these products to deteriorate. Again, as with other issues, it is important to bear in mind the experience of Asia. Governments there strove to achieve food security in conjunction with improvements in the agricultural export sector and on this basis built economies "so successful," as Timmer points out, "that they now challenge American economic interests."

Experience in sub-Saharan Africa and other regions of the developing world, Duncan notes, shows that success in exporting nontraditional agricultural products as well as manufactured goods is closely connected with "foreign collaboration." This is one means by which local producers and entrepreneurs can acquire new expertise and gain better access to markets. The topic of "joint ventures" (another aspect, perhaps, of the partnership that Carter calls for in his introductory remarks) is taken up in somewhat more detail by General Olusegun Obasanjo, former head of state of Nigeria. He does so, however, in the broader context of agribusiness development in Africa, which embraces food production for domestic consumption and export as well as commodities grown specifically for the latter purpose.

In order to attract foreign participation in agribusiness, says Obasanjo, African countries must "create a more hospitable environment" for investment. Among the main features of this environment are political stability, consistency in government policy, a transparent legal framework, and adequate infrastructure. In matching "African realities" against these requirements, Obasanjo points out that the continent is making notable progress in some areas (as evidenced, for example, by a "new wave of democratization" and by widespread acceptance of structural adjustment programs) but remains woefully behind in others, such as the improvement of infrastructure (a goal from which the current preoccupation with macroeconomic policy appears to have detracted somewhat).

Obasanjo's perspective on these matters is that of a person who not only thinks about the African realities but lives them. For that reason, his statement that "we [Africans] must have something to offer the world" and "must accomplish more toward putting our underutilized human and other resources to work" is particularly compelling.

THE VERDICT ON STRUCTURAL ADJUSTMENT

Any discussion of current policy options for agricultural development in sub-Saharan Africa must take as its starting point the choice that most countries in the region have already made. This is their acceptance of structural adjustment programs, with varying degrees of commitment. The changes resulting from that choice either provided the background or were dealt with directly in the workshop's first six sessions. In the seventh, structural adjustment was the main focus. To a greater degree than in any previous session, the views presented on this subject (by World Bank economist Graeme Donovan and Adebayo Adedeje, executive director of the African Centre for Development and Strategic Studies) would appear to be diametrically opposed. And yet a closer examination of the two verdicts on structural adjustment reveals that even here the common ground is surprisingly large.

In determining exactly where it lies, one must first be clear about the facts with which both Donovan and Adedeje are dealing. As suggested earlier, structural adjustment is a cluster of policy reforms, including, among others, devaluation of the domestic currency, reduction of budget deficits through cuts in government spending, reduction or elimination of subsidies, and liberalization of foreign trade. In defending this approach, Donovan underscores the evidence that many countries receiving adjustment lending have experienced a recovery in their economic growth rates. But he also recognizes the shortcomings of structural adjustment, acknowledging that "the appalling consequences in per capita terms weigh heavily on us all: falling exports, incomes, and food production and availability." As a vocal critic of that approach,

Adedeji dwells on its drawbacks, supporting his points largely with quotations from World Bank documents.

Where the two views presented in this session diverge, therefore, is not so much in the facts regarding structural adjustment's limitations and negative effects, as in the interpretation of those facts. As far as Adedeji is concerned, the World Bank approach has failed the "fundamental test of any economic program," which is its record in "improving the human condition." In place of structural adjustment, he would have a more "human-centered" development strategy aimed at alleviating poverty and increasing levels of productivity, mainly through heavy investment in research (particularly on food crops) and in the improvement of rural infrastructure. He also advocates a "discriminating exchange rate policy that favors high-priority inputs required for food production" and a "policy of producer price supports" for the region's half dozen or so major staples, which would provide farmers with stronger incentives to adopt new technology and increase food production.

Based on essentially the same evaluation of the impact of structural adjustment, Donovan urges that, rather than discard this approach, African countries must "stay the course on adjustment programs." The central assumption underlying this recommendation is that, since development efforts were previously frustrated by "policy distortions," "a concerted effort was [and still is] needed to correct the situation." If the results in Africa have so far been disappointing, it is partly because policy reforms are slow to exert their intended effects, particularly in lowincome countries. Another important consideration, says Donovan, is that structural adjustment was never intended to consist only of policy reforms but was

also predicated on "a program of investments." Since these have apparently been insufficient, Donovan recommends that African governments give greater encouragement to private sector initiatives, reexamine their priorities in public spending, and try to stimulate "povertyreducing growth" (to a large degree through adjustments in agriculture).

Once acted upon, these important amendments would probably go far toward accomplishing the main objectives of Adedeji's "human-centered" strategy. It is noteworthy that, in describing such a program, he refers approvingly to a new World Bank publication entitled *Poverty Reduction Handbook*. This he takes as an indication that the Bank "has decided at last to abandon its futile effort to give structural adjustment a social face." What Adedeji sees as a policy reversal, however, Donovan prefers to call "staying the course," though with significant corrections. In the end, therefore, the differences between their positions are less substantive than the rhetoric would suggest. For all his complaining about the negative effects of structural adjustment, Adedeji acknowledges that the "maladjusted macroeconomic framework" must be "put right," but he insists that this cannot be accomplished "on an enduring basis as long as excruciating poverty exists." The World Bank assumes, on the other hand, that measures to alleviate poverty are largely ineffectual in the absence of macroeconomic reform.

How are African policy makers to resolve this conundrum? As with other issues dealt with in these workshop, the challenge is not necessarily to choose between mutually exclusive alternatives, but to reconcile complementary courses of action that compete with one another for scarce resources. In the process African leaders will perhaps demonstrate the value, as Donovan puts it, of "better government," as opposed to "less government."

INTRODUCTORY COMMENTS

Yohei Sasakawa President, Sasakawa Foundation

Let me first take this opportunity to extend the warmest greetings from my father, Ryoichi Sasakawa, who regrets not being able to be with you today. Let me also express our heartfelt gratitude to all of you for taking time from your busy schedules to attend this meeting.

Seven years ago my father joined hands with Norman E. Borlaug and former US president Jimmy Carter in launching the SG 2000 Agricultural Projects in sub-Saharan Africa. The goal of these three men was to free Africa from chronic hunger and starvation by the 21st century. The way to achieve this, they agreed, was to work for a revolution in agricultural production.

The progress made since then has amply demonstrated the validity of Dr. Borlaug's assertion that, with technology already available, the yields of major food crops in Africa can be doubled and even tripled. In Ghana, Sudan, Zambia, Tanzania, Benin, and Togo, more than 100,000 farmers have participated in our technology demonstration programs, and many have proved willing and able to adopt new varieties and crop management practices.

The SG 2000 Projects have also shown that significant improvements can be achieved in the effectiveness of national extension services when sufficient budgets are provided. Even so, much room remains for improvement in extension as well as research institutions. Under the structural adjustment programs promoted by international finance agencies, both will be forced to make severe personnel cuts, which may lead to further deterioration in research and extension programs. All of this is happening at a time when continued development and transfer of new technology are imperative for achieving sustainable growth in agricultural production in Africa's fragile ecosystems.

Agricultural pricing is also a matter of concern. Markets for food crops are not well developed; storage facilities are often

According to the International Human Suffering Index, every country in sub-Saharan Africa was rated as a place of either high or extreme suffering.

inadequate; and transportation networks are still limited. These circumstances, compounded by erratic rainfall patterns, cause wide variations in crop prices from year to year and even from month to month. This adds to the farmers' uncertainty, making them less willing to risk investing their scarce resources in agricultural production.

More than half a dozen countries in sub-Saharan Africa have been ravaged during recent years by civil war, and each faces critical food shortages, at least in some areas. To make matters worse, the countries of southern Africa are experiencing the worst drought in more than 50 years. According to the International Human Suffering Index (published in May 1992 by the Population Crisis Committee), which is based on 10 measures of human welfare and covers 141 nations, every country in sub-Saharan Africa was rated as a place of either high or extreme human suffering.

Each of the organizations represented in this workshop bears significant responsibility for formulating development policies in Africa. Though I am sure you will differ on the merits of particular strategies, I hope you will all agree that a brighter future can be achieved for African farmers and consumers if policies are established that favor small-scale food production. It is my earnest desire that we will find the means to achieve these objectives.

The Sasakawa Foundation will devote itself fully to meeting the goals of the SG 2000 Agricultural Projects. In 1992 we established new projects in several northern states of Nigeria, and we are studying the feasibility of a project in Ethiopia. In addition, we have launched the Sasakawa African Fellowship Program to provide extension workers with opportunities for undergraduate and graduate studies, mainly in African universities.

Obviously, the financial resources of just one private foundation are far from adequate to perform the wide array of tasks before us. The government of Finland has generously provided additional funding, but much more is badly needed. We invite all the organizations represented here to join forces with us as donors or as partners in implementing agricultural programs in Africa.

INTRODUCTORY COMMENTS

Jimmy Carter Former President of the USA

I wish to make a few points that may not be covered by the scientific and scholarly papers presented at this workshop but that are still quite relevant to agricultural development in sub-Saharan Africa.

A central one is that there is no way to improve the lives of people who are at war. In no region on earth are the prospects for development as imperiled by continuous warfare as in Africa. At The Carter Center, we monitor the conflicts raging there and on every other continent, with assistance from students at Emory University in Atlanta. Of the 110 armed conflicts now taking place in the world, we classify more than 30 as major wars. These are defined as those conflicts in which more than 1,000 people have died. With the exception of the war in Yugoslavia, which has become an international conflict, almost all of the major wars under way now are civil wars. Most of them go largely unnoticed in the industrialized world, until the media focus attention on the devastating consequences, particularly for children, as they have done in Somalia recently and did some years ago in Ethiopia and Sudan. The public knows little about the savage nature of other, less publicized conflicts, such as that in Mozambique.

In addition to monitoring conflicts, we contribute to resolving them, often with the help of prominent Africans, such as General Olusegun Obasanjo, former head of state of Nigeria. In Ethiopia, for example, we spent considerable time trying to help negotiate an end to the civil war and have made similar efforts in Sudan and other countries. In dealing with these situations, we have a certain advantage over institutions, such as the Organization of African Unity, which are precluded by their charters from intervening in civil wars, except under very special circumstances.

Sometimes our efforts are directed more at preventing disturbances that are in the making. In October of last year, for example, with the help of Dr. Richard

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Joseph, we traveled to Zambia, at the request of then president Kenneth Kaunda and his major political opponents, to help conduct a peaceful and honest election. In returning from an upcoming trip to Ethiopia, we will stop for several days in Liberia, at the invitation of both sides in the horrible conflict there, to participate in the holding of an election, which was the major condition of a cease-fire agreed to by the warring parties.

Another key element of our strategy for helping create the necessary social and political conditions for development in Africa is a strong commitment to the democraticization of government. Under the direction of Dr. Joseph, we regularly publish African Demos, which documents the progress of African countries toward democracy and gauges national governments' degree of commitment to this process. The principle underlying our work in this area is that, as long as political leaders remain indifferent to the will of the people, the latter will have few ways in which to influence the shaping of government policies and to seek redress of grievances, such as human rights violations.

An important feature of this and other work undertaken by The Carter Center is its recognition of the intricate connections between the different aspects of the development challenge in Africa. In a real sense it is impossible to separate political upheaval and autocratic government on the continent from its complex problems in public health, food production, and other areas.

The Carter Center currently maintains 26 health programs, two of which provide an important motive for my upcoming visit to Africa. One of these initiatives is the Task Force for Child Survival, whose goal is immunization of all the world's children. This is a coalition of the World Health Organisation (WHO), United Nations International Children's Emergency Fund (UNICEF), Rotary Clubs throughout the world, the Rockefeller Foundation, United Nations Development Programme (UNDP), and other agencies, whose major contribution is to provide vaccine for polio immunization. Working jointly in a given country, the task force members simultaneously marshal the support of the head of state, the media, police, teachers, parents, and so forth to make a concerted effort to immunize the nation's children in the course of two or three days.

Another initiative based at The Carter Center is a task force for disease eradication. Under the guidance of the Center's director, Dr. William Foege, this program is focusing on two diseases, polio and guinea worm. In the work on polio, particularly good progress has been made in the Western Hemisphere, where it appears that the disease has been entirely eradicated. With the help of WHO, we hope to achieve this goal worldwide by the end of the century. Within an even shorter time (by 1996), we also expect to have eradicated Guinea Worm, a devastating disease that is common in India and Pakistan as well as some 20 countries of sub-Saharan Africa.

Apart from the direct benefits of improving public health, we hope to contribute indirectly through these programs to containing the continent's population explosion. As paradoxical as it may seem, reductions in the infant mortality rate in a given country are invariably associated with declining rates of population growth. Among all the countries of the world in which 50 or fewer infants per thousand die, none has a population growth rate above 2%. This contradicts the common assumption of selfish, callous people, who question the ultimate wisdom of saving the lives of children in areas of the world that are already seriously overpopulated. What these people fail to realize is that, once families learn to keep their children alive through better nutrition, immunization, and the use of oral rehydration therapy to control diarrhea, the number of children they have tends to decrease. A major reason for this is that the parents of healthier children feel less compelled to have large families, which often constitute a kind of social security.

Particularly while the rates of population growth in Africa remain high, more rapid growth in food production is imperative. We are supporting efforts to achieve this end through our participation in the SG 2000 Agricultural Projects. These were initiated as a result of a workshop held at Geneva, with financial support from the Sasakawa Foundation and technical guidance provided by Dr. Norman Borlaug. Afterwards, Yohei Sasakawa, Dr. Borlaug, and I traveled to Ghana, Sudan, Tanzania, and Zambia to explore the possibilities of establishing pilot projects for stimulating increased production of staple food crops in these countries.

In the seven years since then, the projects have had successes and disappointments, and we have learned from both. It has been particularly exciting for me, as a farmer, to witness what Africa's small-scale food producers can achieve with the proper kind of support. I recall one visit to a remote area of Sudan, where a two-hour field visit was planned for about 50 people. As it turned out, the event lasted all day and was attended by a large gathering of farmers, many of whom had traveled for two days on foot to get there and who were eager to learn about new technology for increasing agricultural production.

The project in Ghana has also made considerable headway in improving on farmers' traditional slash and burn system of food production. The program proved so popular, in fact, that it nearly got out of control. After the first year, in which just 40 farmers were involved, the program expanded rapidly to include 1,600 farmers in the second year, 16,000 in the third, and an unmanageable 80,000 in the fourth. We learned from this experience to keep the numbers of participating farmers within reasonable limits.

It has been inspiring for me to see how eager and willing farmers are to take the steps required to achieve technical change. In Ghana and other countries, notably Tanzania, farmers adopting the technology promoted by the SG 2000 Projects have often managed to at least double their crop yields. Similar results in Sudan have helped the country become nearly selfsufficient in wheat, a truly remarkable achievement for a country in the throes of civil war. One distinctive feature of the projects—a dimension that has not figured so importantly in similar efforts by other organizations—is that they seek to involve the top political leaders of the host country. This is the area in which I have tried to be of help. At the outset of each project, we have negotiated, not just with the minister of agriculture, but with the head of state and other ministers (of finance, transportation, and so forth), whose support can be indispensable for increasing the likelihood of success.

It is hard to emphasize enough what a difference this feature of the projects can make. In certain countries so many development agencies and nongovernmental organizations are present that it is practically impossible for government ministers to be familiar with the work of all of them. The first time we met President Moi of Kenya to discuss one of our health projects, he remarked, "there are already some 200 NGOs in Nairobi working on public health. I really do not know who they all are, nor does my minister of health."

To keep the SG 2000 Projects from being virtually anonymous in the eyes of their host governments, we sign a contract with the head of state, specifying what both we and the government will provide. Our contribution generally consists of two or three agricultural specialists, along with selected logistical support (such as bicycles, motorcycles, and pickup trucks), while the government designates extension staff to work with the project.

In the negotiations leading up to the signing of this contract, we also discuss policy issues that impinge on agriculture. It is especially critical that farmers have adequate price incentives if our efforts to stimulate food production are to have much effect. Before signing a contract to work in Tanzania, we waited three years until the government altered its policies on grain marketing. In Zambia we finally brought the project to an end, precisely because the policy environment was highly unfavorable to more intensive production of maize. Partly as a result of the debacle in agriculture, the country's former president received less than 25% of the votes in the elections held last year. His successor, President Chiluba, is

We are hopeful that we can lay the groundwork for a partnership among organizations represented at this meeting.

committed to liberalizing grain markets and is anxious for us to resume our activities in Zambia.

Though highly important, gaining the support of the nation's political leaders does not eliminate every problem. During a 15-month period in Sudan, for example, the country had five different ministers of agriculture. When difficulties arose, we were sometimes uncertain about whom to contact. On one occasion, after our efforts to raise wheat production were starting to have an effect, the government suddenly lowered the price just before harvest, prompting farmers to leave much of the crop in the field. Eventually, we succeeded in persuading the government to reverse its decision on prices, but not before some 25% of the crop had been lost. Eventually, we had to close down the project in Sudan, primarily because the unsavory nature of its government and the civil war made it impossible for us to obtain financial support from donors for continuing the field program. This was highly unfortunate in view of the impressive progress that had been made.

Currently, we are examining the possibilities of establishing an SG 2000 Project in Ethiopia, where we hope to take part in the exciting changes taking place in that country.

Our ongoing efforts to help create a more favorable policy environment for agriculture in Africa are primarily what has occasioned this workshop. We are here to learn more about specific policy issues and measures that should receive emphasis in our discussions with government leaders.

We are also hopeful that we can lay the groundwork for a partnership with organizations represented at this meeting. In seeking to strengthen African agriculture, we have gone about as far as the generous support of the Sasakawa Foundation can take us. We desperately need for the World Bank, US Agency for International Development, and others to join us. We are also concerned about the general lack of coordination among donors and development agencies in the region. The knowledge of Africa's tremendous needs and possibilities should bind us together in the common purposes of reducing warfare, working toward more enlightened government, improving the environment, providing better health care, and raising food production in the context of a better understanding between North and South. These are inseparable goals, and their achievement requires a concerted effort by national and international institutions.

The SG 2000 Projects are making a valuable contribution to this effort, and we at The Carter Center are proud to have a part in them. As Yohei Sasakawa has pointed out, the projects represent a highly efficient use of funds. For relatively modest sums, hundreds of thousands of farmers can be introduced to simple technical innovations—consisting largely of improved seed, fertilizer application at moderate rates, and accompanying adjustments in crop management—that make a substantial difference in the yields of staple foods. I would urge all of you to consider applying a similar approach, either independently or in conjunction with the Sasakawa Africa Association.

As a further means of promoting mutual understanding and teamwork, we will hold a meeting at The Carter Center in December of this year with support from the Carnegie Foundation. The event will be cosponsored by Boutros Boutros-Ghali, secretary general of the United Nations, and myself. Our aim is to bring together some 40 or 50 developing world leaders, along with representatives of governments and development organizations in the

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industrialized world. In examining the prospects for greater cooperation, I would like for agriculture to be the test case. If we cannot do something to improve food production in Africa, then it is no exaggeration to say that the continent's situation is hopeless. I honestly do not believe that this is the case but am convinced that we will not make much progress without a new partnership in African development.

In closing I would like to express my gratitude to the African government ministers attending this workshop, whose views and insights we look forward to hearing and whose participation will be essential for making the new partnership work.

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ANTRIAGED FAILS IN

STRATEGIES FOR TECHNICAL CHANGE IN SMALL-FARM AGRICULTURE, WITH PARTICULAR REFERENCE TO SUB-SAHARAN AFRICA

Derek Byerlee and Paul Heisey*

More than two decades of rapid technical change in many areas of the developing world have powerfully demonstrated the potential benefits of increasing small-scale food production, especially through the adoption of improved seed and purchased inputs. The task of disseminating this technology remains incomplete, however, particularly in the many environments where crop production is extremely marginal. Even in some areas of medium or high production potential, mostly in sub-Saharan Africa, the benefits of new technology have not yet been reaped.¹ This is partly because land is still relatively abundant there and because strategies focusing exclusively on increasing yield per unit of land are less appropriate. Most countries in the region will have exhausted their land frontiers, however, within the next 10-25 years (Binswanger and Pingali 1988).

Lagging food production, worsening rural poverty, and rapid environmental degradation under traditional fallow systems underscore the urgency of increasing the productivity of food crops in Africa's small-farm agriculture. As indicated in Figure 1, the continent is faced with the difficult challenge of reversing a steady decline in per capita cereal production at the same time that per capita area planted to these crops is falling at a rate similar to that in other regions of the developing world. Indeed, just to maintain current low levels of per capita consumption, food

Just to maintain current low levels of per capita consumption, food production in Africa must increase by at least 4% annually.

production in Africa, nearly all of which occurs under rainfed conditions, must increase by at least 4% annually (Delgado et al. 1987).

This paper reviews some important issues in developing and transferring improved food crop technology, with particular reference to Africa. The first part of the paper addresses strategic issues in promoting technical change in small-farm agriculture, drawing on experience with cereal production in the developing world's medium- and high-potential rainfed areas. Is the "high-payoff input model" for technical change, emphasizing the use of

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¹ This paper follows CIMMYT's definition, according to which areas of medium and high potential are those where economically achievable yields are at least 40% of potential yields, as defined by available solar radiation. The remaining areas are designated as low potential or marginal. Locations that are prone to severe drought (and where irrigation is not economical) are classified as having low potential.

external inputs (Hayami and Ruttan 1985), still relevant, especially in Africa? Or is the more recent emphasis on "low-input sustainable agriculture" a better approach for the future? And given suitable technology, what mix of price policy, input supply, credit, and extension is needed to promote more rapid technical change in rainfed agriculture? Since the great diversity of sub-Saharan Africa makes it difficult to generalize about food production in the region, the second part of this paper focuses specifically on maize.² This crop has great potential in the continent's lowland savanna and mid- to high altitudes and is expected to contribute importantly to meeting Africa's future demand for food.



Figure 1. Trends in cereal production in the developing world, 1961-1991. Source: Calculated from FAO data tapes.

² For excellent reviews of other systems, see Matlon (1990) (sorghum and millet) and Spencer and Polson (1991) (humid forest areas).

This paper challenges the widespread view that the agroclimatic and factor endowments of the major maize production zones in Africa are so unique as to require an entirely new approach to generating and transferring technology.

STRATEGIES FOR TECHNICAL CHANGE

Much of the progress achieved during recent decades in increasing the productivity of food crops in small-farm agriculture has resulted from wide application of the high-payoff input model of technical change. This is the combination of improved, input-responsive varieties and increasing levels of chemical fertilizers, which serve as a substitute for increasingly scarce land (Hayami and Ruttan 1985). This technology is closely associated with the Green Revolution, initiated during the 1960s in Asia, where rice and wheat yields were dramatically increased over a wide area, with the aid of improved supplies of irrigation water and more intensive use of external inputs.

Though the story of technical change in irrigated agriculture is well known, it is

not widely appreciated that much the same model has also produced gradual changes in many rainfed areas of medium or high production potential, where land is used intensively. In the northern Punjab of Pakistan, for example, where agriculture depends entirely on rainfall (an average of 350 mm to 750 mm annually), semidwarf wheats were adopted rapidly in the 1980s, a decade after the Green Revolution was initiated. Since then the use of fertilizer and yields of wheat in rainfed areas have increased steadily (Figure 2).

Seed-fertilizer technology for maize has also been taken up rapidly in many rainfed environments, including parts of Africa. Smallholders have adopted hybrid maize in land-scarce areas of El Salvador, Kenya (Figure 3), and several other countries and even in some, such as Zambia, that have a relatively abundant supply of land. Improved open-pollinated varieties (OPVs) of maize are now widely grown in Thailand, Nigeria, and Ghana (Figure 4). Indeed, where food production has been increased in Africa, this has mainly resulted from the adoption of improved maize seed.



Figure 2. Adoption of improved seed and fertilizer in rainfed wheat (A) and yield of rainfed wheat (B), Punjab, Pakistan. Source: Byerlee and Siddiq (1990).

Of course, even in land-intensive systems, this model of technical change has not been universally successful. In low-rainfall areas subject to frequent drought stress, for example, farmers have proved reluctant to accept the seed-fertilizer technology. Wider adoption in these areas is usually contingent on improvements in crop and resource management, aimed at conserving moisture and using it more efficiently (Morris et al. 1991).

Even in rainfed areas of medium or high potential, though, experience has shown that, in the generation and transfer of new technology, special attention must be given to several factors that are less relevant to irrigated areas (Byerlee and Husain, in press). One is the variability of the production environment across space and time, which is usually greater in rainfed than in irrigated areas. Variability over time requires that particular attention be given to risk in technology design. And variability over space calls for more sitespecific research, aimed at tailoring recommendations to particular soil, moisture, and topographical conditions.³

Because yield potential is more limited in rainfed areas, yield gains from modern







Figure 3. Adoption of hybrid maize in four zones of Kenya. Source: Gerhart (1975).

³ The coefficient of variation in yields observed during farm surveys is usually much higher in rainfed areas (50-100%) than in irrigated areas (20-40%) (Byerlee and Husain, in press).

varieties are correspondingly lower.⁴ The adoption of this technology is therefore likely to result in more evolutionary than revolutionary change. A further limitation stems from the greater sensitivity of technology in rainfed areas to environmental and farming system interactions. As a result, researchers must pay greater attention to farmers' priorities and circumstances—and to variation in these—than is generally the case in research for irrigated areas.

We have dealt at some length with the application of seed-fertilizer technology in rainfed environments because of the widespread perception that its success has been confined largely to irrigated areas. Nonetheless, it is important to consider whether the pattern of agricultural change described above is relevant to those large areas of Africa that have reasonably good production potential but where the use of improved seed and fertilizer is still minimal, despite rising population pressure. Some view the adoption of these inputs (combined in certain areas with the development of small-scale irrigation) as prime movers in African agriculture, just as they have been elsewhere (Lipton 1989; Smith et al., in press). Others argue that, where small farmers are short of cash and operate almost entirely under rainfed conditions, such a strategy is inappropriate. A better one, they suggest, is to emphasize technologies that do not depend on external inputs and that increase productivity through conservation and improvement of natural resources already available to the farmer (Harrison 1990; Spencer 1991; Lynam and Blackie 1991). To resolve this debate, we must gain a better understanding of the tradeoffs involved in choosing between these two approaches. In either case the appropriateness of the strategy must be measured on the basis of returns to the limiting resource. Until recently most of Africa has had a relatively abundant supply of land, thus reducing the relevance of any strategy requiring more intensive use of labor. However, as the land frontier is reduced under growing population pressure, technologies that increase yields and conserve the soil will assume greater importance.

INPUT-INTENSIVE OR INPUT-EFFICIENT VARIETIES?

In most regions the introduction of modern varieties (MVs) has served as the major catalyst of technical change. In devising a strategy to improve small-farm agriculture, an important question to ask-one which continues to generate tremendous confusion and controversyis whether the varieties developed should be tailored to low-input conditions or be able to respond to higher levels of inputs. This dilemma is generally expressed in the form of the genotype-by-environment (G x E) interaction. To gain a better appreciation of the alternatives, it is useful to divide the "environment" into three broad types of variables: 1) biotic stresses, such as diseases and insect pests, 2) abiotic stresses (such as low soil fertility) that vary from site to site but not much from year to year at a given site, and 3) abiotic stresses (such as drought) that vary from year to year at a given site (and also across sites) and pose a considerable risk to production. Many of these stresses can be countered with management practices already available. Thus, environmental stresses, such as soil nutrient deficiencies, can be reduced (as represented by the X-axis in Figure 5) through the use of inputs (e.g., the addition of plant nutrients), provided either internally from organic fertilizers or

⁴ For example, for wheat the gains from adopting MVs and applying moderate doses of fertilizer in irrigated areas usually averaged about 40%. In rainfed areas of medium potential, the gains usually did not exceed 20-25%.

externally from inorganic fertilizers. The resulting economic gains, as represented by the Y-axis of the figure, are derived from increased yield per unit of the limiting production factor and net of input costs.

Much of the recent controversy about technical change in small-scale food production centers on the kind of genotype that is most productive and appropriate.



Figure 5. Types of genotype-byenvironment interactions.

Many critics of the Green Revolution assert that the G x E interaction of the rice and wheat MVs is characterized by a "crossover" (see type A in Figure 5). That is, these MVs are supposedly superior to traditional varieties only under high levels of inputs, while under low levels they yield less. Thus, in adopting type A varieties, farmers must also accept a complementary package of inputs in order to grow the new seed profitably. Proponents of low-input agriculture, including critics of the wheat and rice MVs, favor MVs with the type B interaction, whose major advantage is expressed at low levels of inputs.

Defenders of the rice and wheat MVs maintain that they are intermediate between the two extremes (see type C in Figure 5): that is, for most inputs (especially fertilizer and moisture), they perform as well or better than traditional materials at low levels of inputs but are highly responsive to increased levels. Considerable evidence on the performance of rice and wheat MVs under different management conditions, together with data on their widespread and rapid adoption by small farmers, suggest that they are input-responsive, type C varieties with respect to nitrogen and water (except under very marginal conditions) and type B varieties with respect to pest pressure (at least in the case of wheat). In other words, the MVs do not require higher levels of inputs but respond better to them (see Lipton with Longhurst, 1989, for a comprehensive review of these issues; see also Anderson and Hazell 1989).

Of course, in sub-Saharan Africa, where input use is still very low, farmers may well prefer type B varieties. But the critical question is whether breeding type B varieties is more or less cost-effective than a combined strategy of breeding type C varieties and altering the environment (i.e., moving to the right along the X-axis in Figure 5) through changes in input use, management practices, and investment in land quality to reduce the level of biotic and abiotic stresses. The relative costs of these alternatives depend in turn on the type of environmental stress under consideration. In general, plant breeders have been quite successful in breeding type B varieties for resistance to biotic stresses, such as diseases. Even in marginal areas, the introduction of such MVs can often improve yield stability. One of the myths in the development literature is that traditional varieties have higher levels of resistance to diseases and insects than do MVs. On the contrary, yield losses to these stresses are often quite high in traditional farming systems, and an important advantage of the MVs is their ability to stabilize yields under pest and disease pressure.5

Plant breeders have achieved only modest successes in breeding for resistance to soil and climatic stresses (the two types of abiotic stresses). While registering important advances in work on micronutrient deficiencies and some soil toxicities (such as acidity), their progress in breeding for resistance to the more common stresses of low soil fertility and drought has been slow. In the case of nitrogen, for example, there is little evidence to support a strategy of breeding for tolerance to severe deficiency, as opposed to reducing stress by increasing the available supplies of this nutrient (Fischer 1981).

To summarize, then, the bulk of the evidence suggests that, in generating new germplasm for sub-Saharan Africa, breeders should seek to develop MVs that are type B with respect to disease and insect resistance. In the short to medium run, however, especially in areas where land is scarce, the most cost-effective strategy for alleviating the major abiotic stresses of Africa (low soil fertility and drought) will be to develop type C varieties while at the same time promoting changes in crop and resource management.⁶ Varieties of this type will increase the payoffs to additional inputs, regardless of whether these are generated internally (as in the case of organic sources of nitrogen) or purchased off the farm (as are chemical fertilizers).

It appears, then, that input-responsive varieties are generally also input efficient and appropriate for farmers with limited access to external inputs. Nonetheless, to ensure widespread adoption of MVs in rainfed areas, where the potential for increasing yields with such varieties is generally lower than in irrigated areas, breeders must go beyond a narrow definition of productivity as grain yield and give greater attention to the total value of production. In other words they

⁵ For example, the price of wheat in 19th-century India was highly correlated with the incidence of weather suitable for developing a rust disease epidemic (Howard and Howard 1928); hence most of the early work in wheat breeding in India, Mexico, and elsewhere was aimed at developing varieties with improved resistance to the three major rust diseases of the crop. The semidwarf varieties associated with the Green Revolution were the culmination of more than 20 years of intensive effort to improve disease resistance. Semidwarf rice, on the other hand, was developed through a "crash" program; it took almost another decade to release MVs that are resistant to the most important diseases and insects. In maize research some of the major success stories of the 1980s involved the release of MVs with improved resistance to debilitating diseases, such as downy mildew in Asia, corn stunt in Central America, and maize streak virus in Africa.

³ Recent evidence suggests that plant breeding can achieve rapid progress in the improvement of drought tolerance at no cost to yield potential in the absence of stress (Edmeades et al. 1990). In land-extensive systems, where labor scarcity may inhibit investment in crop and soil management practices aimed at alleviating drought stress, development of tolerant varieties may be the most cost-effective strategy for stabilizing yields.

need to take into account factors such as postharvest losses, grain quality, the value of intercrops, and the fodder value of crop residues, since these will often be decisive in farmers' decisions about variety adoption (Haugerud and Collinson 1990).

INPUT INTENSIFICATION: EXTERNAL VERSUS INTERNAL SOURCES

In rainfed areas of medium or high potential where fallow periods are no longer adequate to maintain soil fertility, production cannot be intensified unless soil nutrients are provided in combination with complementary improvements in weed control, plant stand, and planting time. Over the past 25 years, the primary means of enhancing soil fertility in smallfarm agriculture has been to use chemical fertilizers. In Asia and Latin America, it is estimated that these have contributed 50-75% of the increase in yields of food crops over the past two decades (Viyas 1983; Narayana and Parikh 1987). At the same time, the use of organic nutrients generated on the farm has tended to decline. Manures and composts, once the major sources of nutrients in Asia, have become less important, partly because of competing uses for these materials (as fuel, for example) and also because of their heavy labor requirements.7 The almost exclusive emphasis placed by research and extension organizations on inorganic sources of nutrients has probably also hastened the decline of organic alternatives.

In many small-farm systems, there is great potential for increasing the supply of organic sources of nitrogen by integrating livestock, green manure crops, or food or fodder legumes into the cropping pattern. Nonetheless, nutrients provided from these sources have a cost, specifically the opportunity costs of land and labor and in irrigated areas of water. Since land must be set aside to grow crops exclusively for green manuring, this practice is most attractive in land-extensive systems, where the green-manure crop can replace bush fallow, as has happened in several areas of Mexico and Central America (Buckles 1992). As cropping is intensified, the opportunity cost of land increases, and so do the nutrient requirements of food crop production. Satisfying these through alley cropping or crop-livestock systems, which place heavy demands on labor, appears to be an attractive option in more intensive systems (Ehui et al. 1990; Reynolds et al. 1991; Binswanger and Pingali 1988).

Thus, the appropriateness of internal versus external sources of nutrients depends in part on their relative costs, measured in terms of farmers' most limiting resources. These costs include not only those incurred on-farm but also the costs of extension and other support systems required to develop and transfer the technology as well as off-farm environmental costs. Since many systems for increasing the supply of nutrients from internal sources appear to be quite complex (and thus require that the farmers possess greater knowledge and skill), one can expect their extension costs to be relatively high (Dowswell and Borlaug 1991). Other costs are those not incurred by the user (generally referred to as "externalities"). In the use of chemical fertilizers, the most common externality is pollution of water sources, though this cost may also be incurred through the use organic fertilizers.

Given present knowledge, the rapid rate at which food production must increase in developing countries, and severe soil degradation, farmers probably have little

⁷ This is true even in China, where farmers make heavy use of organic manure (including green manure crops) and yet apply chemical fertilizers at levels that are among the highest in the developing world.
choice but to depend heavily on external sources of nutrients in the foreseeable future (Desai 1990). It should be recognized, however, that, since most systems which rely exclusively on external sources of nutrients are not sustainable over the long term, some combination of organic and inorganic sources of nitrogen is desirable. Practices such as the use of green manures and grain-legume rotations improve soil structure and health (and sometimes control erosion and weeds), in addition to enhancing the efficiency with which inorganic sources of nutrients are employed. More research is needed to develop simple methods by which smallholders can draw on internal sources of nutrients to improve soil fertility.

DESIGNING TECHNOLOGY TRANSFER SYSTEMS

The development of appropriate technology is a necessary, but not sufficient, condition for ensuring its adoption. One must also design a system of technology transfer that provides farmers with the inputs and information they need to enhance productivity. The adoption of seed-fertilizer technologies, for example, is strongly conditioned by the state of input supply markets, the availability of credit, and price policies. Likewise, the extent to which farmers use information related to improved crop and resource management depends on the effectiveness of extension services and of other communications media and on farmers' level of formal schooling (Figure 6).

In the early phases of input adoption and production intensification, the major impetus for change comes from institutions and policies supporting the development of input supply systems and from the availability of input-responsive MVs. The important elements of the policy environment at this stage, as indicated on the righthand side of Figure 6, are price policy and



Figure 6. Factors influencing improvements in crop management.

Research and extension

Policy environment

input supply systems (including infrastructure). Extension plays a supporting role at this point, serving primarily to stimulate adoption of inputs. As the policy and institutional environment evolves and farmers begin using higher levels of inputs, adaptive on-farm research and extension become increasingly important for providing improved information that helps farmers employ inputs more efficiently. The emphasis in technology transfer then shifts to the lower left-hand side of Figure 6.

One of the most widely used strategies for transferring technology during the initial stages of technical change has been the production campaign, in which heavy emphasis is placed on input supply, extension, and sometimes credit to promote a technological package for a particular crop (Wortman and Cummings 1978). This approach takes into account the need for farmers to adopt MVs in combination with improved management and higher use of inputs to realize a significant proportion of the yield gains that are possible with the new varieties. The extension service is charged with promoting this package, usually by applying it in a large number of on-farm demonstrations. This approach has seemed to work well in irrigated areas and in some rainfed areas (e.g., the hybrid maize areas of Kenya and Swaziland), particularly as a means of initiating technology adoption (Anthony 1988; Rauniyar and Goode 1992).

In the many settings in which the package approach has been applied, however, a number of problems have limited its effectiveness. First, the recommended packages have often been too complex. A particularly common mistake has been to promote several divisible inputs as one "lumpy" technology, even though smallholders the world over adopt technology in a stepwise manner that is consistent with their priorities and resource endowments (Byerlee and Hesse de Polanco 1986). Second, in rainfed areas characterized by variability over space and time, it has proved difficult to develop a package, especially a complex one, that is relevant to large groups of farmers. Finally, the package is often a product of research on single commodities that does not address the requirements of complex cropping systems.

In response to problems with the package approach, strategies emphasizing farmer participation were developed and gained popularity in the 1980s. Most of these were a product of the farming systems research (FSR) movement, which focused on the needs and circumstances of small farmers in designing and evaluating improved technologies and which sought to introduce technological components in a sequential manner. In the application of FSR, particular emphasis was placed on rainfed and marginal environments, where the package approach had been least successful.

After 10-15 years of experience with FSR, much of it in Africa, it is clear that this approach has a mixed record in meeting the expectations it created, especially when judged according to its success in promoting rapid adoption of improved technology (Tripp et al. 1990; Anderson 1991). In many cases FSR programs suffered from "institutional isolation" (Eicher 1984). On the one hand, they were unable to relay information about farmers' priorities and problems to commodity research programs charged with developing new technologies. And on the other hand, they often lacked sufficient contact with the extension and input supply organizations needed to promote the adoption of research results. Even where FSR is well institutionalized, extension agents have experienced difficulty in understanding and promoting recommendations that address the problems of complex farming systems (Low et al. 1991).

The challenge, then, is to combine the ability of FSR to determine the priorities of small-scale farmers with the strength of the package approach in transferring technology. Experience in Ghana suggests

Maize provides a welcome exception to the generally gloomy record of technical change in African food production.

that this combination can be a potent one. Farmers there have widely adopted a simple maize production package that was thoroughly tested under farmers' conditions, consists of flexible recommendations (adjusting fertilizer application to cropping history, for example), and was promoted through an integrated program of adaptive on-farm research, extension, and input supply (Edmeades et al. 1991). Until extension services in Africa are able to impart a wider array of information, there is little choice but to refine the package approach, emphasizing simplicity, flexibility, and relevance to the greatest number of farmers. To fulfill this latter condition will require greater investments in research, especially adaptive research.

MAIZE TECHNOLOGY IN AFRICA: ISSUES AND CHALLENGES

Experience in bringing technical change to small-farm agriculture over the past two decades suggests that, when human and financial resources are limited, there are distinct advantages (at least in the early stages) to focusing on a few, well-chosen regions, staple crops, and simple technologies. If we accept this strategy as a reasonable one, then in Africa it would make sense to place high priority on maize in the zones of medium and high potential, which are indicated in Figure 7 (Matlon 1990). Maize is the major cereal crop in eastern and southern Africa and is becoming more important in those areas of the West African savanna where rainfall exceeds 750 mm (Smith et al., in press; Matlon 1990). Since the 1950s production of maize has expanded faster than output of other cereals (Figure 8), and its share of total cereal production in Africa has grown from 25 to 36%. About 75% of Africa's maize production takes place in relatively favorable environments (CIMMYT 1990).8

In addition, maize provides a welcome exception to the generally gloomy record of technical change in African food production. Many countries in the region-especially Kenya, Nigeria, Zimbabwe, Zambia, and Ghana, as indicated in Table 1; Swaziland (Kariuku 1990; Rauniyar and Goode 1992); and South Africa (Bembridge 1991)—have had considerable success in introducing improved maize technology to small-scale farmers (Table 1). In fact, if one excludes the developing countries with large commercial or irrigated maize sectors (China, Argentina, and Brazil), it is apparent that improved maize varieties and hybrids have been adopted almost as rapidly in sub-Saharan Africa as in Asia and Latin America (Table 1). The pattern of adoption in the former has been patchy, however (often, with neighboring countries showing very different results), and the use of fertilizer on maize lags well behind that in other regions. Even in areas

Some of this "favored" area is in the humid forest zone, where the resource base for annual crops is particularly fragile and where appropriate technologies are still being developed. CIMMYT (1990) estimates that drought occurs frequently on 25% of the total maize area and occasionally on another 46%.



Figure 7. Areas of sub-Saharan Africa classified as suitable for maize production Source: USDA (1981).



Figure 8. Average annual growth (percent) in area, yield, and production of cereals in sub-Saharan Africa.

of Africa where hybrid maize has been widely adopted, fertilizer use is still low.⁹ As a result, yield gains have been more modest in Africa, especially since 1970 (Figure 9).

There is much scope for making more rapid progress. The following sections discuss some of the requirements for realizing this potential, with emphasis on two key elements: 1) input-responsive, yieldstabilizing varieties and 2) improvements in soil fertility, especially where population pressure or market development has severely reduced the fallow period. This discussion concentrates on areas of

	Total	-0-	Percent MV				
	area	Improved OPVs			M	Vs	to IARC
Country	(000 ha)	Min. ^a	Max. ^b	Hybrids	Min.	Max.	germplasm
Tanzania	1,631	6	18	6	12	24	44
Nigeria	1,500	22	872	2	24	89	100 ^b
Kenya	1,500	8	8	62	70	70	1
Malawi	1,344	3	3	11	14	14	0
Zaire	1,200	8	8	14	22	22	22
Zimbabwe	1,150	0	0	96	96	96	0
Ethiopia	1,050	8	24	5	13	29	?
Mozambique	1.015	17	17	1	18	18	96
Zambia	763	5	5	72	77	77	3
Cote d'Ivoire	691	14	42	4	18	46	85
Ghana	465	16	48	0	16	48	90
Benin	454	9	27	1	10	28	100 b
Uganda	389	30	70	10	40	80	0
Togo	296	7	18	3	10	21	86
Burkina Faso	216	15	70	2	17	72	48
Cameroon	200	20	67	1	21	68	45 b
Mali	170	36	50	0	36	50	60
Lesotho	145	12	12	70	82	82	0
Burundi	124	5	20	0	5	25	81
Senegal	117	100	100	0	100	100	100
Swaziland	84	0	0	90	90	90	0
Total	14,500	11	26	23	34	49	32

Table 1. Area sown to improved maize in sub-Saharan Africa

Source: CIMMYT files on maize research impacts.

* The minimum area is usually based on seed sales and the maximum on surveys or breeders' estimates.

^b In these countries, farmers use mainly IITA germplasm (which often has CIMMYT material in its genetic background). Most other germplasm from the international agricultural research centers (IARCs) is from CIMMYT.

^c Excludes more than a million hectares of maize not accounted for in the CIMMYT files.

⁹ The proportion of farmers who grow improved maize in Africa is generally higher than the proportion using fertilizer (Rorhbach 1989; Ongaro 1990; Ghana Grains Development Project 1991). Even in areas that have a long history of growing improved varieties, fertilizer use is still low. For example, even though most farmers in Kenya adopted maize hybrids and improved OPVs 20 years ago, they still apply fertilizer to hybrid maize at an estimated average rate of only about 30 kg of nutrients per hectare (calculated from data in Lele et al., 1989, assuming that no fertilizer use by smallholders stagnated in the late 1980s at about 30 kg of nutrients per hectare after a period of rapid growth (Conroy 1990).

medium or high potential, a focus that for several reasons seems consistent with the present reality of development in sub-Saharan Africa (Matlon 1990). First, most maize is grown in favorable production areas, where the payoffs to improved technology will be largest. Second, since most households in marginal areas are food deficit (Reardon et al. 1988; Lele 1989), improvements in productivity that reduce food prices will benefit food purchasers to the extent that interregional marketing of food takes place.¹⁰

We also emphasize the seed-fertilizer strategy here, which, given current knowledge and resources, is the only approach likely to spur rapid growth in maize production over the next decade or so. Even so, we suggest some important modifications to make this approach better fit the variable conditions in A frica.

DEVELOPMENT OF IMPROVED VARIETIES

Though most countries of sub-Saharan Africa have maize breeding programs, their performance in delivering appropriate OPVs and hybrids to small-scale farmers operating under diverse conditions has been mixed.

In many cases the priorities of these programs have not been based on a knowledge of farmers' circumstances. One important feature of small-scale maize production in much of the region is late planting, a practice made necessary by labor constraints, risk considerations, and crop rotations (Haugerud and Collinson 1990; Low and Waddington 1990; Zeigler 1986). Another is that farm households try to increase their food security by planting a variety that can be consumed in the "hungry season" before the main harvest



Figure 9. Trends in maize yields in the developing world.

¹⁰ We recognize that maize is expanding in many of Africa's marginal areas and that poor infrastructure commonly inhibits interregional marketing of food. Hence research for these environments is certainly justified. Nonetheless, the overall food security of most countries will depend largely on increased productivity in the areas of medium and high potential.

(Negassa et al. 1991; Low 1988). As a consequence, farmers generally prefer a variety that matures earlier than the actual length of the growing season would suggest. Where early maturing varieties have been made available, smallholders have sometimes adopted them widely, as in Zimbabwe and Swaziland (Rohrbach 1989; Kariuku 1990). Breeding programs have also paid insufficient attention to the quality and storability of grain and to its suitability for small-scale processing. This accounts to a large degree for the limited representation of smallholders among farmers adopting the currently available maize hybrids in parts of southern Africa (Tables 2 and 3) a trend that has persisted for a longer time

Table 2. Ado	ption of im	proved te	chnology	by far	m size g	roup,	eastern :	Zambia
	a contract of a second			- ,				

2. off an arman part of the	- 7 ALCON	13/8	- Far	rm size (ha)	NU AU	-0 = 0
an china wuxa china Anna ang ang ang ang ang ang ang ang ang	<1	1-2	2-3	3-4	>5	All
Percentage of farmers	24	32	15	19	11	100
Percentage of area	6	19	15	28	33	100
Area in hybrids (%)	3	15	18	24	49	29
Area fertilized (%)	46	50	52	44	72	56
Fertilizer applied (kg/ha) ^a	103	92	95	105	94	97
Area oxen plowed (%)	18	46	58	70	93	69

Source: Jha et al. (1991).

^a Fertilized area only.

Table 3. Ado	ption of new	maize technology	by farm size,	Malawi, 1985
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	21 100	- L	Farm si	ize (ha)	torial static	0
u interest in the second se	<0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-3.0	>3.0
Households headed	-			no harrow	n heavyman	0.0000000
by women (%)	i parte					
1985	42	34	24	18	10	8
1990	51	29	19	9	15	9
Maize area planted			-110000			
to improved seed (%)					0.000	
1985	2	2	6	8	15	25
1990	4	10	19	20	27	26
and the second second second	1000				Name / Com	
Use of inorganic fertilizer (%)	ho or	0.01				P
1985	9	16	25	40	44	54
1990	33	48	70	72	86	75
Avg. fertilizer dose applied to hybrid (kg/ha)				the strength of the	T and the Second	
1990	46	64	62	81	83	61

Source: Data for 1985 are from Kydd (1989) and Sahn and Arulpragasam (1991). Those for 1990 were calculated from data provided by M. Smale (pers. comm.) for three major maize producing areas. In both samples farm size is confounded with region, a fact that tends to exaggerate farm size effects.

than normally elapses between adoption of improved seeds by large-scale growers and by smallholders. In this case the problem is that farmers prefer flinty or harder grained maize varieties, which are much less susceptible to losses in on-farm storage and processing than the dent or soft-grained hybrids (Smale et al. 1991). This preference, combined with the uniform maize price set by grain marketing authorities, has led farmers to regard hybrid maize as a cash crop distinct from local flint varieties, which are grown for consumption in the home (Smale 1992; Kydd 1989; Jha et al. 1991; Friis-Hansen 1989).11 When grain yields are corrected for postharvest losses incurred in smallfarm storage and processing, the hybrids are inferior to local varieties (i.e., show a crossover with them) at low levels of inputs (Smale et al. 1991).12

Finally, breeding programs have made little effort to select varieties that are suitable for intercropping, even though a considerable proportion of the maize grown in sub-Saharan Africa is planted in complex crop combinations, which help farmers improve returns to labor and reduce risks (Fisher 1979; Zeigler 1986). Research and extension organizations have generally promoted improved maize varieties for sole cropping and have often actively discouraged farmers from growing hybrids in intercropping systems. Nonetheless, many farmers have incorporated MVs into intercropping systems, especially maize-bean combinations (Smale et al. 1991; Kariuku 1990). In other systems, though, such as maize-cassava intercropping, adoption of such varieties has been limited (GGDP 1991). In addition

to valuing intercrops, farmers that practice crop-livestock systems in areas where land is scarce also rely on crop residues as an important source of fodder. In fact, some work has shown that these farmers rank maize varieties differently when fodder supplies are taken into account (Onim et al., n.d.; Collinson 1982).

Some breeding programs have come to recognize more fully the importance of these factors in developing appropriate varieties for small-farm systems. Because the cost of varietal development increases exponentially with the number of traits selected for (Arnold and Innes 1984), researchers must make explicit efforts, especially through diagnostic farm surveys, to establish which needs and circumstances are most important (Matlon 1990; Edwards et al. 1988). We have preliminary indications that newer generations of MVs which better satisfy the special needs of smallholders are being accepted more widely than the previous ones (GGDP 1991). For example, in Malawi, where the adoption of hybrids has been very limited (Kydd 1989), preliminary evidence suggests that two maize hybrids released in 1991, which come closer to satisfying farmers' preference for flinty grains, are now being widely accepted, even for consumption in the home (M. Smale, pers. comm.). It would seem, then, that the increased investments made in maize breeding at the national and international levels during the 1980s could provide major payoffs in the 1990s.

The challenge now is to sustain this investment and ensure continuity in breeding programs. The experience of

¹¹ Note in Table 3 that the adoption of hybrid maize in Malawi continues to be strongly biased toward larger farmers, while inequality in the adoption of fertilizer has declined over time, largely as a result of increased fertilizer use on local maize.

¹² In Mozambique, where there is a free market in grain, the value consumers place on grain and flour quality is manifested in price variations of as much as 100% between maize meals of different qualities (Weber et al. 1992).

successful programs in eastern and southern Africa suggests that a decade or more of sustained effort is needed to produce suitable varieties and hybrids (Eicher 1984; Anthony 1988). In countries where research programs have not been able to maintain continuity in staff and breeding strategies, maize research has usually not been successful (Goldsmith 1990).

SEED SUPPLY SYSTEMS

Because maize is a cross-pollinating crop, multiplying seed that is true to type requires special care. Thus, even where appropriate maize varieties and hybrids are available, small farmers cannot adopt them widely unless a good seed supply system has been established. In contrast, MVs of rice and wheat, which are selfpollinating crops, can be spread rapidly from one farmer to another, once the seed has been made available to a few growers (Byerlee and López 1992). For that reason effective seed systems are not a prerequisite for rapid uptake of rice and wheat MVs.

Though distribution of maize seed from farmer to farmer does take place, it is generally not an adequate means of disseminating improved varieties. Particularly for hybrid maize, a well-developed system for producing and distributing seed is essential, as shown by experience in Kenya and Zimbabwe, where small-scale farmers have adopted hybrid maize fairly widely.

This requirement has led CIMMYT and other institutions to pursue a strategy of providing smallholders with improved OPVs, seed of which does not have to be purchased annually. For two reasons this strategy has had less impact than expected. First, the spread of OPVs from farmer to farmer has often been ineffective. Where varieties of similar maturity are grown mostly in small fields, outcrossing can rapidly reduce the genetic purity and yields of improved seed (Byerlee and López 1992). Second, low profit margins in the production of OPV seed have generally discouraged private sector seed suppliers from handling this type of product. In some cases seed of OPVs has been widely distributed to farmers, especially in Nigeria and Ghana, through production projects. But these efforts have not resulted in the creation of a mechanism for ensuring regular replenishment of farmers' seed supplies and thus maintaining the higher levels of productivity of improved varieties (GGDP 1991).

Countries that have emphasized hybrids (as in eastern and southern Africa) have generally done a better job of providing seed, even to small-scale farmers, who in some cases grow these materials under very low levels of inputs. In the dry areas of Zimbabwe, for example, where yields average less than 1 t/ha, almost all smallholders grow hybrids, though less than 20% of farmers use any fertilizer (Rohrbach 1989).

In supplying seed of OPVs, which many argue are more appropriate for small-scale farmers, neither multinational seed companies-which the US Agency for International Development has promoted in Cameroon (Novichi 1991)—nor large private or parastatal companies (like those established in eastern and southern Africa) have been successful. A more viable approach for distributing this type of seed is to rely on small private companies (often family owned), nongovernmental organizations, and farmers' cooperatives, which the public sector can support by providing credit and training. In devising strategies for promoting maize production in Africa, an important question that must be addressed is whether to emphasize OPVs or hybrids. In either case the strategy must include a plan for building a seed system that can meet the needs

of small-scale farmers on a continuing basis.

IMPROVING SOIL FERTILITY

Despite increased adoption of improved maize seed, the use of chemical fertilizer on this crop in Africa remains very low, even though much maize is now grown in areas where fallow periods are short or virtually nonexistent (Smith et al., in press). As a result, soil fertility is declining, and soil degradation through nutrient mining is increasing in many areas.

An important issue faced by countries in the region (most of which must import chemical fertilizers) is the relative emphasis they should place on this external source of nutrients versus internal sources. Several considerations will influence their decisions about this issue over the next decade or so. First, where there is less pressure on the land, farmers may be able to rely on organic sources of nitrogen in the short run, assuming that appropriate technologies, such as green manuring, can be developed for improving the fallow system and extended quickly to farmers. (Even where these technologies are adopted, however, phosphorus and other nutrients may often be limiting and will have to be provided from external sources.) Second, the price of external sources of nutrients is heavily influenced by transport costs and by the scale-economies of purchasing and shipment (Bumb 1988). In much of sub-Saharan Africa, fertilizer costs more than in other parts of the developing world because of the limited quantities purchased, the long distances over which they must be transported, and generally poor infrastructure (Table 4). The high cost of transport and marketing can cause the price of imported fertilizer in a landlocked country, such as Malawi, to be double that in a country, such as Kenya, which has relatively good infrastructure and ready access to a port. Third, the available knowledge about the use of organic

sources of nutrients (in alley cropping, for example) is still insufficient, and extension services, whose contribution will be essential for achieving widespread adoption of such systems, are often poorly developed.

The economics of using chemical fertilizer in Africa are highly site-specific, depending on land pressure, agroclimatic variables, and fertilizer costs. In Malawi's very land-intensive systems, it was found in a recent program (in which 110 on-farm demonstrations were grown over two years in one district) that it is economical for food-deficit households to use fertilizer on local maize, although using this input on hybrid maize at recommended doses gives even higher returns (Table 5). If the subsidy on fertilizer were removed, however, it would no longer be economical to apply this input on local maize. Even with hybrid maize, the returns to fertilizer use would be less than the 100% rate of return usually considered the minimum

Table 4. Prices of nitrogen fertilizer	
in relation to those of maize grain in th	e
developing world, 1989	

- 11	Nitrogen-to-maize price ratio
Africa	
Cameroon	7.3
Malawi	11.1
Zambia	2.8
Zimbabwe	7.2
Tanzania	6.0
Ghana	8.0
Kenya	5.0ª
Other regions	
India	2.1
Pakistan	2.6
Philippines	2.9
Thailand	7.9
Mexico	1.6
Brazil	6.0

Source: CIMMYT (1990).

* Estimated from Lele et al. (1989).

required for small farmers to adopt this type of technology widely (Table 5),¹³ It is sobering to note that the returns to fertilizer use in Malawi under certain price assumptions are quite modest, even though the expected yield gain is 2.4 t/ha. This is substantially greater than the increases brought about in most regions through the adoption of seed-fertilizer technology.¹⁴

In the more land-extensive systems of Ghana, where the payoffs to fertilizer are lower (about 15 kg of maize per kilogram of nutrient with an improved variety and about 10 kg with the local variety), fertilizer is generally profitable only where continuous cropping is practiced or where the fallow period has lasted for less than three years (Edmeades et al. 1991). Not surprisingly, the adoption of fertilizer is closely related to the length of fallow (Figure 10), and the recommended package has been adjusted to take into account the substantial variability in cropping history among fields (Table 6).

These examples show how the profitability of fertilizer use on maize can vary and underline the importance of increasing fertilizer efficiency—that is, the rate at which nutrients are converted into grain. As is evident from experience in Ghana, one can contribute to this end by tailoring the recommendations to site-specific and seasonal conditions and by promoting appropriate products (e.g., those with a high nutrient composition) and timing and methods of application. Farmers can benefit from these measures, however, only if a cost-effective means can be found to transfer the recommended practices to

Table 5. Effect of price policy on the profitability of alternative malze technologies in 110 on-farm demonstrations, Malawi, 1990-91

	Local maize with fertilizer	Hybrid maize with fertilizer
Fertilizer applied (kg/ha) Vield increase over local	55	145
maize without fertilizer (kg/ha)	750	2,400
	Marginal rate	of return (%) ^c
Subsidized input prices ^a :	100	007
Maize-deficit households ^b	133	237
Maize surplus households ^b	64	136
Unsubsidized input prices:		
Maize-deficit households ^b	79	145
Maize-surplus households ^b	27	72
The second		

Source: Calculated from data provided by the FAO/Malawi Ministry of Agriculture Fertilizer Program.

Subsidy of 25% on fertilizer and about 40% on hybrid seed.

^b The price of maize in households that purchase it is about 40% above the farmgate selling price.

^c Marginal rate of return on input expenditures. A return of more than 100% is usually assumed to be necessary for widespread adoption by farmers.

¹³ A similar situation has been observed in Tanzania, where the profitability of fertilizer use on maize is low in the inland regions, given current price regimes (Lele 1992).

¹⁴ These calculations are based on the recommended dose of fertilizer. In practice it is likely that a lower dose would be more economical.



Figure 10. Use of fertilizer in maize production by cropping history of the maize field, Ghana. Source: Edmeades et al. (1991).

them (Byerlee and Heisey 1987) and if research and extension can be more closely integrated than they have been in the recent past (Low et al. 1991).

Another way to increase the efficiency of chemical fertilizer and help maintain yields over the long term is to provide organic matter from internal sources of nutrients, such as green manures and alley crops (Spencer and Polson 1991; Matlon 1990). This step may be particularly important under continuous cropping, which in some ecologies has been found to result in degradation of the soil structure and in micronutrient deficiencies, which in turn lead to a long-term decline in yields, even where chemical fertilizer is used at relatively high levels (International

	Fertilizer (bags/acre) ^a
Agroecology/cropping history	Starter (20-20-0), 10 days after planting	Sidedress (amm. sulfate), 6 weeks after planting
Forest		
Land fallowed for at	No fertilizer	No fertilizer
least 5 years	recommended	recommended
Land cropped the previous year or cleared after less		
than 5 years of fallow	1	1
Transition		
Land fallowed for at	No fertilizer	No fertilizer
least 5 years	recommended	recommended
Land cropped the previous year or cleared after less		
than 5 years of fallow	1	1
Continuously cropped	2	2
Savanna		0.1
Land fallowed	1	1
Continuously cropped	2	2

Table 6. Fertilizer recommendations for maize in Ghana

Source: GGDP (1991).

^a One bag/acre each of starter fertilizer and ammonium sulfate is equivalent to 50-25-0 kg N-P-K/ha. Institute of Tropical Agriculture 1991). Thus, it is important to seek a balanced approach for improving soil fertility.

Finally, regardless of whether nutrients are provided from internal or external sources, probably the most important means of increasing the efficiency of nitrogen use, and hence its profitability, is to adopt input-responsive MVs. Data from Ghana and Malawi show that the payoff to each unit of nutrient applied is at least 50% higher for the improved variety than for the local one (Figure 11). Nonetheless, in Malawi an estimated 62% of the fertilizer is applied to local maize, even though it was not recommended for this purpose until recently (estimated from Smale et al. 1991). Note also that in both Malawi and Ghana the MV yields better than the traditional variety even without nitrogen (although in Malawi storage and processing problems with the hybrids currently available negate this advantage at low levels of input use).15

Another consideration for farmers who have little cash is the possible risk involved in using fertilizer. Yield risk is especially high in drier areas, as shown by a comparison between maize yields in Malawi, where the crop is mostly grown under relatively favorable climatic conditions, and those in Zimbabwe, where a large proportion of the maize is sown under limited moisture (Figure 12). In Malawi, since the seed-fertilizer technology performs better than local varieties under all circumstances, there is only a small chance that the former will be unprofitable (Figure 13). Consequently, risk is not an important factor in the decision of many farmers to reject the new technology (Smale et al. 1991). This conclusion is consistent with general observations on the yield risk of fertilizer use in many rainfed areas (Roumasset et al. 1989).16 Often, price instability and problems with input supply pose a greater hazard for farmers using fertilizer than yield risks per se. Of course, in marginal



Figure 11. Response of maize to fertilizer in (A) Ghana and (B) Malawi. Source: CIMMYT (1990).

¹⁵ It is likely that the payoffs to using MVs are similar when organic sources of nitrogen are used, although the more relevant measure of efficiency is the amount of nitrogen produced for each unit of land or labor devoted to nitrogen-fixing legumes.

¹⁶ It should be noted that the supply of nitrogen from organic sources, such as green manure, is also subject to risk, as measured by variability in the amount of nitrogen supplied.

production areas where drought occurs frequently, the yield risk associated with fertilizer use increases substantially. Results from marginal areas of Kenya, where maize is grown on highly degraded soils, indicate that drought is probably a key reason for the low rate of fertilizer adoption (McCown et al. 1992). Finally, concern is sometimes expressed about the environmental effects of the use of external inputs, such as chemical fertilizers. Given the low levels at which these are applied in African agriculture, the hazard of pollution resulting from their use will in the foreseeable future remain minor by comparison with the



Figure 12. Variability in maize yields in Malawi and Zimbabwe.





effects of soil nutrient mining and the expansion of agriculture into marginal areas as a result of increasing population pressure. Thus, far from contributing to environmental degradation, rapid technical change in areas of medium and high potential for food production will be important for alleviating this problem (Schuh 1988). In the long term, though, the use of energy-intensive external inputs, such as fertilizers, will expose smallholders to price shocks, since the real price of fertilizer must eventually rise, as fossil fuels become more scarce. This is a legitimate concern that underscores the need for increased efforts to find efficient ways of providing nutrients from both internal and external sources.

This review suggests that, in efforts to address the problem of soil degradation, priority setting will be site-specific, depending on agroclimatic conditions and on infrastructural and institutional development. More detailed, microlevel research is needed to define appropriate strategies for each location (Lele et al. 1989). In general, chemical fertilizers could be promoted vigorously in land-intensive areas having medium or high production potential and reasonable infrastructure (or access to a port). Meanwhile, in all areas where declining soil fertility is a major limiting factor, research on organic sources of nutrients must be strengthened to redress the exclusive emphasis in past research and extension work on external sources.

Improved Technology and Returns to Labor

In sub-Saharan Africa, it is critical that new technologies be evaluated in terms of their effects on returns to labor. Even where land is scarce, shortages of seasonal labor often have a decisive influence on farmers' choice of technology. Several reasons for this are that hand-hoe agriculture demands a great deal of labor, offfarm work is important in many areas, and no pool of landless rural laborers can be called upon during periods of peak labor demands (Low 1988; Delgado and Ranade 1987). As indicated in Figure 14, improved maize technology can accentuate these seasonal labor demands. The profitability of this technology can be altered significantly when evaluated in terms of returns



Figure 14. Labor peaks in maize production, Zambia. Source: Celis and Holleman (1991).

to labor rather than land (Table 7). What generally happens is that small-scale farmers reject labor-intensive practices, such as precise plant spacing, frequent weeding, and separate operations to apply fertilizer, affecting in turn the profitability of other elements in the package.

THE POLICY ENVIRONMENT

The adoption of improved technologies that depend on the use of purchased inputs is strongly conditioned by the policy environment. In sub-Saharan Africa information on two critical policy issues is still lacking. First, what mix of price policy, credit, input supply, and extension is the most cost-effective and appropriate, given the scarce human and financial resources of most countries in the region? Second, how do we ensure that crop production programs are sustainable over the long term, especially since most are instituted as short-term projects, usually with donor funding? Since other papers presented at this workshop address the policy issues in depth, here we make only some general observations that are relevant to the adoption of seed-fertilizer technology.

Probably the most important element in making the policy environment conducive to technology transfer is reliable and

Table 7. Returns to land and labor in maize production in Ghana

1,	Farmers' practice	Old recom- mended package ^a
Yield -	1.10	2.04
Returns to land (C/ha)	734	1,386
Labor inputs (days/ha)	61	106
Returns to labor (C/day)	12	13

Source: Bruce et al. (1980).

Included planting in individual hills, separate operations for fertilizer application, and two weedings. This package was later substantially revised to reduce labor inputs. efficient supply of inputs. All too often, these do not arrive on time or must be purchased on the black market (for an example in Senegal, see Kelly, 1988). In one study of farmers' reasons for not following recommendations developed through adaptive on-farm research in Zambia, it was found that, in 44% of the cases, inputs simply were not available (Low and Waddington 1991).

The current response to this problem (especially among donors) is to urge rapid privatization of input supply. Past experience suggests, however, that when farmers first begin to use purchased inputs the public sector has an important role in supplying inputs and promoting demand. The private sector is initially discouraged from taking part by the low market volume and high risks involved in smallfarm agriculture, often combined with poor infrastructure. The challenge for the public sector, including extension, is to lay the groundwork for the private sector to assume responsibility for input supply. The transition is not easy because of problems in coordinating the importation of inputs, building stock-holding capacity, servicing remote areas where transportation is poor, and avoiding input adulteration (Shepherd 1989). Some recent experiences suggests that once a market is developed the private sector can import and deliver inputs at a lower cost, provided that it receives appropriate support from the public sector, such as the provision of credit and technical assistance (see Truong and Walker, 1990, for an example in Cameroon).

Many countries (e.g., Zimbabwe, Zambia, Malawi, and Nigeria) have promoted the use of inputs, especially fertilizer, through input subsidies and/or credit (which is often subsidized as well). These measures have been justified as means of overcoming market imperfections resulting from farmers' inadequate knowledge of new inputs in the initial stages of adoption, combined with farmers' aversion to risk, the high cost of capital in informal markets, and high transport costs resulting from poor infrastructure.¹⁷ Subsidies on inputs, it is argued, may speed their adoption and enhance overall economic efficiency (Ahmad et al. 1989) as well as improve the food security of poor households (Lele 1989).

In recent years the elimination of input subsidies has been a favorite target of donors and structural adjustment programs, although there has been little analysis of the cost-efficiency of input subsidies versus other means of promoting input intensification, such as rural credit and extension campaigns. Clearly, in some countries, such as Nigeria, fertilizer subsidies have far exceeded any reasonable level dictated by efficiency or equity concerns. Moreover, in many cases the key constraint on increasing fertilizer use has not been the price but rather the unreliable supply of this input. In the initial stages of input adoption, a subsidy (not exceeding local distribution costs) may be a costeffective way of overcoming market imperfections and underwriting the cost of learning to use new inputs. It may also be one of the easiest interventions to implement in countries where managerial skills are limited. But a subsidy should be applied only to promote economic efficiency, as in the case of Malawi discussed above (Table 5). There adoption of hybrid maize and fertilizer is economically efficient (with a rate of return on the investment of 75%) only if inputs are subsidized. Otherwise, the rate of return to farmers is below that generally considered necessary for rapid and widespread adoption.

Over the long term, investments in extension services, in rural infrastructure, and in the development of rural capital markets (measures that will reduce both the cost of inputs and the cost of learning to use them) should make subsidies unnecessary. There is little theoretical justification for continuing them once input adoption is under way. The challenge-one which few countries have met successfully-is to phase out subsidies in proportion to the increasing volume of input sales. This is essential for keeping the costs of subsidies from reaching unsustainable levels and for avoiding input rationing because of fiscal constraints.

Government-sponsored credit programs are another widely used means of promoting input adoption. Often, inputs are provided in kind at low or negative real interest rates. Although such programs have sometimes stimulated a significant proportion of farmers to adopt inputs (e.g., the use of fertilizer on maize in Zimbabwe during the 1980s), this has usually been achieved at a high cost, and the programs have proved unsustainable over the long term (Adams et al. 1984; Eicher and Rukuni 1992).18 Moreover, credit programs have tended to be monopolized by powerful political groups in rural areas and by male farmers (Gladwin 1992) and are difficult and expensive to administer. Where credit is provided in kind, the recipients miss the opportunity to learn how to adjust the levels of input use to their specific circumstances, while farmers not included in the credit program are denied access to inputs.

Other important elements that make the policy environment conducive to

¹⁷ In addition, input subsidies may sometimes be justified as a means of avoiding resource degradation (e.g., fertilizer subsidies aimed at avoiding soil nutrient mining or farming of more marginal and fragile land).

¹⁸ It is significant that in the early stages of the Green Revolution in Asia credit programs played a very minor role in input adoption.

technology transfer are producer price incentives and stability. In some cases distortions in producer prices are the major factor limiting technology adoption. In Ethiopia, for example, fertilizer use on maize was found to be uneconomical at any level under prevailing prices for this crop but was determined to be an attractive investment if the price of maize reflected its import price at a realistic exchange rate (Dadi et al. 1990). A further problem is that producer prices for staple foods in Africa are often subject to wide fluctuations, both from season to season and year to year, owing to climatic variability, high storage costs (because of high capital costs or storage losses), poor transportation, imperfect information, and variable prices in world commodity markets. The problem is particularly acute for maize in West Africa, where fluctuations in producer prices, both between seasons and years, are commonly 50-100% (CIMMYT 1990; Sarris and Shams 1991), compared to just 10-20% for food staples in the major cereal producing countries of Asia and Latin America (Byerlee 1991).

Under these conditions governments may be justified in attempting to stabilize prices by intervening in product markets through grain reserves and trade, especially if they use world price levels and trends as the reference for their stabilization programs (Timmer 1988). There is little doubt that price stability for major food grains has contributed importantly to the rapid and widespread adoption of improved food crop technologies in Asia, though with the benefit of hindsight more cost-effective ways of achieving stability can surely be identified.

CONCLUSION

The seed-fertilizer strategy has been the major source of growth in small-scale food production over the last three decades, especially in Asia. In this paper we have challenged the widespread view that such an approach is not relevant to Africa.

Doubts on this point arise from three perceptions. First, it is commonly believed that the seed-fertilizer strategy has been effective only in irrigated areas of Asia. But in fact essentially the same approach of intensifying the use of inputs has also been remarkably successful in rainfed areas of Asia and Latin America. To be sure, technical change has occurred in rainfed areas later than in irrigated areas; the rate of progress has generally been less spectacular; and in marginal areas subject to frequent drought, the strategy has still not had much impact. Moreover, the greater diversity of rainfed areas across time and space has required that the technology be carefully tailored to local agroclimatic conditions and farming systems.

A second perception is that, although pressure on the land is growing and fallow periods are declining in many areas of Africa, population pressure is still generally lower there than in other regions of the developing world, and hence strategies to substitute external inputs for land scarcity are less relevant. What low population pressure really implies, though, is that yield-increasing technology must be more carefully targeted to areas where it provides the highest payoffs and that special attention must be given to designing improved technologies which increase the returns to scarce labor.

Finally, and most importantly, many believe that "low external input" strategies are more appropriate for small-scale farmers and avoid the environmental problems sometimes associated with the use of external chemical inputs at high levels. We have argued that, given the current state of knowledge, it is unlikely that low-input systems will be sufficient for achieving rapid growth in food production, for reversing the decline in rural incomes, and for slowing environmental degradation. Advocates of these systems, including some donors, often reveal a patronizing attitude toward the African smallholder. They assume that, because farmers are poor and have no access to irrigation, they cannot use socalled "high-input technologies," such as hybrids and external sources of nutrients

There is ample evidence that small-scale farmers in Africa do accept well-adapted technologies, once these are made available, along with appropriate institutional support.

(Harrison 1990). Yet there is ample evidence that small-scale farmers in Africa do accept well-adapted technologies, once these are made available, along with appropriate institutional support. Even so, one can still make a strong case for investing additional resources in the development of systems that will enhance the use of internal sources of inputs, especially soil nutrients.

In summary, then, the central issue of the technology debate should not be the relevance of high-input versus low-input systems, but the development of technologies that make efficient use of farmers' scarce resources, can be transferred with the available extension and other institutional support, and are equitable and sustainable over the long term. To generate and disseminate such technologies will require location-specific research, more effective extension services, and reliable systems of input supply, all of which must be closely attuned to farmers' priorities. Whether the resulting technologies rely on external or internal sources of nutrients, a

key component of them will be inputresponsive, yield-stabilizing varieties.

a series and desired

In most cases the best approach will be one that balances the use of external, inorganic inputs with measures that draw on internal, organic sources to enhance soil fertility. Exclusive reliance on the former is just not sufficient to sustain most systems over the long term. The difficulty, of course, with a more integrated approach to nutrient management is its requirement that farmers possess more information and skills, which in turn implies stronger extension programs and probably greater investment in site- and season-specific research.

The evidence presented here demonstrates the great potential for increasing food crop production in Africa, especially in the savanna and mid- to high-altitude areas, where maize is a major crop. Contrary to common belief, the record shows that seedfertilizer technology has already been adopted quite widely in these environments, with improved varieties and hybrids being planted on 30-50% of the maize area. Adoption has sometimes been patchy, though, and the impact less than expected, partly because of deficiencies in local research and institutional support and inappropriate macroeconomic policies. The uneven pattern of adoption is exemplified by limited acceptance of maize MVs in Tanzania and Malawi, compared to wide dissemination of such varieties in neighboring countries (Anthony 1988). Even in areas where improved technology has been relatively successful, there is cause for concern. In some cases hybrid maize and fertilizer use has been adopted mainly by larger scale farmers, and the delay in wider acceptance of this technology among smallholders has been more prolonged than in other regions of the developing world. Moreover, where the technology has been adopted, the use of improved inputs has often stagnated at low levels, apparently because input supply systems are still

underdeveloped. Clearly, more emphasis needs to be placed on strengthening local institutions for the development and transfer of improved food crop technology than on crash food production programs emphasizing short-term payoffs.

It is also important that the seed-fertilizer strategy be adjusted to fit the state of infrastructural and institutional development in most African countries. Among the factors that must be taken into account are lower population densities, seasonal labor bottlenecks, and poor infrastructure, which increases the cost of external inputs and the instability of prices. The small size of many African countries, combined with the considerable diversity of their environmental conditions, also complicate the design of efficient research and extension systems. As a result, the profitability of using chemical fertilizers, for example, often varies considerably in time and space because of variability in the crop response (e.g., according to fallow periods) and the high and variable cost of fertilizer in relation to product prices.

For these reasons, in the development of improved packages of technology for Africa, special efforts must be made to encourage efficient use of inputs and to maximize returns to scarce labor and cash in the early stages of adoption. The government credit program in Malawi, for example, provides fertilizer in kind at a rate of about 150 kg of nutrients per hectare (a level only just achieved by farmers in the irrigated Punjab of Pakistan 25 years after the introduction of high-yielding wheat and rice varieties). To encourage efficient use of inputs requires a strong program of adaptive research and extension for developing and promoting realistic and flexible, site-specific recommendations. Farm-level research is particularly important for guiding technology development and transfer.

The availability of appropriate technology is a necessary, but not sufficient, condition for rapid technical change. Other key requirements are that institutional structures be established for supplying inputs, credit, and information and that prices be conducive to the adoption of new technology (Russell and Dowswell 1991). To assume that policy reform and privatization of input and output markets will take care of these constraints is overly simplistic (Tripp 1992). Indeed, the record clearly shows that, wherever small-scale agriculture has been successfully transformed, the public sector has played a key role in providing input markets and appropriate price incentives. What Africa needs is more guidance in finding cost-effective ways to provide this kind of support with limited financial and human resources.

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Comparing Technology Options on the Basis of Risk

F.S. Idachaba*

Africa is once again in the news. During the last few weeks, the media have shown shocking and disturbing images of mass famine and starvation in Somalia. In less dramatic form, the recent drought in southern Africa has cast doubt on the ability of countries in the region to sustain what appeared to be substantial gains in the production of maize and other staple crops. Zimbabwe, which was self-sufficient in maize, is reported to be importing cereals to cope with the consequences of the drought. In West Africa and other regions unaffected by this natural calamity, national food systems are suffering from the negative consequences of structural adjustment programs. The food picture for sub-Saharan Africa remains dismal by all indices: declining per capita food production, growing instability in domestic production, and increasing dependency on food imports, to mention just a few. After almost a century of organized public agricultural research, sub-Saharan Africa cannot boast of a single crop whose production has been revolutionized on a regional or continental scale.

UNIQUE CIRCUMSTANCES

Even so, the region can claim certain advantages, as it works toward breakthroughs in food production. It can profit from the experience of newly transformed agricultural economies in Southeast and South Asia. It need not spend scarce resources on basic research in genetics, plant physiology, and so forth, and it has access to large germplasm collections around the world, representing all of the continent's major crops. As a consequence, African researchers are free to concentrate on adaptive work, such as the development of cultivars that are well suited to specific locations.

At the same time, though, efforts to transform the agricultural economies of sub-Saharan Africa are complicated by

After almost a century of organized public agricultural research, sub-Saharan Africa cannot boast of a single crop whose production has been revolutionized.

circumstances that are either unprecedented or were less of a hindrance to the developed countries and the newly transformed agricultural economies of Asia. One of these is global concern about the environmental impacts of agricultural and industrial growth, which has created doubts in the minds of policy makers about the types of technology that should be promoted.

A second factor is the demographic transition taking place in sub-Saharan Africa. Declining mortality rates, brought about by improvements in public health, together with rising fertility rates, have created a population explosion that has greatly increased the demand for food—a trend to which two other circumstances have contributed importantly. One is the

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extremely high proportion of the growing population that is young and dependent, and the other is the region's high rate of urbanization. Because the urban populations enjoy better access to education and modern communications, they have achieved a high level of social and political consciousness and managed to coerce national leaders into pursuing cheap-food policies to the detriment of domestic production. These policies have included generalized subsidies on imported food (in the form of overvalued exchange rates), agricultural taxation, price controls, unfavorable domestic terms of trade, and an urban bias in the provision of infrastructure. This last feature of development policy has induced a massive influx of rural people into urban areas, thus depleting the farm labor force.

A third factor is that agriculture in the developing world is being subjected to rigorous tests of competitiveness and efficiency on a scale not experienced by the developed countries when their agricultural economies were undergoing structural transformation. Current standards of performance in agriculture are being set according to conditions in the industrialized world, where farmers have employed modern technology for many years and are likely to achieve further advances as a result of biotechnology research. Their counterparts in developing countries are expected to adopt new technologies in the context of liberalized economies and lower tariffs on food imports, so that they can compete effectively with border prices, show acceptable domestic-resource cost ratios, and attain export competitiveness. Key conditions for lending to developing countries are that agricultural subsidies be eliminated and exchange rates be adjusted.

As a result of these three factors, agriculture in sub-Saharan Africa is faced with challenges that are unprecedented in world history. Against that background, this paper examines the choice that countries in the region must make between modern varieties and inputs, on the one hand, and low-input/low-output improved technologies, on the other, based on the risks involved. A wide array of options of both types is available. In practical terms the choice between them is hardly clear-cut; the relative emphasis they receive will vary not only from country to country but among regions within a country.

CONSTRAINTS OF AGRICULTURAL DEVELOPMENT

In evaluating technology options and their risks, it is important to view these in the context of various conditions on this continent that impede agricultural development.

FRAGILE SOILS

In general, the soils of sub-Saharan Africa are poorer than those in the temperate zone. They tend to be highly weathered, heavily leached, and poorly drained. In the drylands particularly, the soils are low in organic matter content and easily become compacted under mechanical operations. They are also highly subject to degradation brought about by erosion, which often exceeds soil-loss tolerance levels. In dry areas and particularly during the dry season, wind erosion is common, while sheet and gully erosion cause extensive damage during the rainy season.

Because of the poverty and thinness of the topsoil in Africa, the use of farm machinery designed for soils in the temperate zone can be highly destructive. This is a fact to which agricultural engineers and policy makers on this continent must reconcile themselves. Rather than bemoan the inappropriateness of the equipment currently available, which was designed for different conditions from those prevailing in this region, they need to search for technologies that are more appropriate, given the low nutrient status and vulnerability of African soils.

UNRELIABLE RAINFALL

Over large areas of most countries in sub-Saharan Africa, rainfall is low (less than 700 mm per year in most of the Sudan-Sahelian zone, for example). The arid and semiarid areas can support the production of coarse grains (millet and sorghum). But for none of these crops are improved varieties widely available that outperform local landraces by as large a margin as do modern varieties of maize, wheat, and rice. Without dramatic yield increases, the high costs of production render the cultivation of coarse grains with modern inputs unprofitable. The challenge in this case is to develop short-season varieties and practices for achieving optimal soil management and efficient use of water.

The limited amount of rainfall is compounded by its erratic pattern. The two components of this problem are the onset of the rains and the length of the rainy season. Delayed rains and compressed growing seasons lead to repeated sowings and crop failures. Under these circumstances, the challenge is to develop cropping systems that fit and effectively utilize the expected rainfall distribution. To facilitate the development of these practices, African countries urgently need to support the generation of agroclimatic data. One useful step would be to compute rainfall probabilities based on correlations between the onset of the rains and length of the growing season. The information so derived should have particular social value for the development of agricultural economies in which levels of production are still low. S. Minnovilla

When the rains do come, they are generally quite intense, causing further problems for agricultural production in the form of flash floods and erosion. One investigator notes that rainfall in the Sudano-Sahelian zone is far more intense than that in temperate and subtropical areas. At one location in West Africa, for example, he recorded that 82 mm (a seventh of the average seasonal rainfall) was received in just three hours. And these findings are not atypical. Apart from its contribution to erosion, intense rainfall greatly reduces the capacity of the soil to retain moisture and utilize supplementary soil nutrients.

PRESSURE ON NATURAL RESOURCES Rapid population growth across most of sub-Saharan Africa has placed increasing pressure on natural resources, leading to deforestation in the humid tropics and desertification in the semiarid and savanna regions. Another consequence of population pressure is the shortening of fallow periods. In the absence of this traditional means of restoring soil fertility, farmers must resort to fertilizers to permit more intensive cropping. This is a difficult pattern to maintain where the organic matter content of the soils is low, a problem that is aggravated by heavy exploitation of forests for fuelwood, construction materials, and industrial purposes.

Continuous cultivation within a short walk from the farm household tends to reflect, not only increased population pressure, but families' declining ability to cultivate plots lying at greater distances. This phenomenon may be a consequence of the aging farm labor force in most of sub-Saharan Africa. Pockets of high population density in West and Central Africa—around Kano, Nigeria, for example, and in the southeastern part of this country—graphically illustrate the limits of continuous cultivation without inorganic fertilizers or other means of restoring soil fertility.

POOR INFRASTRUCTURE

The inadequacy of rural roads in sub-Saharan Africa is perhaps the single most important constraint impeding the structural transformation of agriculture. Since the systems of agricultural production and distribution in this region are highly decentralized, an extensive grid of rural and trunk roads is required to connect food producers with consumers. Improvements in rural roads produce dramatic rightward shifts in curves representing input supply and marketing of outputs.

The traditional policy prescription for improving agriculture has focused narrowly on productivity per unit area of land, taking rural infrastructure as a given. As a first approximation, individual households can treat rural roads and markets as exogenous. However, there is a growing tendency in Nigeria and other countries for farmers, working through traditional chiefs and other local leaders, to demand better rural roads from government at all levels. The poor state of these roads tends to bias public support of development in favor of intensive agriculture with its emphasis on raising the productivity of the land, to the neglect of extensive agriculture with its emphasis on bringing more land under cultivation.

Rural roads constitute capital inputs that yield future income streams for rural farmers. So do on-farm structures, such as barns and soil conservation works. Unless African countries vastly improve on- and off-farm production inputs, they will continue to underutilize the productive potential of extensive agriculture.

TECHNOLOGY AND SOURCES OF RISK

Modern crop production technology embraces a wide range of options, including improved planting materials, the use of inorganic fertilizers and other agrochemicals, biological control of insects, and farm machinery and other equipment. The public sector generally plays a prominent role in the generation and dissemination of this technology. In contrast, under the traditional, capitalistic organization of agricultural economies in Africa, local or imperial authority had no direct involvement in commodity production and distribution. This changed with the creation of modern states in sub-Saharan Africa, which introduced new forms of risk into the calculus of individual farm households.

Like the higher input alternative, lowinput/low-output technologies also consist of various elements, including improved varieties based on indigenous germplasm, the use of organic fertilizer, control of pests through cultural methods, reliance on manual labor, improvements in animal traction, and improved on-farm structures. How do these options compare with technology that depends on modern inputs with respect to various sources of risk?

YIELD VARIABILITY

One way to determine the risk involved in using modern inputs is to examine the possible outcomes. For this purpose it is useful to bear in mind Georgescu-Roegen's simple definition of risk: "Risk describes the situation when the exact outcome is not known but the outcome does not represent a novelty." Several types of risk are relevant to this analysis, including production and income risk. These in turn are closely related to yield risk, which consists of several elements.

First is the risk created by a trend toward genetic uniformity, as diverse landraces are displaced by more narrowly based improved varieties. Where a few genotypes with a common parent line are widely grown, yields can become more variable as a result of increased vulnerability to disease epidemics. Thus, as production systems become more dependent on varieties developed from a narrow genetic pool, individual farmers and societies become subject to greater risk.

A second component of yield risk is that caused by errors occurring during the transition from old to new agronomic practices. Yield and production may fluctuate as a result of the varied performance of individual farmers in applying new recommendations for seeding, weeding, applying fertilizers, and so forth.

RISK AND INPUT SUPPLY

A third element of yield risk (one which I discuss in more detail because of its overriding importance) is the variability arising from fluctuations in the supply and distribution of seed, fertilizers, pesticides, and tractor services. The more responsive new varieties are to fertilizer and the more dependent they are on pesticide applications, the more yields vary and the more risk farmers face, as the availability of these inputs changes from year to year. Thus, modern hybrids that are highly responsive to fertilizer entail greater yield risk than traditional varieties or improved versions of them. The risk involved is particularly great if the public sector is involved in fertilizer procurement and distribution, tasks in which it is notoriously inefficient.

Evidence from East and West Africa shows that farmers are more concerned with getting fertilizers at the right time and place than they are with getting them at subsidized prices. Because fertilizers are commonly delivered well after the recommended application dates, farmers must often apply them at less than optimum dosages. The consequent inefficiency in the use of this input prevents farmers from realizing the yield potential of modern varieties, resulting in the loss of income (Idachaba 1980). Extremely late arrival of fertilizer also creates enormous storage problems, since it must then be held for distribution in the next growing season.

Credit is the single most important determinant of farmers' access to modern varieties and other inputs. There is a good chance that in a given year farmers will be unable to purchase modern inputs on credit. This is one more source of risk (which does not arise with traditional inputs and their improved versions) that increases the farmer's production, yield, and income risks.

In Nigeria there is a public outcry against glaring deficiencies in the arrangements for public procurement and distribution of fertilizers in 1992 (Table 1). Much the same problems affect the provision of other modern inputs, especially tractor services, and these have similar effects on production risk related to variability in the area under cropping. The more responsive production is to cropped area, the more will fluctuations in area be transmitted to fluctuations in production. Thus, the greater the government's role in the provision of tractor services, the greater will be the fluctuations in production that are caused by variations in cropped area. The same propositions hold in the case of production risk derived from yield risk, when government is involved in generating and distributing improved seed. The risks associated with modern varieties and other inputs are greater than those with low-input/low-output technologies because of the government's propensity to get involved, often quite aggressively, in the procurement and distribution of inputs.

FLUCTUATIONS IN INCOME

Income risks can also be greater with modern varieties where output is increasing dramatically but the demand for food is price inelastic. This type of risk might also be greater where modern inputs are largely imported and there are significant fluctuations in the foreign exchange rate under structural adjustment programs. In most countries of sub-Saharan Africa, fertilizers are imported, and the quantity supplied in each country during a given year is determined by the foreign exchange budget and quite often by the fertilizer subsidy budget. Variation in these budgets often gets transmitted into fluctuations in farmers' net incomes.

COMPANY NAME OF T

Table 1. Selected cases reported in the Nigerian press of inefficiency in government distribution of fertilizer to various states, 1992

Akwa-Ibom

An attempt to steal 400 bags of fertilizer from the Uyo depot was foiled.

Adamawa

Out of 320 truckloads of fertilizer, 72 were reported to be missing. By 10 July, long after the start of the rains, just 6,000 t of the 42,000 t ordered had been received.

Jigawa

Twenty-seven truckloads of fertilizer were lost in transit.

Kano

The state assembly was reported to be divided over allegations of malpractice in the distribution of fertilizer. Delivery of only 8,000 t out of 53,000 t expected was blamed on transportation problems.

Kogi

Of the 116 truckloads of fertilizer expected, 56 were declared missing. A task force was formed to locate them and arrest the culprits.

Niger

Some 50 truckloads of fertilizer meant for this state had still not arrived five months after leaving Port Harcourt. Smuggling of fertilizer to neighboring countries was reported.

Taraba

About 3,000 bags of fertilizer were reportedly diverted by legislators for sale to wealthy businessmen.

RISK AND INFRASTRUCTURE

A major source of risk related to the use of modern inputs is poor infrastructure. Rural road networks and trucking services are essential for timely delivery of fertilizers and other purchased inputs and for prompt removal of farm produce to avoid heavy postharvest losses, particularly where bumper harvests have been made possible by wide adoption of modern varieties. The more dependent agricultural production systems are on purchased inputs and the greater the share of marketed surplus in total production, the more sensitive these systems are to deficiencies in rural roads and trucking services. Traditional inputs or improved versions of them are less vulnerable to risks arising from poor infrastructure.

RISK AND POLICY SHIFTS

Risk may stem from sudden changes in public policy affecting agriculture generally or particular agricultural enterprises. There are more public policies dealing with modern inputs than with traditional inputs or their improved versions. Policy shifts may affect public support for agricultural research and extension, agricultural pricing and subsidies (including exchange rates), import tariffs, institutional minimum wages, and the role of government in the production and distribution of commodities. Sometimes changes in policy are based on the lessons of experience. But more commonly frequent reversals are rooted in political instability. Different regimes naturally express differences, whether real or imagined, in their priorities and political agendas. Often, new administrations introduce cosmetic policy changes as a means of legitimizing their rule. The effects of political instability are aggravated by the absence of a consensus across social strata on the values and beliefs that should guide agricultural policy.

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COMPRESS INCOMENDATION

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Much of the policy instability we observe is caused by frequent changes in the political and professional leadership of agricultural ministries. Nigeria, for example, has had 11 different ministers of agriculture over the last two decades or so (Table 2). Changes in agricultural leadership are, of course, strongly correlated with changes in the nation's political leadership. Nonetheless, as is evident from recent experience in Nigeria, stability in national politics does not necessarily have the desired stabilizing effect on agricultural policy. During the seven years in which Ibrahim Babangida has been Nigeria's president, there have been five federal ministers of agriculture, giving an average of 1.4 years per minister. Frequent changes in leadership give rise to corresponding changes in the efficiency of the government's institutional arrangements for procurement and distribution of fertilizer. These in turn increase the risk associated with adoption of modern varieties and other inputs.

STRATEGIES FOR MINIMIZING RISK

Each of the individual forms of risk discussed above has serious consequences for the technological transformation of agriculture. In combination they pose a formidable barrier to the adoption of

Table 2. The changing political leadership of Nigeria's Federal Ministry of Agriculture

Commissioner or minister	Period served
A.Y. Gusau	1969-72
J.O. Okezie	1972-75
A. Adetoro	1975-76
B.O. Mafeni	1976-79
I. Gusau	1982-83
A. Ciroma	1984-85
A. Akinrinade	1985-86
G. Nasko	1986-90
S. Mamman	1990-91
S. Mustapha	1991
A. Hashidu	1992

modern varieties and other inputs. Faced with a combination of risks in adopting new inputs, farmers may employ various risk-minimizing strategies, some of which are discussed below.

One is the practice of intercropping, which is the predominant pattern in traditional agriculture. Farmers are cautious about monocropping because of yield variability and the risks associated with poor infrastructure, changing policies, and unreliable access to credit. In a recent study of a project that promoted monocropping, it was found that 50% of the farmers who had adopted this practice reverted to intercropping as soon as project management withdrew credit and other support services. It should come as no surprise that small-scale farmers in particular have proved reluctant to practice monocropping. Medium- and large-scale farmers are more inclined to do so, since they are able to absorb greater production and income risks.

Another risk-reducing strategy often employed by small-scale farmers in rainfed agriculture is to adopt modern inputs on a limited scale. For example, they may decide to limit their fertilizer purchases, even though they may then realize lower gains in production with fertilizer-responsive varieties. In a recent evaluation of the SG 2000 Project in Tanzania, it was found that farmers in the Dodoma Region cut back on their fertilizer purchases in response to drought.

A related strategy is fertilizer rationing, which makes sense where the government is highly inefficient in the procurement and distribution of this input. Farmers may hoard part of their stock, applying less than the recommended dosage in the current season, to ensure that some fertilizer is left over for the next crop. Assuming that farmers are eager to adopt modern inputs but face considerable risk from unreliable input delivery, they may be able to lessen the risk through farmer associations. This is the approach encouraged by the SG 2000 Project in Tanzania. It is hoped that, in addition to pooling their resources for purchasing inputs, groups of farmers will be able to pressure both public and private sector agencies to improve the availability of seed and other inputs.

Another form of partial technology adoption is illustrated by the experience of some participants in the SG 2000 Project in Tanzania. These farmers are operating in two worlds: while cultivating their Management Training Plots (MTPs) strictly according to the recommendations, they practice intercropping in the traditional manner around their homesteads, without applying the lessons learned from the one experience to the other. The evident purpose of this strategy is to minimize the risk of failure with modern inputs by maintaining the time-tested traditional technology.

Where drought is especially common, farmers tend to avoid the improved seed/ fertilizer technology altogether, preferring their own traditional inputs or improved versions of these. Though inferior to modern inputs in yield, the traditional materials are perceived as being less risky.

The surest way to minimize the risk of drought, of course, is through irrigated agriculture. Modern varieties show a particular advantage under irrigation, though plant breeders have also sought to make the new varieties more drought tolerant and better adapted to a wide range of environmental conditions. Most African countries have concentrated on promoting new varieties without a corresponding emphasis on the development of irrigation facilities. As a result, drought continues to be a major barrier to the technological transformation of agriculture on this continent.

THE RISK OF ENVIRONMENTAL DEGRADATION

Because of the intensity of tropical rainfall and the resulting high degree of surfacewater runoff in sub-Saharan Africa, fertilizer use is a potential environmental hazard, though only where applications are moderate to heavy. Since the current level of fertilizer use in sub-Saharan Africa is still quite low (averaging 10 kg/ha), this problem is not yet serious on a regional scale. More serious threats to human health might arise from increased application of pesticides, particularly on a continent where many farmers are unable to read the labels. Minimizing inappropriate use of these chemicals will require that both the public and private sectors make increased efforts in extension.

Greater reliance on irrigated agriculture is another source of environmental degradation. The construction of dams to create manmade lakes for supplying irrigation water destroys valuable flora and fauna and has other negative effects on agroecosystems and on the farmers and livestock that inhabit these. The resettlement of displaced villages constitutes a serious social problem. There is considerable risk of siltation and sedimentation in irrigation schemes and, unless proper safeguards are put in place during construction, there is some risk of dam breaks and major disasters. Where irrigation water is obtained by means of tubewells, the effects of these on water tables and aquifers must be carefully monitored.

Farm mechanization poses a serious threat to Africa's fragile soils. If not done properly, it can accelerate surface runoff and increase the damage caused by erosion. The challenge is to contain the greed of urban contractors and their political patrons and keep them from turning delicate soils into desolate wastes through careless and destructive bush clearing. Proper guidelines need to be formulated and enforced to ensure that bush is cleared in such a way as to minimize soil degradation resulting from mechanization.

CONCLUSION

When government plays the dominant role in fertilizer procurement and distribution, there is significant covariability-see Evans (1986) for a succinct statement of this problem-in crop yields and production across different regions within a country. Delays in the delivery of inputs will tend to affect all regions to a more or less equal degree, giving rise to positive spatial correlations. Where the regions of a country are not jointly dependent on the national government for input distribution, there might well be offsetting covariances in yields among states, leading to greater stability than is the case with positive covariability. Spatial covariability across regions is a serious hindrance to national food security.

Countries with diverse agroecologies and cropping systems have naturally offsetting covariances in the yields of different crops across regions. Where fertilizer-responsive varieties are introduced and where fertilizers are obtained from a single unreliable source, then there will be positive spatial correlations for different crops across regions. A naturally stable cereal economy thus becomes unstable when it depends on inefficient public sector agencies to procure and distribute inputs.

In that case it is essential that improved varieties be resilient under trying environmental conditions. It is unlikely, though, that new cultivars will offer all of the characteristics that are desirable for good adaptation to local conditions and preferences. Holden (1986) describes one example of this difficulty: "it rapidly becomes impossible to retain palatability and digestibility in forages or grain quality

When government plays the dominant role in fertilizer procurement and distribution, there is significant covariability in crop yields and production across regions.

in cereals when selecting for resistance to increasingly low soil water." Obviously, plant breeders will have to make tradeoffs in the development of new genotypes.

Even where modern varieties are available that have most, if not all, of the requisite characteristics, efforts to promote them will be heavily constrained by the poor condition of rural infrastructure, particularly roads, markets, and water supplies. In this respect the newly transformed agricultural economies of Southeast and South Asia were much better off at the beginning of their Green Revolution than sub-Saharan Africa is now.

A further problem for the agricultural economies in Africa that rely heavily on imported farm inputs is the cost-price squeeze. The agricultural leaders and producers of these countries are faced with a clear choice: they must either look inward and develop agriculture on the basis of their own natural resource endowments, with emphasis on extensive agriculture, or they must reorder their priorities, so that fertilizers, pesticides, and farm machinery command a greater share of foreign exchange and domestic budgets. Governments can sustain current levels of subsidies on farm inputs, without severely constraining the growth of fertilizer consumption, only by allocating far greater resources to this input than has previously been the case.

In view of government's glaring inefficiency in fertilizer procurement and distribution, political opposition to its disengagement from this activity must be broken. Otherwise, the benefits of public policy (e.g., fertilizer subsidies) will continue to flow to unintended beneficiaries.

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ACHIEVING MORE EFFECTIVE TRANSFER OF CROP TECHNOLOGY IN SUB-SAHARAN AFRICA

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The SG 2000 Agricultural Projects in sub-Saharan Africa, the first of which were established in 1986, operate on the basis of three main premises: 1) with improved technologies already available, the average smallholder can double or even triple the yields of staple food crops; 2) such farmers are willing and able to adopt those technologies; and 3) given an effective

Given an effective approach to technology transfer, national extension services can transfer improved practices to smallscale farmers quite effectively.

approach to technology transfer and the funds with which to apply it, national extension services can transfer improved technology to small-scale farmers quite effectively.

Though none of the SG 2000 Projects has been free of difficulties and disappointments, their collective experience has largely borne out those three assumptions. This experience is the product of a cooperative effort with African ministries of agriculture, in which project staff (including two or three internationally recruited scientists), with relatively limited annual budgets, have worked directly with hundreds of extension officers and more than 150,000 small-scale farmers in demonstrating the proper use and value of improved seeds, fertilizers, and associated cultural practices.

The purpose of this paper is to describe the approach they have employed and in doing so to make a case that it should be implemented on a much larger scale to enhance the effectiveness of national extension systems and to achieve more rapid and widespread dissemination of improved technology for producing Africa's staple food crops.

ELEMENTS OF THE SG 2000 Approach

The SG 2000 Projects focus primarily on technology testing and demonstration. In doing so they establish field plots managed by individual farmers under the supervision of extension staff. Though the plots are variously referred to as Management Training Plots (MTPs), Production Test Plots (PTPs), and Extension Test Plot (ETPs), for the purposes of this discussion I will use the term MTP.

TECHNOLOGY AND THE PRODUCTION ENVIRONMENT

Though not necessarily perfect, the technology tested in the MTPs has generally been investigated in on-farm trials and found to be acceptable to farmers and effective in addressing their most important production constraints. Initially, the field demonstrations have concentrated on introducing improved practices for monocropping of two or three major

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staples. In rainfed environments these have usually been maize and sorghum, while in irrigated areas (in Sudan and northern Nigeria) the projects have mainly emphasized wheat production during the winter season.

There comes a time when many farmers in areas where the MTP program operates have adopted improved varieties, fertilizer use, row planting, and other simple innovations. The MTP program must then start exploring new options for achieving improvements in other crops and cropping systems. This shift is already taking place in some of the SG 2000 Projects. In Ghana, for example, improved technology for production of cowpea, cassava, groundnut, rice, and soybean has been incorporated into the field program, and some of the MTPs now include intercropping of improved maize and cassava varieties. In Benin the use of a green manure crop, velvet bean (Mucuna utilis), is being demonstrated on soils that are very low in organic matter and have severe weed infestations.

All of the SG 2000 Projects have given first priority to production environments that are relatively favorable in terms of moisture availability (i.e., those with more than 700 mm of rainfall or irrigation) and have given only minor emphasis to the more arid ecologies. They have done so for two main reasons: 1) the more favored environments are where most people live, and 2) technology of proven worth is available for these ecologies (though it is still underutilized) and can enable resourcepoor farmers to achieve dramatic improvement in crops yields with acceptable levels of risk.

CONVINCING FARMERS

The main features of the MTPs reflect a belief that small-scale farmers must be provided with opportunities to handle new practices under realistic circumstances. Otherwise, they are unlikely to be convinced that these technical innovations represent useful modifications in their current systems. In this respect African farmers are no different from their counterparts anywhere. As Dr. S.A. Knapp, founder of the U.S. Extension Service, pointed out nearly a century ago: "what farmers hear they often disbelieve; what they see on someone else's land they may also doubt; but what they do themselves they cannot deny."

In order to provide a realistic demonstration of the possibilities with new technology, project staff believe that for cereal crops MTPs should occupy at least 0.25 ha and preferably 0.4 to 0.5 ha. Plots of this size allow the cooperating farmer to judge the resource requirements of the new practices and to realize an immediate and clear-cut benefit from them, usually amounting to an additional 1,250-1,500 kg of grain. Some specialists in technology transfer have advocated that on-farm demonstrations be limited to no more than about 100 m², based on the perception that in growing larger plots smallholders would be exposing themselves to excessive risk. But if farmers test new technology on such a small scale, the benefits they realize will not be sufficient to persuade them of its potential value.

Another requirement for realistic technology testing is that farmers apply at least intermediate levels of fertilizer (e.g., 80-120 kg N/ha on maize). This feature, too, deviates from the practice of other technology transfer programs. Some of them reason that, where small-scale farmers are concerned, "realistic" automatically implies the use of extremely low levels of chemical fertilizers, if any at all.

It is, of course, true that use of this input on food crops is quite limited throughout most of sub-Saharan Africa. But from this observation, SG 2000 staff have arrived at
a different conclusion. We believe that, rather than perpetuate the status quo, technology transfer programs should provide farmers with a compelling reason to change it. And the best way to do this is to let growers see for themselves the biological potential of their own fields under improved soil fertility. Once the demonstration is over, resource constraints and risk considerations will likely compel farmers to cut back to lower fertilizer doses. But at least for one or more seasons, they will have seen the effect on their crop of adequate soil fertility, and they will be more likely in the future to seek ways of acquiring the necessary resources for applying fertilizer at more nearly optimum levels.

A final requirement for realistic demonstration of improved technology is that cooperating farmers pay the bill for inputs included in the recommended package. If the money for these items comes out of their own pockets, it will not take farmers long to assess the risks and the opportunities for gain.

MOBILIZING EXTENSION

To convince farmers of the merits of new technology, extension staff must obviously be mobilized for implementing on-farm demonstrations on a sizable scale. For that reason all of the SG 2000 Projects provide partial funding for the purchase of bicycles, motorcycles, and pickup trucks (along with fuel and spare parts) and for helping cover the cost of per diems for extension staff who supervise the MTPs.

Enabling them to make more regular contacts with farmers is important but still not enough for improving the effectiveness of extension staff in technology transfer. It is also necessary that they take on a more vital, active role. One way in which the SG 2000 Projects accomplish this end is to give extension staff the responsibility for supplying farmers with the inputs needed to grow MTPs and for collecting payment after harvest.

This feature of our approach has proved to be controversial and is often misunderstood. Its purpose is not to make the extension service into a commercial input distributor or production credit agency, but to fulfill two important conditions for effective technology demonstration. The first is that cooperating farmers have ready access to key components of the recommended technology package. In the delivery of these items, timing is critical. Late arrival of fertilizer, for example, forces farmers to apply it after the recommended date and thus to forgo much of the potential benefit. In the absence of effect systems of input supply, the most logical candidates for ensuring timely delivery-though only for the purpose of technology testing and demonstrationare extension staff.

The second condition has to do with the relationship between them and farmers. When extension officers have to collect payment for MTP inputs (and thus assume some of the risk associated with the new technology), they tend to take a much more direct interest in ensuring that farmers follow the recommendations closely. For unless farmers apply the improved practices correctly and achieve the predicted yield gains, it is unlikely that they will be able repay the MTP input loan.

PRACTICAL TRAINING

The efforts of the SG 2000 Projects to mobilize extension and convince farmers through realistic technology testing would stand little chance of success without practical training for both these groups, based on the principle of learning by doing.

During a given cropping season, training for extension workers is provided in six or seven one- or two-day sessions. The first is held before sowing and deals with MTP planning issues. Four more sessions take place during the cropping cycle and focus on technical matters related to crop production and harvesting. The final session is concerned with data analysis. Though some of the training consists of classroom instruction, most of it occurs in the field, where extension officers apply the same practices they are recommending to farmers.

Training for participating farmers is provided by extension officers in four or five field sessions, beginning with planting and ending with harvesting. These sessions are held in the field at different MTPs grown in a particular village. The importance of training farmers cannot be overemphasized. Though many of them may be generally aware of improved seed, fertilizer, and so forth, they often lack the more detailed knowledge required to take full advantage of these inputs. Fertilizer, for example, is of little use to farmers if they are unfamiliar with the appropriate timing, dosage, and method of application. Likewise, they will derive few benefits from the combination of improved varieties with fertilizer use, if they neglect to plant more densely and to weed early.

Together with timely delivery of inputs, practical training in their application is a key factor determining whether farmers will adopt or reject new technology. In combination with greater mobility and a more active role, training is similarly important for converting extension staff into agents of technological change. To grasp the significance of this change, one need only consider the current state of most national extension services.

By and large, their problems have less to do with quantity than with the quality of service. Most ministries of agriculture in sub-Saharan Africa have a considerable number of extension workers on the payroll. But the academic credentials of these staff are generally inferior to those of workers in research institutions. In no country of sub-Saharan Africa, do all extension field staff have at least a good secondary school education plus two-year diploma training. The quality of service they provide is further diminished by a lack of transportation for visiting farmers regularly, inadequate budgets for field programs, and limited practical knowledge about recommended technologies.

INCREASING THE MOMENTUM

The MTP approach is highly flexible in terms of the geographical area that can be covered and the number of farmers included. Ordinarily, the program operates for three years in a given village before moving on to other locations or at least shifting the focus to a different crop technology. If the program fails to maintain this pace of change, it runs the risk of stagnating or getting co-opted by a few privileged farmers. When that happens, the MTP program abandons its educational function and becomes an easy credit scheme for input acquisition.

In a given village, about 10 farmers take part during the first year. Assuming that this initial experience is successful-in terms of crop yields and repayment of input loans-another 20-30 farmers may join the program in the second year, giving the village a total of 30-40 MTPs. Each cooperating farmer is asked to get at least 10 neighbors to participate in the training sessions and in field days. Though the associated farmers do not necessarily learn by doing, the experience of observing someone else's plot may compel them to seek more direct participation in the MTP program and to begin applying some or all elements of the improved technology on their own. After a maximum of two seasons, farmers growing an MTP for a

particular crop are "graduated" from the program and must then secure inputs and credit on their own, though, of course, they may continue to receive less direct technical support from extension staff.

In most of the SG 2000 Projects, the formation of associations among cooperating farmers is one condition for increasing

Group action can help farmers ease the transition from testing technology with the assistance of extension staff to applying it routinely with no outside support.

the number of MTPs in a village. The main advantages of these groups are that they enable the extension worker to train a larger number of farmers and facilitate input delivery, collection of payments, and data gathering. A further advantage is that, once the MTP program has come to a close at a particular location, the association can provide a mechanism for collective action, such as renting a truck for bringing inputs from the nearest town or taking the group's output to market. Clearly, these tasks are easier for 10 or 20 people to organize than just 1. If group action does prove to be an effective way of obtaining inputs, then it can help farmers ease the transition from testing technology with the assistance of extension staff to applying it routinely with no outside support.

In addition to working with individual farmers and groups, the SG 2000 Projects have sought to include primary schools in the MTP program. In this case training is given to teachers, who in turn supervise the students in growing demonstration plots on the school grounds. The ultimate purpose of shifting the MTP program from one village to another and increasing the number of cooperating farmers from year to year is to create support at the grass roots level for agricultural modernization. The formation of farmer associations is also intended to contribute to the momentum of technological change. Our hope is that, by first building demand for improved technology among farmers, research and extension organizations will then have a stronger basis for persuading government leaders, development agency officials, and private entrepreneurs to invest in the development of more effective systems for supplying inputs and for storing and marketing surplus production.

PROGRAM MANAGEMENT

Though an MTP program can readily be accomodated in the administrative structure of national extension services, several adjustments are required in order for it to function effectively. One is the establishment of a national coordinating body to set priorities with respect to target crops and geographical areas. Responsibility for managing project operations, however, can be handled largely by the regional and district managers who supervise frontline extension staff. They can also supervise the collection of data required for program management.

Since an MTP programs calls for larger operational budgets (to cover the costs of inputs, travel, etc.) and increased capital investment (in vehicles, field equipment, and so forth), suitable management information systems are needed to ensure that these funds are properly used and that program activities are carried out. For this purpose data must be compiled on selection of participating farmers, distribution of inputs, MTP yields, and input loan recovery. With a proper system of financial control and good recovery of past MTP loans, the cost of supplying inputs to participating farmers need not be a large recurring cost. The SG 2000 Projects have established revolving funds in which to deposit the recovered funds. Assuming that the number of MTPs per frontline extension worker is kept at reasonable levels (5-10 during the first year in a particular village and a maximum of 10-20 during the second and third years), input loan recovery rates can be above 90%. At higher numbers of demonstrations per extension worker, the quality of training and supervision and the percentage of loans recovered begin to decline markedly. To handle a reasonable number of MTPs, each frontline extension officer needs access to an initial revolving fund of US\$500-750 for supplies and materials; about 10% of that amount must be added to the fund after each cropping season.

IMPROVED POSTHARVEST TECHNOLOGY

While focusing mainly on improved technology for crop production, the SG 2000 Projects are applying much the same principles and practices outlined above to the transfer of improved postharvest technology for small-scale farmers. We view this work as a vital means of enabling farmers to benefit more from improved production technology by marketing surplus grain more advantageously.

Because of limitations in current marketing and storage systems, grain prices fluctuate wildly in the course of the year. It is not uncommon for wholesale and retail maize prices to be four or five times higher during the last months before harvest than in the months immediately afterwards. Moreover, inadequate drying methods and storage structures can lead to significant grain losses caused by fungi, insects, and rodents. If farmers are to have a sufficient incentive to increase productivity, they must be provided with the means of storing safely larger quantities of grain on the farm for consumption and for sale during periods when prices are favorable.

In cooperation with ministries of agriculture, the SG 2000 Projects are developing extension programs to transfer improved practices for postharvest grain handling and for constructing low-cost storage structures. Wide dissemination of this technology complements efforts to promote the adoption of improved methods for crop production and is therefore an essential requirement for modernizing smallholder agriculture.

IMPACT OF THE SG 2000 PROJECTS

In view of the limited size of their budgets and staff, the SG 2000 Projects have had a remarkable impact on the orientation of technology transfer and on food production in their host countries. What mainly accounts for this is the catalytic effect of the projects on national extension services, which have supplied virtually all of the human resources needed to operate the MTP programs and in many cases a considerable proportion of the necessary funds.

Overall, participating farmers have increased average grain yields of maize and sorghum by about 2.5 times. In spite of the difficulties faced by "graduated" farmers in obtaining inputs and marketing surplus grain production, the impact of the MTP programs on national production is becoming evident. In Ghana, for example, national maize production has increased by about 40% (from 550,000 per year to 760,000 t), and average yields have risen by about 20%. In Sudan national wheat production has expanded by 400% (from 160,000 to 830,000 t), and average yields have risen by about 50%. Important institutional benefits have accrued as well. Extension officers involved with the SG 2000 Projects have shown a new enthusiasm and are working more closely with small-scale farmers. Through their emphasis on group action, the MTP programs have contributed to the development of farmers associations in most countries where the projects operate. They have also helped focus the attention of government leaders and development agency officials on the need to invest more heavily in agricultural development.

The SG 2000 Projects have made mistakes in management. The most notable of these was the rapid expansion of the field program in Ghana, which grew from 17,000 demonstration plots in 1988 to nearly 80,000 in 1989. The expanded program was too large for extension managers and frontline staff to handle. Being overburdened with input distribution and loan recovery, the latter became much less effective in performing their training function. The result was a decline in the quality of the demonstrations (manifested by lower yields) and a precipitous drop in loan recovery. Clearly, safeguards are needed to keep the MTP program from being turned into a commercial production campaign.

OTHER OPTIONS IN TECHNOLOGY AND ITS TRANSFER

Given the reasonably good performance of the SG 2000 Projects so far, what is there to prevent the MTP approach from being applied in additional countries and on a larger scale? Two possible objections to such a step are that: 1) the type of technology being promoted in the MTPs is not what African farmers really need and 2) perfectly adequate approaches to strengthening extension and transferring technology are already in place.

WHAT IS APPROPRIATE TECHNOLOGY?

A common assumption among agricultural researchers and development specialists is that the first step toward improving small-scale food production in the tropics is to introduce so-called lowinput technologies. Examples are mulch farming, ley farming (i.e., growing food crops in lightly grazed pastures under a no-tillage system, as is done in Australia), and alley cropping (in which food crops are planted in "alleys" formed by rows of leguminous woody species). Over time, the argument goes, resource-poor farmers will reach the point at which they can adopt more advanced technologies, involving the use of purchased inputs (such as chemical fertilizers), mechanization, and so forth.

Considering the still rudimentary state of input delivery systems, particularly in Africa, the low-input approach has some appeal, particularly for addressing problems in the maintenance of soil fertility. Nonetheless, it also has serious drawbacks. An important one is that lowinput technologies often turn out to be knowledge-intensive, requiring that farmers possess more than the ordinary skills in crop management.

A more realistic sequence of events is to start by introducing technology based on improved seed and fertilizer, which is much easier to demonstrate and diffuse among smallholders. This view is supported by the experience of the SG 2000 Projects with tens of thousands of farmers in sub-Saharan Africa. Once growers have gained experience with the new technology (i.e., reached the post-Green Revolution stage), they may then be likely to adopt more knowledge-intensive practices, largely as means of lowering their production costs. In sub-Saharan Africa, a further prerequisite is that levels of literacy be raised in rural communities. Until this happens few of the environmentally friendly technologies now avai'able—such as integrated pest management and greater use of crop rotations, organic manures, and crop residues—are likely to spread very far beyond the research station.

Though often referred to as "high-input" technologies, improved varieties, in combination with chemical fertilizers and improved cultural practices, are more appropriately termed "input-efficient" technologies. The point is that, at given locations to which they are adapted, modern varieties do not generally need fertilizer to perform at least as well as traditional landraces; if it is available, though, the improved cultivars employ fertilizer far more efficiently in grain production. Contrary to a common perception, modern varieties also possess higher levels of genetic resistance to important diseases and insects as well as greater tolerance to abiotic stresses, such as drought. In spite of these advantages, commercial seed of improved varieties is still not widely available to small-scale farmers in sub-Saharan Africa outside the handful of countries that have developed effective seed industries.

A frequent criticism of the use of inorganic fertilizer is that it poses a serious environmental hazard. This is arguably the case in areas of North America and Europe, where agrochemicals are used at extremely high rates. But in sub-Saharan Africa, the use of inorganic fertilizers is unlikely to reach dangerous levels, especially if farmers are trained to use these materials properly and in the moderate amounts promoted by the SG 2000 Projects. In fact, chemical fertilizers should help reduce soil erosion by increasing plant biomass and vegetative ground cover. Assuming that crop residues are returned to the soil, this input can also contribute indirectly to improving the organic matter content of the soil.

A COMPARISON OF THE SG 2000 AND T & V APPROACHES

A second objection to wider establishment of MTP programs is that this might overlap unnecessarily with the efforts of the World Bank to promote its training and visit (T & V) system, various forms of which are currently being applied in 37 African countries. Though there are important differences between this model and the approach employed by the SG 2000 Projects, the two are not inherently incompatible.

Among the strong points of the T & V model is its well-developed administrative framework for national, regional, and local extension personnel. Another is its heavy emphasis on continuous on-the-job training for frontline staff, who are charged with delivering technical messages to farmers. Each of these extension workers receives fortnightly training from subject matter specialists (who serve to link research with extension) in various aspects of crop production. Extension staff are then supposed to pass this knowledge on to groups of "contact farmers" through a program of regular visits. These farmers are expected to grow Small Plot Adoption Trials (SPATs), in which they demonstrate the recommended practices to their neighbors.

The differences between this approach and that followed by the SG 2000 Projects have much to do with the form and manner in which technology is transferred to farmers. With the T & V approach, each frontline extension officer delivers specific messages (or technical advice) to at least 80 contact farmers through regular visits in the course of the cropping cycle. The SG 2000 Projects, in contrast, offer farmers something more concrete by providing them with the inputs and training they need to apply new technology on a commercial scale. The demonstration plots employed with the T & V approach are too small to provide a realistic test of the improved practices. The SPATs generally occupy only 50 to 100 m², compared to 2,500 to 5,000 m² for MTPs. In such small plots, even if high yields are obtained, the

The demonstration plots employed with the T & V approach are too small to provide a realistic test of the improved practices.

outcome can easily be attributed to natural variations in the soil fertility and waterretention capacity of the soil. In other words, from the results of the SPAT, farmers cannot easily extrapolate the yield benefit they would obtain by applying the recommendations on a larger scale. Nor can they get a realistic sense of the work involved in applying the improved technology. A related difficulty is that farmers growing SPATs are not necessarily able to apply the full package of recommended practices. Rarely are extension officers in a position to supply them with the recommended dose of fertilizer or with sufficient quantities of improved seed.

Another problem with the message-based approach of the T & V system stems from the limited formal training of extension staff in the agricultural sciences. Even those with higher than average levels of theoretical knowledge usually lack practical experience in crop production. This seriously undermines their credibility with farmers as sources of reliable technical information. The training provided by subject matter specialists is supposed to take care of this problem, but all too often the specialists also lack practical experience with the recommended technology. The type of in-service training that extension staff receive in the SG 2000 Projects is scheduled somewhat differently from that offered in the T & V system. In the former, as mentioned previously, six to seven training sessions are held at key stages in the cropping cycle, whereas in the latter it is recommended that training be provided fortnightly. In several countries it has proved necessary to modify this practice, mainly because it is costly to get extension workers together so often and because there is not enough information to discuss every two weeks.

When asked to compare the SG 2000 and T & V demonstrations, farmers who have experience with both regularly rate the MTPs as superior for three reasons. One is that extension officers enable participating farmers to obtain the recommended inputs—mainly seed and fertilizer—on time. The second is that the inputs are supplied as a loan. And the third is that farmers appreciate the interest extension workers show in the progress of the MTP. As mentioned previously, they do so partly because they are responsible for recovering payment for the inputs after harvest.

Extension workers also note that the MTP approach provides them with clear advantages. One is that the hands-on, practical training they receive in the recommended technology gives them greater confidence in their ability to teach its fundamentals to farmers. Another is that, by guaranteeing access to inputs, extension officers are able to establish a sort of partnership with the cooperating farmer, in which they have greater credibility as a source of technical innovations. In contrast, many frontline staff refer to T & V as the "talk and vanish" system, underscoring its lack of a firm basis for strong relationships between extension staff and farmers.

Proponents of the T & V system argue that, on the contrary, giving extension officers responsibility for input supply jeopardizes their relationships with farmers. They suggest that delivering inputs and collecting payment is not consistent with the extension officer's role as "the farmer's friend." The best means of maintaining this relationship, they believe, is to limit extension's function to the delivery of information.

As explained previously, extension officers involved in the SG 2000 Projects supply inputs on a loan basis only to farmers taking part in the MTP program, only for limited periods to each cooperator, and only as a means of training them in the use of new technology. Moreover, they are given this responsibility only because it enables them to play a more active role in helping bring about technical change. Obviously, this addition to their normal duties would be unnecessary if systems of input supply and other pregrequisites for the modernization of agriculture were well developed in sub-Saharan Africa. But since they are not, we believe that extension officers must assume somewhat broader responsibilities if small-scale food production in this region is to be transformed.

It will be difficult for them to do so as long as extension organizations are starved for funds, their workers are grossly underpaid, and government procedures for disbursement of funds inhibit the establishment of field demonstration programs of the type promoted by the SG 2000 Projects. We are convinced that, until governments and donor agencies have made further progress in eliminating the obstacles to wider establishment of such programs, the dissemination of improved technology for crop production in sub-Saharan Africa will remain limited.

BUILDING ORGANIZATIONAL BRIDGES

Though extension services must take the leadership in increasing the pace of technology transfer in agriculture, their success in this task will depend heavily on the contributions of other organizations. For that reason extension must make special efforts in building bridges to research and other institutions whose work is vital for improving food production.

RESEARCH INSTITUTIONS

Research and extension remain poorly integrated in many countries of sub-Saharan Africa. Often, the two are not even located within the same government ministry. Other barriers have to do with differences in levels of training and reward structures. Whatever the cause of their separation, the result is generally the same. In seeking to push forward the frontiers of scientific knowledge, researchers often lose sight of the most pressing concerns of farmers and cease to develop products that extension workers can promote successfully.

MTP programs provide a valuable opportunity to mend the rift. The extension service can contribute to this end in several ways. An obvious one is to invite researchers to participate in the training of extension staff. A second and even more important step is to use the sizable amount of information generated by the MTP program to provide researchers with feedback about the technologies they have developed. For this purpose researchers should be invited to accompany extension staff on their visits to farmers' plots. They should also be encouraged to conduct onfarm experiments in areas where the MTP program operates, with a view to developing new production recommendations or tailoring the current ones more closely to specific agroecological circumstances.

INPUT SUPPLIERS

Better linkages are also needed between the extension service and input suppliers. At present little effort is made to coordinate the work of extension in promoting new seed-fertilizer technology with the activities of organizations that are responsible for input supply. An additional handicap is the general lack of mechanisms for conveying information to and from the grass roots level concerning the sale of inputs and marketing of output.

Extension officers can play an important role in helping to develop input markets. First, by training farmers to make optimum use of improved seed and fertilizer, they can help stimulate demand for these products. Second, by developing management information systems of the sort described earlier, they can provide feedback to input suppliers and researchers, which should help them shape their products more closely to farmers' requirements. Third, because of their close contacts with growers, they can identify bottlenecks in the distribution of inputs and thus contribute to improving the delivery system.

POLICY MAKERS

The extent to which improved technologies are adopted and disseminated will be governed to a large extent by the condition of rural infrastructure and of marketing and input delivery mechanisms and by government policies on the price of farm inputs and produce. Through a dynamic field program of technology testing, the extension service has an excellent opportunity to give government officials first-hand evidence of the need to reexamine policies and resource allocations that impinge on the modernization of food production. It will be hard for these officials to deny the implications of a large-scale demonstration of the potential for dramatic improvement in national crop production and in the

welfare of small-scale farmers. Our hope is that government leaders will find it easier to encourage these developments than to ignore them.

CONCLUSION

In response to a plea for greater efforts to transform agriculture in sub-Saharan Africa, governments and donors may rightly respond that much has already been done, particularly by the public sector, and apparently to no avail. For the last three decades, a system of national and international institutions has been engaged in research and extension with the aim of modernizing small-scale agriculture. The relatively limited impact of this work in sub-Saharan Africa (compared to that in other regions) is the cumulative result of many factors, but the organizations involved must bear much of the blame.

One problem is that managers and decision makers have remained too aloof from program execution at the grass roots level. They simply have not spent enough time in the field, monitoring what is happening. In spite of much involvement with onfarm experimentation, research organizations have also been somewhat detached from the realities in farmers' fields, preferring to measure their achievements by the number of products developed rather than by adoption of these in the countryside. Likewise, in evaluating the agricultural development projects they have supported, donor organizations have too often been concerned more with determining whether the funds were disbursed according to the original plan than with measuring the impact of the work on agricultural development.

If future investments in research, extension, and related activities are to enjoy greater success, impact in farmers' fields must become the paramount criterion for judging the value of this work. And if the organizations concerned are to exert enough impact to justify the investment in them, they will have to concentrate more fully on simply giving farmers what they evidently want.

Based on the experience of the SG 2000 Projects, it seems clear that farmers want access to technologies that can reduce the drudgery of agriculture and dramatically improve crop productivity. However much they may respect traditional practice, agricultural scientists must resist the temptation to idealize it. They must not succumb to the illusion that Africa's food needs can be met through low-input systems that are based largely on traditional practice but require much more from farmers in terms of knowledge, skill, and labor. The necessary increases in food production can be achieved only through wider adoption of simple modern technologies that are already available or well advanced in the research pipeline. These consist by and large of improved varieties, inorganic fertilizer, crop protection chemicals, and animal and machine traction.

In addition to modern technology, farmers want the conditions that would allow them to enjoy its benefits more fully. These include better roads for transporting inputs and farm produce, fair prices for their output, and minimum standards of public health and education for their families.

Over the next decade, much greater and more effective investments must be made in agriculture, rural education, primary health care, and community development if we are to succeed in reversing the current trends in sub-Saharan Africa of declining per capita food production, worsening poverty, and rapid environmental degradation. International donor agencies have a tremendous influence on the course of development in every country of the region. But the bulk of the responsibility for improving human welfare must be borne by national governments. There are no substitutes for good governance and effective management.

MAKING AGRICULTURAL EXTENSION WORK IN AFRICA

Kevin Cleaver*

Agricultural extension—the transfer of agricultural techniques and knowledge to farmers—is undertaken in virtually every country of the world. But the organization of extension and its transfer mechanisms vary from one nation to another. The USA, for example, has both public and private agricultural extension systems that comple-

World Bank evaluations of its own efforts indicated that extension systems were poorly managed and that the technology being promoted was often irrelevant.

ment one another. While the public sector supports county extension agents, who provide farmers with various types of advice on agricultural technology, private suppliers of fertilizer, pesticides, and equipment offer highly specialized information on the use of their products. Farmers can also obtain advice from cooperative organizations as well as universities and research stations.

EXTENSION'S MIXED RECORD IN AFRICA

In sub-Saharan Africa, agricultural extension is largely confined to the public domain, being provided through ministries of agriculture or parastatals supervised by them. In general, this type of extension service is highly centralized, with a national director in the capital city, supervisors at the regional level, and field staff scattered throughout the country. Common criticisms of public sector extension systems in Africa are as follows:

- 1. Extension staff are poorly trained and know little more than the farmers do.
- They are also poorly paid and therefore have little motivation to share the knowledge they do possess.
- Since management systems are poor, there is little pressure on staff or their supervisors to seek new knowledge and transfer it to farmers.
- Farmers are treated as ignorant recipients of information rather than knowledgeable partners in technology transfer.
- Extension agents are not accountable to farmers.
- 6. In some cases vehicles and bicycles are so scarce that the few motivated and competent extension staff cannot visit farmers regularly.

The result of these defects is typically a large, inert bureaucracy, which has no impact on agriculture.

In the 1960s and 1970s, extension in Africa was financed by donors mostly through rural development and commodity projects, which had high failure rates. World Bank evaluations of its own efforts indicated that extension systems were poorly managed and that the technology being promoted was often irrelevant to farmers. Analysis by the World Bank of other donors' projects led to much the same conclusions. A common problem was poor

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training of extension agents. Moreover, the technical messages they communicated to farmers were often of an extremely general nature; though intended to be useful across diverse agroecological conditions, in fact they applied to only a few, if any. This shortcoming was made worse by competition between the various donor-inspired extension systems, often with each delivering contradictory messages. Cotton companies, for example, would focus only on this commodity, while rural development projects dealt just with food crops, often in the same places. For the most part, farmers wisely ignored the resulting "noise."

This unhappy experience has led to several schools of thought about what to do with agricultural extension in Africa. One group suggests that, if the technology is profitable, farmers will adopt it even without an extension service. The limited experience of successful technology transfer in this region does not support that view.

Hybrid maize varieties were taken up widely in Kenya and Zimbabwe as a result of strong extension efforts over a number of years. Though not all farmers in these countries have adopted the new maize (even in environments where it is both appropriate and profitable), extension agents convince more growers every year to accept the hybrids and to improve their crop husbandry. Recent surveys in Kenya and Burkina Faso (see the discussion below) indicate that extension has had a considerable impact on the adoption of improved technology. In Burkina Faso extension appears to deserve much of the credit for widespread dissemination of soil conservation technology. The survey in Kenya indicates that farmers greatly appreciate the excellent extension service of the Kenya Tea Development Agency (KTDA). The British-American Tobacco Company has established a private

extension system as the cornerstone of its program for supporting African farmers. In Cote d'Ivoire, The African Society of Rubber Plantations (SAPH) has placed extension at the core of its successful service to growers.

THE TRAINING AND VISIT SYSTEM

The challenge is to replicate these successful experiences more widely. In its own efforts to improve the efficiency of public sector extension in sub-Saharan Africa, the World Bank has employed the training and visit (T & V) system developed by Daniel Benor. The central aim of this approach, which the Bank is supporting in 37 countries of the region, is to ensure that well-trained agents, bearing suitable messages, visit farmers regularly. Toward this end heavy emphasis is placed on improved management and training of extension staff and on technology testing in farmers' fields with their participation.

A central task of the extension service is to assess farmers' technology needs and to communicate this information to researchers. They in turn seek ways of meeting evident demands based on existing research or, if necessary, new investigations. The outcomes are then disseminated through the extension service to farmers, who make the final decision as to what constitutes appropriate technology.

The farmers themselves are an important source of useful innovations. Extension agents observe the practice of particularly successful farmers and pass the lessons learned from this experience to other growers. When this system is working, much useful information is communicated from one farmer to another, making it unnecessary for extension agents to contact all farmers or even a majority of them. The main features of the T & V system are as follows:

- All staff of the extension service have access to regular training. Agricultural researchers (and other higher level specialists) are responsible for providing instruction (say every month) to university-trained subject matter specialists. These staff in turn conduct training for field agents (preferably every two weeks but at least once a month) on the recommendations they will communicate to farmers. In all cases the training is practical, with demonstrations in the field commonly being used as a teaching tool.
- A premium is placed on developing new extension messages and on channeling feedback (concerned with the impact of messages and problems requiring further research) from farmers to extension agents and through them to researchers. Extension messages are thus never regarded as fixed but may be modified through a process in which farmers' views and experience are critical.
- Extension agents communicate agricultural knowledge to the maximum number of farmers possible. They do so by working with contact groups (such as cooperatives, women's groups, school children, and extended families or clans), each of which is visited by an agent according to a regular schedule. All farmers belonging to the group are invited to take part in the visits. Demonstration plots in farmers' field (of a size decided by the farmers) are the major extension tool. If farmers do not accept the advice offered, this is taken as an indication either of the poverty of the message or the inadequacy of the trainers. In either case remedial action is taken.
- Extension managers must ensure that extension agents actually visit farmers.

They can do so only by making regular trips to farmers' fields to see for themselves what the extension agents are contributing. In this way they can identify and remedy any shortcomings.

- Public extension systems need to be national in scope. It is expensive and confusing for several public sector extension services to be operating simultaneously under various donor projects. To make public sector extension work throughout an entire country requires a concentrated, coordinated effort.
- Improvement of local capacity to manage extension receives high priority. Reliance on foreign management is not sustainable and prevents capable Africans from realizing their leadership potential. Preparing local staff from the start to manage national institutions is critical to the success of any effort aimed at enhancing the effectiveness of extension. French experts have criticized T & V as a top-down, government-managed approach, involving little or no community participation. Though this is a valid observation on the application of T & V in some countries, the system does not necessarily exclude community participation. There is no reason why well-organized communities should not be responsible for managing frontline extension staff. To do so effectively, however, they still need the support of subject matter specialists in communicating improved technology to farmers and in conveying their needs to agricultural researchers.
- Extension systems are designed, not in the context of the traditional five-year project, but with a long-term perspective.

THE IMPACT OF T & V

The T & V system has had a very positive impact in various countries of sub-Saharan Africa.

KENYA AND BURKINA FASO

Two notable examples are Kenya and Burkina Faso. In the former a national extension system was established (with World Bank financing and using the T & V approach) during 1982, and it currently operates across the country's entire agricultural area. The system in Burkina Faso was set up in 1986 with Bank support and is also now nationwide.

According to an impact study conducted by Evenson and Bindlish (1992), 48% of 676 randomly selected farmers in Kenva had received advice from extension at one time or another since the introduction of the national system. For most it was the first time they had received the advice. Of the households that had been in direct contact with extension, 45% were headed by females and 50% by males. In Burkina Faso 44% of the 3,556 farmers surveyed in an impact study conducted by Evenson et al. (1992) reported that they had been in direct contact with extension, and for 71% this had taken place since the new system was established.

A key assumption of the T & V system is that farmers who receive advice from extension directly will in effect become extension agents themselves, passing the information on to other farmers. The results of the above-mentioned impact studies, showing high rates of technology adoption, suggest that this assumption is a sound one. In Burkina Faso 70 to 80% of the farmers surveyed, and in Kenya 70%, had adopted the simple practices introduced by extension. These percentages are higher than the proportion of farmers who actually had direct contact with extension agents, evidently because these growers had conveyed the messages to their neighbors. and the second

Data from Burkina Faso show that farmers belonging to groups that are in contact with extension achieve crop yields 28% higher than those of farmers not involved. Results from Kenya indicate that crop yields can be as much as 50% lower in areas not served by extension agents than in those that do have this advantage.

In Kenya the annual cost of extension increased from \$4.44 per farm family before the national extension project was introduced in 1982-83 to an average of \$5.46 (in 1991 US dollars) during 1983-1991. The cost increase was mainly the result of an increase in the number of extension agents. In Burkina Faso, where their number was reduced, the annual cost of extension declined by 30% from \$10.40 per farm family in 1985-86 to \$7.24 in 1991. In Kenya the rates of return to increased investment in extension were found to exceed 100%. The returns to declining expenditures in Burkina Faso are infinite (which results when benefits are positive and costs are reduced).

COTE D'IVOIRE

A third case in which the T & V system has been quite successful is that of Cote d'Ivoire—the second African country in which the Bank introduced this approach in cooperation with the government. At the outset of the new venture, yields in farmers' fields were low, compared to those obtained at research stations (Table 1).

Table 1. The yield gap for various crops in Cote d'Ivoire, 1986

	Average yields (t/ha)		
	Farmers' fields	Research stations	
Coffee	0.4	3.0	
Cocoa	0.5	1.5	
Cotton	1.3	3.0	
Rainfed rice	1.5	4.0	
Maize	2.0	6.0	

Established in 1986, the extension project operated through three parastatal agencies: the Society for Technical Assistance in the Modernization of Agriculture in Cote d' Ivoire (SATMACI) in the forest region, the Ivorian Company for Crop Development (CIDT) in the cotton-growing northern region, and the Ivorian Company for Textiles Development (CIDV) for grains production in the southern part of the country. The project also collaborated with two Ivorian research institutes. A modified form of the T & V extension system was introduced, in which extension agents paid regular visits to contact farmers and groups, extension messages were designed on the basis of experience in farmers' fields, extension staff received continuous training, and field agents were closely supervised. Tens of thousands of demontration plots were established in farmers' fields. The messages delivered were related to the topics listed below:

- Cotton: control of weeds (including the parasitic weed Striga), soil fertility maintenance, application of inputs at optimal levels, and improved cropping patterns
- Coffee and cocoa: improved plant populations, cleaning, thinning, and pruning
- Food crops: better varieties and husbandry

These simple technological improvements were converted into practical messages, which varied according to the agroclimatic zone and level of farm management. By 1989-90 the new practices had been adopted on nearly 600,000 farms (60% of the total), compared to 20% adoption of similar messages before the T & V extension system was established. Measurements of the impact on yield, though imperfect, show improvements of about 15% for rainfed rice, 25% for irrigated rice, 15% for maize, and up to 100% for coffee. These increases are still short of yields obtained on research stations, indicating much scope for additional improvement.

Unfortunately, Cote d'Ivoire's economic problems have led to an extremely sharp decline in local funding for extension. Nonetheless, until quite recently, the government has been reluctant to reduce the size of its extension system, simplify the organizational structure, and reallocate funds from staff salaries to operations. As a result, extension operations have been greatly curtailed. The lesson of this experience is that the extension system must be of a realistic size that is tailored to the available budget. All too often, African governments are unwilling to settle for a more limited extension system that is in line with their financial and human resources.

IMPROVING T & V

The experience summarized above suggests that, when properly applied, T & V can have considerable impact. Even so, much remains to be done for improving this approach specifically and extension services generally.

FARMER PARTICIPATION

Much of the recent literature on agricultural extension argues convincingly that extension systems need to be even more responsive to farmers' needs than the government-managed schemes now supported by the Bank. Farmers need to be involved more actively in selecting and testing messages and in identifying the farm-level problems that should be addressed by research and extension (Venkatesan and Schwartz 1992). Often, the best way to achieve this end is by making farmer groups the major point of contact with extension. Groups are important in African societies and need to be brought into extension programs as partners in management. Increasingly, the

groups should be able to guide field-level extension activities with assistance from smaller numbers of better trained extension officers.

As farmers begin to participate more fully in extension, it will be important that agents offer them "menus" of options rather than preestablished, homogeneous packages. Recommendations on maize production, for example, should involve various alternatives (including simple, lowinput practices as well as more complex, high-input technologies) to meet a wide range of needs. At the same time, extension should deliver recommendations for various crops and address issues that are relevant to any crop, such as agroforestry, livestock-crop interactions, water control and drainage, and processing and storage. Efforts are already under way to develop technology menus. And though much work remains to be done, these are now available in all of the countries where the Bank is financing national extension programs.

Experience in Burkina Faso, Cote d' Ivoire, and Kenya indicates the weakness of the research from which extension messages are derived. Unless the quality of this work is improved, the development of more sophisticated menus of messages will not take place. In fact, most analyses suggest that improving research capacity should now receive higher priority than strengthening extension, though obviously both are much in need of further support. In some cases (specifically in Congo, Cote d'Ivoire, Guinea, and Togo), extension and research support have been combined under a single project. In general, the effect of this arrangement has been to focus research more sharply on farmers' needs. This orientation can be further reinforced through research conducted in farmers' fields with their participation.

MEETING THE INFORMATION NEEDS OF WOMEN

Increasingly, agricultural extension is being oriented to the needs of women, and female extension agents are acquiring greater importance. These trends are the result of a heightened awareness of the multiple roles that women play in rural societies and of the consequent heavy demands on their time. In addition to bearing and rearing children, most African women are closely involved in the production of food crops and in postharvest processing; they are also responsible for gathering fuelwood and providing water, for porterage of commodities, and for household maintenance. The burdens on rural women are increasing, as growing numbers of men leave the farm for urban and industrial jobs. In the Congo, for example, 70% of farm household heads are now women. Environmental degradation is further complicating their lives, forcing them to walk further to fetch fuelwood and water and in doing so to rely more heavily on their daughters for help.

Obviously, women have numerous information needs, which differ from those of men. And yet they have limited access to advice from extension and to other forms of support, such as institutional credit and improved technology for production, processing, and transport. In Botswana, for example, a 1984 study found that, although women contribute nearly 70% of the value of crop production, they benefit from less than 15% of national agricultural outlays (Cleaver and Schreiber 1992).

Women need advice centered on simple, low-input technology that deals with the production of food crops rather than export commodities and with food storage and processing. They could also benefit from labor-saving devices designed to help them with transport, pumping water, and crop husbandry. Agricultural extension is the most likely means for addressing the special needs of rural women (Saito and Weidman 1990).

PRIVATE SECTOR INVOLVEMENT AND OTHER IMPROVEMENTS

African governments should encourage the private sector to provide extension services wherever possible. Agribusinesses will usually be interested in supporting the production of high-value crops and will tend to concentrate on the most efficient growers. Since most crops and the majority of farmers (most of whom have

Another possibility for improvement lies in closer collaboration between extension systems managed by NGOs and the public sector.

very limited resources) are of less interest to the private sector, they will require support from public extension agencies for many years to come.

Contract farming is one arrangement under which private concerns commonly provide extension services. Many horticultural enterprises in Kenya offer advice to farmers, as do the British-American Tobacco Company and East African Industries in Kenya (for sunflower). Seed companies generally assist the farmers they contract to multiply seed, and some fertilizer and chemical distributors give advice on the use of their products.

By collaborating with private initiatives and by ceding certain functions to them, public sector extension services can free more of their resources for work with poor farmers and on commodities and technologies that the private sector generally neglects. Roots and tubers, many cereals, traditional fruits and vegetables that have limited local markets, and cattle and sheep in some countries are among the enterprises that are most likely to need support from the public sector extension service. It can also contribute usefully by transferring technology related to soil conservation, agroforestry, the use of nonpurchased inputs (e.g., manure and crop residues), and storage.

The effectiveness of extension can be enhanced through other innovations as well. Where extension services have become too expensive, for example, they may well profit from restructuring, as is happening in Benin and Cote d'Ivoire. Much additional work should be done to improve the quality of agricultural education and to use modern communications technology for reaching farmers. World Bank projects increasingly employ the mass media in support of extension activities. Another possibility for improvement lies in closer collaboration between extension systems managed by nongovernmental organizations (NGOs) and the public sector. In Zaire, where government services in the countryside have collapsed, the World Bank and government have agreed that extension should be managed by NGOs and private enterprises, to which the Bank provides support.

CONCLUSION

One criticism levelled at the World Bank is that it has made extension the centerpiece of its support for agriculture in Africa to the neglect of other aspects of agricultural development. The reality is quite different. The bank's first priority in agriculture is to help create an enabling policy environment in which farmers, marketing agents, input suppliers, and processors can invest and flourish. The Bank is also moving to expand proactive assistance to the private sector and cooperatives in agriculture. Other priorities include rehabilitation of agricultural research and education, development of rural infrastructure and social services, improved natural resource and forestry management, water development, and empowerment of farmers. Extension is one of many interventions supported by the World Bank in African agriculture.

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The T & V system has proved useful in many African nations as a bridge for moving from inert agricultural bureaucracies to useful public services. Though most of these countries still have some distance to go before arriving at truly efficient extension services, they have at least begun the journey.

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MACROECONOMIC POLICY AND AGRICULTURAL DEVELOPMENT

G. Edward Schuh*

A sound strategy for agricultural development has basically two policy components: one dealing with science and technology and the other with macroeconomics. The significance of a proper science and technology policy is that, by giving producers access to technical innovations, it creates the conditions under which agricultural output can be increased efficiently, the productivity of resources can be raised, and agriculture can contribute to general economic development in a broad way. Sound macroeconomic policy is significant, because it assures that producers have the proper incentives to use their resources efficiently and to adopt the new technology made available to them.

Since the two elements of a sound strategy for agricultural development are highly complementary, this paper deals with both of them, though it concentrates mainly on macroeconomic policy.

Over the past decade, there has been a growing recognition that macroeconomic policy is a key element of agricultural development. Previously, one could attend conferences such as this and never hear macroeconomic policies even mentioned. The development of agriculture was generally viewed as a matter of sectoral policy and thus primarily an issue for the minister of agriculture and his or her sectoral colleagues. Today that is no longer the case. We now know that both the minister of agriculture and the minister of finance are important in guiding agricultural development. Macroeconomic policy is important for a number of reasons. One is its close relationship with the domestic terms of trade. Though there is much complaining about the external terms of trade, we have learned over time that the domestic terms of trade are what really counts. Policy

Though there is much complaining about the external terms of trade, we have learned over time that the domestic terms of trade are what really counts.

makers prefer to complain about the former, because there is nothing they can do about them and they are thus relieved of responsibility. The domestic terms of trade, on the other hand, depend in large part on macroeconomic policy, over which policy makers do have control.

A key element determining the domestic terms of trade is a nation's exchange rate the value of its currency in foreign exchange markets. Arguably, this is its most important price, perhaps even more important than its interest rate. The exchange rate, especially in the short term, is determined largely by the monetary and fiscal policies the country pursues, together with its trade policies.

In this paper I focus on the nexus of interactions among monetary, fiscal, trade,

 Dean and Professor, Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis, USA. and exchange rate policies. In doing so, I link these issues of macroeconomic policy to the main elements of science and technology policy, first, by discussing the general equilibrium effects of a technology-based agricultural development policy and, second, by showing how a sound science and technology policy is perhaps the best and only defense against a decline in the external terms of trade. My remarks are primarily of a prescriptive nature; that is, I focus on what the goals of policy should be instead of describing what they actually have been.

A TECHNOLOGY-BASED Agricultural Development Policy

One of the tragic paradoxes of today's world is that we seem to have unlearned a lot of what we once knew. During the 1960s the development community went through a painful process of learning that agriculture must be an important component of general economic development policy. There was a surfeit of books at that time with the general title, "The Role of Agriculture in the Development of Country X."

Since then, however, agriculture has fallen from grace as the basis of sound economic development policy. The World Bank has de-emphasized it; the regional development banks are giving it less attention; and so are many of the bilateral development agencies. Perhaps more importantly, many national governments, including that of the USA, are also placing less emphasis on agriculture.

There seem to be a number of reasons for this increasing neglect. One is that we have not had a spike in commodity prices since the middle of the 1970s. Another is the common, but mistaken, belief that the world food problem has been solved. More important than either of these, however, is that many people seem to have forgotten just how agricultural development, if pursued in a sound way, contributes to economic growth. It does so largely through general equilibrium effects. For precisely that reason, the effects of agricultural development are diffuse in the economy and somewhat difficult to identify.

Consider briefly how this process works. Let us assume that policy makers decide to base their approach to agricultural development on investments in research aimed at producing new technology for the country's main domestic food commodity, specifically one that is not traded. These investments lead to a flow of new technology into that sector. At first the larger and more entrepreneurial producers tend to adopt this technology and to reap economic benefits by thus reducing their costs of production with no change in the price of the commodity.

As more and more producers adopt the new technology, however, output increases significantly, and the price of the commodity declines in real terms. That is the point at which the real benefits of developing agriculture-and of developing it through investments in researchcome to the fore. Members of the population who consume this commodity experience an increase in their real incomes, since they have to pay less for their food. Since everybody consumes food, the benefits of investments in agricultural research are widespread in the economy. (That is why the rate of return to public sector investments in agriculture are so high-on the order of 80-100% in perpetuity.) Moreover, the benefits are distributed in favor of the poor, since they tend to spend a larger share of their budget on food. What more desirable features of a development policy could one want?

Fortunately, the benefits do not stop there. As agricultural modernization proceeds, a flow of savings is generated among producers, and, if mobilized effectively, these funds can be used to finance additional investments. Moreover, as the per capita incomes of consumers rise, they increase their demand for goods and services from the nonfarm sector, thus inducing additional rounds of development.

Consider an alternative approach. Suppose that instead of supporting research on a domestic consumable, policy makers invest in new technology for a tradeable commodity—one that they are now importing or one that has export potential. In this case the price of the commodity will not decline as the new technology is disseminated, unless the country happens to be either a dominant exporter or importer of the commodity. Thus, it is unlikely that the investment in research will yield widely distributed benefits that favor the poor in particular.

Even so, the increased supplies of foreign exchange made available through such a policy will enable the country to finance a higher rate of economic growth. Thus, eventually the policy may give widespread benefits. Moreover, the important backward and forward linkages of certain exports (to input supply industries and to the processing and distribution sectors, respectively) also stimulate development on a broad basis. If the export or importcompeting sectors are modernized to such an extent as to prompt a significant increase in foreign exchange earnings or a significant reduction in food imports, the real value of the nation's currency may rise in foreign exchange markets. In that case the benefits of the new technology will be widely distributed in the economy.

To summarize then, the cases described above have a twofold message. First,

agriculture is an important part of a country's economic development policy, because the entire population is dependent on food. If agriculture is modernized through a strategy of investing in the development of new production technology for widely consumed food items and in its dissemination among producers, the benefits will be widely distributed in society and will favor the poor in particular. Second, the benefits of such a strategy will be realized largely in the form of general equilibrium effects, flowing from a decline in the real price of food.

DEALING WITH DECLINES IN THE EXTERNAL TERMS OF TRADE

Developing agriculture by investing in research can be an important means of dealing with declines in the external terms of trade. The most important consequence of this trend is not that it inherently makes a country worse off, as is so widely believed, but that it creates a balance of payments problem. A second and related difficulty is that it usually involves a decline in the real prices received by the producers of exportables.

The classic remedy for a decline in the external terms of trade is to devalue the nation's currency. When policy makers resort to this measure, the result is usually a loss in national welfare. But that is not the only alternative open to them.

In taking our bearings on this issue, it is useful to investigate what accounts for the decline in the external terms of trade in the first place. It tends to result from longterm or secular declines in the prices of agricultural commodities. Both trends are driven for the most part by technological changes in other parts of the world. Thus, they are the result of the general equilibrium effect discussed above. A decline in the external terms of trade becomes a problem for a particular country, usually because of its failure to keep pace with technological developments elsewhere. The solution to the problem, of course, is to invest in agricultural research. If this is done, producers will not suffer from the decline in the international price of the commodity, since their productivity will be increasing at the same pace as it is abroad. Similarly, the country will not suffer balance of payments problems, since it will be able to increase its exports sufficiently to offset the decline in international prices.

If by chance the rate of technological change domestically can be made to outpace that in other countries, domestic producers and the nation as a whole may be better off, even though the international price is declining. This is why the external terms of trade per se may be misleading as an indicator of the effects of developments in the external economy on the domestic economy.

There is an important corollary here for policy makers. One reason a country should have a vital capacity for agricultural research is so it can take advantage of new production technology being developed elsewhere. In its original form, most biological technology (improved varieties, for example) tends to be location-specific and thus cannot be transferred as easily as industrial technology. Nonetheless, it is often possible to make this technology available to domestic producers simply by adapting it to local ecological conditions. The ability to adapt technology in this way can be a cheap and efficient source of economic growth.

Suppose, however, that economic and ecological conditions are such that the technology generated abroad cannot be adapted to local conditions and thus that the level of technology in the country cannot keep pace with that in the international economy. To deal with this problem, the country can apply the same principle as that used to cope with a decline in the external terms of trade. The challenge is to develop alternative sources of export earnings or of import savings. Investments in agricultural research can be an important means of attaining that goal.

Domestic Terms of Trade, Macroeconomic Policy, and Incentives

Most developing countries have discriminated against agriculture by shifting their domestic terms of trade against it. A frican countries are no exception to this general rule, even though they have not pursued import-substituting industrialization with the same intensity as some Latin American countries.

Discrimination against agriculture generally involves grossly overvalued exchange rates (which are a tax on exports and a subsidy on imports), high levels of protection for the manufacturing sector, and the use of vent-for-surplus export models as a guide to trade policy. (According to this model, domestic markets must be satisfied before supplies can be made available for export.) The domestic terms of trade are thus shifted against agriculture by means of macroeconomic policy. In Africa the prevalence of marketing boards has contributed significantly to the same end.

When the domestic terms of trade are turned against agriculture, incentives to adopt new technology are weak. Particularly if improved varieties require modern inputs (such as fertilizers and pesticides) to be effective, it will be difficult for producers to adopt the new genotypes. The risk and uncertainty associated with such technology is usually high enough that incentives need to be relatively strong if producers are to adopt it.

A number of steps must be taken to shift the domestic terms of trade back to a level which is consistent with that prevailing in the international economy and is thus more favorable to agriculture. One is to establish a more realistic exchange rate.

Investments in agricultural research and in the means of extending knowledge generated from research are a key factor in remaining competitive.

The best way to achieve this end is through a flexible exchange rate policy. African policy makers generally view this step as controversial, because they fear the political consequences of a substantial decline in the value of their currency.

A number of points are pertinent to this issue. First, the best way to avoid such consequences is to have sound monetary and fiscal policies, a point to which I will return below. Second, if a country begins to pursue such policies as part of a reform of the exchange rate system, the decline in the real value of the nation's currency should for the most part be a one-time event. Third, a country will be able to maintain the strength of its currency over the long term only if it remains competitive in international markets. Investments in agricultural research and in the means of extending knowledge generated from that research are a key factor in remaining competitive.

Having a flexible exchange rate is important for a number of reasons. Above all, it is the most effective means of absorbing external shocks to the economy, which in today's world are almost inevitable. With a flexible exchange rate, the adjustments to an external shock start almost immediately. Moreover, they are spread widely throughout the economy (including both the export and import sides), thus lessening the adjustment imposed on any single sector.

Contrast that series of events with what happens with a fixed exchange rate policy. The domestic economy may be protected from external shocks for a time. But as the pressures build up, the devaluation eventually needed to reestablish equilibrium may be quite large, with correspondingly large shocks in individual sectors.

In practice there is really only one reason why policy makers might have reservations about a flexible exchange rate system. If the nation has a sound economic policy and thus begins to attract private investment or relatively large quantities of foreign aid, the inflows of capital might cause the real exchange rate to rise. This might create problems for the export or import-competing sectors.

Of course, this is a nice problem to have and should not be considered intractable. In the first place, it says a great deal about the general policies of the country, which in turn should make it easier to carry out the needed adjustments. Second, the benefits from a rise in the real value of a nation's currency tend to be widespread in the economy. If other policies are what they should be, the general effects will be positive.

In establishing a flexible exchange rate policy, the development of sound trade policy is imperative. An important consequence of creating barriers to trade is to cause the nation's currency to be overvalued. If a realistic exchange rate is the policy goal, a reduction in trade barriers is thus an essential ingredient in the policy package. Moreover, if these barriers are modest or minimal, the inflow of imports that accompany a revaluation of the currency should help limit the degree to which the value of the currency will rise. Minimal barriers to trade refer both to those which limit the access of domestic producers to external markets and those which limit the access of foreign producers to domestic markets.

Another requirement for establishing a sound macroeconomic policy is neutral monetary and fiscal policy. A neutral monetary policy is one which stabilizes the aggregate price level; a neutral fiscal policy is one which leads to a balanced budget over a period of, say, a moving three-year average. Under such policies the exchange rate will tend to stabilize. Realignments in exchange rates will be the result either of long-term trends in productivity, significant inflows or outflows of capital, or external monetary disturbances.

In most African countries, the key to pursuing neutral monetary and fiscal policies is to privatize parastatals and reduce government interventions in the economy. Having a sound and sustainable tax system is also important. Much of the money emitted by governments in Africa and other developing countries is for financing deficits incurred by parastatals. Privatizing these enterprises will permit governments to eliminate this source of printed money.

In summary, sound macroeconomic policy is the key to providing agricultural producers with proper incentives. Governments have discriminated against agriculture in the past by means of overvalued exchange rates and high levels of protection for the manufacturing sector. If sound macroeconomic policy is combined with socially optimal investments in agricultural research, the basis will have been laid for sound economic growth.

CONCLUSION

International trade has grown more rapidly than global GNP throughout the post-World War II period. One of the reasons is that significant technological breakthroughs in the transportation and communication sectors have greatly expanded the scope of markets. African countries have much to gain from participating in this international division of labor. In order to take part in and benefit from this process, they need to establish sound macroeconomic policies. In today's world these are imperative for any nation that wants to experience economic growth. Decades of experience in many countries demonstrate that other approaches simply do not work.

THE EFFECTS OF MACROECONOMIC Policy on Agriculture in Sub-Saharan Africa

Uma Lele and Kofi Adu-Nyako*

The importance of a stable macroeconomic environment for rapid and sustained economic growth is now undisputed. In African countries, agriculture is so central to the economy (in terms of employment, exports, investment, government revenues, and so forth) that agricultural and macroeconomic policies and performance are closely intertwined. Though no African country's experience is really typical of the rest, all those entering structural adjustment have seen severe appreciation of their exchange rates and encountered large budget and balance of payments deficits.

Their difficulties in external financing have been triggered by a combination of factors, such as shifts in the terms of trade and expansionary domestic policies (Figure 1). Most countries in the region are especially vulnerable to these factors because of their heavy dependence on a few export crops and minerals as well as

Most countries in the region are especially vulnerable because of their heavy dependence on a few export crops and minerals as well as foreign aid.

on foreign aid. Though the share of agricultural exports in GDP and total exports has declined in sub-Saharan Africa as a whole, this decline has been slower and year-to-year variability has been



Figure 1. Terms of trade index.

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greater than in Asia or Latin America (Figure 2). Dependence on foreign aid as a share of GDP and in government expenditures as well as exports is much greater in the small, open economies of Africa than in most of the larger Asian and Latin American countries.

The large receipts of foreign aid as a share of GDP have tended to result in a "Dutch disease" effect, as external aid has often contributed to growth in the nontraded goods sector. (Lele 1992a). When government spending encourages the growth of nontradeable goods (i.e., goods and services whose prices are determined by domestic supply and demand), it reduces tax revenues, as a result of the declining share of trade taxes and diminished real export earnings. This can lead to large budget deficits and appreciation in the exchange rate as the prices of nontradeables rise,

Most African countries have embarked on International Monetary Fund (IMF) stabilization programs and received structural adjustment loans from the World Bank for implementing policy and institutional reforms. Of course, macroeconomic reforms are critical to growth in agriculture, since they often involve changes in relative prices (through devaluation of exchange rates, adjustment of trade taxes, etc.) that favor exports. But they need to be accompanied by sectoral reforms (for example, in parastatals, which have absorbed a large share of the margins between producers and exporters) to ensure that macroprice adjustments are actually passed on to producers. Only an insignificant number of loans have been made for adjustment in the agricultural sector, and their disbursement has not been tied to meeting specific conditions in agriculture. Adjustment loans do contain a number of general conditions involving the removal of subsidies, improvement of budget management, reform of price policies, increased privatization, etc. But often, slow progress in structural adjustment has resulted in sectoral adjustment loans being approved simply as a means of making lower profile, fast disbursements.

THE IMPACT OF ADJUSTMENT ON GROWTH

Considerable evidence gathered since the beginning of the adjustment process suggests a positive relationship between adjustment and growth (Khan 1990; Corbo



Figure 2. Share of agriculture in GDP. Source: World Bank (1992b).

and Rojas 1992). Studies show that this is no less true for Africa than elsewhere (after controlling for losses in terms of trade and in external finance), though clearly adjustment has not been as successful in this region. The available evidence also suggests that adjustment has had a positive impact on African agriculture (Jaeger 1992; Faini 1992). These conclusions are supported by analysis of growth in the agricultural exports of 53 adjusting countries from 1970 to 1990, including 14 in Africa (Lele 1992a).

Though both price and nonprice factors have been significant in explaining the response of agriculture, price factors have been found to be more significant in middle-income countries (where the manufacturing sector is predominant) than in those more dependent on agriculture. By and large, markets work better in the former, whereas in countries at an earlier stage of development, in which agriculture is still predominant, market failures are common (Faini 1992). These findings concur with earlier studies on aggregate supply response, which showed that nonprice factors are more important than price factors in determining the long-run supply response, while price factors are more important in the short run. Moreover, the supply response of individual commodities tends to be greater than that of the agricultural sector as a whole, and the export crop sector typically shows a greater response than the food crop sector (Binswanger 1989).

If we consider both the food crop and export sectors, we get a less bright picture of the effects of adjustment on growth. At best per capita food production in 1989-90 seems to have maintained its 1984 level (World Bank 1992a). Cereal imports, which increased from 8 million tons in 1980 to 11 million in 1985, declined to 7.6 million tons in 1990. The large increase in food imports throughout much of Africa has been prompted by low international prices for cereals, overvalued exchange rates, and changes in consumer preferences resulting from rapid urbanization. This trend changed as a consequence of the ban imposed on imports by Nigeria (which imported 2 million tons of cereals annually at the height of its oil boom), combined with devaluations (see below), which increased the prices of imported cereals, and perhaps some supply response to adjustment in the food crop sector.

Whether reduced food imports have been accompanied by increased availability of domestic food supplies remains unclear. Though food statistics are notoriously unreliable, there is no evidence that production of traditional food crops has increased. Meanwhile, African countries seem to have become more dependent on food aid, which reached over 3 million tons in 1991-92. Even this level does not accurately reflect food import needs. According to the US Department of Agriculture (1991), the amount of food aid needed to maintain the 1986-1990 average nutritional level was 6 million tons and 11.4 million tons to satisfy calorie requirements. Because of logistical problems, those levels of food aid were not attained, suggesting that there must be considerable malnutrition in the region. The extent of this problem is well documented in various World Bank reports on food security in African countries.

Trends in food prices should offer additional clues as to the performance of the food crop sector. But no uniform pattern emerges in the movement of these prices overall in Africa. They tend to be determined by internal supply and demand forces, and food crop markets tend to be highly fragmented, a circumstance that has been made worse in recent years by the deterioration of already inadequate infrastructure, lack of market information, shortage of working capital for the private sector, etc. So severe are the infrastructural deficiencies in Africa that, according to World Bank estimates, nearly 14% of GDP is needed just to replace the existing infrastructure. Taking into account the limitations these conditions pose in obtaining price data, the World Bank's food security reports suggest that during the 1980s food prices may have shown a secular increase in West Africa (e.g., in Nigeria, Ghana, and Cameroon) and a decline in some East African countries. such as Tanzania (Lele 1992a). Severe drought in 1992 across much of southern Africa led to a substantial rise in maize prices, making it difficult to discern longterm trends.

Average annual growth in GDP for Africa is estimated to have increased from -2.7% during 1980-1985 to 2.0% in the period between 1986 and the most recent years for which data are available (World Bank 1992a). Per capita growth in GDP, however, remained negative. This is the context in which we must view the evolution of macroeconomic policy in Africa. Even though considerable progress has been made in the liberalization of markets and prices, savings and investment rates have declined (Figure 3). This is part of the general pattern that has emerged in developing countries since adjustment began (Khan 1990; Corbo et al. 1992), but the rate of decline in savings and investment seems to be more precipitous in Africa than in other regions (Lele 1992a). It is unlikely that the gains made from price adjustments can be consolidated without a substantial increase in investment, particularly in agriculture and the rural sector generally.

EXPERIENCE IN EXCHANGE RATE ADJUSTMENT

A central tenet of the adjustment programs in the 1980s was that the real exchange rate must be depreciated to restore international competitiveness. The record of exchange rate alignment in 24 countries of sub-Saharan Africa (including 7 CFA and 15 non-CFA countries) indicates that considerable real devaluation was achieved in most countries that adopted structural adjustment programs. As shown in Figure 4, following a real appreciation that peaked at about 110 in 1982, the





exchange rate index declined continuously and hovered at just over 60 in 1990.

However, the extent of real devaluation has varied across the region, with countries in the CFA zone generally lagging behind the rest. Their lack of progress in significantly depreciating their currency is attributable to the inability of individual member countries of the monetary union to adjust nominal exchange rates. In the face of budgetary deficits, they can achieve real devaluation only by reducing prices. Devarajan and Rodrick (1992) show that the higher inflation rate associated with exchange rate devaluation does not outweigh growth to such a large extent as to discourage the use of a flexible exchange rate regime to achieve adjustment in response to external shocks. The CFA countries have seen slower growth in their agricultural exports, because overvalued exchange rates have reduced their competitiveness.

Whether real depreciation translates into real incentives for agriculture depends on the extent to which the prices received by producers reflect the improved exchange rate regime. In some instances most of the gains were absorbed by marketing parastatals (e.g., in Tanzania and Malawi), thus aborting any linkage between the farmgate and the improved macroeconomic environment. To make matters worse, the prices of inputs have increased as a result of devaluations, and reductions in subsidies have imposed a considerable cost squeeze on farmers. Additional empirical research is needed at the farm level to determine the degree to which price adjustments have improved the profitability of farming.

THE PRICE OF FISCAL BALANCE

When the trade sector declines, the government comes under greater pressure to limit expenditures as a means of reducing its budget deficit and achieving internal balance. The tax structure in Africa has already undergone a marked shift away from export taxes to sales, excise, and import taxes. Nevertheless, in the face of declining export earnings (prompted by a decline in the international terms of trade), adjustment has depended primarily on reductions in expenditures,



Figure 4. Real effective exchange rate index. These figures are annual averages (1987=100). Source: World Bank (1992a).

even when export volumes have improved.

As shown in Figure 5, budget deficits in sub-Saharan Africa have been declining since 1982. For 24 countries the overall deficit dropped from an average of about 7.5% of GDP in 1981 to just over 2% in 1989, though there were significant differences among countries. Thus, whereas Ghana and Mauritius have exhibited a slight surplus since 1986, Zambia has experienced deficits of over 20% of GDP, which declined to 13% in 1988.

In the CFA countries, budget deficits were lower on average, though Cote d'Ivoire has recently incurred large deficits, averaging about 12% in 1990. Rates of public investment have dropped, since it has proved easier to cut capital expenditures than recurrent costs. The share of wages and salaries in total expenditures has remained particularly high in the CFA countries, where it averaged about 28%. The deficit in the current account balance averaged 16% of GDP in the early 1980s but declined in the latter part of the decade. The current account deficit has shown a declining trend in the 1980s. In most countries debt repayment has increased sharply as a share of government expenditures, with total debt repayment for the entire region increasing by nearly 45% from 1980 to 1990 (World Bank 1992a).

PRICE STABILIZATION MEASURES

In much of eastern and southern Africa, food procurement and distribution programs have had major fiscal or monetary effects (depending on whether such operations were financed by increased fiscal deficits or increased drafts on the commercial banks). Liberalization of the grain markets and reduction of subsidies on inputs, trucking, and agricultural processing and finance have been integral components of adjustment programs for reducing budget deficits and inflationary pressures. Several African countries have made considerable progress toward these



Figure 5. Overall government budget balance.

ends, though with varying degrees of success. Kenya, for instance, has moved more slowly to reform its maize board than has Tanzania.

Yet the fragmentation of goods, labor, and financial markets; the extreme deterioration of physical infrastructure and of national agricultural research systems; and the slow rate of growth in fertilizer consumption suggest that pricing and marketing reforms, though necessary, are not sufficient to increase per capita food production. Since population is growing rapidly and the agricultural sector remains stagnant, the incidence of poverty is rising. Even though much of this poverty is concentrated in rural areas, the safety nets (e.g., food subsidies) being designed as part of the adjustment effort are targeted more toward urban areas. The populations there are more vocal in politics and pose a greater problem for governments and their donors, which tend to focus on the needs of the urban areas as a means of ensuring the political stability required to carry out reforms.

DECLINING INVESTMENT IN AGRICULTURE

Government expenditures on agriculture, transportation, education, and health all influence the long-term response of agriculture to adjustment. This sector's share of total government expenditures (Figure 6) has generally held up in sub-Saharan Africa, though in Ghana (where adjustment has been pursued most successfully) it has fallen by 6% since 1983 and in Cameroon it dropped from 7.2% in 1987 to 3.3% in 1989.

These declines are partly the result of shifts in donor resources away from agriculture toward structural adjustment and other sectors. In World Bank lending, for example, the share allocated to agriculture dropped from more than 30% in 1980 to 25% by 1989 (Figure 7). The share of total expenditures going to the social sector maintained its historic levels in the 1980s, though on a per capita basis it has declined since 1982. Evaluations of adjustment lending in the region indicate



Figure 6. Share of agricultural expenditures in total goverment expenditures. Source: World Bank (1992).

that the gross rate of enrollment in primary school decreased from 70% in 1980 to 65% in 1988 (World Bank 1992a). Recent IMF studies support these findings (Heller and Diamond 1990).

The drop in donor assistance to agriculture in Africa can be attributed to overexpectations in the 1970s and a lack of country-by-country strategies for agricultural development, based on a realistic knowledge of the physical and economic potential of areas, crops, and activities. The resulting disillusionment with project lending, combined with macroeconomic difficulties in the region, gave rise to fastdisbursement lending.

The physical infrastructure (transportation, storage, and processing capacity) of many African countries has deteriorated significantly. Although considerable resources are being allocated to the rehabilitation of road networks, initial efforts have focused mainly on trunk roads. The inadequacy of feeder roads remains a serious problem.

Budget cuts have taken a heavy toll on agricultural research systems for export crops, which were already in decline prior to adjustment. The shortage of funds to cover recurrent costs and the tendency of managers to maintain employment while reducing real wages has placed severe limits on research and extension activities. Moreover, because of import compression and shortages of recurrent resources, critical needs for imported agricultural inputs are not being met.

As a result, growth in fertilizer consumption in Africa has been quite low, compared to rates in Asia and Latin America, reflecting a slower rate of intensification in food production. Budget and credit ceilings, devised as part of the stabilization and adjustment measures, are leading to a considerable credit crunch in rural areas, as documented in recent studies of the



Figure 7. World Bank commitments to Africa.

Sasakawa-Global 2000 Agricultural Projects in Ghana and Tanzania (Lele 1992b). One desirable development, though, is the shift in credit availability from government parastatals to the private sector. Even so, evaluations of adjustment programs have so far produced relatively little information about the impact of financial liberalization on access to financing needed for intensification of agriculture (Lele 1992c; Lele and Adu-Nyako, forthcoming).

An even more fundamental problem is that the technical expertise needed to develop agricultural strategies, together with the political support required to implement them, has waned, as the international donor community has shifted its attention to the environment, women, poverty, etc. Agricultural development must be at the center of any effort to address these concerns. More intensive use of favorable production environments relieves pressure on fragile lands, thus reducing environmental degradation, while at the same time creating employment and alleviating poverty (including that of women, who are the mainstay of African agriculture). To make more rapid progress toward these goals, African countries need to design and implement long-term strategies for economic development. Though the region has considerably greater expertise now than at the time of independence, this has not been employed adequately to address the complex challenges of adjustment and long-term, broad-based growth.

CONCLUSION

Clearly, if sub-Saharan Africa is to maintain the momentum created by adjustment lending, substantial increases in investment rates (in the context of sound strategies for economic growth) will be essential. The share of agricultural and rural development in total expenditures will need to increase. As is evident from experience in the 1970s, however, greater expenditures will not be productive unless they are accompanied by improvements in the quality of those expenditures and in the capacity of African countries to absorb and utilize them effectively. The region urgently requires further assistance in the development of trained personnel, institutions, and development strategies as well as in fostering entrepreneurship.

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FERTILIZER SUBSIDIES: BALANCING SHORT-TERM RESPONSES WITH LONG-TERM IMPERATIVES

Per Pinstrup-Andersen*

As is well known, fertilizer subsidies are widespread in sub-Saharan Africa and in most other regions as well (Table 1). These subsidies are of two types: implicit and

During the last few years, the implicit subsidies on fertilizer have been reduced significantly, as countries have adjusted their exchange rates.

explicit. The former result primarily from overvalued exchange rates, which have the effect of making imports, such as fertilizer, cheaper. During the last few years, the implicit subsidies on this input have been reduced significantly in sub-Saharan Africa, as countries have adjusted their exchange rates. Explicit subsidies are those which are paid for directly or indirectly from a country's fiscal resources. They, too, have come down since the mid-1980s, though to a lesser degree, I believe, than implicit subsidies.

The question I wish to pose is whether it makes sense to eliminate explicit subsidies. Much of the policy advice being given to countries in sub-Saharan Africa these days assumes that it does.

r - 0	Fertilizer	Subsidy rate (%) ^a	Year
Benin	All products	33 b	1987
Burkina Faso	15-20-15	30 b	1985-86
Cameroon	AS	43 °	1987
Cote d'Ivoire	TSP	0	1987
Gambia	15-15-15	16 °	1986
Ghana	20-20-20	40 c	1987
Guinea	17-17-17	0 b	1987
Madagascar	16-16-16	17 °	1985-86
Malawi	All products	22 °	1987
Niger	15-15-15	36 b	1987
Nigeria	Urea	40	1987
Rwanda	17-17-17	29 °	1985-86
Somalia	Urea	12 °	1985-86
Tanzania	All products	60 °	1988-89
Togo	NPK	65 ^b	1987
Zambia	Urea	42 °	1985-86

Table 1. Estimated fertilizer subsidy rates in selected countries of sub-Saharan Africa

Sources: Shepherd and Coster (1987); International Fertilizer Development Center (1987); Jabara (1990).
 ^a Comparisons of subsidy rates across countries should be made with caution, since these rates were not calculated on the same basis for each country.

^b Determined by government.

Estimated from in-country costs.

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A QUESTION OF RESOURCE. ALLOCATION

One can argue about whether the demand and price elasticity of fertilizer is high or low. But there is no doubt that, if the price of fertilizer increases, the demand for this input will decline. The size of the reduction will depend on a number of nonprice factors. Clearly, any country that allows fertilizer prices to increase must be prepared for a reduction in fertilizer consumption, which in turn implies a drop in agricultural production.

For any country in sub-Saharan Africa, this is certainly an undesirable outcome. But, on the other hand, most are burdened with large fiscal deficits (though these are generally somewhat smaller than they were a few years ago) and must therefore consider whether fertilizer subsidies really represent the best use of their limited resources.

DEALING WITH FERTILIZER COSTS

In dealing with this issue, it is important to bear in mind that fertilizer subsidies distort the pattern, not only of fertilizer use, but of crop production as well. That being the case, then why are they so common in sub-Saharan Africa? Part of the answer to this question is that the price of fertilizer for African farmers is very high. As indicated in Table 2, the ratio between the price of nitrogen and that of grain varies between 6 and 11 in various African countries, compared to only about 2 or 3 in Asia. The price African farmers pay for fertilizer, relative to the price they receive for their output, is thus much higher than in Asia.

THE HIGH PRICE OF FERTILIZER IMPORTS

The reasons for this are well known. First, the price of importing fertilizer tends to be at least twice as high in sub-Saharan Africa (though it varies by country) as in Asia (Table 3). What mainly accounts for this large difference is the small volume of fertilizer that most A frican countries import, which increases their transportation costs and weakens their bargaining position in negotiating for lower prices. As indicated in Table 4, almost half of the 40 countries analyzed imported less than 5,000 t of nutrients annually in the mid-1980s, with only one country importing more than 100,000 t.

One possible solution is regional cooperation in international fertilizer procurement, which would enable African countries to ship larger quantities and thus reduce their shipping costs, while at the same time strengthening their bargaining position. Another advantage of such an arrangement is that it would facilitate participation by the private sector in fertilizer distribution. At present the volume of fertilizer imported by each

Table 2. Ratio of farm-level prices of nitrogen fertilizer to maize grain prices in sub-Saharan Africa and other regions

	Price ratio
Africa	
Cameroon	7.3
Ghana	8.0
Kenya	5.0
Malawi	11.1
Tanzania	6.0
Zambia	2.8
Zimbabwe	7.2
Asia	
India	2.1
Pakistan	2.6
Philippines	2.9
Thailand	7.9
Latin America	
Brazil	6.0
Chile	4.4
Mexico	1.6

Sources: CIMMYT (1990); Byerlee, these proceedings; Lele et al. (1989).
country is insufficient to permit competition within the private sector. For various reasons, then, it would be advisable to incorporate international fertilizer procurement into the schemes currently being promoted for regional integration and trade.

THE HIGH COSTS OF FERTILIZER DISTRIBUTION

A second reason for high fertilizer prices in sub-Saharan Africa is the high cost of distributing this input—commonly twice that in most Asian countries (Table 5). This is the result of high transportation costs, which in turn are a consequence of insufficient physical infrastructure, among other factors. One is the small volume, which increases the cost of shipping fertilizer into the country (as mentioned above) but also within the country. Another is the inability of the public sector

Table 3. Costs of importing fertilizer in sub-Saharan Africa and Asia, 1985-86

	Product	Price (US\$, c.i.f.)
Africa		
Burkina Faso	15-20-15	318 ª
Ghana	AS	103
Madagascar	16-16-16	219
Rwanda	17-17-17	252 b
Sudan	Urea	138
Tanzania	Urea	240
Zambia	Urea	255 °
Asia		
Malaysia	Urea	128
Philippines	Urea	178
Sri Lanka	Urea	115
Thailand	Urea	170
World	Urea	136 d

Source: Shepherd and Coster (1987).

* Exfactory, Abidjan, Cote d'Ivoire. The cost at the border was \$345.

- ^b c.i.f. Mombassa. The cost at the border was \$425.
- ^c c.i.f. Dar-es-Salaam. The cost at the border was \$330.
- ^d f.o.b. northwestern Europe.

to operate fertilizer distribution systems efficiently and to foster competition within the private sector distribution network. High storage costs also increase the expense of fertilizer distribution.

A large part of the solution to this problem, of course, is to invest more in rural infrastructure, especially roads, and thus lower transportation costs. Another important step is to privatize fertilizer distribution but in such a way as to assure competition. Governments can contribute to this end by providing information and at least some of the necessary marketing facilities. Without competition the private sector fertilizer distribution system may be no more efficient than the public sector system it replaced, and monopoly profits are likely to contribute to higher marketing costs.

In both the macro and sectoral policy reforms implemented in Africa, Latin America, and a few Asian countries during the last seven or eight years, the liberalization and privatization of domestic markets have figured very importantly. In most cases, though, the implementation of this approach has been flawed. One reason for the general failure of efforts to liberalize and privatize markets is that not enough attention has been given to the role of

Table 4. Distribution of fertilizer imports, by size, in sub-Saharan Africa, 1984-1986

Size (000 t of nutrients)	Number of countries	Share of total imports (%)	
Less than 5	17	3	
10-20	6	5	
10-20	5	7	
20-50	6	19	
50-100	5	33	
More than 100	1	33	
Total	40	100	

Source: Bumb (1991).

government. On this issue one generally hears two opposing views—that the government either should or should not have total control—neither of which is particularly useful. What developing countries need is some kind of balance between the two extremes.

What they often have, however, is unpredictable government policies and unstable institutions. Under these circumstances, private entrepreneurs have been unwilling to invest in input distribution. Thus, the first challenge for governments is to find the appropriate policies and work toward greater stability in their institutions and policies. Only then will it be possible to make any head way in privatizing input distribution.

So far, efforts to accomplish this end have been hindered by mutual distrust between the public and private sectors. The public sector generally believes that fertilizer distribution, as well as the marketing of food, are too important to be left to the private sector. Because creating monopolies in these activities is perceived as being easy, governments often prefer to keep

			Costs (US\$/t)	
	Fertilizer	Distribution system	Internal transport	Total marketing
Africa	1.00	1.	and the second	
Burkina Faso	15-20-15	Public	41	77
Gambia	Urea	Public	11	117
Ghana	AS	Public	42	107
Madagascar	16-16-16	Public	56	124
Rwanda	17-17-17	Public	41	268
Somalia	Urea	Public	17	57
Sudan	Urea	Public	40	165
Tanzania	Urea	Public	124	246
Zaire	d	Public	44	107
Zambia	Lirea	Public	47	92
Zimbabwe	AN	Private	20	78
Acia				
China	All fort	Public	0	18
India	Liron	Public	22	56
Inula	Urea	Privato	10	53
Indonata	Ulea	Public	22	65
Indonesia	TCD	Public	35	46
Voron	1 SF	Public	12	52
Korea	01ea	Public	12	50
Malauria	21-1/-1/ Ulree	Public	12	37
Malaysia	Urea	Privato	10	46
Nepal	Ulrea	Dublic	10	27
	0 rea	Public		20
DLillestere	20-20-20	Public		20
Philippines	Urea	Private	7	74
0.17	14-14-14	Private	1	/5
Sri Lanka	Urea	Public	6	45
	MOP	Public	6	39
Thailand	Urea	Private	2	60
	20-20-20	Private	7	28

Table 5. Costs of fertilizer marketing and distribution in Africa and Asia

Source: Shepherd and Coster (1987).

them under tight control. The public sector's unwillingness to reduce its involvement with input distribution and food marketing naturally discourages the private sector from investing.

One policy that inhibits the privatization of fertilizer distribution is the practice of panterritorial pricing, which causes major distortions both in the distribution and use of this input. As I understand it, this policy is still followed in a number of countries in sub-Saharan Africa, even though its drawbacks have been well documented. A far better approach is to free up price formation and take steps to assure competition, so that prices will be set in accordance with competitive market forces.

Another problem that greatly complicates privatization is the tendency of governments to subsidize the distribution of some portion of the fertilizer allocated to certain regions. Since it is often not clear which regions are concerned and what quantity of fertilizer is involved, entrepreneurs trying to compete with the public sector in fertilizer distribution are at a decided disadvantage.

A related problem is the distribution by government of fertilizer imported as foreign aid. In the past this source has accounted for a large share of fertilizer imports in sub-Saharan Africa. Since this fertilizer can be made available at any price-from zero to the free-market price-its release into the market can do serious damage to any effort to privatize distribution. Aid projects, including the SG 2000 Projects, can contribute to this problem, if they make fertilizer available to participating farmers at subsidized rates. In doing so, they make it more difficult for entrepreneurs to compete in the same market. An important issue, then, is the role of the public sector-including the various projects it sponsors-in trying

to promote private sector involvement in fertilizer distribution.

Another common problem is that governments maintain control over fertilizer imports, while at the same time liberalizing or privatizing domestic distribution. This makes sense where the quantity imported is so low as to make competition in the private sector impossible. In that case there can be only one importer. The way to get around this difficulty, as I suggested earlier, is through regional cooperation.

The main drawback to an approach in which government controls imports and privatizes distribution is its unpredictability. Private distributors have no way of knowing whether the government will import enough fertilizer and whether it will arrive on time. Decisions about the quantity are part of the whole process of allocating foreign exchange. Because of the inherent uncertainty of this process, the amount imported may be too little and too late, making matters extremely difficult for the domestic private sector.

A number of other things have gone wrong in the implementation of market liberalization and privatization. Apart from the ones I have already mentioned, there are many other barriers to private sector participation and to competition in domestic markets. One is the tendency of governments to maintain large fertilizer stocks. The private sector often cannot predict when these will be released or what will be their price.

A further problem is governments' failure to coordinate input and output price changes. Usually, a large share of changes in the import price of fertilizer are transmitted quickly to the price paid by farmers, while price transmission for output is more likely to be incomplete and slow. Recent developments in Tanzania provide an example of the results. The government liberalized with respect to macroeconomic policy (devaluing the local currency and thus driving up the price of fertilizer), but the price of maize did not rise correspondingly. Farmers and private distributors of fertilizer were caught in the middle.

OTHER REASONS FOR FERTILIZER SUBSIDIES

The high cost of fertilizer in sub-Saharan Africa is perhaps the central reason for maintaining subsidies, but there are a number of others as well. One of their purposes is to compensate for low output prices. There is much debate about whether it is better to subsidize inputs or outputs. In seeking an answer to this question, governments should first specify their goals. Are they concerned with transferring income to resource poor farmers or to consumers or with producing more food? Having defined their goals, policy makers can then determine by means of a certain set of elasticities which approach to pursue.

Another common purpose of fertilizer subsidies is to make this input more readily available to small farmers and thus fulfill an equity goal. I doubt very much that subsidies are an efficient way of transferring resources to the rural poor. In fact, figures on actual fertilizer use show that, on the contrary, where this policy is applied, resources are transferred more to farmers that are well off than to the rural poor.

It is also frequently argued that subsidies on fertilizer and other modern inputs are needed to promote their adoption. This, too, would seem to be a weak argument. Why should farmers be given fertilizer at a lower price to compel them to adopt new varieties that are highly responsive to this input? As the response function changes, farmers will automatically and quite rationally demand more fertilizer.

One can make a case for subsidizing new inputs for a certain period, based on the argument that farmers do not yet have sufficient information to make decisions about these inputs. That being the case, the argument goes, the adoption of new varieties, fertilizer, and pesticides is too risky in the absence of at least temporary subsidies. My own travels in Africa suggest to me that farmers there already know quite a bit about fertilizer, though arguably they could be taught more about the finer details of its application.

Another argument in favor of subsidies has to do with credit. Its limited availability to small-scale farmers greatly reduces their opportunities for purchasing inputs. One way around this problem is to make fertilizer available to smallholders at low cost. I would argue, however, that this is only the third or fourth best solution. If farmers need credit that badly, then why not make credit programs work?

There are other arguments for subsidies (that they can help prevent declines in soil fertility, for example), but I have covered the main ones. Let me now briefly summarize the lessons we can draw from the literature and from experience with fertilizer subsidies.

A SUMMARY OF POLICY OPTIONS

In the absence of subsidies, African farmers pay very high prices for fertilizer. The unsubsidized price at which this input can be made available to them must be brought down.

Governments can take various steps to achieve this end (including investment in physical infrastructure to reduce transportation costs), but often there will be limits on how much they can do. For example, a landlocked country, such as Malawi, can do little to reduce the costs of transportation through neighboring countries, though obviously it should choose the least expensive route.

In the short term, there is a place for fertilizer subsidies to compensate for the various factors that result in very high

Though I have no doubt that liberalization and privatization are the right goals, I am not at all certain we know how to achieve them.

prices. Countries that take this route, however, may further complicate the already difficult matter of allocating scarce fiscal resources. In countries that have maintained large, explicit subsidies on fertilizer in the past, a common way of dealing with this problem is to reduce fertilizer imports-not so much to save foreign exchange as to reduce the amount paid in subsidies once the fertilizer is in the country. While thus balancing a policy of subsidizing fertilizer with the need for fiscal responsibility, these countries import less fertilizer than farmers will demand. The result is lower agricultural production and a distribution system that is not based on the market and is costly and inefficient. This approach also creates possibilities for rent-seeking and distortions of various kinds. My point here is that, in considering the possibility of short-term subsidies on fertilizer, policy makers must do so in the broader context of allocating fiscal resources.

Another issue is whether the limits on fertilizer use are related more to supply or

demand. I do not think we have general agreement on this issue, and the reason we do not is that, in such a large and diverse region as sub-Saharan Africa, the situation varies over time and among countries. The only way to deal with this issue is to examine specific cases within particular time frames. In most cases it will probably turn out that farmers' limited access to the right kind of fertilizer at the right time is just as important a constraint as the fertilizer price.

What policy options are open to government decision makers, then, as they try to make this input more readily available to farmers at a reasonable cost? The first is to pursue opportunities for regional cooperation in international fertilizer procurement. The second is to facilitate privatization and competition in fertilizer distribution. Though I have no doubt that liberalization and privatization are the right goals, I am not at all certain we know how to achieve them. Obviously, much more work needs to be done on the implementation of this second policy option.

Other important requirements are more predictable policies and more stable institutions. Two specific measures that need to be taken are the elimination of panterritorial pricing and increased investment in infrastructure. This latter measure is an expensive one but essential if we are to get at the fundamental causes of high fertilizer prices rather than just treating the symptoms. If rural infrastructure does not receive the attention it deserves, then 30 years from now those of us who can still attend a meeting like this will be here again, asking ourselves why greater investments were not made in rural roads, information, storage, credit facilities, research, and all of the other things that are essential for transforming African agriculture.

The big question is where to get the money for these investments. To a large extent this issue is the classical one of balancing short-term solutions with long-term goals. More specifically, how much of their current expenses on fertilizer subsidies can African countries divert to the longer term solution of investing in infrastructure? Obviously, there is no simple answer, and each country will have to deal with this question as best it can. Of course, the World Bank and aid agencies, such as the US Agency for International Development, could make matters somewhat easier for them by making more funds available for developing infrastructure and by extending the grace period for loans for this purpose.

Another issue that must be dealt with more effectively is that of credit, not only for producers, but for private marketing agents as well. The latter cannot be expected to to take over fertilizer marketing with no access to credit, storage facilities, and the other things they require in order to operate efficiently. In supporting private sector involvement, the government should help improve its access to credit.

In closing I will repeat that I am not opposed to fertilizer subsidies as a temporary measure to compensate for the factors that account for high prices. What I do question is the use of these subsidies as an alternative to longer term efforts to deal with the problems that keep prices high. The longer these problems go unresolved, the longer African countries will experience low productivity in agriculture and be saddled with the heavy financial burden of fertilizer subsidies.

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FOOD PRICE STABILIZATION: THE RELEVANCE OF THE ASIAN EXPERIENCE TO AFRICA

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The images of Africa played out in the American media portray a continent mired in poverty and famine, prone to drought and tribal warfare, and burdened with a colonial legacy of inept and even venal governments. The news from Africa is never good. By contrast, the Asian

Using markets to stimulate growth is not the same thing as governmental disengagement in favor of "free markets."

countries on the Pacific Rim are seen as so successful that they now challenge American economic interests. "Where Tigers Breed" was the banner headline across the front page of *The Economist's* Survey of Asia's Emerging Economies (16 November 1991). A contagion of rapid economic growth seems to be spreading from Japan through the arc of East Asia all the way to the far tip of Southeast Asia. Nearly all of the countries in this region have learned how to use markets to stimulate their economies, and nearly all are growing rapidly.

Using markets to stimulate growth is not the same thing as governmental disengagement in favor of "free markets," a concept so dear to the heart of neoclassical economists. From Japan to Indonesia, governments gave early priority to agriculture, especially to raising the productivity of rice farmers to ensure food security. Simultaneously, investments were made in improving the efficiency of domestic marketing systems, especially in rural areas, but governments continued to intervene to assure stable prices. International markets are used as the outlet for exports, especially labor-intensive manufactured goods, but in the early stages of industrialization the domestic market was reserved for local firms to learn how to manufacture high-quality products.

The contrast with governmental development strategies in Africa is sharp. Almost universally across the continent, agriculture and rural infrastructure have been undervalued; governments have attempted to displace markets rather than invest in improving their efficiency; the manufacturing sector has served mainly to substitute for imports; and competitiveness in world markets has been lost in sector after sector.

At one level it is easy to say that the African development paradigm has failed and the Asian model has succeeded. But it is a much more difficult task to say in what way the Asian model might actually be applied in specific African contexts. This paper proposes to narrow the question in a number of dimensions to make the task more manageable. In particular the paper focuses primarily on Southeast Asia, on agricultural development, and on the use of policies for stabilizing rice prices to provide food security at the national level. The focus on Southeast Asia

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deliberately juxtaposes the region along the Pacific Rim that faced the least-favorable prospects for development in the 1960s with the newly independent states of Africa, for which such high hopes existed at the same time.

Since 1960, the rice-based economies of Southeast Asia have outpaced the coarsegrain and root-crop-based economies of sub-Saharan Africa. Yet compared with Southeast Asia in the early 1960s, Africa had definite advantages. In 17 countries of the region, with a total population in 1960 of 144.2 million, income per capita averaged \$437 in 1989 US dollars. This income was one-sixth larger than in four countries of Southeast Asia in 1960—Indonesia, Thailand, the Philippines, and Malaysia which had an average income per capita of \$376 in 1989 US dollars. The population in these four countries totalled 157.5 million,¹

Although the populations of the two regions being compared are similar in size, their control over natural resources is not. Land area per capita, for example, is five times larger in the African sample than that in the four countries of Southeast Asia, despite the vast, thinly settled regions of Kalimantan, Sulawesi, and Irian Jaya in Indonesia. In the mid-1960s, many members of the development profession were pessimistic about the prospects for Southeast Asia. Mass poverty and famine seemed the most likely outcome for Indonesia, the largest country in this region.² History did not play out as expected. In spite of the advantages they possessed in the 1960s, African countries did not achieve rapid economic growth. By 1989, per capita income in the same 17 African countries had fallen to \$334, a drop of 24% from the 1960 level. During the same period, per capita income in the four Southeast Asian countries had risen to \$762, a gain of 103%. In 1992 many specialists in African development no longer remembered that the continent had indeed been richer than Southeast Asia just three decades before.³

What accounts for such divergent paths of development? This paper argues that at least part of Africa's failure and Southeast Asia's success can be attributed to differential treatment of agriculture. Two dimensions are important. First, because government policy makers maintained a macroeconomic environment that supported exports, Southeast Asia invested heavily in building a comparative advantage in a wide range of agricultural exports. The contrast with Africa is striking.

Much can be learned from Asia's experience of changing its long-term comparative advantage in export commodities through investments in research, training and market development over the past three decades. For example, Thailand, Pakistan and Vietnam are routinely selling rice throughout Africa by outcompeting African farmers even after international and internal transport charges

¹ The African countries used for this comparison, in increasing order of income per capita in 1976, are Mali, Burkina Faso, Chad, Malawi, Zaire, Niger, Tanzania, Madagascar, Kenya, Cameroon, Sudan, Nigeria, Senegal, Zambia, Zimbabwe, Ghana, and Cote d'Ivoire. These are all the countries in sub-Saharan Africa with 1960 populations of 3 million or more, with the exception of Ethiopia, Mozambique, and Uganda. Data for these three countries are not available for much of the period of comparison.

² See in particular the gloomy assessment by Gunnar Myrdal of Indonesia's prospects that appeared in Asian Drama in 1968.

³ This reminder of Africa's advantageous starting point was given at the Winrock Seminar on African Development, which was held on 27-29 May 1992 and sponsored by the US Agency of International Development. Of course, the point is much stronger if all of Asia is included rather than just Southeast Asia. In particular, South Asia, with its 1.1 billion inhabitants, was still poorer in 1990 than sub-Saharan Africa in the same year (World Bank 1992).

are taken into account. Moreover, Nigeria, Kenya and many other countries are importing palm oil from Malaysia to meet their growing demand for cooking oil. This is especially humbling to Nigeria because at independence in 1960, it was the world's leading producer and exporter of palm oil. Today, Malaysia's production of palm oil is about ten times larger than that of Nigeria. (Eicher 1992, p. 80)

Second, governments in Southeast Asia actively sought to provide food security to domestic consumers, both urban and rural. Their ability to do so had both economic and political roots. Because populations were large in relation to agricultural resources and because domestic rice consumption was large in relation to supplies available in world markets, countries in Southeast Asia were forced to develop successful rice intensification programs to ensure domestic food security.

This food security was implemented in the short run through policies that stabilized rice prices—the narrow topic of this paper. But these policies would have been impossible to sustain without rising productivity in the domestic rice economy. The broader argument of this paper—that food price stabilization is a crucial determinant of investment rates and subsequent economic growth—is also, in the context of Southeast Asia, an argument for substantial investment to raise productivity in the cultivation of food staples.

The multistaple food economies of Africa differ markedly from the irrigated rice economies of Southeast Asia. This paper sets out to identify the crucial linkages between stabilization of rice prices and the consequent stimulus to economic growth, and it asks whether similar linkages can be established in the agricultural environment of Africa. If the rice economy of Asia is sufficiently different from food systems of Africa, which are based on maize, millet, sorghum, cassava, and yams, substantial doubt will be cast on the relevance to Africa of the growth models that propel Southeast Asia. Unless new growth models can be discovered specifically for the African context—and in 30 years of trying, they have not been—such doubts are very troubling. We may be in the awkward position of knowing that agricultural development and stabilization of the domestic food economy are necessary for rapid economic growth but not knowing how to do it in Africa.

THE ANALYTICAL CASE FOR STABILIZING FOOD PRICES

Farmers, consumers, and governments agree that stable food prices are a good thing. Farmers want high and stable prices; consumers want low and stable prices; and governments often end up trying to do both and succeeding at neither. Failed efforts to stabilize food prices by controlling markets, displacing middlemen, and subsidizing consumers are almost certainly more harmful to economic development than no stabilization efforts at all. The empirical demonstration of this reality during the 1970s and 1980s was a major factor in the revival of interest in agricultural price policy with a greater market orientation.

Two schools of thought have dominated the debate over agricultural pricing. The neoclassical approach favors free trade with world markets to maximize the efficiency of resource allocation. Structural approaches have tended to ignore the efficiency dimensions of agricultural pricing in favor of the consequences for income distribution. Neither approach is fully relevant in the Asian context, where a single food commodity, rice, dominates the patterns of both production and consumption. Instead, an approach based on the macroeconomic, dynamic, and political consequences of price stabilization provides a more realistic basis for

evaluating the benefits of pricing interventions.

The stabilization approach is a challenge to the consensus among economists that the gains in welfare brought about through price stabilization, though identifiable theoretically, are not very important empirically, relative to the costs governments must incur in order to stabilize prices.⁴ Three innovations proposed during the late 1980s in the analysis of policies designed to stabilize food prices—two microeconomic and one macroeconomic make it possible to reach very different empirical conclusions.⁵

PRICE STABILIZATION AND FARMER BEHAVIOR

The first innovation is to consider the farmer as an investor rather than the manager of a static stock of assets and a flow of variable inputs. The model of "farmer as manager" is the basis of nearly all theoretical and empirical assessments of risks from price and yield instability. Clearly, this model excludes important elements in farmer decision making that are strongly influenced by these risks, especially expectations about future returns and patterns of investment in physical and human capital. Transforming the problem into one of portfolio analysis of dynamic investment decision making enormously complicates the analysis of risk, even when it is restricted to farm-level issues.⁶

Unforeseen instability in food prices is likely to cause reduced investment in both human and physical capital. At the farm level, price instability leads to lower investments than are optimal in production for the market, relative to production of subsistence crops, and to lower investment in productivity-enhancing soil amendments, irrigation and drainage facilities, land leveling, new technology, and in commodity-specific knowledge and skills. Farmers also invest in processing and marketing equipment-small mills, motorcycles, and trucks-that allow them to increase the value added of their sales through better quality or timeliness of delivery. Substantial instability in prices makes such investment riskier than is optimal for the society as a whole.

The displaced investments are likely to be reflected in lower savings rates from farm incomes, because rural credit markets usually do not offer efficient financial intermediation.⁷ There is also likely to be some displacement of work, and hence earned income, in favor of greater leisure. Both the added consumption from displaced savings and increased leisure

⁴ This is the key conclusion in Newbery and Stiglitz (1981), in Stiglitz (1987), and in Bigman et al. (1988). The latter authors, for example, in their discussion of Just's (1988) arguments for price-stabilization policies, make the following comment: "Attempts to quantify the net (efficiency) benefits of institutional attempts to reduce risk, like commodity price stabilization or quota policies, suggest that they are usually small and often negative" (p. 461), Similar conclusions are reached by Runge and Myers (1985) and Helms (1985).

⁵ The analytical approach discussed here was first outlined in Timmer (1989). Elements of the concern over adverse effects of price instability on the rural economy, however, have deep roots. Schultz (1945) contains an early analytical treatment of the inefficient allocation of farm investments in the face of price uncertainty. The first specific application was the "forward pricing" model of Johnson (1947).

⁶ See Morduch (1991) and Rosenzweig and Wolpin (1989).

⁷ It is important to note that rural savings rates must be "corrected" for the impact of large transitory incomes on patterns of permanent consumption. Savings rates appear to be higher where transitory incomes form a large share of total income, but these savings are for consumption smoothing, not productive long-term investments. See Morduch (1991) for an elegant demonstration of this effect in the case of India. There is also a macroeconomic equivalent due to instability in export earnings. Dawe (1992) has shown that greater instability leads to higher levels of aggregate savings but to a diminished "quality" of investment and hence to a lower rate of economic growth.

contribute to the welfare of the farm family, but the shift in allocation of time and resources because of price instability is not optimal for economic growth.

Investments by the private sector in marketing infrastructure are also dampened in the face of price instability, and there is a shift toward short-run investment in speculative ventures rather than in facilities with a longer term payout. The lack of investment in marketing, and its more speculative character, have a particularly negative impact on economic growth. Development of an efficient marketing system offers increasing returns because of lowered transaction costs and improved information. Many of these important benefits of investment in marketing systems cannot be captured by private investors, thus requiring that some investment in marketing be treated as a public good.

No farmers anywhere in the world have stock markets in which they can choose a portfolio of farm assets that can match their personal risk preferences. They are mostly stuck with the farms they have. Nor can yield or price risks be hedged in existing markets at reasonable costs. Asymmetric information makes crop insurance a very expensive option, one that is frequently nonexistent. Futures markets have very short time horizons; they are adequate perhaps for the short-run allocation of inputs but not for longer run investments decisions in which price uncertainty is a major impediment.8 Even in developed countries, few farmers use futures markets to offset their price risks. Stiglitz (1987) speculates that transaction costs might be too high; farmers might feel an informational disadvantage relative to large traders; and they might fear manipulation.

Lack of liquidity can also create risks when new market information causes prices to change more than trading limits permit. This lack of liquidity is an impediment to those farmers who do want to use futures markets; most do not or cannot.

Farmers everywhere talk about two kinds of risks-from the weather and from the market. The craft of farming, the skills passed from one generation to the next, is to a large extent the lore of coping with nature in the context of the soils and seeds at the disposal of the household. Coping with market fluctuations requires different skills and resources, and this ability to deal successfully with changing markets is often missing or underdeveloped in rural households. In addition, farmers perceive an important difference between weather and market risks. The former are unavoidable and not the responsibility of the state. Farmers must learn to cope with them to survive. But market risks have the appearance of human action. They are mediated by traders, can visibly be exacerbated or attenuated by government actions, and seem always to favor the well-off. Universally, farmers clamor for governments to relieve them of the risks from price instability so that they can concentrate on the real business of farming. Universally, governments respond to these pressures as soon as economic circumstances and political balances permit.9

PRICE STABILIZATION AND CONSUMER BEHAVIOR

The second microeconomic innovation is in modeling consumer behavior. It is clear empirically that consumers value price stability, because they are willing to pay higher prices for food, on average, in return for guaranteed reliability of supplies and

⁸ See Crawford (1988) for a model that demonstrates the downward bias in investment under such circumstances.

⁹ See Lindert (1991) for a historical review of agricultural pricing policies and a statistical test of the various political models that explain their evolution.

prices. And yet standard models of consumer surplus suggest that consumers might actually gain from price instability, although the result depends on the shape of the demand curve (Samuelson 1972).

At least two factors are missing in these standard models. First, the transaction costs involved in reallocating expenditures to find a new, optimal consumption bundle when price changes are not included in the analysis. This failure to include the transaction costs of budget reallocations holds even when full household production models are used that include time as a basic constraint on income.10 Because the poor typically have a lower wage and hence lower opportunity cost of time, these transaction costs are less of an impediment to reallocating expenditures than for the rich. Empirically, the poor would be expected to be much more price responsive than the rich in their food purchases, even controlling for the income effect of price changes.11

In addition, stable food prices may be psychologically satisfying, especially for urban consumers who must purchase all of their food from the market. The anxiety that comes from lack of confidence in the availability and cost of staple foods contributes directly to lowering consumers' welfare, irrespective of the quantities purchased and prices paid for the food itself. Of course, there is no market where consumers can "buy" food price stability and the confidence that comes with it. Only government intervention in the formation of food prices can provide such stability, which makes food price stability a classic example of a public good. The economic rationale for public goods and their provision by the public sector is well established and creates a direct argument for government intervention to stabilize food prices if the costs of intervention are not larger than the benefits.

The political and psychological dimensions of instability in urban food prices

Price policies that stabilize the market balance between food supply and demand contribute directly and substantially to improved social welfare.

should not be dismissed as "uneconomic." Fear of food shortages in urban areas evokes a universal and visceral reaction. Governments are held accountable for provisioning cities at reasonable costs, and citizens have repeatedly demonstrated their capacity to bring down governments that fail in this obligation.12 It is acute food shortages-not the average level of food prices-that induce antigovernment panics. Sharp increases in food prices are simply the reflection of these food shortages. Price policies that successfully avoid such episodes by stabilizing the market balance between food supply and demand contribute directly and substantially to improved social welfare. This higher level

¹⁰ The standard Becker-type models include time as a constraint on household activities (some of which are for wages, while others are nonwage activities carried out within the household), but the decisionmaking process itself has never been included as one of those activities.

¹¹ This factor alone could account for the overwhelming prevalence of "curvature" in the Slutsky matrix for basic foods. See Timmer (1981) for the basic argument and early evidence that the pure substitution effect of a change in food prices is systematically larger in absolute terms for the poor than for upper-income households. Alderman (1986) and Waterfield (1985) review more recent empirical work.

¹² See Kaplan (1984) for a fascinating historical account of the relationship between urban masses and their rulers with respect to provisioning of basic foodstuffs.

of social welfare is also reflected in a more stable political economy, with its attendant positive impact on investors' expectations. With appropriate policies on other issues, these positive expectations on the part of investors can be translated into faster economic growth.

THE MACROECONOMIC EFFECTS OF PRICE STABILIZATION

The third innovation in the stabilization approach is to include in the analysis the dynamic consequences for investment and the macroeconomy of unstable food prices. Tracing the macroeconomic ramifications of price instability is complicated. Generalequilibrium analysis is needed with dynamic investment functions, and these must be influenced by stability-sensitive expectations.13 Though difficult to do, incorporating these dynamic factors into both the micro- and macroanalyses offers the opportunity to examine the impact of price-stabilization policies on agricultural development and economic growth. The static, microbased models typically used to analyze price stabilization policies simply do not address these issues; they are incapable of assessing the consequences for the economy of widely implemented pricestabilization policies-consequences that policy makers actually worry about.

The benefits from stabilizing the prices of basic foodstuffs, or other agricultural commodities with significant macroeconomic linkages, are considerably larger than those reflected in the models that have been used so far to analyze relative costs and benefits of price-stabilization programs. Though little is known yet about the empirical size of the dynamic and macroeconomic benefits of stability, it is difficult to agree that they should be ignored in the evaluation of such programs. The pervasive, indeed universal, tendency of Asian governments to stabilize their domestic rice prices in relation to unstable world market prices for rice suggests that the benefits may be very large. The rapid economic growth in many of these countries argues that the impact of short-run efficiency losses and budgetary costs on growth cannot be too large, at least if the price-stabilization program is well designed and implemented.

In the African context, there are two important questions: 1) does the analytical support for policies that stabilize food prices hold only for rice economies? and 2) is the implementation of such policies inherently more difficult and expensive in multistaple food economies? If the benefits are smaller and the costs are larger in African food systems, stabilizing food prices might not be necessary or desirable. But if food prices are not stabilized, how can the investment climate be stabilized for farmers and urban industrialists? How can consumers be assured of food security? What would stimulate the dynamic linkages between agriculture and industry, which have been the basis of rapid economic growth in East and Southeast Asia?

AGRICULTURAL PRICING IN RICE-BASED ECONOMIES

Getting prices right seems so easy. The opportunity cost of a commodity is its value to a society, and the price should reflect this value. Few prices for food staples are actually set in this manner. Farmers argue that prices should cover their costs of production; consumers demand that prices should be within their purchasing power; and governments insist

¹⁸ The macroeconomic dimensions of price stability are stressed in Ravi Kanbur's review of the Newbery-Stiglitz book. See Kanbur (1984). The extreme difficulty of building dynamic investment factors into general-equilibrium models of agricultural pricing can be seen in de Janvry and Sadoulet (1987) and Dawe (1991).

that food prices are too important to leave to the impersonal forces of the market. In the face of such conflicting demands, the right price for food is not so obvious after all.

THE EFFICIENT PRICE

Central to any discussion of price policy for staple foods is the border price, the price for the commodity in international markets, with suitable adjustments made for transportation costs and quality to make the delivered commodity competitive with the domestic commodity under discussion.14 By assumption, if no policies are introduced to alter domestic prices, competition from the international market will force equality between the border price and the domestic price. With no price interventions, the nominal protection coefficient (NPC) should be approximately equal to one (allowing for small differences in quality and transportation costs).15

The border price paradigm used by neoclassical economists to analyze the efficiency of pricing policies argues that NPC = 1 is the optimum. Any deviation from this unitary value—whether NPC < 1 to favor consumers or NPC > 1 to protect farmers—incurs efficiency losses, because decisions about rice consumption and production do not reflect the opportunity cost of the commodity to society—that is, its value at the border as an export or an import.

Although this paradigm has a very clear logic and is used widely by major donor agencies as the basis of their policy advice (and as a condition for loans), there are significant problems with the paradigm when applied to basic food commodities in the highly unstable world in which actual policy must be implemented. The conclusion about efficiency is valid only in the perfectly competitive, static, partialequilibrium world in which the underlying assumptions hold. Experience in developing countries since the 1950s suggests that border prices are also important for enforcing dynamic efficiency and speeding economic growth, but this is an empirical lesson and does not come directly from the analytical logic of the border price paradigm itself. More important, the paradigm ignores the macroeconomic consequences of changes in prices. When the commodity in question is important to the macroeconomy, as rice is to nearly all countries in Asia, the paradigm requires, even on efficiency grounds, significant further analysis before policy conclusions can be accepted.

One additional macroeconomic proviso is important. Even if the domestic rice price equals the border price at the existing exchange rate, the actual incentives received by farmers and consumers are not necessarily unbiased. In the face of substantial industrial protection and an overvalued domestic currency, tradable commodities such as rice are severely discriminated against relative to industrial products and nontraded goods and services. A largescale study conducted by the World Bank during the 1980s found that agriculture typically faced discrimination of 30% or more from indirect macropricing and trade policies (Krueger et al. 1988). This indirect discrimination often outweighed policy efforts to provide incentives to the agricultural sector, as measured by the simple nominal protection coefficient for a specific commodity.

The significance of a relatively open exchange rate policy for the general health of the agricultural sector should be

¹⁴ This discussion of models of price formation is a very abbreviated summary of Timmer (1986).

¹⁵ Naturally, this border price paradigm is relevant only if the staple food is tradable in international markets.

stressed. It is highly unlikely that any of the countries in Southeast Asia could have maintained a high rate of growth, even with strong incentives through rice prices directly, if the domestic currency had been substantially overvalued for most of the period.¹⁶

Low PRICES/HIGH PRICES

If not border prices and free trade, then what? Most poor countries have tried to keep the price of the staple food cheap enough to maintain low wage rates and allow the poor increased access to food at market prices (Lipton 1977). The World Bank study by Krueger et al. (1988) found that this "cheap food" bias is stronger at earlier stages of economic development, and it weakens noticeably when the staple is imported.¹⁷ Nonetheless, the underlying macroeconomic bias keeps the statement true on average, even when direct policy no longer reflects an urban bias.

There are obvious reasons for trying to keep the price of a staple food as low as possible in a poor country. Two-sector development models focus on maintaining low real wages in order to generate industrial profits for reinvestment. These wages depend to a large extent on the real cost of the staple food, often called the "wage good" in these models (Lewis 1954). In addition, when a single commodity such as rice provides 50 to 60% of calories, on average, and 80 to 90% of the calories of the poor, the food price directly determines their real standard of living in the short

run. Raising this price to international parity is the same as making most of the population much poorer. It might be necessary for short-run budgetary reasons; it might be desirable for long-run economic growth. But it will never be popular as a political decision, and it can cause severe, even irreversible, hardship for the most vulnerable groups. A price policy that keeps food cheap is an understandable, perhaps desirable, response to widespread poverty. Unfortunately, because of its impact on agricultural productivity and rural incomes, a cheap food strategy is also a major factor causing that poverty (Timmer et al. 1983).

Stimulating growth in agricultural productivity is necessary to start the process of overall economic growth. While this statement would have been highly controversial in the 1960s, it is widely accepted at the start of the 1990s. "Getting agriculture moving," to quote the title of Arthur Mosher's (1966) influential book, is a complex task involving institutional change, new technology, rural infrastructure, and improved markets. But price incentives are a key stimulus to farmers to experiment, take risks, and invest in the components of higher crop yields. Most countries have found it impossible to increase agricultural productivity very rapidly without price incentives for farmers that matched (or often exceeded) those available in international markets.18 As the macroeconomic significance of agricultural growth became apparent after

¹⁶ A partial exception to the prevalence of neutral macropolicy is that of the Philippines. Macropolicy and agricultural pricing policy were inconsistent during the period concerned. This might be a significant factor explaining the inconsistent results in economic growth in the Philippines, in contrast to the records of the other three countries in Southeast Asia that are being compared with Africa.

¹⁷ Lindert (1991) reports similar results in a longer historical perspective.

¹⁸ Several important provisos apply. Productivity of individual crops, including rice, can be enhanced through investments in infrastructure, new technology, and procurement programs that reduce farmer risk, even if domestic prices are below world prices. However, the agricultural sector as a whole is unlikely to remain a major source of growth if the price squeeze is sector-wide. Crops into which farmers might diversify in search of higher incomes require incentive prices. An entire literature exists on the "role of agriculture" in the development process. For recent reviews, see Timmer (1988, 1992a).

the world food crisis of the 1970s, more and more countries ended their cheap food policies in favor of stimulating their rural economies. Because of high prices in world markets during the mid-1970s, border prices were incentive prices, and agriculture thrived.

In the mid-1980s, however, world commodity prices collapsed. A combination of large debts in many importing countries, long-term supply response to the high prices in the 1970s, and the world recession combined to push commodity prices, including rice prices, to historic lows in real terms. If these border prices were passed through to farmers, incentives would be slashed and recent productivity gains threatened. No rice-importing country in Asia permitted such a direct transmittal. Thailand, as a rice exporter, had little alternative to presenting its farmers with the low world prices.¹⁹ Rice farmers in the Philippines, Indonesia, and Malaysia received substantial protection from world competition during the mid-1980s, even when earlier history reflected a pattern of discrimination.

STABILIZATION AS A GOVERNMENT OBJECTIVE

A pattern of discrimination against farmers when world prices are high (mid-1970s) and of protection when world prices are low (mid-1980s) suggests that an obvious policy approach—stabilization—is at work. In principle a policy of price stabilization can avoid discrimination or protection in the long run, and the domestic price follows some trend in the world price. When the trend is measured over a long period, such as 10 years, the domestic price fluctuates only a little. Year-to-year deviations from the border price can be substantial and might require equally substantial budgetary resources to implement. If the trend is measured over a short period only, such as two or three years, the domestic price can never get too far away from the actual international price, and the budgetary commitments are accordingly smaller.²⁰

When price stabilization becomes an overriding objective of policy, however, and a country becomes rich enough to afford it-in terms of budgetary resources and consumers' ability to pay-the domestic price can diverge steadily from the border price. When this divergence is in one direction only, protecting farmers from a progressively lower real price in the world market, the empirical record looks as though policy makers have switched from protecting consumers to protecting farmers. Economists who search for explanations of this switch fail to find them in static models of economic efficiency and look instead to explanations in political economy. Answers have been forthcoming, as indicated by the work of Anderson and Hayami (1986), Gardner (1987), Lindert (1991), Krueger (1992), and Srinivasan (1985), which is based on modern theories of political choice.

Unfortunately, in the Asian context, these are answers to the wrong questions. The right questions are: why is stabilization of rice prices so important, and what institutional mechanisms for stabilizing prices propel countries down the path that ends up protecting rice farmers? The first question requires an understanding of the

¹⁹ Subsidizing the export of rice is an option for rich countries, such as the USA, Japan, and Italy, but would be very costly for a low-income nation, such as Thailand, which is a large exporter of rice. For many years Thailand imposed a "rice premium," an export tax that kept the domestic rice price below the world price. This tax was eliminated in the early 1980s as world prices fell, but Thai farmers ended up receiving the lowest real prices in history in 1985 and 1986.

²⁰ This discussion of price stabilization is summarized from Timmer (1991).

unique role of rice in Asian economies (that is, of the reason that rice is "different"). An answer to the second question requires close analysis of experience in individual countries.²¹

Differences in levels of national income help explain the degree of price stability a country can afford and thus help explain the switch in policy to parity of real income for rice farmers relative to those of urban workers. Low-income countries usually cannot afford a wide departure from the world price for long periods, and they try to stabilize around the trend in world prices or even below it. Rich countries-in Asia, Europe, and North America-tend to stabilize the real price of grain when measured in domestic currency, thus insulating their farmers from both the instability and the declining trend in world prices for grain. Because of volatile prices in the world rice market, however, stabilization is a goal in both rich and poor Asian countries.

Rice is different—The massive literature on Asian rice societies attests to the extent of their cultural, ecological, and political uniqueness, but surprisingly little effort has been devoted to understanding how these unique noneconomic dimensions translate into advantages and disadvantages for economic development. Cultural and sociological aspects are treated in Geertz (1963) and Castillo (1975), ecological dimensions in Grigg (1974) and Hanks (1972) as well as Geertz, and political effects of large-scale irrigation systems in Wittfogel (1957). The Asian rice economy

is examined as a commodity system in the classic study by Wickizer and Bennet (1941), an approach updated by Barker and Herdt (1985). Country or village studies that use economic methodologies to analyze rice systems are more numerous representative examples are Mears (1981) for Indonesia, Hayami and Associates (1978) for a village in the Philippines, and Croll (1982) for a household perspective in China. But apart from Bray's (1986) extensive historical treatment and Oshima's (1987) incorporation of labor demands in wet-rice cultivation into a general explanation of Asian poverty relative to European development, the unique characteristics of rice cultivation the Asian environment have not been examined for their direct and indirect contributions to the overall process of economic growth.

This paper can merely highlight the key linkages that are likely to mediate these contributions. The Asian rice economy can be characterized in sufficient detail to outline the story and to indicate the nature of the rice economy, especially in economically important ways, without becoming lost in the complexity of any given setting. Grigg (1974) provides an excellent description of wet-rice cultivation in Asia before the advent of high-yielding varieties developed at the International Rice Research Institute (IRRI). Barker and Herdt (1985) provide details on the post-Green Revolution rice economy.²²

Rice in Asia is produced primarily in irrigated or rainfed paddy fields that are

²¹ The Indonesian experience is analyzed in Timmer (1991; in press). The latter paper also includes a formal statistical analysis of the process of price formation for rice in five Asian countries—Japan, Korea, Malaysia, the Philippines, and Indonesia. On average, nearly 90% of the annual variation in the NPC for rice in these five countries is accounted for by policy actions to stabilize rice prices in domestic markets rather than actions to raise the real price of rice to farmers!

A less detailed set of stylized facts for Asian agriculture is developed by Haggblade and Liedholm (1991) as part of their simulation model that traces the evolution of the rural nonfarm economy under the stimulus of linkages between labor demand in agriculture and in the nonfarm rural economy.

managed in a highly labor-intensive manner. Typical management units are households that own or rent these paddy fields, and few households actively manage more than 1 or 2 ha of irrigated paddy. The median size of management unit for rice cultivation in Southeast Asia is probably less than 1 ha, with double cropping the norm if water supplies are adequate.

Most households retain some rice for home consumption, but nearly all households that cultivate rice in Southeast Asia market at least small quantities after the harvest. Farmers with larger surpluses often store rice for sale well after harvest when seasonal prices are higher. Purchased inputs are used almost universally, and nitrogen fertilizer—usually urea—is normally the single most important input bought from the market. Hired labor has become an important cash purchase as well, although exchange labor during planting and harvesting has been a feature of Asian rice cultivation for ages.

Large cash purchases of fertilizer and labor, small size of rice plantings managed by individual households, and active marketing of a significant share of output combine to make intensification of rice cultivation and the achievement of high yields an important objective of farmers and governments alike. Successful intensification has been important to farmers as a means of keeping their incomes on a par with opportunities elsewhere in the rural and urban economies. Likewise, intensification has been important to governments concerned about the availability of marketed supplies of rice, which are needed to feed growing urban populations.

Intensifying rice cultivation—The very nature of irrigated rice cultivation makes it impossible for farmers to raise their rice yields successfully unless the government provides key ingredients in the intensification process. At the same time, governments cannot intensify rice cultivation directly; farmers are needed to make all the key managerial decisions that translate productive potential into high yields. An important symbiosis exists in the relationship between farmers and governments, even if the political system does not support a democratic voice for the rural populations. Each party is dependent on the other to provide a crucial element of success.

Asian rice cultivation uses small-farmer technology that offers high rewards to farmer knowledge and skilled management. These rewards depend on the availability of high-yielding varieties, productive inputs, and incentives for their use, all of which can be delivered efficiently only through a system of competitive rural markets. Governments have had to build rural marketing systems that are able to connect farmers with local buying agents, thus transmitting market information and permitting exchange to take place, which generates gains in efficiency from trade. The marketing system serves to transform agricultural commodities at the farm gate into foods at the time and place and in the form desired by consumers. An efficient marketing system has to solve the problem of price discovery, at least at the local level and seasonally, even if government price policy sets a band in which such price discovery must take place.23

Asian governments have also had to make large-scale investments in rural infrastructure. Managing these investments provided government bureaucrats and policy makers with important opportunities for "learning by doing." Part of this rural infrastructure supported the marketing system—roads, communications systems, market centers, and so on. But large investments were also needed in irrigation systems so that rice cultivation could be intensified successfully. Such systems have

Governments must learn how to play their role in a market economy, just as traders, banks, shipping companies, and supporting institutions must learn theirs.

been the responsibility of governments nearly everywhere. The coordination and planning skills required to design, build, and maintain large-scale irrigation systems imposed serious obligations on those governments that undertook the tasks successfully. On the other hand, governments that acquired these skills by learning how to manage an irrigation-based agriculture also acquired a confidence in governance that was quickly applied to other aspects of managing economic growth.

The key elements of the argument are now in place. Food security became the principal task of Asian governments with large populations in relation to their arable land. Policies to stabilize rice prices were the key interventions used to provide food security at the national level. Heavy reliance on rice imports was not feasible, except for small countries (e.g., Singapore, Hong Kong, and to some extent Malaysia). But the larger countries of Southeast Asia had to grow nearly all of their own rice. Inducing farmers to produce this rice, for their own needs as well as surpluses for urban consumers, required governments to pursue an agricultural development strategy that focused on small farmers, reached them via markets, and raised the productive potential of rice cultivation through large investments in rural infrastructure, irrigation, and research on highyielding rice varieties.

AGRICULTURE, ECONOMIC GROWTH, AND THE GOVERNMENT

Both tasks undertaken by Asian governments-reaching small farmers via markets and raising agricultural productivitycreated positive externalities for the overall process of economic growth in addition to the direct contribution from higher output of the staple food grain and the consequent lowering of the real wage bill.24 First, making rural markets work is a direct lesson in the efficacy of a market-oriented economy. Building an efficient rural marketing system requires careful intervention and support from the government, but not too much if the private sector is to grow, learn how to take risks, and compete effectively. Governments must learn how to play their role in a market economy, just as traders, banks, shipping companies, and supporting institutions must learn theirs. Dealing with the issue of food security in Asia forced governments to learn the importance of a market-oriented economy and the means to make it work.

Simultaneously, however, the need to invest in public infrastructure, irrigation, and research and extension systems and to ensure the price stability that enabled the market economy to grow quickly and efficiently also forced Asian governments to develop a high degree of governmental competence in economic management. Without both components—a market

²³ See Chapter 4 of Timmer et al. (1983) for further analysis of the importance of an efficient marketing system and the role of price policy in developing one.

²⁴ For a review of the importance of externalities in the development process, see Stewart and Ghani (1991).

economy and a competent government investing in agriculture-Asian countries could not have developed the high degree of food security that they have achieved at the national level. Not all countries have been equally successful in translating this aggregate degree of food security into equitable access to food on the part of all households. That success would require a government devoted to alleviating poverty as well as stimulating growth while maintaining political stability. Among the countries of Southeast Asia, Malaysia and Indonesia have good records of achieving all three objectives of growth, stability, and improved welfare.25

If this argument for a market economy and competent management on the part of government is correct, the rapid economic growth in Southeast Asia since the 1960s can be traced to a considerable extent to the development of a new rice technology that greatly increased yield potential when the surrounding environment—economic, ecological, and political—was conducive to rapid adoption by farmers. The elements of this environment are well known for irrigated rice systems, but they have never been assembled successfully for the staple foods of sub-Saharan Africa.

AFRICA IS DIFFERENT

The staple food economies of sub-Saharan Africa cannot be described as easily as rice cultivation in Asia. Two standard references on African food systems, Johnston (1958) and Grigg (1974), stress the heterogeneity and complexity of production systems even within small localities. The point can be made in a vivid fashion by comparing the area around Krawang in West Java, Indonesia, one of the country's major rice bowls, and the Machakos region of Kenya, home to some of the country's most progressive small farmers. A drive across Krawang reveals that irrigated rice is grown as far as the eye can see. Small home gardens surround the many villages, but farming is almost completely a matter of managing a homogeneous ecological environment to grow one crop. The relative simplicity of developing a highyielding technology for this environment and of learning to optimize its management accounts for the nearly universal adoption of IRRI varieties and the high and stable yields produced from them.²⁶

The contrast with Kenya and the rest of sub-Saharan Africa is striking. Wherever it is possible to drive through regions of intensive food production-and the poor state of the road networks often makes travel very difficult for tourists and for trucks—an unbroken stretch of a single food crop is uncommon. Small patches of land with multiple and intercropping are the norm, and the pattern shifts radically as one crosses areas that vary according to altitude, soil type, or rainfall. Maize, sorghum, millet, cassava, groundnuts, cowpeas, and many others are intercropped in complex combinations, which reflect the farmer's knowledge of local growing conditions, available technologies, market prices, and the family's need for food.

MODERNIZING AFRICAN AGRICULTURE

Raising the productivity of such complicated, multistaple food systems requires more of agricultural scientists than improving the average yield of a single crop when grown under ideal conditions in a pure stand. As for upland regions in Asia, not enough farming systems research has been conducted to overcome the

²⁵ See Timmer (1992b) for a discussion of the relationship between economic growth and poverty alleviation in Indonesia. Agriculture is identified as the key sector linking the two processes.

²⁶ A drive from Jakarta to Krawang in the early 1990s also revealed that a number of factories were being built on former rice paddies.

constraints facing farmers in these heterogeneous environments.²⁷ The economic as well as the ecological interactions among various crops need to be analyzed and incorporated into research strategies. When successful results have been achieved at the research center, they must then be transmitted back to farmers in the form of messages that contain the same range of complexity that stimulated the development of new crop varieties and farming systems in the first place.

The point here is not that rice intensification is easy-that would misrepresent Asia's hard-won achievements since the mid-1960s and the continuing challenge facing Asian researchers, farmers, and policy makers-but it will be harder to achieve similar results in Africa. The farming systems that produce the great bulk of Africa's food staples are much more complicated and less understood by researchers, and they operate under environmental stresses (especially drought) that vary more widely than in the rice-based systems of Asia. A major difference between Africa and Southeast Asia is the role of women in household decision making and management of food crop production, which complicates the design of institutions that provide modern inputs, new technology, and credit to farmers. None of these difficulties is insurmountable with appropriate investments in research, infrastructure, and incentives. It remains to be seen how much more expensive these investments will be in Africa than they were in Asia.28 A serious test has yet to be made.

A multistaple food system is more complicated to modernize, not only at the farm level, but also at the level of marketing inputs and output. Marketing a wide variety of different commodities with varying degrees of substitutability requires greater knowledge on the part of traders, higher storage and transaction costs because of smaller average lots handled, and far more sophisticated policy designs if governments attempt to stabilize prices for the three or four important food staples. But is this degree of intervention in pricing necessary? In the specific context of Ghana, Alderman (1992) has asked whether cross-commodity substitution in consumption, production, and storage is adequate to link prices of maize with prices of sorghum and millet. The answer is a qualified yes, with price integration requiring three months on average. Such integration offers the potential for government policy to stabilize the price of maize only, if that is desirable, while allowing market forces to transmit these stable prices to other staple foods that are close substitutes.²⁹

RELIANCE ON IMPORTED FOOD

The food economy of Africa has one other feature that distinguishes it from the rice economy of Southeast Asia: the heavy reliance on imported wheat to provision urban areas. Although wheat is an increasingly popular food in urban Asia, in none of the Southeast Asian countries does it account for as much as 10% of caloric intake. By contrast, in the cities of sub-Saharan Africa, where roughly 30% of the population lives, an average of 50 kg per

²⁷ A good review of this approach has been produced by CIMMYT Economics Staff (1984).

For a particularly eloquent statement of the lack of investment in African agriculture, see Eicher (1992). Block (1992) demonstrates how serious the productivity problems are in agriculture.
The rather long period required for price integration to occur may be a significant impediment to such a single commodity stabilization policy. Three months of highly unstable prices for substitutes may impose very heavy burdens on consumers, who depend on these commodities for most of their

caloric intake. Similarly, the prices of these commodities can collapse at harvest for as long as three months, even if maize prices are stabilized, so that producers receive few of the benefits of stable prices. The difficulties of stabilizing prices in Africa, and the costs of doing so, are modeled in Pinckney (1988).

capita of imported grain, most of it wheat, provides nearly 500 calories per day, or nearly 25% of daily energy intake. To a substantial extent, sub-Saharan Africa is dependent on world grain markets to provision its urban (and vocal) population.

But the world market for wheat (and vellow maize) is not nearly so unstable as the world rice market. Total volumes traded are much higher-on the order of 100 million tons per year each for wheat and maize, compared with only 12 million tons for rice. The shares of production are similarly larger. Rice trade is just 4% of world production, whereas wheat and maize are 20 and 15%, respectively. The thinness of the world rice market has made it notoriously unstable, thus forcing policy makers in rice-consuming countries to insulate their domestic rice economies from the world market. Such insulation is not nearly so important for economies whose staple food is wheat or yellow maize. Many African cities depend heavily on imported wheat for their staple food supply.30

Compared with a rice-based, domestically supplied economy, a wheat-based, importsupplied food economy does not have the same imperative to develop its domestic food production. When the domestic staples produced are root crops or specialized coarse grains not available in world markets, governments are even less inclined to invest in domestic food production. If a political economy with a powerful urban bias is superimposed on this bifurcated food economy, the neglect of African food producers is easily understandable.³¹ Nor is it easy to see how to end this neglect, either politically or economically. In particular, if price stabilization of staple foods is important to both consumers and producers, the nontradable status of root crops rules out the trade-oriented approach used in Southeast Asia. Price fluctuations in world markets for white maize and local varieties of sorghum and millet are similar to those for rice, and high transportation costs mean extraordinarily wide margins between c.i.f. import and f.o.b. export prices.³²

PRICE STABILITY, AGRICULTURAL PRODUCTIVITY, AND ECONOMIC GROWTH

Switching the role of food imports from the mainstay of food security to a vehicle for stabilizing the domestic food economy at levels that provide farmers with ample incentives to increase productivity is an enormous challenge for African governments. Cereal imports are increasing steadily, and more than one-third of them are provided as food aid. Most urban food systems are not well linked to domestic supplies but rely heavily on imports. Redressing this bias requires more than simply improving price incentives to farmers, although this step is necessary. A marketing system that is "pointing in the wrong direction" requires substantial changes in its way of doing business and improved infrastructure, institutions, and credit facilities before food supplies grown domestically can become the foundation of a stable and secure food system.

Without these changes, it is difficult to see how stability in food prices and genuine food security can be achieved in Africa.

³⁰ Imported rice is increasingly important in several West African countries.

³¹ The political economy dimensions of the argument are explained in Bates (1981).

³² Several countries in East Africa fluctuate around self-sufficiency in the production of white maize, their staple grain. In good years exports are possible, and in bad years imports are needed. For landlocked Malawi, the swing between the c.i.f. and f.o.b. prices can be very wide indeed—from negative prices for exports to more than \$300/t for imports!

Reliance on food aid and subsidized grain exports from North America and western Europe undermines the political will needed to invest in domestic agriculture through a form of "Dutch disease" that undervalues local food production. Such reliance is not sustainable in the long run. Even worse, it may not be stable in the short run. Africa relies heavily on exports of primary commodities to earn the foreign exchange needed to finance a foodimport strategy. The prices of these commodities in world markets are highly unstable. The result is that earnings of foreign exchange are also highly unstable. thus destabilizing the entire macro economy. Research by Dawe (1992) has demonstrated that this destabilization takes a significant toll in terms of economic growth. Because it is harder to stabilize export earnings than to stabilize food prices, a switch in priority away from export crops toward domestic production of food crops is likely to improve food security as well as stimulate economic growth.

Nothing said so far suggests that such a switch will be easy. High priority will have to be placed on rural infrastructure and on research aimed at raising the productivity of farming systems. Governments will have to intervene to restructure incentives in favor of food production, and these incentives will involve both stability and price levels for inputs and output. Such priorities were not so difficult to establish in the Asian context, where populations are large relative to land resources and where the density of economic activity justifies an extensive network of roads and traders who use them. Population pressures and favorable ecological settings also justified massive investment in irrigation systems that have stabilized Asian agricultural output while raising crop yields. It is easy to see how the emphasis on increasing domestic rice

production evolved in the Asian context as a mechanism for stabilizing rice prices and that this focus on production was the key to food security at the national level. It is difficult to see how a similar orientation can evolve in Africa.

The failure of African countries to look to domestic agriculture as the basic mechanism for providing food security comes at high cost in a final arena—learning how to manage the ingredients of rapid economic growth. By solving their food problems through agricultural development, Asian governments arguably learned both the appropriate role of the government in this process and the careful management of the economic environment required to bring it about.

Asian governments realised, in the words of Lee Kuan Yew, that they "must create an agricultural surplus to get their industrial sector going." Rich and industrious ricefarmers have been the foundation of Asia's industrialisation. (*The Economist*, 16 November 1991, p. 18)

There is an obvious economic rationale for the strategy articulated by Lee Kuan Yew, even if, as prime minister of Singapore, he did not have to follow it for his own country. This paper explains Asia's high level of governmental competence in managing economic growth by pointing to the learning that took place in the course of solving domestic food problems. The low level of competence at similar tasks demonstrated during the 1960s and 1970s in Africa can be traced to development strategies that met growing urban food needs from imports. That is, much of the explanation for the differential competence can be traced directly to how governments treated, and learned from, their agricultural sectors. The underlying political economy of the different approaches has already been explained, but the full

consequences of the difference are just now being recognized.

ALTERNATIVE STRATEGIES FOR AFRICAN DEVELOPMENT

The alternatives to agriculture-led growth in the African context are limited but do exist. Within agriculture there is the choice between food crops and export crops. Beyond agriculture there are opportunities for mineral exports, tourism, and manufactured exports. Each of these opportunities faces its own problems; however, none of these seems less daunting than the task of investing in development of the food system.

FOOD CROPS OR AGRICULTURAL EXPORTS?

A substantial literature exists on Africa's comparative advantage in producing agricultural exports, with an equally substantial critique arguing that such exports jeopardize the nutritional status of households that specialize in cash crops.³³ There is substantial evidence that concentration on export agriculture misses much of the potential for agricultural development to alleviate poverty by providing direct access to food.

TOURISM

This option can generate substantial earnings of foreign exchange if large numbers of foreign tourists want to visit the country, can spend their money on goods and services that generate domestic value added, and return home safely with happy tales that encourage their friends to seek similar adventures. Being robbed at gunpoint while on safari is not what most tourists have in mind. Sighting elephant carcasses with ivory tusks hacked off is a sad reminder of how difficult conservation is in poor countries. Population pressures in Africa argue that ecotourism is likely to be a declining industry.

MANUFACTURED EXPORTS

The path to rapid economic growth in all the successful Asian countries has ultimately led to manufactured exports. Why not put Africa on this path sooner rather than later? There are at least three problems with this approach. First, African exports will have to compete with Asian exports of similar products, and real wages in Africa will have to be lower still for such competition to be effective. Second, Asia has a head start in this business. The learning by doing that comes with such experience will tend to leave African competitors to supply the products that have lower value and are less profitable. Third, much of the efficiency and growth in total factor productivity that makes Asian economies such successful competitors was stimulated by successful agricultural development. Without this stimulus, Africa's productivity is likely to continue to stagnate.

The fundamental lesson from Asia's economic success is that there is no substitute for agricultural development in societies that have a substantial rural sector. Providing food security is an important rationale for investing in agriculture, and widespread confidence in food security—made manifest by stable food prices—can be translated through extensive externalities and linkages into rapid economic growth. There might be alternative strategies that would also generate rapid economic growth, but Southeast Asia is not the place to look for them.

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³³ The most balanced review is that done by von Braun and Kennedy (1986).

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THE DEVELOPMENT OF RURAL FINANCIAL MARKETS IN SUB-SAHARAN AFRICA

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Well-integrated, rural financial markets to which poor smallholders—including women farmers—have access are essential for creating an environment in which agricultural technology can stimulate rural development. This paper indicates the

The pattern of "giving and forgiving" credit for political purposes has undermined trust in credit systems as well as borrowers' sense of commitment.

factors—mostly related to policy and its implementation—that have hindered the creation of such markets in sub-Saharan Africa and outlines a new perspective on their development. Focusing on credit for the rural poor, the paper then describes a strategy for rural capitalization based on innovative programs already under way.

HINDRANCES TO DEVELOPMENT

The main factors that have held back the development of Africa's rural financial markets are as follows:

 Physical environment: Widespread drought has led to periodic, wholesale decapitalization, which is a particularly severe hindrance where financial markets are still in their infancy.

- Land tenure: Uncertain land tenure and land markets inhibit efficient utilization of land as collateral.
- Political interference: The pattern of "giving and forgiving" credit for political purposes has undermined trust in credit systems as well as borrowers' sense of commitment, thus contributing to high rates of delinquency.
- Institutional weaknesses: Inadequate management and the low density of rural financial institutions has prevented smallholders from gaining access to financial services, including credit and savings.
- Subsidized interest rates: In formal systems interest rates were typically subsidized to such a great extent during the 1980s that real (i.e., inflation-adjusted) rates were often negative. As a result, public resources were used to give the rich and powerful increased, though still rationed, access to credit rather than to expand the rural banking system for smallholders.
- Inadequate input delivery: Deficiencies in systems for delivering agricultural inputs, such as seed, fertilizer, and machinery, have reduced the incentives for development of rural financial markets.
- Lack of rural infrastructure: Poor rural infrastructure has increased transaction costs in input, produce, and financial markets and weakened the linkages between them.

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These factors, which naturally vary in importance according to the country and agroecology, are increasingly well understood and are being taken into account in new approaches to the development of rural financial markets.

A NEW PERSPECTIVE

The marginal circumstances of the poor who have few assets to offer as collateral and often no representation in political decision making—pose a number of challenges in the development of financial markets for them. Special attention must be given to the formulation of appropriate policies, to the institutional approach, and to project design.

It is generally accepted that capital formation is a necessary condition for development. Of the two principal sources of capital—external funds and domestic resource mobilization—internal funds are by far the most important. In most lowincome countries, the latter account for the major portion of investment funding. Financial markets play a key role in mobilizing internal resources and ensuring that they are allocated efficiently. How well financial markets accomplish these aims depends on the degree of financial intermediation.

In the past development of financial markets was based on the assumption that low-income groups, mainly found in rural areas, are too poor to be able to save and lack the necessary collateral for obtaining credit. As a consequence, the poor were almost entirely ignored in the design of policies pertaining to financial markets. In establishing agricultural credit programs, with their own or external funds, governments paid little attention to the mobilization of internal savings.

The dismal history of many of these institutions is well documented (Adams et al. 1984). A number of them, particularly in sub-Saharan Africa, have collapsed. Others are continually plagued by repayment problems, organizational inefficiencies, inadequate loan administration, and operational losses. Only a few farmers, often the ones that are better off, have access to institutional credit.

Given the failure of most finance and insurance schemes, a considerable amount of research has been conducted on indigenous, informal arrangements for savings and credit. Studies in Africa indicate that, apart from those services, such arrangements provide options for insurance, coinsurance and risk-pooling. Major constraints to the development of formal systems—high transaction costs due to information asymmetry, moral hazard, and poor infrastructure—appear to be less serious in networks involving close social interaction (Huppi and Feder 1990).

Recent experience shows that low-income groups often have substantial savings potential (Seibel 1985). The flourishing informal sector (savings and credit groups) in many countries of sub-Saharan Africa and successful efforts in the formal sector, such as that of the Grameen Bank in Bangladesh (Hossain 1988), suggest that it is quite possible to build rural financial institutions based on the savings potential of the poor.

Taking into account the problems and potential described above, strategies for rural capitalization need to encourage the following institutional innovations:

- Building financial institutions from the bottom up with and for farm households
- Facilitating short-term credit for the trading sector in a competitive environment
- Strengthening development banking for financing rural infrastructure and the provision of other public goods

Public policy can contribute importantly to each of these goals. In the development of such policy, two points should be kept in mind: 1) credit does not foster development if other, nonfinancial problems remain unsolved, and 2) it is difficult to target credit for specific uses, such as investment in agricultural technology. The disappointing net-capital outflows from rural areas in many African countries will not be halted until investment in agriculture has been improved. The opportunities to do so in this region will remain limited until policies have been put in place that improve farmers' access to technology, facilitate market development, and address the various factors described above that have so far hindered the emergence of financial markets.

THE UNDERCAPITALIZED RURAL ECONOMY

Africa's rural economy is severely undercapitalized. Nonexistent or rudimentary rural financial markets are one symptom of this problem. Others are the prevalence of subsistence farming (a means by which smallholders cope with risk) and unproductive holdings of assets (such as excessive livestock herds with low per unit output).

Detailed studies of farm households show high returns to capital, even where infrastructure is deficient and agricultural technology unavailable. In Gambia, for example, each US\$1.00 invested in smallholder farming yields about \$1.96; in Rwanda the short-term return is \$1.47 (von Braun et al. 1989; 1991).

Labor bottlenecks, especially seasonal ones, are a well-known constraint of farming systems in the semiarid regions of Africa. Increased use of capital—e.g., for mechanization—reduces the peaks in labor input. But its overall effect in many cases is to expand employment, and this effect in the rest of the season is larger than the employment-reducing effect during the period of peak labor demand.

The problem of rural undercapitalization is evident, not just from limited capital investment in farming, but from the lack of rural infrastructure. Across sub-Saharan Africa, there are large differences in the density of rural road networks (e.g., 2.9 km of roads per km² of arable land in Zimbabwe, 2.3 in Kenya, 0.3 in Ethiopia, and 0.1 in Sudan). It seems likely that the level of financial intermediation is highly correlated with improved infrastructure. Transaction costs in rural financial markets are strongly related to information and to the density of financial institutions in rural areas, and both these factors are closely related to infrastructure.

The absence of formal financial institutions in rural areas is both a symptom and a cause of undercapitalization in rural Africa. Commercial banks lend relatively little to agriculture. The share of agricultural credit in the total loan portfolios of commercial banks during the 1980s was typically less than 6% (e.g., 4.3% in Ethiopia and 5.1% in Nigeria), though there were some notable exceptions (15.4% in Kenya, 31.5% in Swaziland, and 40.5% in Malawi) (Adera 1991). Specialized agricultural banks have generally made only limited efforts to reach smallholder agriculture, with the exception of some group-lending schemes, such as that in Malawi and the small-farm credit program in Zimbabwe.

FOOD SECURITY AND CREDIT

At the household level, food security is defined in its most basic form as access by all members of the household at all times to an adequate supply of food. This is a necessary but not a sufficient condition for a healthy life. Other requirements are sanitation in the household and public capacity to care for society's vulnerable members (von Braun et al. 1992).

By contributing effectively to income generation and stabilization, providing finance to the poor can address their food security problems in both the short and long term. It is not easy, however, to distinguish clearly between credit needs for production and those for consumption, since the two spheres are closely intertwined in poor rural households. Given the vulnerable position of the poor, risk aversion and insurance against food security risks are extremely important.

Food security can be improved through three types of policy instruments, those that: 1) diversify or increase household income or both, 2) stabilize or lower food prices, or 3) improve household access to intertemporal markets.

The first two types of policies are intended to accomplish their aims in particular seasons or years or may form part of longterm development strategies. Technology transfer, investment in rural infrastructure, and extension and credit programs are key elements of such strategies and are essential for achieving long-term food security. Policies that can contribute directly to raising income and purchasing power during specific periods include stabilization of key commodity prices and targeted interventions, such as income transfers and public works projects.

The third set of policies aims to improve the ability of households to adjust consumption and investment over time through improved access to savings, credit, and insurance markets. Unlike the first two types, these policies enable households to make intertemporal adjustments in disposable income rather than influence directly their incomes in a particular period. While reducing disposable income and consumption in the

present, savings can increase them in the future. For households in which food security is quite fragile, savings in the form of cash, food, and other assets are an important means of insuring against anticipated or unexpected interruptions in the food supply. Credit, on the other hand, increases current disposable income at the expense of available income in the future. It permits investment in human and physical capital, which may improve future income and consumption or avoid shortfalls in current consumption. In rural Africa, even average households have only limited possibilities for exercising these options.

Research has provided us with a greater understanding of the role of new agricultural technology, rural infrastructure, and prices in alleviating poverty and has led to the development of clearer policy guidelines. Such has not been the case with regard to the role of credit or, more broadly, rural financial markets. Even so, it is obvious that both formal and informal arrangements can play a critical role in alleviating poverty within subsistence agriculture. New technology requires financial inputs; periods of slack labor demand create needs for financing, savings, or borrowing as well as opportunities for both employers and employees; and provisions must be made for unforeseeable fluctuations or interruptions in the income stream, which for the poor can quickly lead to declining nutrition.

ACCESS TO CREDIT

In Asia, the Middle East, and Latin America, formal financial markets satisfy a large proportion of rural financial needs. In contrast, only an estimated 10 to 20% of African farmers secure credit from formal institutions (Mittendorf 1987), and this share has probably declined in the late 1980s and early 1990s. If they obtain credit at all, the majority of the region's smallholders do so in informal financial markets. The nature of these markets varies greatly across sub-Saharan Africa and is complex within countries.

According to the results of a survey conducted in Gambia, the richest households obtain 42% of all credit for agricultural inputs, while the poorest quartile get only 11% (Table 1). About 80% of all credit obtained by sample households is provided by the informal credit sector. Friends and relatives are the most important source of credit (41%), followed by shopkeepers, who supply 35%, either in the form of cash or consumer items (von Braun et al. 1990).

Interest charges on informal loans in Gambia depend on various factors. In 68% of the credit transactions (58% of the loan volume) made by sample households in 1987-88, no direct interest was charged. Interest was usually not charged at all on loans to family members. Credit within the "moral community" is thus better characterized as mutual help than as commercialtype financial transactions. For the remaining cases, however, annualized interest rates were 126% on average.

Loans exchanged between family members and friends in Gambia tend to have lower interest rates (by 14 to 21%) than those from other sources. Moreover, the higher the amount of the loan, the lower the interest rate. Since transaction costs have a fixed-cost character, reductions in interest rates on larger loans are more feasible. Interest rates on loans of food are lower than for other loans.

Women farmers are generally not well integrated into credit schemes. Given their important role in decisions and their contribution of labor to food crop production in much of Africa, this shortcoming detracts simultaneously from the goals of equity and efficiency. To address this problem will require studies of the position role poor women occupy de jure and de facto in the whole institutional framework. How much control do women have over monetary income? More generally, how autonomous are they in financial and economic activities? What are the implications then for reimbursement of loans for income-generating activities?

Preliminary findings suggest that in many parts of Africa small women's groups at the village level (frequently organized as savings clubs) can serve as a point of entry for more formal institutions (such as credit unions), which serve as savings facilities and lend production and consumption credit to the rural poor (Seibel 1985). In Gambia, for example, 8 out of 10 villages surveyed recently had at least one active women's savings society. When pooled resources permit, several of these provide credit for ensuring basic food security during the "hungry" season. Cameroon has a similar network of societies. In

Table 1. Percentage of people in different income quartiles having access to credit in rural Gambia, 1987-88

ltem for which credit obtained	Income quartile			
	Lowest	Lower	Upper	Highest
Agricultural inputs (in kind)	11	19	28	42
Food	21	32	25	23
Other consumer items	27	14	11	48
Total	14	18	25	42

Source: von Braun et al. (1990).

Zimbabwe, savings clubs run mainly by rural women are already widespread, numbering more than 5,000.

It is increasingly accepted that savings mobilization can contribute importantly both to investment growth and consumption stabilization at the household level. Adams et al. (1984) conclude that savings mobilization ought to receive more emphasis and that nonfarm rural firms need to provide more access to formal loans, charge more realistic interest rates, and do less loan targeting. Given the diversity of income sources upon which the poor depend and their need for both production and consumption credit as well as savings outlets, it is apparent that multipurpose financial institutions would be more useful than specialized savings or lending institutions.

Lending programs need to respond quickly and efficiently to the demands of rural households. Institutions that offer only highly restrictive lines of credit and prohibit consumption loans are not likely to be perceived as helpful establishments for retaining household savings in anticipation of rural loans (Meyer and González-Vega 1986). In Sierra Leone approximately 70% of farmers' demand for credit relates to subsistence and consumption needs. These are not met by institutional credit systems, which typically provide only production loans for a specific purpose (Johnny 1985).

A critical challenge in lending to the poor and in mobilizing their savings is to bring down the transaction costs of rural financial institutions. These are the costs of mobilizing deposits, lending, monitoring, and loan recovery. In addition, clients incur real costs in time spent going to banking institutions and possibly in other resources needed to gain access to rural banks. Transaction costs determine to a considerable extent the cost-effectiveness of credit schemes and of input delivery systems. Frequently, credit schemes tied to technical assistance projects exist only as long as the projects do.

Many formal systems of rural credit in sub-Saharan Africa are more or less directly linked to agricultural input delivery systems, and the two often hinder one another because of internal weaknesses in both systems. This is particularly the case with medium-term credit schemes tied to equipment but also for short-term credit. For instance, when a parastatal's system for delivering inputs (such as fertilizer) breaks down, the credit system also frequently disappears, and vice versa. In that case farm households simultaneously lose two degrees of freedom-the input supply and the source of financing for investments-to increase the productivity of their resources. It is not surprising then that, as a result of macroeconomic and fiscal disruption, the current search for innovative credit schemes is focusing on small-scale systems that are not linked to input delivery.

INNOVATIVE PROGRAMS IN AFRICA

This section, which draws heavily on Zeller et al. (1992), reviews and analyzes some innovative financial projects in sub-Saharan Africa. These projects were selected on the basis of two criteria: 1) they seek to ensure long-term financial viability, and 2) the financial services they offer are demand-oriented and attempt to satisfy the needs of all rural poor in the project area.

The most prominent trait of innovative and successful projects is their voluntary or mandatory savings schemes. Considering the diversity of these programs, of the agencies supporting them, and of the countries in which they operate, the uniform significance of this particular trait is striking. Generally, the clients have to accumulate savings in order to become eligible for credit, although there are exceptions, such as village savings and loan associations in Mali, Gambia, and Madagascar. Savings mobilization is part of the financial strategy of these projects, but the poor may obtain loans without having accumulated savings. In general,

Group savings and credit mechanisms have proved especially promising for reaching smallholders.

however, debtor savings serve as loan collateral, and the amount of credit granted is a multiple of savings deposits.

The village savings and loan associations in Mali, Gambia, and Madagascar do not discourage social and consumption loans. In contrast, similar organizations in Burkina Faso extends credit solely for productive purposes. Another difference is that the management of the latter is not completely autonomous. In Gambia and Madagascar, village committees decide for themselves on interest rates for savings and loans. The bank of Wellingara in Gambia, for example, paid 40% interest on savings and charged 60% interest on loans, compared to official rates in commercial banks of about 12 and 24%, respectively. The higher interest rates chosen by the village committee perhaps reflects the scarcity of capital in rural areas. Village savings and loan associations in Burkina Faso must adapt to the terms and conditions defined by project management, donors, and other refinancing institutions.

Analysis of the financial programs of these projects showed that temporary sponsoring (subsidy) of institutional development is frequently a precondition for achieving financial sustainability. Nevertheless, innovative projects seek to keep operational costs low by leaving management to volunteers at the village level. In the interests of reducing costs, financial services are extended to savings and credit groups in much the same way. By working with homogeneous, coherent financial groups, these projects can rely on social regulating measures and foster a sense of joint responsibility.

In addition to the traits mentioned above, two other features seem to characterize innovative financial programs: 1) performance-related incentives for clientele or intermediary staff and 2) parallel, nonfinancial support services that are separate from the financial program but complement it. The Liywontse Association of Nkar in Cameroon, for example, rewards its member-groups for satisfactory credit repayment. The village savings and loan associations in Burkina Faso follow the opposite approach, rewarding their staff for perfect loan recovery. In addition, both savings and credit projects are accompanied by agricultural and commercial extension programs. For this same purpose, the Cameroon Cooperative Credit Union League (CamCCUL) cooperates with the African Institute for Economic and Social Development (INADES). INADES provides CamCCUL's primary credit union members with services in agriculture and commerce aimed at increasing productivity.

From this review of innovative projects, it is clear that rural financial intermediation can work in sub-Saharan Africa. If properly designed, savings and credit programs can reach the poor effectively. And at the same time, rural financial intermediaries can provide sustainable services to savers and borrowers of limited means. Group savings and credit mechanisms have proved to be especially promising for reaching smallholders and for keeping the operational costs of financial intermediaries low.

The most important finding of this brief review is that savings schemes are essential for maintaining the well-being of innovative financial programs. It is not absolutely necessary, however, that savings figure in the development of financial markets from the very beginning. Financial projects may start out by offering only credit services, but they should view this as a temporary phase.

ELEMENTS OF A STRATEGY FOR RURAL CAPITALIZATION

- There is no blueprint for the development of rural financial markets in sub-Saharan Africa. How this is accomplished depends on the relevant institutions, which differ greatly among and even within countries. Indigenous (informal) institutions, including those at the village and grass roots level, are a valuable resource. Gaining a better understanding of these institutions is the first element of a strategy for building on them.
- Giving smallholders wider access to savings and credit services requires institutional growth. Group formation appears to be the best and most sustainable way of achieving low transaction costs, accountability, and efficiency. Support of group formation and training (in savings mobilization and loan management) during the early stages should be viewed, not as a subsidy, but as an investment that creates institutional capital. Donors and governments ought not be deterred from making this kind of investment by the past failures of so-called credit programs.
- Many specialized agricultural credit institutions have failed because of general deficiencies in governance and public sector accountability. This has

not happened to all of them, however. Thus, where formal credit institutions show real potential for catering to poor smallholders, they ought not be discarded. Some of these institutions may be useful for providing short-term lines of credit at unsubsidized rates to traders in agricultural inputs.

- Any effort to build rural financial markets from the bottom up, based on informal institutions, must eventually create links between them. Otherwise, these markets will not be able to achieve their purpose of allocating capital across regions, sectors, and time. Establishing these links requires careful timing, however. Developing them too quickly may interfere with the dynamics of fragile institutions, while proceeding too slowly can be costly in terms of foregone benefits from the expansion of financial markets. Regulations and laws need to be developed that protect the partners in semiformal financial institutions.
- Drought will continue to affect large segments of African agriculture. Improved financial markets in rural areas can help mitigate the consequences. Deposits will need to be protected through proper adjustments in interest rates when inflation rates increase (because of drought or for other reasons), and debt resched uling for farmers hit by drought will need to be executed carefully, as opposed to wholesale debt write-offs, which may undermine the sustainability of financial institutions.
- Deficient rural infrastructure in sub-Saharan Africa is a prominent feature of its undercapitalized rural economy. As a consequence, smallholders are forced to produce nontraded goods and to forego potential gains from specialization and trade. Both public and private investment in infrastructure (and the services that accompany this investment) require large-scale capital

mobilization. Small-scale, group-based credit and savings schemes are simply not adequate to the task. Well-managed banking institutions (with the capacity to evaluate projects properly) remain essential for mobilizing domestic and international capital to improve rural infrastructure and fund the development of irrigation and other systems in support of agricultural production.

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DESIGNING FINANCIAL INTERMEDIARIES TO MOBILIZE SAVINGS AND ALLOCATE INVESTMENT MONEY

Douglas H. Graham*

The title of this paper is a bit worrisome, since it is not immediately clear how one might successfully design financial intermediaries to mobilize savings and allocate investment money in sub-Saharan Africa. Or to put it differently, one could argue

There are two schools of thought on the promotion of financial markets: 1) the traditional credit project view and 2) the more recent market performance view.

that, in the context of this region, the title is an oxymoron, a contradiction. Short-term savings dominating the liability side of the balance sheet of African financial institutions have never been associated with longterm loans on the asset side. In financial terms, we would have a classical mismatch of term maturities between financial liabilities and assets. This, of course, can quickly lead to the terminal disease of insolvency, as illustrated by the recent experience of the savings and loan industry in the USA.

Nevertheless, the title does raise a number of important issues that merit exploration. Hopefully, by the end of this paper, we may have reached an understanding of the degree to which the challenge implicit in the title can or cannot be met. To gain insight into this problem, it is instructive to review the recent experience of both formal and informal financial markets in Africa. This will make it apparent what are the relevant parameters for designing financial intermediaries.

APPROACHES TO RURAL FINANCE IN AFRICA

There are two schools of thought on the promotion of financial markets and measurement of their success: 1) the traditional credit project view and 2) the more recent market performance view (Adams and Fitchett 1992; Adams 1992). The contrasting features of these two approaches are shown in Table 1.

THE CREDIT PROJECT VIEW

Many designers of rural development programs consider loans to be merely one element in a package of productive inputs. In the schemes they have created, performance is measured on the basis of the number of loans and speed with which they are disbursed to a targeted clientele, the amount of inputs financed and allocated within the project, the rate of technology adoption, and the increase in employment and output. Given the fungibility of finance, however, it is naive to assume that a substantial share of targeted credit is not diverted for other uses. And since increased output has multiple causes, it is also naive to casually associate it with the increase in credit rather than other factors.

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The loans in these schemes invariably incorporate interest rate subsidies and are granted through specialized lending institutions with undiversified and concentrated portfolios. These features create a borrower-dominated institution, in which all the procedures and practices (including perfunctory loan evaluation, quick disbursement, and lax loan recovery) favor the borrower's interests. Credit needs are given precedence over the creditworthiness or debt-carrying capacity of the borrower. In project evaluation, no weight is given to the sustainability of the financial flows, the interests of depositors (where they exist), or the projects' effects on the health of the financial system as a whole. All attention is on the borrower and the alleged impact of loans on farm output.

Not surprisingly, most of these supply-led credit programs and their specialized institutions have not been financially viable because of high overhead costs and

Table 1. Contrasting features of the two principal approaches for promoting financial markets.

Project focus	Market perspective focus
Credit	Finance
Borrowers	Depositor-savers
Targeted credit	Open, untargeted loans
Output, income, employment, technology adoption	Long run institutional viability
Credit needs	Creditworthiness or debt capacity
Quick disbursement as dominant goal, with little interest in effective loan recovery	Strategic role of loan recovery in evaluating institutional performance
Subsidized interest rates	Realistic interest rates
Transaction costs ignored	Transaction costs reduced (noninterest rate operational costs)

low loan recovery. Their transaction costs (both for the borrower and lender) have been greatly underestimated, and in many cases they have collapsed into expensive, one-shot, income-transfer schemes. The landscape of sub-Saharan Africa is littered with the skeletons of development banks done in by supply-led credit schemes.

MARKET PERFORMANCE VIEW

The second perspective on the role of financial markets can be labelled the market performance view. Its supporters emphasize the mobilization of domestic deposits and savings as a strategic ingredient in any recipe for making healthy financial institutions. More attention is given to the role of financial intermediation, to reduced transaction costs, and to cost- and risk-reducing financial innovations as means of supporting a sustainable flow of untargeted financial services. Interest rate ceilings and selective credit policies that limit portfolio choice (i.e., targeting) are harshly criticized by this school. The principal criteria for measuring success are good loan recovery, low transaction costs of lending and deposit mobilization, increased numbers of people with ready access to financial services (both loans and deposits), and the proportion of total funding that comes from locally mobilized deposits. These measures emphasize the vitality and durability of the financial institutions and the efficiency of financial intermediation.

The focus in the market performance view shifts from servicing the borrower to the fiduciary responsibility of protecting the saver. Instead of creating borrowerdominated institutions of the sort that characterize supply-lending strategies, this approach strives for a more neutral balance between borrower and saver constituencies. Instead of quick disbursement of poorly evaluated loans to high-risk, targeted clientele, the market performance view demands (in the interests of savers) more careful loan evaluation, aggressive loan recovery, and properly priced loans (devoid of subsidies) that reflect the opportunity cost of capital. This latter point needs emphasis. The subsidized loan rates that are common in project-based lending schemes come at the expense of belowmarket interest rates for depositors, thereby promoting a regressive transfer of income from a substantially more numerous and, on average, lower income constituency of depositor-savers to a far smaller set of borrowers with, on average, higher income.

Though the market-performance view has many virtues, some still see limitations. If formal lenders are unusually risk averse and therefore take protection of depositorsavers to the extreme (as might be the case in private commercial banks), one can imagine very few loans going beyond the most risk-free clients. Indeed, one can even imagine a bank placing the majority of its assets in risk-free government securities. In this case the bank is not engaging in financial intermediation (between saver and investor) as much as it is acting as a fiscal substitute for government by financing the government's deficit with the public's deposits. That is happening to varying degrees in the formal financial systems of various African countries. This behavior, of course, reflects the perceived high level of uncertainty and risk in the continent's loan markets, growing out of risks associated with policy, the economy, and natural environment.

Obviously, one would like to arrive at some reasonable compromise between the default-ridden, borrower-dominated development bank model, which has collapsed into bankruptcy in practically all countries of sub-Saharan Africa, and the extremely risk-averse, saver-dominated private bank model. Some balance of risks and returns is required to arrive at a compromise. Before exploring this possibility further, it is instructive to review the experience of informal finance in Africa.

INFORMAL FINANCIAL MARKETS

Ironically, as formal financial institutions and markets have collapsed during the past decade in many African countries, informal finance has flourished. Recent studies have challenged most of the conventional stereotypes about informal finance in Africa (Adams and Fitchett 1992; Eswaran and Kotwal 1989; Udry 1989; Von Pischke 1991). Informal finance has turned out to be far more heterogeneous and important than policy makers have heretofore recognized, and it exhibits certain strengths that are generally absent in formal financial markets.

Village-level studies underscore the overwhelming importance of informal finance. Both individual intermediaries and self-help groups are common. Many of them are self-sustaining even in hostile economic environments that weaken or bankrupt formal financial institutions. The activities of the former are well organized and businesslike; they are also of wide scope and significant magnitude in terms of liquidity circulation (Graham 1992). The demand for financial services at the village level clearly emphasizes deposits and savings, a fact generally unrecognized by authorities that are always interested in pushing loans.

Short-term consumption loans are also widespread, reflecting the strategic role of this kind of finance in household survival strategies. Moreover, recent work has highlighted how consumption credit, by smoothing the seasonal fluctuations in consumption flows, can create a form of social insurance, which reduces risk sufficiently that households can consider making investments that otherwise would be impossible. In short, consumption credit obtained through village-based intermediaries can play a valuable indirect role in stimulating investment (Eswaran and Kotwal 1989).

A significant number of loans are openended (reflecting indeterminate term maturity). This creates a longer term financial contract than one usually associates with informal finance (Graham 1992). Also, loan repayment obligations can be flexible post facto between selected informal lenders and borrowers, who live and work in close contact with each other. These "state-contingent" contracts reported by Udry (1989) are a common form of insurance among the Hausa in northern Nigeria. Borrowers repay if they experience no problem but are excused from their obligations in a bad year or season. In these situations, there is no doubt that the failure to repay is due to inability rather than unwillingness to repay.

High interest rates charged by individual operators form only a very small part of the heterogeneous world of informal finance in Africa, which is made up of merchants, farmers, money keepers, rotating savings and credit associations (ROSCAs), savings groups, family, and friends. Though high rates may be charged in some instances, they are usually associated with small amounts of money loaned for very short periods to cover the borrowers' inventory turnover for trading, which earns rates of return comfortably higher than the daily or weekly interest charges they may have to pay. Individual lenders must cover the opportunity cost of their money and the risk of default, which is not uncommon in informal markets. In settings where little competition may exist, relatively high interest rates may emerge, but in the end unreasonably high rates do not make economic sense for lenders, who generally benefit from on-going relationships with established clients. Such rates

cannot be sustained in a borrower-lender relationship if the economic activity cannot support them. (Adams and Fitchett 1992).

Informal finance does not suffer from the problem of asymmetric information to the same degree as formal financial institutions. Banks must protect themselves from

Informal finance clearly meets the demand for a wide variety of deposit and loan services at the village and township level.

their lack of information about a prospective borrower by demanding collateral. This is unnecessary for informal lenders, since they live and work in close contact with the client-borrower. They deal largely with collateral substitutes, such as land pawning, marketing agreements, labor arrangements, or some other reciprocal obligation.

In short, informal finance is made up of such a large, heterogeneous collection of individual operators (merchants, farmers, traders, family, and friends) and groups (ROSCAs of various types, savings societies, and self-help groups) that generalizations are difficult or hazardous. Still, this rich variety of participants generates substantial liquidity flows in rural Africa and has shown great resilience in the face of economic and natural adversity, which has severely hindered formal finance. Informal finance clearly meets the demand for a wide variety of deposit and loan services at the village and township level.

Nevertheless, informal finance does have certain limitations. It cannot offer large,

long-term loans (though, as we have seen, African development banks have also been unable to do this on a sustained basis). Nor can it intermediate between surplus (saver) and deficit (borrower) units over long distances, as the national network of branch banks can do. Informal financial operators cannot pool large volumes of deposits that can in turn allow for some degree of term transformation (i.e., issuing loans with longer terms than deposits). Informal savers are not protected by explicit or implicit deposit insurance, as are depositors in formal systems (although here we must recognize the possibility that a formal system may not be able to prevent the wholesale loss of savings to depositors, as was the case in Cameroon's recent financial crisis). For all these reasons, it may appear that informal financial agents are not ideal vehicles for mobilizing deposits to be reallocated for long-term investment.

THE SAVINGS-INVESTMENT DILEMMA REVISITED

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This review of both formal and informal finance in sub-Saharan Africa was necessary to place the challenge posed by the title of this paper in a proper empirical context. Both markets have limitations in meeting this challenge. The supply-led financial schemes established by development banks and donors have not led to the creation of sustainable institutions, which can supply long-term finance for investment. At most, they have achieved only one-shot injections and have then died out unless resuscitated by yet another capital inoculation from external sources. These weaknesses are inextricably bound up with various obstacles to term finance, which are discussed below.

OBSTACLES TO TERM FINANCE

More specifically, long-term finance—the ideal form of lending for investment—faces serious obstacles in the African setting.

- The problem of term mismatch between assets and liabilities, alluded to at the beginning of this paper, suggests that the term transformation (from shortterm liabilities to longer term loan assets) in the balance sheet is seriously limited for the purpose of avoiding a liquidity crunch, which could produce a deposit run on the institution.
- Replacing short-term, domestic deposit liabilities with long-term donor funding removes the maturity or term mismatch problem, but at the same time it removes the bank from local control, eliminates its local identity, and increases moral hazard. The bank now becomes fair game for political intrusion and rent seeking by established groups demanding loans. These are not likely to be repaid, given the lack of effective sanctions with donor money and the entitlement psychology associated with government-allocated funding. In terms of the assymetric information school, an "incompatible incentive" structure is created by the principal (i.e., the bank) for its agents (i.e., the borrowers.)
- The absence of well-defined property rights and undeveloped legal systems in Africa have compounded and reinforced the borrower-dominated entitlement syndrome by making the enforcement of collateral foreclosure rare and costly. This compromises the classical guarantees backing long-term finance.
- Public sector development banks (the usual source of long-term finance in Africa) are administered mainly by civil servants, not bankers. These institutions invariably lack performance-based incentives. Loan decisions are fragmented by the multiple layers of bureaucracy, so that in the end no one is responsible for a default-ridden portfolio.

- Accounting procedures in these institutions reflect poor information systems. This manifests itself most dramatically in the inability to track installment payments on long-term loans in such a way as to compare installment amounts paid over amounts due. No development bank in Africa has been able to document accumulating arrears in this fashion. As a result, the bank is unaware of the seriousness of its arrears until it is too late.
- Term finance institutions in Africa usually do not have many branches in rural areas, thereby limiting their access to a rural clientele that cannot negotiate loans at headquarters. Finally, in relying heavily on donor funding, these institutions do not mobilize deposits from the public as aggressively as commercial banks and in many cases not at all.

In summary, the African experience does not encourage us to be sanguine about term finance. Domestic deposits cannot match easily with a longer term asset portfolio. Long-term, fixed interest rates, which are characteristic of donor-supported, term finance contracts, erode the bank's portfolio in real terms in the face of inflation, and the high administrative costs associated with servicing targeted loans worsen the bank's income position. Most important of all, however, is the entitlement psychology that permeates the borrower constituencies of donor funding. This syndrome creates the potential for political intrusion and rent seeking in the allocation of funds, leading to delinquency and default.

PATHS TO INSTITUTIONAL CHANGE

So how can one redesign formal financial systems in Africa, so that they can curb rent-seeking intrusion in development bank portfolios, improve deposit services, increase the number of loan beneficiaries

who receive and repay loans in both private and public banks, and extend the term transformation to incorporate investment loans in the portfolio? At the same time, how can one introduce scale, scope, and spatial economies to the heterogeneous collection of segmented informal financial markets, so that they can pool a larger volume of savings and extend larger loans for slightly longer terms than they do currently? Put differently, how can formal institutions emulate some of the virtues of informal finance to gain legitimacy and sustainability, and how can informal financial markets incorporate some of the scale and scope economies of more formal finance to broaden their services at the village and township level?

Two development bank approaches-Two approaches can be considered in restructuring development banks to address these challenges more effectively. Crucial to the first approach is the substitution of domestic deposits for external donor funding. It might take a number of years before domestic deposit liabilities can rise to cover a majority of the outstanding loan balances (since many of these loans will be a legacy of the past). Nevertheless, they could quickly begin to account for a growing proportion of new loan issues. These deposits would likely grow fairly quickly in branches located in rural areas, since the sheer convenience of moneykeeping services is ranked highly in regions where private bank branches are absent and the public bank branches have hitherto not mobilized deposits. Formal deposit instruments provide informal financial groups with a useful means of managing their fluctuating surpluses.

From these actions two consequences are likely to follow. First, the local populace will begin to identify with the bank, considering it theirs rather than the government's. In short, one would be creating a depositor-savers constituency to balance the borrower domination that gives rise to the entitlement syndrome where a donor is the source of funds. Second, with proper decentralization or delegation of responsibility, the branch manager's psychology will begin to change, once local deposits begin to predominate as a source of funds for new loans. It will no longer be acceptable to issue new loans with lax evaluation and perfunctory recovery. The growth of a local savers constituency introduces starch into loan administration-i.e., a more rigorous and disciplined approach to determining creditworthiness to protect local depositors' savings. More often that not, this means that a greater proportion of loans will be made for trading, an activity in which the risks of default are lower.

In addition, to stimulate an even greater pace of deposit mobilization, one could reward the staff for every new deposit account they bring into the branch. Recent experiments along these lines in the Dominican Republic and the Philippines suggest that staff incentives (generally based on one quarter to one half of 1% of the deposit) lead to a sharp rise in deposits. Finally, one could reward all employees of the branch through an equal distribution of a fixed amount of the new deposits opened.

In the end the balance between domestic deposits and external funds will shift, improving the loan recovery record of the branches involved and the solvency of the bank. It is difficult to imagine a development bank surviving on a self-sustaining basis through responsible loan recovery without a savers constituency built on local r² cposits. Most likely, this deposit base will have to account for a majority of the bank's liabilities to achieve viability, though ultimately this is an empirical question, whose answer depends upon the country and institutional factors. What one cannot doubt, however, is that any institution which depends entirely on external funding will in a short time become financially insolvent.

Development banks and also private banks cannot reach a large number of small borrowers successfully. Administrative costs are high, given the small loan sizes, and, more importantly, selection of clientele is hindered by a lack of relevant information about the borrowers, none of whom have acceptable collateral. This is one reason, among others, why bank loan portfolios invariably become concentrated among larger clientele with secure collateral.

Nongovernmental organizations (NGOs), on the other hand, specialize in loans to small farmers and other low-income clients in villages. They work closely with these clients and are usually quite knowledgeable about their activities and creditworthiness. In short, the comparative advantage of NGOs perfectly matches the comparative disadvantage of banks. It makes sense therefore to draw the two together. NGOs could act as brokers between banks and small clientele, preparing group loans or selecting borrowers in the communities where they operate. The bank would thus be spared the costs incurred by the NGO to sort and process these borrowers and would act primarily as a wholesaler of funding and a clearinghouse for accounts. The degree to which these clients graduate into the regular portfolio of the bank is an open question. Past experience in Latin America is not encouraging on this point. Nevertheless, in the short to medium term, the approach outlined here does offer an opportunity to move investment funds further down the lending chain to a much larger number of clients than the bank could handle directly. The private bank marketing chain-In many African countries, private commercial banks are the only game in town, since development banks in a number of countries have been closed by the authorities or have terminated operations. Therefore, one has to explore the way in which private banks and their branches could be drawn into servicing a clientele that could include an investment component. Commercial banks should have no difficulty servicing a large wholesalerimporter of agricultural inputs. The wholesalers in turn can service the downstream network of retail operators in their marketing chain with sales on credit or consignment. In short, these enterprises can and do act as intermediaries, wholesaling bank loans downstream to a larger number of retailers and microentrepreneurs, which banks could never be expected to reach. The larger enterprises are very likely to be net debtors to the formal sector and net creditors to the informal microentrepreneurial sector. In the end, financial liquidity is released to lubricate regional economies, insofar as established, wholesale retail marketing networks function in these settings.

In more rudimentary economies, where these marketing networks are less developed or where formal and informal finance are less integrated, bank finance will have a lesser effect on regional economies. At the same time, wholesalerimporters of agricultural inputs may find it too risky to lend to downstream retailers and will therefore demand up-front payments in cash. The most secure way to insure effective repayment is to play a strategic role in the purchase or processing of the output of the input user. Wholesale processors of cotton in Mali, for example, face little risk in marketing inputs on credit to cotton growers because of the monopsonistic role they play in purchasing and processing the output. Loans can

be deducted from crop purchases, thereby removing the danger of delinquency or default.

Village-based savings and credit cooperatives—The final institutional path for financial growth in rural Africa includes village banks and village-based savings and credit cooperatives. As for the latter, it is clear that there is a promising savings base at the village level in Africa. The conventional wisdom that the rural

The conventional wisdom that the rural population is too poor to have savings has long been disproven through field studies.

population in Africa is too poor to have savings has long been disproven through field studies documenting the large number of ROSCAs, savings societies, and money keepers handling an impressive flow of savings. The problem with this activity is that it is broken up into segmented markets by occupational group, place of residence, etc. In short, these indigenous forms of informal finance lack scale economies.

Combining these small units into broader based, village-level savings and credit cooperatives or associations offers the opportunity to pool a much larger volume of savings into larger loans for slightly longer periods than is characteristic of most forms of informal finance. Such associations would still enjoy the villagebased identity and social cohesion necessary for a properly performing portfolio.

It is likely that a large proportion of these loans will be for what is conventionally called consumption rather than production. However, one should be careful about the meaning of these terms. Expenses for education and health care can easily be conveyed as investments in human capital. Furthermore, regardless of the expenditure in question, it is clear that it ranks highest in the utility function of the household or individual receiving the loan. We should not be so cavalier as to replace the utility function of these borrowers with our own, based on the presumptuous notion that we know more about their needs than they do themselves. Finally, and most importantly, consumption loans replace what households would already have planned to use from their surpluses to smooth the flow of expenditures over a crop cycle. Consumption loans release this surplus and thus indirectly stimulate household investment beyond the levels that would otherwise have occurred (Eswaran and Kotwal 1989).

The final issue to explore here is the damage that donors and NGOs can do to fledgling savings and credit cooperatives before they have become well established. There is always a temptation to push money through these associations to provide some targeted village clientele with inputs. This increases risk and creates the potential that a donor virus might spread through the membership, as everyone lines up to take the money and run. In short, a variant of Gresham's Law operates, in which cheap, external money drives out expensive, local money, creating an entitlement or dole psychology that destroys the disciplined loan services built up through local savings deposits. This is not to deny the possibility that some access to external funds could be considered for some "productive" purpose. Donors and NGOs should delay such actions, however, until the village-based associations are up and running and have a good portfolio. Moreover, these lines of credit should always remain a minor portion of

the funding base to avoid the donor virus syndrome. For the most part, donor resources should be focused on technical assistance, training, and the infrastructure and/or equipment costs of the cooperative, not on replacing domestically generated deposits for further lending.

CONCLUSION

In answer to the question raised at the start of this paper, we can reply that it is not difficult to mobilize savings in rural Africa. Indeed, many informal financial vehicles and actors already do this in impressive fashion. It is also possible to imagine long-term investment funds being allocated at high costs in this same setting, as long as the funds come from donor sources and no one is concerned about the costs incurred and the financial solvency of the institutions through which these funds are allocated. The enigma is how to combine these two financial activities within the same institution in a selfsustaining way.

This paper has suggested that such a combination is unlikely. To the extent that it could be cobbled together, several institutional parameters are essential. First, local mobilization of deposit-savings must form the core of the liabilities of such an institution. Donor or external funding must be kept to a minor share to avoid the rampant rent seeking and political intrusion associated with external lending schemes. Second, some degree of decentralization and delegation of responsibility must be established in the branch network of public sector banks to reinforce the local impact of a growing savers constituency on loan evaluation and recovery by local management. Some degree of term transformation is conceivable under these circumstances, though not as long term as is the case in projects run exclusively by donors.

Private commercial bank loans to wholesalers with marketing networks for agricultural inputs and outputs are a natural and logical vehicle for expanding liquidity into rural economies. In some African countries, these banks may be the only ones functioning. Finally, villagebased savings and credit cooperatives have been created on the base of indigenous informal financial groups. By combining these segmented niches of liquidity circulation into broader based village banks or savings and credit associations, one can gain both scale and scope economies in financial intermediation (i.e., the pooling of a larger volume of savings into larger loans over slightly longer terms for possible investment by microentrepreneurs and farmers). In brief, there is no one path but rather several institutional approaches that could be expanded in an effort to meet the challenge of marrying domestic deposit mobilization to domestic investment in rural Africa.

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Market Diversification and Agricultural Export Prospects in Sub-Saharan Africa

Ronald C. Duncan*

When discussing agricultural exports in sub-Saharan Africa, one is basically talking about coffee, cocoa, and cotton. Sugar, tea, and tobacco are next in line but of much less importance. During the period 1985-1987, the region's exports of the first three

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The prospects for African exporters are largely a matter of their own performance and the effects of their policies on production.

commodities earned about US\$5.1 billion annually, while the latter three earned about \$1.3 billion. Only in cocoa, coffee, and tea do African countries, in aggregate, have a large share of the world market. Their share is largest, by far, in cocoa, constituting over 60% of world exports.

For commodities in which these countries have a small share of the world market, they can expand their share without affecting the world price or prompting a reaction from other producers. This is not true for cocoa, coffee, and tea. However, in either case, the prospects for African exporters are largely a matter of their own performance and the effects of their policies on production. Therefore, in discussing implications for the region of the outlook for existing export markets and possibilities for diversifying into exports of other agricultural commodities, I will focus mainly on domestic issues that I believe are very important for agricultural development in sub-Saharan Africa.

TRENDS IN COMMODITY PRICES

No discussion of agricultural export prospects would be complete without covering the disastrous decline in agricultural commodity prices in the 1980s and 1990s (see Figures 1 and 2). As indicated in Figure 2, the real prices for beverages suffered the worst decline in this period. The decline in real commodity prices after 1982 is puzzling, since it has coincided with continuous economic growth in countries belonging to the Organisation for Economic Co-operation and Development (OECD) after the 1981-82 recession and up to the 1991 recession.

I have given reasons elsewhere why I do not agree with Peter Drucker's so-called "decoupling" thesis to explain the decline or with the idea that developing countries with large external debts have increased primary exports to maintain export revenues in the face of declining prices (Duncan 1991). I do agree that the collapse of the coffee and tin international agreements, widespread reductions in export taxes on cocoa and coffee, depreciations of overvalued exchange rates in developing countries, and policies of subsidizing competitive agricultural exports in the European Community and USA all contributed to lowering the prices of some commodities. Certainly, the larger decline in beverage prices in real terms must be

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attributed to the collapse of the coffee agreement, to reductions of export taxes, and to depreciations of exchange rates in many cocoa- and coffee- producing countries.

However, the sharp, across-the-board decline in real commodity prices in the 1980s, including metals and agricultural raw materials (see Figure 2), compels us to look also to other, more general explanations. In the paper mentioned above, I suggested the need to study the relationship between commodity prices and macroeconomic factors—particularly the real interest rate.

We have now completed some research on this question. A study conducted by Alogoskoufis and Varangis (1992) shows that there is a relationship between fiscal deficits in OECD countries and the relative



Figure 1. Nonfuel commodity prices, 1948-1991 (current dollars, index 1979-1981=100). Source: International Trade Division, World Bank.





prices of commodities (i.e., deflated by manufactures export prices). This effect operates through changes in the real interest rate, with increases in fiscal deficits raising real interest rates and lowering commodity prices. The empirical results show that an increase in the fiscal deficit of the G-5 countries by 1% of their GDP causes a reduction of 2% in the relative price of commodities. Furthermore, changes in OECD fiscal deficits explained 40-50% of changes in real commodity prices over the sample period. Monetary expansion has the opposite, though more temporary, effect on commodity prices, lowering interest rates and raising commodity prices. Thus, different policy mixes in the OECD countries will have different effects on commodity prices.

The direct causes of the declining trends in cocoa, coffee, and tea throughout the 1980s and up to the present are clear—continually expanding production in the face of stagnant or slowly growing demand. In the case of cocoa, growth in demand has increased in recent years as a result of very low prices, but growth in supply has outpaced that in demand in seven of the last eight years. The obvious question is why production of these commodities has continued to increase in the face of falling real prices.

Several factors have contributed to increasing world output of these perennial crops in the last decade or so: 1) more efficient production, 2) reductions in export taxes, 3) depreciation of real exchange rates, and 4) the growing labor force in producing countries. For cocoa and coffee, other reasons also appear important: the high prices of the 1976-1978 period were seen as a permanent upward shift in prices, leading to sustained planting programs; and there was a lack of close competitors for the land. Reductions in the cost of production have been achieved, as described below, through improvements in yields:

- High-yielding varieties (HYVs) of coffee, such as Caturra (an arabica variety), were introduced in many countries during the early 1970s. There were extensive replantings with the HYVs in the 1970s and 1980s.
- HYVs of cocoa were also introduced in the mid-1970s and have been widely planted in Brazil, Southeast Asia, and to a lesser extent in Africa (particularly Ghana).
- Tea yields have been increasing at rapid rates over the last two decades in almost all major producing countries as a result of replanting, including some improved varieties.

Less spectacular but important decreases in production costs have come from reductions in marketing costs, brought about through marketing reforms, especially in Africa. Nigeria abolished its cocoa marketing board; Ghana has reduced its cocoa board staff substantially; and the marketing fees given to traders in West Africa have been reduced significantly in recent years.

Reductions in explicit and implicit export taxes are another important development, especially for coffee and cocoa in Africa and Latin America. For example, export taxes on coffee in Brazil and Colombia, which were as high as 50% of f.o.b. prices in the early 1980s, have since been cut to zero (Brazil) or become negative (Colombia).

Declining real exchange rates have favored export commodities in several countries, including Indonesia, India, and Kenya. To illustrate the impact of the changes in export taxes, marketing costs, and exchange rates on producer prices, I present in Table 1 a decomposition of the effects of these changes on coffee prices in major producing countries. In Brazil, for example, the real producer price declined by 32%. This was the net result of a 41% drop in the export unit value, a 37% decrease in the real value of US dollars in terms of Brazilian currency, and reductions in taxes and domestic marketing costs, which increased real producer prices by 46%. As shown in the table, Brazil, Colombia, El Salvador, Ethiopia, and Mexico reduced taxes and marketing costs substantially to alleviate the impact of lower world prices on producer prices. Kenya and India cushioned the impact of real depreciation, but taxes and / or marketing costs increased. Meanwhile, in Brazil, Ethiopia, and Mexico there was considerable currency appreciation, which reduced real producer prices.

Another factor that has contributed to expanding the world's supply of perennials is an increase in the share of population that is of working age. In many countries producing perennial crops, job opportunities in other sectors have not been growing rapidly. As a result, governments have adopted policies to encourage the expansion of perennial crop production as a means of creating jobs. Perennial crops are well suited for this purpose, since their production is labor-intensive.

An important development in the global, perennial crop scene has been the increasing market shares of Asian countriesespecially those in Southeast Asia-at the expense mainly of African countries. In the 1980s Indonesia was the only major coffeeexporting country to increase production substantially. The combined share of Indonesia and Malaysia in world production of cocoa increased from about 3% in 1980 to over 16% in 1990. In palm oil Asia's world production share increased from 73% in 1980 to nearly 80% by 1990. Asia's growth in market share was mainly the result of improved efficiency of production, low export taxes, sensible exchange rate policies, and an efficient labor force.

COMMODITY MARKET OUTLOOK

Let us now examine how the factors I have discussed so far are likely to behave in the future. We believe that production will continue to become more efficient, though possibly at a lower rate than in the 1980s. The countries of Southeast Asia are likely to continue to be trend setters in new technologies. This factor is critical for

importanter of the		Components					
Country	Changes in real producer price	Export unit value	Exchange rate and CPI ^a	Taxes and marketing costs ^b			
Brazil	-32	-41	-37	+46			
Colombia	-3	-37	-2	+36			
El Salvador	-27	-45	-5	+23			
Mexico	-26	-29	-26	+29			
Cote d'Ivoire	-53	-52	-10	+9			
Ethiopia	-59	-40	-35	+16			
Kenva	-28	-35	+11	-4			
India	-44	-41	+33	-36			
Indonesia	-48	-49	-9	+10			

 Table 1. Percent changes in the real producer price and its components in selected countries between September 1988 and September 1991

^a Change in the value of nominal US dollars in terms of local currency deflated by CPI.

^b Effects of changes in taxes and domestic marketing costs on real producer prices.

Malaysia, since its labor costs are likely to increase significantly from already high levels (witness its new, labor-saving technique for rubber tapping and its gestation-reducing technology for bud grafting). Also, marketing costs will continue to decline, especially in African countries, where there are still large reductions to be realized. Only a limited number of countries still have highly overvalued exchange rates, however. As for the labor force, we expect increasing numbers of workers to be engaged in perennial crop production in Africa and Indonesia. Because of their low supply elasticities, production growth rates will be reduced only slowly. The plantings that have taken place over the last decade or so will continue to exert an impact on production for several years as trees mature. Export taxes on perennial crops have already been eliminated or reduced to low rates in most countries.

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An interesting question to consider is whether these taxes will be increased again. One rationale for imposing them in the past was to create buffer funds for stabilizing domestic prices. Since the funds generally have not been used effectively for that purpose, it is unlikely that they will be implemented again on a wide scale. Another rationale for export taxes was that they were the only tax that governments could levy effectively to generate revenues. If efforts to create a broader tax base in developing countries succeed, this rationale will no longer have as strong an appeal as it once did. Finally, because of the monopoly position of large exporting countries, the benefits expected to accrue to them from levying export taxes seem to have been eroded by an economic force that some of us believe made this an unfortunate policy. Though in the short run, some monopoly may exist, in the long run, when competition from substitutes takes effect, the elasticity of foreign demand is quite high, so that the use of

export taxes to raise world prices leads eventually to loss of market share (Imran and Duncan 1988).

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For example, coffee consumption in industrial countries, especially the USA, has seen strong competition for many years now from fruit juices and soft drinks, which have become much cheaper in relative terms, leading to larger and larger proportions of young people growing up not drinking coffee. In another example, the high export taxes imposed by cocoa producers, such as Cameroon, Ghana, and Nigeria, served only to benefit other producers, such as Cote d'Ivoire and Malaysia, which expanded their market shares.

DEMAND FOR BEVERAGES

On the demand side, I am afraid that the factors which depressed world perennial crop prices in the 1980s will continue to exert their effects. For commodities consumed mainly in industrial countries (cocoa and coffee), low and declining rates of population growth and income elasticities are expected to have an even more serious impact in the future than in the past. However, the demand picture could eventually be quite different if rates of growth in income continue to be high in particular developing countries (China and India) or if certain regions (eastern Europe and the former Soviet Union) achieve economic growth rates much higher than those in the recent past. The difficulties experienced by the former Soviet Union in making the transition to a market economy has led to sharp reductions in imports of cocoa, coffee, and tea over the past two or three years.

World demand for coffee is projected to increase at an average rate of only 1% per annum for the period 1992-2005. Countries that are expected to increase consumption include the former Soviet Union, Japan, Spain, the UK, and low- and middleincome countries in East Asia and Latin America. Present market indications are that world prices for arabica coffee will recover somewhat in 1993 because of expected lower production in Brazil and the stagnation of production in most other countries. Any possibility of a significant price increase, resulting from a sharp reduction in world supply, would be dampened by the release of large stocks now held in the importing countries. Real arabica prices are expected to increase during the second half of the 1990s contingent on continuing stagnation of world supply in the face of slowly increasing demand.

Prices for robusta are projected to fare worse than those of arabica, mainly because of continuing changes in taste among consumers in high-income countries. With low coffee prices, consumers have been willing to pay relatively higher prices for arabicas, which have a milder taste. In eastern Europe and the former Soviet Union, demand has recently shifted towards robustas because of the widening price differential. But as income levels in these countries recover, they will shift back to arabicas. Prices for robusta are projected to average about 63% of those for arabica in the mid-1990s, and this percentage is expected to decline steadily to about 55% by the early 2000s. That is bad news for African producers of robustas, particular those in West Africa.

Growth in world demand for tea has depended very much on imports by the former Soviet Union ever since the Chernobyl incident. Prior to that, it was supported by growth in demand from the Middle East, where oil-exporting countries were employing large numbers of migrant labor. After the drop in oil prices during 1985, this demand became less important. Since the breakup of the former Soviet Union, its demand for tea has collapsed, with imports declining from 231,000 t in 1990 to 170,000 t in 1991; they are expected to fall to 160,000 t in 1992. Another reason for stagnating import demand has been the trade embargo on Iraq, whose recorded imports have fallen from 52,200 t in 1988 to 27,500 t in 1990 and to an estimated 20,000 t in 1991.

Long-term growth in the consumption of black tea is estimated to be less than 2% per annum (compared to 3.5% annually for the 1970-1990 period). Import demand in industrial countries is expected to continue declining at something like 1% per annum, mainly because of a 2% projected decline in the UK. Australia and Canada are also experiencing declining demand, as a result of shifts to other beverages, including coffee. India's consumption growth is projected at 3% per annum-down substantially from the average of 4.6% annually for the 1970-1990 period. Population growth has slowed, and income elasticity has declined with higher per capita incomes. The large uncertainties are developments in the former Soviet Union and Middle East. Crude oil prices are not expected to increase in real terms, which will have important effects on tea consumption in these areas.

Cocoa prices, in real terms, are projected to remain almost unchanged from 1992 to 1995. Despite slower growth in production, prices should show only very gradual recovery, due to the existence of large stocks (1.5 million tons). In the medium to long run, we expect only a small real price recovery, in the absence of major supply shocks. In the short to medium term, the rate of growth in world cocoa consumption is expected to be around 2% per annum-including some response to the current low prices-but the growth rate should decline as cocoa prices recover. In the medium run, world consumption will be critically affected by events in the former Soviet Union and eastern Europe. Following the political and economic

changes in these countries, consumption declined sharply; but while consumption in eastern Europe shows signs of recovery, that of the former Soviet Union has continued to decline, with no sign yet of recovery. Cocoa consumption is expected to increase in the Far East, particularly in nontropical countries, such as China, Japan, and Korea. However, we do not expect these countries to have a significant impact on world cocoa consumption within our present forecasting period (1992-2005).

BEVERAGE SUPPLY

During 1992-1995 cocoa production is expected to increase but at a much slower rate than in the recent past. It will be affected positively by the high level of new plantings, made in the mid- to late 1980s, coming into maturity. But this positive effect will be countered by poorer farm care due to lower prices. Hence, yields are expected to decline in the short run in Brazil, Cote d'Ivoire, Ghana, and Malaysia. An exception is Indonesia, where the low cost of production makes cocoa profitable even at today's low prices. After the mid-1990s, the low level of new planting and replantings (and in some cases diversification away from cocoa because of low prices in the early to mid-1990s) should cause production to decline in some countries (Brazil, Cameroon, Cote d'Ivoire, and Malaysia) and to slow its growth in others (Ecuador, Ghana, and Nigeria). Again, only Indonesia is projected to show significant growth, for the reasons stated earlier.

World coffee supply is projected to increase, on average, at 0.6% per annum over the period 1992-2005. Supply prospects differ significantly from one country to another. Brazil's supply is projected to fall from recent levels and to average around 25 million bags. Colombia's production is projected to decline in the late 1990s as a consequence of lower real producer prices and higher labor costs; it is expected to fall below 14 million bags by 2000 but recover to 15.5 million bags by 2005, following an increase in world prices in the late 1990s. Indonesia is expected to increase production by 1.7% per annum during the projection period because of its abundant land and low-cost labor. Robusta production has been increasing rapidly in Vietnam, and this trend can be expected to continue, which is further bad news for African robusta growers. Production in Cote d'Ivoire is expected to decline at 1.6% per annum because of the recent sharp reduction in real producer prices.

Increases in black tea output, which have driven prices to record-low levels, have taken place primarily in India, Kenya, and Sri Lanka. Between 1989 and 1991, these three countries added 6% to world output. Future increases are expected to occur mainly in India (at an annual rate of 1.9%), Indonesia (2.6%), and Kenya (2.9%). By 2005 Kenya is expected to be the largest tea exporter, with a world market share of 25%, compared to 17% at present. The additional output is expected to come mainly from yield increases on small farms, where average yields are much lower than on estates.

MARKETS FOR COTTON, SUGAR, AND TOBACCO

Markets for these commodities are undergoing tremendous change and have potential for even more upheaval. Cotton prices fell 22% between 1991 and 1992, as a result of large production increases in China (which in turn were due to high producer support prices), in the USA (which has subsequently used its cotton marketing loan program to subsidize its sales in the domestic and export markets), and in Pakistan and as a consequence of distress sales by the republics of the former Soviet Union (only one-half of the 1991-92 crop was sold because of a breakdown in marketing arrangements between the republics and with eastern Europe; the remainder was held over). The US cotton marketing loan program, high support prices in China, and the large volume of synthetic fiber capacity installed in recent years are likely to keep cotton prices down over the next two to three years. Low prices have already led to sharp declines in cotton production in Mexico and Central America.

Over the long term, the rate of growth in cotton consumption is expected to average about 1.9% per annum—slightly higher than expected population growth. In the total fiber complex, the main growth market is for synthetic fibers, particularly polyesters. On the supply side, competition between low-cost producers, such as Australia, and those producing cotton or its products with the aid of subsidies of one kind or another is likely to keep prices declining in real terms.

In sub-Saharan Africa, cotton production increased by over 4% per annum during the 1980s, reaching nearly 1 million tons by 1990. However, it has recently lost some momentum, partly because of the current drought. We project a continued modest increase in the region under reformed policies, resulting in the concentration of cotton production in the more efficient regions.

The sugar market seemed to be building up to another price boom in 1989, with stocks falling to near critical levels and prices at 15¢/lb and rising. Then political upheaval in China that year prompted the country to slash its imports, with the result that consumption declined by 25%. (Average annual growth in consumption in China fell from 8.8% per annum in 1983-1988 to zero in 1988-1992.) Subsequently, political and economic reforms in eastern Europe and the former Soviet Union led to marked reductions in imports and consumption in those economies. As a result of these changes, stocks have built up again, and sugar prices have fallen to around 10¢/lb.

Sugar consumption will probably resume its rather steady growth rate of about 2% per annum, with much of this taking place in Asia (which has about 60% of the world's population), where we project annual growth of 3% per annum, compared to 6% in the two previous decades. Latin America is another region where strong consumption is projected, assuming that incomes in this region grow as expected in response to the reforms being implemented.

The extra 40 million tons of sugar expected to be needed by 2005 should come mainly from China and India (as they strive for self-sufficiency); from Australia, Brazil, and Thailand (the three major low-cost producers); and from the European Community (which, despite its generally high production costs, seems set to continue increasing production). The recent decision to reduce cereals prices in the European Community could well mean pressure to increase the sugar beet area.

Major reductions in sugar production seem likely in Cuba and the former Soviet Union (particularly in Ukraine). In Cuba sugar has been grown for many years under high levels of assistance stemming from access to privileged markets, previously in the USA and since 1960 in the former Soviet Union. The latter has ended the arrangements whereby the price it paid Cuba for sugar was several times international levels (admittedly in rubles but also in exchange for crude oil). Around 95% of Cuba's arable land is presently under sugarcane. Loss of assistance from the former Soviet Union is likely to cause Cuba to shift to other agricultural activities (such as dairying, beef, and fruit growing), as relative producer prices

change. A halving of producer prices could reduce production by 30-40%, equivalent to around 2.5% of world production and 10% of world trade.

Sugar beet production in eastern Europe and the former Soviet Union entails extremely high costs (40-50¢/lb, compared to less than 10¢/lb in Australia). Some countries in those areas may well continue production under subsidies, while others may eventually join the European Community and benefit from its Common Agricultural Policy prices. But Ukraine is a special case. It is the only republic of the former Soviet Union that produces a surplus (around 5 million tons). Since it would be very costly to subsidize such large exports, Ukraine will probably be forced to sell at international prices.

There is little evidence that even efficient producers in sub-Saharan Africa (such as Mauritius, Swaziland, and Zimbabwe) will expand production and exports significantly. These stagnated during the 1980s, and the 1992 drought has had disastrous effects on sugar production in eastern Africa. Zimbabwe, for example, will produce no sugar in 1992 and possibly 1993.

The pattern of world tobacco consumption has changed dramatically during the 1980s. Outside the Asia and Pacific region, consumption declined by 0.9% per annum; in the OECD countries, the rate of decrease was 2.3%. In Asia consumption increased during this period at 6% per annum, led by China at 10%. The reasons cited for the decline in consumption are the increased cost of cigarettes (a result of greatly increased taxation), consumers' heightened concerns over the ill effects of tobacco use, and government restrictions on tobacco advertising and use. The geographical shift in tobacco consumption is expected to continue, though at a slower pace. World consumption is projected to

grow at less than 1% per annum, with China's growth rate forecast at 3%.

Tobacco production has been shifting to low-cost countries in Africa, Asia, and Latin America, while showing a downward trend in North America and Japan. Production in industrial countries is expected to continue its decline, shifting to countries where demand is increasing and liability risks are less intimidating. In the leading African producers and exporters Malawi and Zimbabwe-growth is expected to continue for several more years. These countries produce types of tobacco-mainly burley in Malawi and flue-cured in Zimbabwe-that are in demand for blended cigarettes. The shift to lower cost growers and the potential for increasing productivity-even with current technology-together with slow growth in demand, are expected to cause real prices to continue declining.

To sum up, in the 1980s the terms of trade shifted sharply against primary agricultural commodities of major interest to sub-Saharan Africa. Though there are reasons to believe that relative prices could move in the other direction, with a cyclical slowdown in the growth of supply and / or a lowering of real interest rates, producers should act as though the change is permanent.

AGRICULTURAL POLICY OPTIONS

Turning from market prospects, I want to offer some thoughts on agricultural policy options. First and foremost, I believe that, before thinking about diversification, countries in sub-Saharan Africa have to make sure they do well what they do best. In agriculture this is most commonly producing cocoa, coffee, cotton, and tea. Only in this way will they have good prospects in world markets. Like it or not, these markets have become much more competitive for the reasons I described earlier. To retain, let alone increase, their shares, countries in the region have to adopt sensible macroeconomic and sectoral policies.

Kenyan tea production is a good example to follow: a sensible exchange rate policy, very low export tax, and good research and extension are the main ingredients in a recipe that has enabled Kenya to increase its share of world tea exports from 5.7% in 1969-1971 to 17% in 1990; we project that its share will be 23% by 2005. Ghana's policies affecting cocoa provide an example of the worst policies prior to 1983 and of good policies since then. Under an overvalued exchange rate and exorbitant export taxes (as a result of which farmers received about one-third of the world price), Ghana's cocoa industry lost the favorable position it occupied in the 1960s, when it was the world's largest producer of the best quality product. By the early 1980s, its output had fallen by more than one-half, quality had declined, and the country's reliability as a supplier had been called into question. Since 1983, when changes were made in its exchange rate and export tax policies, production has almost doubled.

Of course, this is the World Bank's standard policy prescription, to which its critics have two main objections. First, if applied to large producers or to many small ones when the country or countries' share of the world market is higher than its world import demand elasticity, such policies lead to a decline in the world price and in total revenue, leaving the country or countries worse off. Second, where such policies have been tried, there is little or no supply response from other export sectors to depreciation of the exchange rate and to reduction in other forms of discrimination against them. Ghana is cited as an example.

Recent work we have done shows that Ghana's cocoa production recovered significantly and that its economic welfare increased substantially as a result of the structural adjustment policies implemented. World cocoa prices were reduced by Ghana's expansion, and other countries suffered welfare losses. Apparently, other export sectors have so far not responded. But what were Ghana's other choices? To maintain its overvalued exchange rate

Before thinking about diversification, countries in sub-Saharan Africa have to make sure they do well what they do best.

and/or high export tax? This would have resulted in further loss of shares to other countries, such as those in East Asia, which have lower or no export taxes and higher rates of growth in productivity. The same choices apply to Africa as a whole.

It has been suggested that all major producers join together in applying export taxes to restrict world production or to hold stocks in an effort to raise prices. The problems experienced with international commodity agreements attest to the futility of that strategy. I also earlier pointed to the fact that the elasticity of import demand is much higher in the long run than in the short run and that a policy of applying export taxes to exploit monopoly rents becomes self-defeating. Jute and tin are rich examples.

The adoption of market-based exchange rates and low to zero export taxes have indeed pushed down world prices of cocoa and coffee (and of rubber in the 1970s). But this must be accepted as unavoidable, and countries have to compete within the kind of market that develops. The key questions then are how to improve the rates of growth in productivity for crops currently grown in sub-Saharan Africa, how to lower the costs of production, and how to improve the supply response of other export activities, whether in agriculture, manufacturing, or services. It is important to bear in mind that declining prices do not preclude profitable production. Improved efficiency is the key to maintaining profitability in the face of a so-called cost-price squeeze. As indicated in Figure 3, marketing costs for cocoa are relatively high among West African producers, reducing the share of the world price that producers can receive.

MARKET DIVERSIFICATION

Just as oil exporters, such as Indonesia, had to look to the development of socalled nontraditional exports (including agricultural commodities) when oil prices fell, relative prices should now provide countries in sub-Saharan Africa with an incentive for developing exports other than the traditional ones. However, before I turn to a discussion of the region's performance in this area, allow me to present a few ideas related to the issue of diversification. Though their relationship to that issue is somewhat indirect, these ideas are important nevertheless.

I think an argument can be made that the sharp reduction in revenues from taxes on export crops, such as cocoa and coffee, will have desirable side effects. Because the government revenues of many small countries have depended upon such taxes, government spending (on research, extension, and marketing and distribution infrastructure) has shown a bias in favor of those enterprises, which has worked against the establishment and growth of other export activities. Then there have been cases, as in Cote d'Ivoire, in which horticultural workers were subject to income and social security taxation, while cocoa and coffee workers were not (Hormann and Weitor 1980). The creation of broader tax bases should help to eliminate such biases, but the vested interests that have been built up on the collection and expenditure of these export taxes will have to be overcome.

Next, I want to make some points about the concept of export diversification. In one sense diversification is an end, not a means. As economies develop, they





diversify-not the other way around. Further, forcing diversification means moving out of activities in which the country has a comparative advantage. However, diversification can be a useful way of hedging both production and price risk. It may be one of the most useful ways to hedge production risk, whether in the form of spatial or product diversification. In that way the cost of losing something in terms of comparative advantage is offset by the benefits of stabilizing revenues. If diversification is being considered as a form of price risk management, one has to make sure that there is a low covariance between the price series. Diversifying within primary commodities is not necessarily a good idea. Commodity prices tend to be highly correlated over time, typically with correlation coefficients between nominal prices exceeding 60%. For example, the coefficients of correlation between the price of zinc and those of cocoa, coffee, and tea all exceed 80%; that between pineapples and coffee and cocoa is about 85%.

Domestic processing of primary products is often suggested as a form of export diversification, with processing of cocoa products most often mentioned. This suggestion should be taken with caution for the following reasons. In general, the factor proportions that give particular countries a comparative advantage in producing a primary product do not necessarily mean that they will also have a comparative advantage in processing that product. For example, tropical climates are excellent for producing cocoa beans, but the humidity makes producing cocoa butter, liquid, and powder very difficult. Also, studies have found that huge savings in the costs of processing cocoa beans can be made through economies of scale; i.e., cocoa-bean processing is capital-intensive and therefore not a promising option for developing countries. Studies of cocoa processing have shown that this activity is

generally unsuccessful in the developing world, with low utilization and recovery rates. The low utilization rates are usually a result of government regulations, which do not allow beans to be imported from other countries for processing. Not allowing imports also affects quality, since the best products are mixtures of beans from various sources.

According to data on the volume of nontraditional exports (essentially fruits and vegetables) in sub-Saharan Africa, pineapples are the only commodity in which reasonable progress has been made (see Tables 2 and 3). The data are, however, of poor quality; most are Food and Agriculture Organization estimates.

Table 2. Volume of exports of selected horticultural crops in sub-Saharan Africa

Commodity	1967-69	1977-79	1987-89		
	000 tons				
Cabbage	0.16	0.13	0.14		
Cloves	17.04	15.12	14.47		
Eggplant	2.42	0.84	0.34		
Grapes	36.90	27.55	47.10		
Lettuce	0.08	0.10	0.03		
Mangoes	0.30	6.15	12.06		
Oranges	919.77	1,041.31	936.10		
Pineapples	27.55	95.81	170.05		
Potatoes	189.66	202.94	231.02		
Tomatoes	129.06	115.95	120.48		
Watermelons	1.96	20.57	11.82		

Source: FAO.

Table 3. Volume of exports of some processed horticultural commodities in sub-Saharan Africa

Commodity	1967-69	1977-79	1987-89	
	000 tons			
Tomato paste	8.08	6.01	10.36	
Orange juice	22.56	21.21	28.73	
Pineapple juice:	- 0.080			
Light	70.44	152.96	116.75	
Concentrate	15.95	20.62	19.03	

Source: FAO.

What are the reasons for the relatively poor performance of African countries in developing these nontraditional industries? Some of the important ones are discussed below.

Export diversification requires the establishment of pricing, distribution, and marketing channels for the new goods or services. Establishing new export markets has proven to be a considerable hurdle for countries that are reforming their trade policies. Often, they simply do not possess the requisite skills and knowledge. Experience has shown that countries which are open to obtaining this expertise from outside, whether through joint ventures or direct hiring, do best in getting new activities going. In a recent World Bank study (1992), in which 121 manufacturing exporters and 56 exporters of (nontraditional) primary resources in sub-Saharan Africa were interviewed, foreign collaboration was cited as a necessary or primary condition for exporting.

As countries in eastern Europe and the former Soviet Union are discovering, setting up markets in which goods can be traded and producers and consumers can compare quality and find out market prices for each grade of commodity is key to getting activities under way in a nonplanned environment. For traditional export commodities, steps have long since been taken to establish price margins, spread information about prices (both domestically and overseas), and set product standards—whether by government fiat or within a free market.

For new commodities, these market functions have to develop, preferably with only the necessary help from government. Competition within these nontraditional markets is very keen. Within Europe, for example, producers of horticultural products in sub-Saharan Africa have to compete with growers in Latin America, the Middle East, and North Africa as well as with local producers trying to extend their growing seasons.

Another point I would stress is that the necessary conditions for establishing entrepreneurial activity include (apart from minimal government intervention in pricing and trade) access to all available forms of risk management. For private investors to flourish, they need to be able to hedge their risks. In the case of prices, this requires access to financial markets to hedge risks associated with currencies, interest rates, and commodity prices-that is, access to futures and options markets overseas as well as to over-the-counter financial instruments, such as currency, interest rate, and commodity swaps. Too often, government restrictions on foreign currency flows prevent firms in developing countries from using futures markets in New York, Paris, London, etc. This puts them at a tremendous disadvantage relative to firms that can do so, even to the point of making them nonviable. Hedging of price risks is particularly important in commodity markets, because commodity prices are so variable and uncertain.

Timing of harvests to fill market niches in industrial countries has proven critical for developing countries that have moved into horticultural enterprises, such as those in Latin America and northern Africa. Research is needed to identify varieties that fit seasonal and other marketing requirements. Most horticultural crops are highly perishable and require specialized storage and transport facilities. In many cases inadequate infrastructure limits transport possibilities. Habashy (1982) estimated that about 50% of horticultural crops were either thrown away or sold at prices reduced by as much as 30%. For the export sector, he estimated that 75% of the quantities purchased were sold

back to the domestic market as unsuitable for export.

CONCLUSION

The prospects that the prices of sub-Saharan Africa's traditional export crops will increase in real terms are poor. This is not to say that the region's shares of world markets in these commodities cannot grow. Improved productivity, under the umbrella of improved macro and sectoral policies, is the key to profitability in these sectors and to increasing marketing shares.

But it has to be recognized that there has been a change in relative prices away from traditional crops, which means that new exporting activities will have to be developed. Government policy and expenditures appear to have been biased in favor of traditional crops and to the detriment of new ones. This bias is likely to change as relative prices change, but change will come slowly because of the vested interests in production, marketing, and distribution of those crops.

Governments can do many things to encourage the development of new export activities. But they can also do many things (and already are) to inhibit this development. It is critical that we identify the things governments should stop doing and the ones they should do. Since any action has an opportunity cost, governments should then assign priorities to the activities they need to undertake. I would suggest that they concentrate on research into appropriate varieties for export markets, extension of advice about new technology, and investment in physical infrastructure for efficient transport and storage of the commodities. However, they must try to avoid the mistake of biasing policies and expenditures in favor of the nontraditional commodities but rather should take a neutral position that favors neither these nor the traditional commodities.

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PROSPECTS FOR AGRIBUSINESS IN AFRICA

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It is commonly said that, because of the magnitude and nature of the crisis in Africa, the continent does not provide an attractive environment for investment. It is generally seen as being too insecure and unstable to allow adequate returns. Though I have no intention of denying the

Political stability in a democratic system is perhaps the most fundamental requirement for minimizing investment risks.

truth of this assumption, I would venture to say that it is true only in a limited sense. Those of you who are familiar with the African environment and have done business in the region will bear me out in this regard. Even so, the element of truth in the argument against investment on this continent is discouraging enough, especially in a highly competitive global economy. For many reasons, investment generally and in agriculture particularly has not been sufficiently rewarding in Africa.

And yet investment is a necessary condition for long-term growth and improvement in living conditions. To achieve these ends, we must first be clear about the key elements of an environment that is conducive to business of any sort and gain a better understanding of the special requirements of agribusiness. On that basis we can then characterize the possibilities for agribusiness in Africa during the 1990s and beyond.

ELEMENTS OF THE BUSINESS ENVIRONMENT

Business and investment decisions are based primarily on the assessment of risks and returns. Political stability in a democratic system is perhaps the most fundamental requirement for minimizing risks and improving the prospects that investments will yield adequate returns. All investors, but particularly foreign investors, want a stable and secure environment, in which investment regulations are straightforward and human rights are fully respected. Conditions that are orderly and therefore predictable better enable investors to realize projected returns and to achieve growth in their businesses. To create such an environment is largely a matter of institutionalizing a calm and dispassionate approach to political affairs, in which controversy and disagreement do not threaten the nation's existence.

Political stability must be complemented by a high degree of consistency in government policy. The business environment must not be unnecessarily disrupted by illconsidered and badly enunciated policy pronouncements and decisions, whether conceived internally or imposed from outside the country. No business can thrive in a situation where the government changes its position like a weathercock on important issues, particularly those affecting financial matters. Of particular concern to foreign investors are currency exchange controls and the likelihood of expropriation. Where these and other important issues are in doubt, businesses cannot make projections with any reasonable hope of realizing them.

A related requirement is the absence of excessive and inefficient bureaucracy, which suffocates business and investment by delaying decisions and encouraging corruption and patronage. One of the more stultifying features of bloated bureaucracies is their jobs-for-the-boys syndrome. Of equal importance is a transparent legal framework, with a clear position on property, commercial rights, and labor issues.

A favorable businesses environment must also provide adequate infrastructure, which allows the economy to function with reasonable efficiency. Shortcomings in either the physical or social infrastructure raise the operating costs of businesses, making it difficult for them to remain competitive. In extreme cases they might be able to function at only a fraction of their capacity or not at all.

Other critical requirements are access to certain basic resources, to markets, and to skilled human resources. I should add that this summary of requirements for encouraging investment is not intended to be exhaustive.

THE AFRICAN REALITIES

Having examined the elements of a healthy business environment, let us now consider how the African realities measure up.

HUMAN RESOURCES

I will begin with the issue of skilled human resources. At independence in the 1960s, some African countries had fewer than 100 university graduates with which to face the many challenges of nationhood. In the last 30 years, Africa has come a long way toward building its stock of experience and skills. Unfortunately, for political and economic reasons, many talented people have migrated out of their countries and out of Africa. Partly for that reason, the available human resources are still insufficient. Nonetheless, I would argue that we now have a reservoir of expertise, which can be further developed (particularly if more Africans working abroad chose repatriation) to meet the needs of the region's business community in general and agribusiness in particular. In the meantime Africa's human resources can and must be supplemented from other resources. Let me add that Africa's edge is its comparatively cheap labor, which should permit the development of laborintensive agribusiness.

CURRENCY EXCHANGE CONTROLS

The concern of foreign investors about currency exchange controls is clearly a valid one. The ease with which investors can gain access to foreign exchange for importing urgently needed raw materials and other inputs oftens makes the difference between failure and success. Particularly in agriculture, timing is of the essence. It is also crucial that foreign investors be able to repatriate profits with a minimum of hassle. I believe that the wave of political and economic democratization now sweeping through Africa will grant an ever increasing role to market forces. In more and more African countries, foreign currency can be purchased over the counter. This is an encouraging sign that governments are realizing the need to release their economies from the stranglehold control they have often exercised in the past. Unfortunately, this change has not had the result of leaving sub-Saharan Africa awash with foreign exchange.

EXPROPRIATION

The issue of expropriation needs to be viewed in the global context of post-Cold War realities. From my perspective as an African, I can see certain positive developments that portend a hopeful future for investment on this continent. For one thing, the view (which was common during the postindependence period) of foreign investment as another form of colonialism has undoubtedly become anachronistic. Africans now realize that investment is imperative for development—that investors are doing as much good for their host country by investing in it as governments are doing by providing them with a hospitable environment. In today's global economy, investors have a wide range of options that extend beyond the host country.

In the post-Cold War era, expropriation is a very unlikely route for Africa. The demand for investment in other regions of the world, including the former Soviet Union, has awakened this continent to new realities. At the same time, though, it is important for investors, whether in agriculture or other sectors of the economy, to realize that businesses must strive to be good corporate citizens and be sensitive to local pride and prejudices. It is in the interest neither of agribusiness to take its host nation for granted nor of the nation to allow itself to be taken for granted. There must be mutual understanding and respect.

On the issue of expropriation, George Moody Stuart, corporate affairs director for Booker Tate Ltd. of London, has commented:

I can assure you we do not lose much sleep about the risk of expropriation or seizure of assets or the result of a change in government. We generally take the view that, if we are doing a good job, any new government will need us as much as the old one did.

This comes from someone whose company has made many successful investments in agribusiness in different parts of Africa.

MARKET POTENTIAL AND REGIONAL INTEGRATION

A common complaint about agribusiness in Africa is that its market is limited by generally low purchasing power across the continent. The size of this obstacle,

however, has perhaps been exaggerated. It is important to bear in mind that the most important cause of Africa's commodity problems is also the greatest advantage of agribusiness. Much of this activity has to do with processing and thus adding value to the raw crops that Africans either grow or buy. There are few limits on the market potential of such businesses, particularly if they heavily emphasize exports to earn foreign exchange for the host country. Africa as a whole offers a large market for agribusiness, and it can easily penetrate these markets because of its capacity to process and add value to raw materials, including cash crops, livestock, and even food crops.

Obstacles are what we see when we lose sight of our goals. This is the attitude I have cultivated in managing my own agribusiness, whose main products are poultry and pork. The fact that these are highly perishable items has not prevented me from marketing them in different parts of my own country, Nigeria, and as far away as Equatorial Guinea. As I have remarked in the past, if there is anything to be learned from the experience of the European Community on the question of regional integration, it is that private initiative is the most potent instrument for tearing down barriers to trade among nations, especially in Africa.

Invariably, government actions merely follow private initiative. We do not give the total picture in saying simply that, because most African countries produce much the same commodities and have similarly structured economies, trade among them cannot be encouraged. Within Europe, France, Germany and the UK all have similar industrial economies, and yet trade among them is on the increase. The important point is that governments cannot achieve integration by themselves but must be led in this direction by the private sector.

ACCESS TO LAND

An important first step in creating effective agribusiness is to gain ready access to land. This has been a problem in Africa in the past and is still an unnecessary bottleneck. In 1976 my government sought, by passing the Land Use Act, to improve access to land for development, to facilitate the process of obtaining titles to land, and at the same time to discourage land hoarding and speculation. Though this legislation was not entirely successful, it did make it easier for land to be dealt with as a commodity.

There has been much controversy in Africa about the inappropriate transfer of large tracts of farmland to foreign ownership. Oddly enough, local entrepreneurs (we might refer to them as "indigenous foreigners") who wish to acquire sizable areas of land for agribusiness have been hindered by much the same constraint. In cases where there is no Land Use Act or land tenure system that allows for the easy sale of land, there are two alternatives. One is to take out a lease rather than purchase the land outright. The second option, developed by the Tate Sugar Company, is a form of partnership, in which a farm owner contributes land, while the agribusiness provides management skills and perhaps the working capital. The partners share the profits that accrue according to the value of their inputs. Such arrangements last for a specific period, after which the land reverts to its original owner. Though this approach has clear advantages, it is not conducive to long-term improvements that would help sustain the productivity of the land.

INFRASTRUCTURE

Then there is the issue of inadequate infrastructure, which is often cited as one of the greatest hindrances to development in Africa. The poor state of transportation and communications networks greatly increases the operating costs of businesses. Clearly, this is one area to which African governments have paid insufficient attention. Nor are the countries that have embarked on structural adjustment programs doing much to remedy the situation; if anything, they are achieving even less than before in maintaining the infrastructure already in place.

In view of the limited resources available to them, some governments have adopted a strategy of developing infrastructure in one part of the country at a time. But, of course, this piecemeal alternative to spreading the butter too thinly on the bread can have serious political consequences. Fortunately, the private sector is helping to finance improvements in infrastructure in exchange for various forms of relief from government. Better conditions in one area may compensate for deficiencies in another.

DEMOCRATIZATION

One area in which conditions appear to be improving is politics. I believe that the new wave of democratization in Africa will lead to genuine and lasting change. Based on my own daily experience of emerging African realities, I am optimistic that democratization will not prove to be just another fad. As the Americans say, "this is for real." In my own country, for example, I have been involved in campaigns aimed at sustaining democracy, and I have witnessed similar movements in my travels to other parts of the continent. In these events I believe we are seeing the emergence of a civil society in Africa, which will lead to greater political stability and provide a firmer basis for growth and development. Africans are today demanding accountability, transparency, and responsiveness from their political leaders. Gone are the days when bad leaders could be protected by foreign

guardian angels interested only in preserving their spheres of influence.

Democratization at the political level, however, does not necessarily provide solutions to Africa's many problems in other areas. It is critical that changes in politics be accompanied by a movement towards economic democratization and empowerment, along with increasing

It is critical that changes in politics be accompanied by a movement towards economic democratization and empowerment.

acceptance of the principle of privatization and commercialization and the gradual withdrawal of government from excessive involvement in the production aspects of the economy. These developments must coincide with the emergence of a new class of African entrepreneurs, who are more conscious of the challenges of the business environment and who can persuade political leaders to be more responsible in formulating and implementing economic policies.

JOINT VENTURES IN AGRIBUSINESS In bringing about these changes, Africa can learn much from experience in other regions of the world. We need to gain a better understanding, for example, of the main factors involved in the transformation of North America's traditional agriculture into agribusiness. Were there special interest rates on agricultural loans? (In my own country, the rate is currently 40%, which makes it impossible to get a return on investment in agriculture.) How was the problem of land acquisition resolved? Were inputs subsidized, and if so how was this managed? More generally, how can the combination of measures that led to such effective use of material and human resources in North America be applied in the special situation of Africa and in a rapidly changing global environment?

One way in which Africa can draw upon experience elsewhere is through joint ventures in agribusiness. Two main options are open to investors that are interested in such an approach: 1) partnerships with government agencies and 2) joint ventures between foreign companies and local investors. In light of my own recent experience, I would suggest that the second option is the more viable of the two. About two years ago, I entered into a partnership with Pioneer Hi-Bred Seed International to produce seed in Nigeria for local farmers. This experience has been highly instructive and, so far, mutually rewarding.

There is, of course, a third alternative, which is for foreign companies simply to go it alone. Though many will naturally prefer this option, I believe they should be discouraged from choosing it, primarily because of the difficulties they will face in dealing with government. It would be naive for the private company to assume that, once it has fulfilled its side of the bargain, it can then relax in the belief that it has done all that is required. Most governments, anywhere in the world, need to be constantly pressured to perform. All too often in the past, companies have met the conditions established by government only to find that it has reneged on its promises or that there has been a change of government and a change in policies.

In addition to complicating matters for private agribusiness, many African governments have stubbornly persisted in establishing and managing large-scale agricultural enterprises. Though in some ways their preference for this approach is understandable, much experience has shown that state-run ventures are largely moribund. Invariably, they have become havens for political appointees.

If the government must be involved at all in agribusiness, its contributions should be the important ones of ensuring political stability, maintaining the right macroeconomic policies, providing infrastructure, and conducting research, and thus creating an environment that is conducive to investment. Government interference in the management and production activities of agribusiness must be ruled out from the start. What government might do in some cases, though, is provide capital for companies whose management will be left to foreign technical partners and their local counterparts to ensure efficiency and profitability.

AGRIBUSINESS AND THE SMALLHOLDER

While seeking more constructive relationships with government, agribusiness should also find ways in which its operations can complement those of small-scale farmers. Some observers of the agricultural scene in Africa are averse to mechanization and large-scale farming because of the many unsuccessful experiences with this approach in the 1960s and 1970s. Others believe that large-scale farming is not widespread enough in Africa to be of strategic value. Though there are reasonable grounds for both of these positions, I believe that to accept either of them is to throw the baby out with the bathwater. Africa is badly in need of improvements in small-scale farming. But must it rely entirely on them to turn its agriculture around? Like the African proverb says, "there is enough room in the sky for birds to fly without being on a collision course." Likewise, there is ample scope for improvement in the circumstances of both

smallholders and agribusiness. The challenge is to achieve greater complementarity between them, particularly in ways that increase the output and earning power of smallholders until such time as industrialization in Africa can provide greaters numbers of them with alternative employment.

If small-scale farming is to complement the activities of companies engaged in agriculture on a larger scale, smallholders will require better access to improved seeds and other inputs, which are not basically different from the technologies employed in agribusiness. By processing crops grown by smallholders, agribusiness can provide growers with much-needed markets and sources of income, while adding value to their products. Farmers should receive prices for their commodities that are near world prices, and they should be free to sell these products wherever they stand the greatest chance of maximizing their earnings. A further contribution that agribusiness can make is to conduct research on possibilities for diversification and on local uses of commodities produced in Africa.

INVESTING IN A NEW AFRICA

Anyone who invests in Africa during the 1990s will do so in the context of new attitudes and a new orientation throughout the region. We are ready to acknowledge our past mistakes and make amends. Though our present situation is rooted in the past, we realize that we cannot go on indefinitely blaming all of our current problems on history. Other cultures in circumstances similar to ours have managed to break with the past and seize the abundant opportunities of the present. Like them, we want to move away from the margin of the world economy and into the mainstream. To do so, however, we need partners.

In particular Africa needs more investment to develop and to become increasingly relevant to the rest of the world. As my friend Kazuo Takahashi of the Sasakawa Peace Foundation has pointed out in this workshop, the post-Cold War era has made Africa seem less significant to the developed world, both politically and economically. Periodic famine, brought on by drought and aggravated by war, still elicits a strong humanitarian response from the industrialized countries. But what we need even more is the ability to avert the disastrous consequences of drought.

Africans want understanding rather than pity, to be empowered instead of remaining on the dole. Our own obligation within the global economy is to do better those things in which we have a comparative advantage. We must have something to offer the world. Already we contribute importantly to global diversity, but we must accomplish more toward putting our underutilized human and other resources to work for the welfare of all. It is in the mutual interest of both the developed and developing countries that equitable and sustainable growth take place in the poorer parts of the world. But the nationalistic basis of current political and economic systems is not adequate for realizing these goals. To the arguments of mutual benefit and enlightened selfinterest, we must add a moral imperative that is based on our obligations as inhabitants of the global village. If the life of nations is devoid of moral considerations,

as I have been told by some of my politician friends, then it is a life fit for animals and not for human beings.

In agriculture Africa has considerable potential for absorbing investment and yielding attractive returns if these investments are well planned and managed. Agribusiness in this region must be built, however, on a strong foundation of food security. We must succeed in making food more readily available and affordable. Another challenge we must take up is to get beyond marketing of agricultural commodities only in their raw form. We cannot hope to get much from our investment in agriculture until we become more closely involved in processing, and adding value to, our agricultural products and in putting them to diverse uses. Given the limited elasticity of demand for our major commodities, we cannot continue producing them for saturated markets. We cannot go on producing commodities that we do not consume and that we cannot dispose of if others refuse to buy them.

Its ability to help remove us from this predicament is what makes agribusiness so important to the African economy, as we move into the 21st Century. Africans can no longer serve yesterday's food on new plates. The wave of economic and political democratization that is sweeping Africa has provided us with a unique opportunity to create a more hospitable environment in Africa for the business community generally but particularly for agribusiness. We cannot afford to let this opportunity pass us by.

STRUCTURAL ADJUSTMENT PROGRAMS IN SUB-SAHARAN AFRICA: ARE THEY MEETING EXPECTATIONS?

Graeme Donovan'

In devising strategies for agricultural development, policy makers commonly pay considerable attention to the delivery of services and inputs to farmers. The policy process also has something to deliver to the farmer, and that is an incentive—whatever it takes to motivate the farmer to use, and use well, all the

The signal that policy conveys to the farmer has to be clear, unambiguous, and consistent.

other services and inputs. For structural adjustment to be successful, this incentive has to be delivered all the way to the farmer's door, or to the farmgate, as we often describe it. It is not enough to correct a distorted exchange rate. The gains from doing this have to be sent all the way to the farmer—as large a proportion of the gains as possible (not merely the 30% that is left over after a heavy export tax has taken the rest away).

The signal that policy conveys to the farmer has to be clear, unambiguous, and consistent. Since there are probably some 50 million farmers in sub-Saharan Africa, delivering policy incentives to them is a formidable challenge. Policy makers commonly refer to incentives in terms of higher prices to farmers, but this is clearly not an adequate view. The incentive that must be delivered to the farmer is an income incentive. And prices are not income; they are only one part of income. That is why it is vital that we keep the generation and dissemination of agricultural technology at the center of our attention in considering policy for agricultural development. One of the ultimate development benefits of agricultural growth is that lower farm prices (in real terms) are diffused widely through the economy. Of course, lower farm prices are only possible if farmers' incomes are increasing and thus give them the incentive to keep on producing. And increasing farm incomes is the goal of most policy incentives in agriculture.

The debate about fertilizer subsidies often focuses on the price dimension. It is helpful to keep in mind that farmers are interested in the extra income they can earn by using fertilizer, not in its price as such. When we focus only on the price of fertilizer, we are in danger of forgetting that fertilizer is only a small part of the cost of production, which in turn is only part of the income calculation. Reducing the subsidy on fertilizer does not necessarily raise its price (which depends more on how efficiently the input is delivered). And even if it did, this would not necessarily lead to a decrease in fertilizer use (which depends on the response of the crop, the costs of other inputs, and the price received for the crop).

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EXPECTATIONS FOR STRUCTURAL ADJUSTMENT

When countries embark upon structural adjustment programs, what expectations do policy makers have? What are the expectations of the most optimistic proponents, compared with those of the most pessimistic? Over what time period do people foresee their expectations being realized? For which countries have structural adjustment programs been expected to bear fruit? To what extent have policy makers focused only on national adjustment programs? In a continent where almost every country has multiple, porous borders, what are the consequences of adjustment uncoordinated across frontiers? These are some of the questions with which to begin an enquiry about the impact of adjustment.

Frances Stewart et al. (1992) distinguish between stabilization policies (which are aimed at reducing short-term disequilibrium and are typically supported by the International Monetary Fund, IMF) and structural adjustment policies (which are aimed at reorienting economies towards greater medium-term efficiency and are typically supported by the World Bank). The authors concede that in practice the distinction is blurred, and so it shall be in my discussion here. In fact, I will assume, with the World Bank's Third Report on Adjustment Lending (from which I shall draw much of the material for my discussion), that the objectives of adjustment policies are to tackle macroeconomic difficulties (as revealed by rising inflation and balance of payments problems) and to place economies on new paths to sustainable, poverty-reducing growth. An important requirement for achieving these objectives is to deliver incentives to the farmgate.

The main policy reforms implemented under structural adjustment programs include the following:

- Cutting the government's budget deficit by reducing public expenditures
- Controlling the money supply and credit creation
- Reducing subsidies (on the production and consumption of inputs and outputs)
- Wage restraint
- Devaluing the domestic currency
- Liberalizing foreign trade by removing import quotas and lowering tariffs
- Reform and / or privatization of public enterprises to improve their financial performance
- Decontrolling prices in all markets (including financial markets)
- Strengthening the capacity of public sector policy analysis and implementation

Other areas of policy that have been included much less often in adjustment programs are land tenure and land reform, technology policy, policies to address the problems faced by women, regional development, environmental protection, food security, and general taxation. (A good question to ask-one that I will pose here without trying to answer it-is why these are underrepresented.) In a nutshell structural adjustment is about reforming the policies I have listed. It has received such strong emphasis, because governments and donors came to believe that policy distortions were adversely affecting all the other essential elements of the development process and that a concerted effort was needed to correct the situation.

What did people expect these reforms to achieve? As I look back at one of the documents that launched sub-Saharan Africa on a decade of structural adjustment programs, I find a certain amount of realism about the difficulties that lay ahead, combined with guarded optimism about the likely achievements of the programs themselves. I refer to a report produced in 1981, entitled Accelerated Development in Sub-Saharan Africa: An Agenda for Action. Let me quote from the conclusion of that report:

The policy reforms required in Africa will be technically difficult and politically thorny. The African governments and the donor community will have to work out a relationship that recognizes these realities if the action program recommended in this Report is to be successful. But the rewards of taking the pains will be great. Policy action and foreign assistance that are mutually reinforcing will surely work together to build a continent that shows real gains in both development and income in the near future.

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It would be easier for us to report positively on the outcome if the author had not added the words, "in the near future." But one hour of hindsight allows us to see clearly what a great deal of analysis would have difficulty in foreseeing, and we must not judge the optimism too harshly. What does turn out to be optimistic, in the cold light of today's hindsight, are the last two words of that statement and the economic growth rates that were projected for the 1980s.

I want to stress that the growth rates were not predicated merely on the policy reforms that make up structural adjustment but rather on a program of investments (in infrastructure, education, health, industrial and agricultural production, and so on), supported by substantial increases in aid and accompanied by policy reforms. The projections were for 5% per year growth in GDP, 2.1% per year growth in GDP per capita, and 3.8% per year growth in agriculture. In the light of these expectations, the results have been very disappointing indeed: GDP in constant prices (of 1987) grew at 1.1% per year from 1980 to 1985 and 1.9% per year for the rest of the decade; value added in agriculture grew at 0.4% per year 1980 to 1985 and 1.5% per year for the rest of the decade.

Though the upturn in these results during the second half of the decade is encouraging, the appalling consequences in per capita terms weigh heavily on us all: falling exports, incomes, and food production and availability, not to mention the events that were both causes and consequences of these trends-a decade of strife that included civil wars in at least 10 of the 46 countries in sub-Saharan Africa, military coups or attempted coups in at least 10 more, and seemingly endless troubles among competing ethnic groups. I have included some data for 40 countries of sub-Saharan Africa (Table 1), which among other things compare growth rates of agricultural production during the period 1965-1980 with those from 1980 to 1990, when most of the structural adjustment programs were implemented. The table includes the numbers of Structural Adjustment Loans (SALs), Agricultural Sector Adjustment Loans (AGSECALs), and other Sectoral Adjustment Loans (SECALs) implemented during the 1980-1991 period. These give some indication (albeit not an infallible one) of the intensity of the adjustment effort in various countries.

For a number of reasons, it is very hard to assess the results of structural adjustment programs in general terms. First, there were enormous differences among countries in their initial conditions and in their degree of commitment to and implementation of individual reforms. Second, the economies experienced political, economic, and weather-related shocks before, during, and after implementation. Third, the economic development programs that took place in the context of structural adjustment varied in terms of investment in education, research, infrastructure, and social welfare. Fourth, adjustment programs have had different impacts on different groups in society, so it is hard to weigh the losses of some against the gains of others. Finally, even when one is able to tie certain results (whether desirable or undesirable) to

	Agricultural growth rates (% per annum)				Other
Country	1965-80	1980-90	SALs, 1980-91	AGSECALs, 1980-91	SECALs 1980-91*
Angola	A lo parade	-0.5			
Benin		36	2	0.00	
Botswana	97	-4.0		and CENTRAL OF	12-2-
Burkina Faso	and the se	2.2	 (a) (a) 	1	
Burundi	66	2.1	2	1	-
Cameroon	4.2	1.6	1	1	
Control African Popublic	4.4	1.0	2	-	
Chad	2.1	2.7	5	1	-
Canad	-0.5	2.7	200	100 100 //11	4
Congo	3.1	3.6	1	1010 July 1010	
Cote d'Ivoire	3.3	1.0	3	immin order set of	2
Ethiopia	1.2	-0.1		100	
Gabon	01 - Test 1 - 1	Month Pter	1		127
Gambia	1000	1.100	2		1
Ghana	1.6	1.0	2	-	8
Guinea	_		2	Store the Statement	1
Guinea Bissau	_		2		1
Kenya	5.0	3.3	2	2	3
Lesotho	and the second	-0.7			
Liberia			_	_	-
Madagascar	-	2.4	-	1	3
Malawi	4.1	2.0	3	2	1
Mali	2.8	2.3	1	1	2
Mauritania	-2.0	0.7	1	1	3
Mauritius		2.6	2	-	1
Mozambique	_	1.3			2
Namibia		-1.0			
Niger	-3.4	1.8	1		1
Nigeria	1.7	3.3		1	3
Rwanda		-1.5	1		_
Sao Tome	1 185771 3.4		2	- () - I	-
Senegal	14	31	4	30 91	1
Sierra Leone	3.9	26	- B. (B.	1911 1911	
Somalia	5.7	3.3		2	5
Sudan	29	5.5	in the second second	2	500
Tanzania	1.6	4.1		4	2
Togo	1.0	4.1	-4	(a)	1
Uganda	1.7	2.4	4	-	1
Zaira	1.2	2.5	LL STATE OF	4	4
Zambia	22	2.5	1		1
Zimbahuua	2.2	3./	1		1
Zindadwe		2,4	10.7	SHE SHELL	and himm
Average/total	2.0	2.1	45	21	45

Table 1. Adjustment and agricultural growth in sub-Saharan Africa

Source: World Bank (1992); ALCID database.

* Includes economic recovery programs, trade adjustment programs (exports and imports), and adjustment operations in the industrial, energy, financial, health, education, water supply, and transport sectors as well as support for reforms in the public sector generally (both expenditures and public enterprises). adjustment with some degree of precision, questions will still remain about whether the design was right in the first place or whether it could have been better.

Of the 21 countries whose agricultural growth rates are recorded for both periods (see Table 1), growth rates in the second period compared with the first registered a decline in 10 countries and an increase in 11 countries. Of the 10 countries whose agricultural growth rates decreased for the latter period over the former, 8 implemented adjustment operations. Of the 11 countries whose agricultural growth rates increased, all implemented adjustment operations. Of the 34 countries implementing adjustment operations of one sort or another (whether SALs or SECALs) during the 1980s, 2 had agricultural growth rates of 4% per annum or greater, 19 between 2% and 3.9%, and 6 between 0.7% and 1.9%, while growth rates were not recorded for 6 countries implementing some form of adjustment. Only one of the 6 countries experiencing negative agricultural growth rates implemented any adjustment operations.

In the rest of this paper, I would like to do three things:

- Give a general overview of the size of the structural adjustment programs undertaken in sub-Saharan Africa
- Review the results to date of these programs and the conclusions that have been drawn from those results
- Make some other observations about policy reforms in development strategy for Africa

AN OVERVIEW OF STRUCTURAL ADJUSTMENT PROGRAMS

What was the magnitude of the task that sub-Saharan Africa undertook in its structural adjustment programs during the 1980s? Between 1980 and 1991, 34 countries undertook adjustment programs supported by the World Bank. At one time or another during this period, all of them also received assistance from the IMF through Stand-by Arrangements or Structural Adjustment Facilities. This makes it hard to get a control group, since only 12 countries were excluded, and they were often particular in one way or another. They were either very small (Cape Verde, Comoros, Djibouti, and Seychelles, with a combined population of 1.3 million), suffered from extensive warfare (Angola and Ethiopia), were independent for only part of the period (Namibia), or had other special circumstances (e.g., diamonds in Botswana).

The World Bank financed 111 adjustment operations in these 34 countries. Of these operations, about 45 (40%) were called Structural Adjustment Loans, signifying that they addressed a set of broad macroeconomic issues. The balance mainly addressed reform issues particular to a sector, such as agriculture, industry, finance, energy, education, health, and so on. Some were trade and export diversification programs, while others focused on the entire public sector. It is important to note that only 28% of these adjustment operations started before 1985. Thus, the pace stepped up in the second half of the decade, with 40% of the operations starting only in the last three years (from 1989 to 1991). Consequently, the period for which we are evaluating results is relatively short. It is also important to note that there was a gradual movement over the decade from SALs to SECALs; that is, the focus changed from the general macroeconomy to issues particular to specific sectors. It has to be acknowledged, however, that virtually all the SALs contained conditions that had an impact on agriculture. Thus, to assess the worth of adjustment for agriculture, one
must look beyond the specific agricultural sector operations, of which there were around 21 during 1980-1991.

The numbers of operations varied widely from one country to another. Six countries undertook only one adjustment operation with World Bank assistance, while at the other end of the scale one country undertook 10. Some countries began adjustment programs and then abandoned them or withdrew for a period before taking them up again.

Of the total funds committed by the World Bank for adjustment lending worldwide from 1980 to 1991, sub-Saharan Africa took about a quarter (US\$10 billion out of \$41 billion) but had about 45% of the operations (which means that the average adjustment operation was smaller in Africa than in other regions). Of the World Bank's total commitments to all projects in all sectors in the region during that period, structural adjustment lending made up 31%. It was thus a leading part of the lending program. But there was also very large financing for the more traditional project operations, and the structural adjustment operations themselves addressed issues in most sectors.

Of course, all these figures are only indicative, since to reform policies it is not necessary to borrow funds from anyone. Thus, the numbers of operations and the amounts borrowed are not necessarily related directly to commitments to adjustment or to the intensity of adjustment. Nevertheless, in its most recent review of adjustment lending, the World Bank classified the 77 countries it examined as those with:

 Intensive adjustment lending: received two SALs or undertook three or more adjustment operations by June 1990, with the first adjustment operation effective in June 1986 or before

- Other adjustment lending: had at least one adjustment loan by June 1990
- No adjustment lending (as of June 1990)

In sub-Saharan Africa, there were in this sample:

- 13 countries with intensive adjustment lending (Cote d'Ivoire, Ghana, Guinea-Bissau, Kenya, Madagascar, Malawi, Mauritania, Mauritius, Nigeria, Senegal, Tanzania, Togo, and Zambia). The unweighted average of their annual growth rates in agricultural production during 1980-1990 was 2.7%.
- 15 countries with other adjustment lending (Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo, Gabon, Gambia, Mali, Niger, Sierra Leone, Somalia, Sudan, Zaire, and Zimbabwe). The unweighted average of their annual growth rate in agricultural production during the same period was also 2.7% per year.
- 5 countries with no adjustment lending (Botswana, Ethiopia, Lesotho, Liberia, and Rwanda). Growth rates in agricultural production for this period were negative in four of those countries and not available for the fifth.
- 13 countries outside the sample (Angola, Cape Verde, Chad, Comoros, Djibouti, Equatorial Guinea, Guinea, Mozambique, Namibia, Sao Tome, Seychelles, Swaziland, and Uganda).

REVIEWING THE RESULTS OF STRUCTURAL ADJUSTMENT

Based on the classification of countries already described, the broad results for the entire sample, covering all regions, are as follows:

 Adjustment lending was associated with recovery of the economic growth rate. For low-income countries (less than \$600 per capita GNP), this was 2 percentage points higher than otherwise expected and for middle-income countries (all the rest) 4 percentage points higher. The only countries classified as middle income were Botswana, Cameroon, Congo, Cote d'Ivoire, Gabon, and Zimbabwe.

- The gains associated with adjustment lending remained, even after controlling for initial conditions, terms of trade shocks, interest costs of external debt, and total amounts of official financing. This last item should be emphasized, because (as the abovementioned World Bank study mentions), it "refutes the argument that successful adjusters—such as Ghana are doing well only because official money is pouring in."
- The adjustment process generally takes years, and there can be significant costs in the transition. This is the bad news coming out of the study, especially for Africa. In only a very few countries (among them Korea, Indonesia, and Thailand), did the adjustment process proceed swiftly and elicit a swift response. In most other middle-income countries, the process took years, and they experienced declining output and labor demand before new sources of growth placed them on the path to sustainable growth. "For low income countries-with sub-Saharan African countries important in this group-it is an even longer haul," the study concludes. "Export and saving responses have been much weaker, total investment has fallen on average, and private investment has grown significantly only in a few cases and remains generally at inadequate levels. The evidence to date for low income countries suggests that adjustment lending is a necessary-but not sufficient-condition for transition to sustainable growth path."

In assessing this statement, it is important to bear in mind the statistics I presented earlier: around 405 of the adjustment operations being reviewed by this particular study started only in the past three years. In view of this, perhaps the study errs on the pessimistic side by concluding that the time required to carry out structural adjustment successfully is distressingly long; in some cases we obviously do not know yet for sure.

Further findings of the study are that:

- There is indeed a substantial lag in private investors responding to adjustment. The reasons for this are the uncertainty engendered by the adjustment process in the expectations of private investors, the decreases in protection for many inefficient former import-substituting industries, and an increase in capital costs arising from devaluation and rising interest rates.
- The results of adjustment in the public sector have been mixed. On the one hand, fiscal deficits have been reduced, often through sensible tax increases, elimination of inefficient projects, reductions in military spending, and maintenance or increases in social sector spending. In two-thirds of the intensively adjusting countries, real per capita social spending increased between the first and second half of the decade. On the other hand, some critical development expenses have been cut; increased social spending has sometimes been mainly on salaries, while the services were starved of complementary inputs; and not much progress has been made in reducing public sector employment or in reducing total subsidies.
- There is increasing evidence that the poor gain from adjustment policies in the medium term, but at least some suffer as the structure of the economy adjusts. They benefit from favorable redistribution to efficient, laborintensive activities; recovery of growth; increased support to rural areas; and

increased labor demand. They suffer as a result of recession, falling labor demand, decreased subsidies on consumer goods, and reduced public services.

The important question, of course, is how the poor can be helped. The answer lies for the most part in smoothing aggregate private consumption by increasing official capital flows (one of the important reasons why adjustment programs are often supported by significant inflows of capital from donors); in price reforms that help agriculture and other tradeable production with high labor demand; in public employment schemes; in nutrition programs for vulnerable children; and in the reallocation of public expenditures in support of better social services, designed specifically for the poor.

To summarize, then, the study's main conclusions are that governments should:

- Stay the course on adjustment programs. Policy reform is still a necessary condition for growth and development.
- Give increased attention to secondgeneration private sector incentives.
- Give increased attention to the allocation of public sector spending.
- Promote poverty-reducing growth.

Let me expand on these four conclusions:

Stay the course: If reform of agricultural marketing is taken as one common component in structural adjustment programs affecting agriculture, then a lot of things must be done to complete the job satisfactorily, and they take a considerable amount of time to get in place. These things typically include, among others: financial and management reform of parastatal marketing agencies; amending and eventually abolishing price controls at every level from farmgate to retail; freeing up private exports; simplifying licensing of traders; ending official harassment of traders, with its associated rent-seeking behavior (which may continue at local levels long after official changes have been gazetted by the central government); opening up donor food and fertilizer to

If we stay the course on structural adjustment, I am convinced that we will look back and see how necessary it was.

private trade; ending restrictions on time, place, and quantities of trade; ensuring access to credit for various intermediaries in the marketing chain; getting rural roads and transport services in shape (and making sure restrictive regulations on them are dealt with). Examples abound of the web of controls that have to be cut through and the length of time this takes.

As an aside here, let me recall for you that not too long after the Green Revolution began exhibiting its successes, there was a period of deep doubt about where it was taking us in development-doubts manifested in books and journal articles with titles such as "The Green Revolution: Generations of Problems." Now, everyone wishes fondly for a green revolution in Africa and deplores its absence. We should expect profound doubts about the efficacy of structural adjustment to arise a few years after its main efforts have commenced. If we stay the course, amending the process as problems show up, I am convinced that we will look back with hindsight and see how necessary it was.

Second-generation private sector incentives: It is hard to overstate the comprehensive structures that have to be in place for the private sector to operate well-structures that are mostly taken for granted by people in economies where private trade has been accepted and well-regulated for a long time. In putting these structures in place in Africa, there is a profound need to understand private sector incentives and constraints intimately and to examine all policies and regulations in an effort to eliminate conflicts; to establish a regulatory system that removes obstacles, sets fair rules for competition, and enforces them rigorously; to put in place a framework for orderly formation and dissolution of private enterprises; to protect against exploitation (especially of labor) without overprotecting; to deal equably with externalities; to encourage development of management skills; and to reformulate taxation systems. With this agenda of regulatory reform on its plate, there is little likelihood that government is going to wither away.

Attention to public sector spending: The points to note here are that, in the process of trimming budgets, we should make special efforts to protect expenditures for infrastructure, agricultural research, education, and health and look closely at the balance between wage and nonwage expenditures.

Poverty-reducing growth: The need for this is obvious, and the type of growth needed is that which stimulates efficient, laborintensive enterprises, increases labor productivity, and reduces the real costs of food. Ultimately, this latter point is what a lot of our adjustment efforts in agriculture are about.

OTHER OBSERVATIONS ABOUT POLICY REFORMS

Beyond reviewing the results of the recent World Bank study, I would like to emphasize seven more points:

- 1. If we are going to have open economies-and I do not see how we can do anything else-the exchange rate is a key issue. In his paper in these proceedings, G. Edward Schuh describes the losses that countries have incurred, and continue to incur, by shutting themselves off from the international trade system, which has grown much faster than global GNP in the past decade. In some econometric work we are doing, the real effective exchange rate (REER) shows up as the most consistently significant variable related to growth in agriculture in sub-Saharan Africa. When we control for many other variables (among them producer prices, transportation inputs, fertilizer, pesticides, weather, primary school enrollment rates, net transfers of aid funds, and specific country factors), our equations show a very significant relationship between falling REERs and agricultural growth. This is at least as important for growth in food production as for growth in export crops.
- 2. In trying to get policies right, it is a mistake to set some sort of false opposition between "food crops" and "export crops" (so called, since food is often both a cash enterprise and potent export). When some of the countries in Southeast Asia were putting a lot of effort into food security during the 1960s and 1970s (as Peter Timmer points out in his paper in these proceedings), they were simultaneously taking market share from some of Africa's principal export crops. And they did this through a deliberate process of intensive, long-term research, combined with getting the policy environment right. They saw the value of these exports. It is time for Africa to focus much more strongly again on export prospects, for both its traditional commodities and for innovative

diversification. Of course, food is important. It is still the primary wage good. And increasing its production and lowering its real price to consumers is essential for achieving efficient, laborintensive growth. If we have learned one lesson about food security, however, it is that this end is best served by adequate incomes. Food security is an income problem. And it cannot necessarily be solved through "food fundamentalism," manifested in an all-out drive for food self-sufficiency. If we keep up the flow of food production technology, as well as getting other policies right, food will be produced alongside export crops and the more so as export crops generate a good cash flow. Many examples exist in which production of a cash crop (whether food or nonfood, for domestic or external consumption) is essential for getting food production moving, especially among smallholders.

- 3. There is a lot of talk about protection of local food production, especially in West Africa, where governments observe the powerlessness of local farmers to compete with rice and wheat imports. May I remind you that the best protection is competitiveness (which means getting policies right and keeping technology generation strong).
- 4. What we need is not less government but better government. Those who live in the industrialized world know that public expenditures in their countries have not fallen as a percentage of GNP, as incomes have risen. There are plenty of things governments can do to create a fair and stimulating environment for producers and consumers; governments will not be going out of business soon.
- 5. It is time to do more thinking about the regional effects of adjustment and even perhaps to launch some regional adjustment operations. Every country in Africa has porous borders. Every

country in the CFAF zone is bordered by at least one country in the non-CFAF zone. Adjustment carried out in only one country can lead to unintended consequences in production and trade. Recognizing this problem, ministers of agriculture in West Africa have established a valuable ongoing process of studies, consultation, and collaborative effort. Other regions in Africa need to follow suit.

- 6. Taking a lead from Norman Borlaug (who frequently expresses impatience with the idea of waiting for the perfect technology package), let us admit our mistakes in structural adjustment, but let us not wait until we have a perfect package of policy reform.
- 7. Finally, how do I sum up the impact so far of structural adjustment on agriculture in sub-Saharan Africa? When we consider the whole package of investments, structural adjustment, and other development initiatives in the 1980s, we must admit that agricultural growth rates fallen far short of our expectations. There is some evidence, however, that growth rates have been higher with structural adjustment than they would otherwise have been. Furthermore, there is evidence that a significantly higher proportion of investment projects succeed in countries where good structural adjustment programs are under way than in those where policy issues remain unaddressed. We have begun a huge enterprise, which is only partly completed, of establishing necessary conditions for economic growth and development, and we must stay the course.

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STRUCTURAL ADJUSTMENT WITH A SOCIAL FACE?

Adebayo Adedeji*

In this paper I wish to draw attention to the problem of linking structural adjustment programs with human welfare and social concerns. Whatever the original expectations of these programs might have been when they were first implemented about a

A fundamental test of any economic program is whether it is improving the human condition.

decade ago, the reality on the ground is that they have not led to poverty alleviation. In fact, all over sub-Saharan Africaadjusting countries included-human and social conditions have gotten worse over the last 10 years or so, no matter what indicators are examined: infant mortality, life expectancy, malnutrition, food security, access to potable water and sanitation, education, income per household, and environmental degradation. The only positive development is that during the past two years South Africa has perpetrated fewer acts of destabilization and aggression (which exact massive costs in human and economic terms) against the countries of southern Africa.

It was, in part, the severity of the African crisis that led the Bretton Woods institutions (i.e., the World Bank and International Monetary Fund, IMF, whose creation was an outcome of the International Monetary Conference, held at Bretton Woods, New Hampshire, USA, in 1944) to design structural adjustment programs in the first place and to insist that these be adopted by African governments seeking assistance. Most of them accepted these programs in the genuine belief that they would result in economic recovery and development. But the bitter reality is that, whether nationally conceived or drawn up in collaboration with the Bretton Woods institutions, structural adjustment programs have caused the human condition on this continent to become worse, and they have rent the fabric of African society. The primary reason this approach has persisted so long is that the overwhelmingly nondemocratic character of most African governments and their appalling lack of political accountability has permitted them to impose structural adjustment on their people without facing the consequences that would have befallen democratic governments.

A fundamental test of any economic program is whether it is improving the human condition, i.e., alleviating poverty and making the poor less vulnerable by empowering them economically, by improving their access to the means of production and to basic services, and by enhancing the role of women, in particular, as agents of modernization. If a program cannot pass this test, it is fatally flawed and in need of total redesign. Any attempt to graft on elements that give the program a social face will be an exercise in futility. This is evident from previous attempts to do so, such as Ghana's

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Programme of Action to Mitigate the Social Costs of Structural Adjustment (PAMSCAD). What is called for is complete redesign of the program.

THE INTERNATIONAL RESPONSE TO THE AFRICAN CRISIS

Structural adjustment lending was initiated by the Bretton Woods institutions during 1980 in response to serious balance of payments problems in many developing countries. These were the direct result of a sharp deterioration in the terms of trade, particularly for oil-importing countries, and of weaknesses in domestic policies. It became increasingly difficult for the developing countries affected to service their debts and to sustain the level of imports to which they had grown accustomed in previous years. Unfortunately, the economic performance of the industrial market economies was somewhat lackluster in the 1980s. The 1979-1982 recession was followed by a long period (1983-1987) of slow recovery.

These factors had disastrous effects on the import-dependent and export-oriented African economies, with their monocultural export sectors. With the possible exception of oil, the real values of many primary products-i.e., their import purchasing power per unit of exportwere at 50-year lows. The industrial economies made matters worse through protectionism and dumping, which hampered export diversification. A frica's problems were further aggravated by intermittent drought throughout the decade over much of the continent, particularly the African Drought Disaster of 1983-84 and the ensuing famine, which threatened the lives of almost 150 million people.

The human tragedy and social crisis emanating from these events were unparalleled in modern African history and perhaps unprecedented anywhere in the post-World War II era. Human suffering was especially great during the drought of 1983-84. It followed a series of droughts, beginning in the Sudano-Sahelian area and in Ethiopia during the early 1970s, which weakened the fragile economies of many African countries and undetermined their social structures. Many people lost their lives or were dislocated, and family life was shaken. Millions of people left their ancestral homes-in many cases with their cattlein search of food, fodder, and shelter. In the Horn of Africa, the drought and its human and economic consequences were compounded by political turmoil.

The international community responded, through the Bretton Woods institutions, by designing programs that have two principal parts—stabilization and structural adjustment. The first involves a managed reduction of expenditures to bring about an orderly adjustment to reduced levels of external resources. The second involves changes in relative prices through devaluation, higher interest rates, the reduction or elimination of subsidies, and growing reliance on market mechanisms rather than government intervention. A typical World Bank/IMF adjustment package thus includes the following:

- Currency devaluation to improve the balance of payments by raising the cost of imported goods and making exports more competitive
- Domestic demand management, with the primary aim of cutting back government budgets, especially social expenditures
- High interest rates and a credit squeeze to reduce inflationary pressures
- Freeing of prices to remove distortions resulting from subsidies on food, fertilizer, and other essentials and from

import taxes on luxury items and to provide an incentive for exports at prices set in the world market

- Import liberalization to open local industry to competition from more industrially developed countries and to encourage expansion of foreign trade
- Privatization of state and parastatal enterprises to reduce government protection of inefficient economic activities

The World Bank introduced Structural Adjustment Loans (SALs) to provide quickly disbursed financing, which would strengthen its hand in the policy dialogue with recipient countries. The Bank and IMF thus made the adoption of structural adjustment programs a condition for loans and other financial support. As it became increasingly clear that these measures would not improve the capacity of debtor countries to service their debts, structural adjustment was also made a requirement for debt rescheduling by the creditor nations of the Paris Club and by the commercial banks and institutional lenders of the London Club.

It is now generally accepted that structural adjustment has not led to sustainable recovery and development. The Bank's own evaluation after 10 years of experience with adjustment lending is eloquent in this regard (World Bank 1988a). On the sustainability of adjustment, it notes that "improvements, in several countries, have not been sustained," that "budget deficits have been increasing ... especially in highly-indebted and Sub-Saharan countries," and that "investment/GDP and debt-export ratios have generally worsened during the decade." On the effectiveness of structural adjustment in improving the capacity of debtor countries to service their debts, the evaluation concludes that "involuntary and concerted commercial bank lending has often been the only

alternative to default" and that "since 1980 external debt has grown rapidly relative to exports and GDP." On social costs, the report notes that "expenditure reductions have forced cutbacks in social and economic programmes and led to a deterioration in public infrastructure" and that "calorie intake has on average stagnated or declined during the 1980s." Finally, on institutional reform, the evaluation concludes that "the supply response to adjustment lending has been slow because of the legacy of deep-seated structural problems. Inadequate infrastructure, poorly developed markets, rudimentary industrial sectors, and severe institutional and managerial weaknesses in the public and private sectors have proved unexpectedly serious as constraints to better performance-especially in the poorer countries of Sub-Saharan Africa. Greater recognition thus needs to be given to the time and attention needed for structural changes, especially institutional reforms, and their effect."

Perhaps it was the failure of structural adjustment programs to achieve recovery and sustainable development (and the consequent frustrations of the institutions that designed these programs) that led Barber Conable, then president of the World Bank, to pose the following questions: 1) "Does Africa face special structural problems that have not been properly understood?" 2) "Has the institutional dimension been neglected?" 3) "Have the recent reform-programmes been too narrow or too shallow?" (World Bank and United Nations Development Programme 1989)

THE AFRICAN RESPONSE TO THE CRISIS

During the second half of the 1970s, African governments were warned about the impending crisis. For instance, in my

address to the ECA Conference of Ministers at its session in Kinshasa, Zaire, in March 1977, I commented that:

Africa, more than the other Third World regions, is faced with a development crisis of great potency. In spite of the region's ample natural resources, of a favourable population to natural resources ratio, in spite of the generous and even indiscriminating incentives for foreign private enterprise . . . and in spite of our adherence to orthodox theories and prescriptions—in spite of all these, neither high rates of growth nor diversification nor an increasing measure of selfreliance and dynamism seems to be within our reach. (Adedeji 1989)

The African response to the warnings and to the evolving crisis was the Lagos Plan of Action (LPA) and the Final Act of Lagos (FAL) of 1980, which the heads of state adopted at their summit meeting in Lagos. The LPA established as a primary objective the alleviation of mass poverty and improvement in the standard of living of the African people. Second, the concept of self-sustained development was taken as essential in view of its relation to the first objective, especially with regard to such basic targets as attainment of food selfsufficiency and the provision of critical goods and services. Third, while the LPA acknowledged the interdependence of the world's economies, it showed a realization that the Balkanization of Africa called for strong emphasis on national and regional, collective self-reliance. This objective was addressed by the FAL, which set a target date for establishing an African Economic Community.

Though geared to achieve long-term development goals, the LPA also took into account the need for short-term adjustments. All of these, however, were seen as constituting a continuum in the long-term process of development and transformation. The framers of the LPA realized that the fundamental causes of continued underdevelopment and persistent economic crisis in Africa are a lack of structural transformation, low levels of productivity, and excruciating poverty in an environment characterized by serious deficiencies in physical and social infrastructure, in research capabilities, in technological know-how, and in other resources that are indispensable to an integrated and dynamic economy.

Unfortunately, the international community failed to support the LPA. Instead, it opted for a business-as-usual approach, namely the continuation of an exportoriented monocultural economic system. Inevitably, the crisis intensified, and the focus of attention shifted to short-term, fire brigade operations. Shortages of foreign exchange for acquiring foreign goods (such as food) and services and for servicing debts became so severe that most governments were willing to adopt structural adjustment programs simply to gain access to the necessary funds. Major socioeconomic objectives fell by the board, including the internalization of the forces of supply and demand (which determine the direction of development and economic growth and the patterns of output), increasing substitution of domestic for external factor inputs, and increasing participation by the mass of the people in the production and consumption of the social product. Structural adjustment remained the predominant development paradigm of the Bretton Woods institutions and the donor community, even after 1985, when at the height of the crisis African heads of state adopted the Africa Priority Programme for Economic Recovery, 1986-1990 (APPER), and the United Nations General Assembly adopted the United Nations Programme of Action for African Economic Recovery and Development 1986-1990 (UN-PAAERD), thus confirming Africans' perceptions as to

how best to end the crisis and initiate a process of long-term, socioeconomic transformation.

Structural adjustment has also persisted in spite of Barber Conable's conclusion that:

although sound macro-economic policies are essential to provide an enabling environment for productive use of resources, they alone are not sufficient to transform the structure of African economies. At the same time, major efforts are needed to build African capacities—to produce a better trained, more healthy population and to greatly strengthen the institutional framework within which development can take place. (World Bank and UNDP 1989)

Structural adjustment remains the basis for providing loans, rescheduling debts, and granting relief to beleaguered African economies. Meanwhile, the crisis continues unabated; sustainable development still eludes Africa; and the alleviation of poverty on this continent is a largely unfulfilled goal.

THE FOOD CRISIS: A CASE IN POINT

At the root of Africa's persistent underdevelopment are pervasive structural disequilibria-of which the food crisis is the most glaring manifestation. It is caused primarily by the low level of agricultural productivity, which in turn is the result mainly of low investment in agriculture, limited use of new technology, and inadequate incentives for farmers (most of whom are women) to increase production and the marketed supply of food. Severe drought further complicates matters by periodically disrupting the pattern of crop production. Another difficulty faced by most African countries is that of environmental degradation, consisting of deforestation, soil erosion, and falling water tables, among other problems.

The limited efforts made so far to transform African agriculture have concentrated mainly on the export subsector, while the food and raw materials subsectors have generally been neglected. Moreover, even though women play a crucial role in agriculture (particularly in food production), their contributions as producers and as agents of change in rural areas continue to be limited by their meager share of the means of production (specifically land, capital, credit, and technology) and their marginal position in production relations.

The occurrence this year of yet another devastating drought, affecting nearly 20 countries, killing tens of thousands of people, and destroying the livelihoods of millions more, shows how basically structural the African crisis is. Every time the rains fail, the fragile African economy collapses, because over 90% of its agriculture is rainfed. Africa has not yet developed the know-how for cultivating crops in increasingly arid ecologies, nor is serious attention being paid to irrigated farming. As a result, little progress is being made in the huge task of transforming food production on this continent.

How can we get at the structural disequilibria that account for poor performance in Africa's food production sector? Currency devaluation, high interest rates, and demand management will contribute nothing to this end; if anything such measures will harm efforts to increase substantially the annual rate of production and achieve self-sufficiency. Import liberalization-another important weapon in the policy arsenal of the structural adjustment programs-will exacerbate Africa's food dependency syndrome and its acute shortage of foreign exchange. As Percy Mistry, a former senior official of the World Bank, confessed in 1989:

Liberalization has not worked in Africa. Unfortunately, it has had a much more important effect on export cash crop production than food crop production. Because the incentives have been to export to pay debt service, liberalization has not done much for food security.... The domestic capacity to switch from imported products to local products is extremely weak in Africa. (World Bank and UNDP 1989)

In reply to this criticism, proponents of structural adjustment urge that African countries increase production of export commodities for which they have a socalled comparative advantage and thereby raise their export earnings, with which they can then finance additional food imports. Africa's main exports, excluding oil, are coffee, cocoa, timber, cotton, sugar, live animals and meat, tobacco, tea, fish products, rubber, groundnut, palm oil, banana, sisal, spices, and fruits. Two of these-coffee and cocoa-make up more than half the continent's total agricultural earnings. The problem is that the prices for these export commodities are declining and world markets for them are contracting. And yet the World Bank has based its argument for expanding African exports largely on the assumption that "declining export volumes, rather than declining export prices, account for Africa's poor export revenues" (World Bank and UNDP 1989).

Granted that Africa has seen its share of the world market decline for many of its export commodities, is it really worthwhile to try to increase the region's share of a declining market? How realistic is the World Bank's assumption that the world is ready and waiting for Africa to reemerge as a major supplier? According to the World Bank's 1988 forecast of real commodity prices, the aggregate indices for coffee, tea, cocoa, sugar, palm oil, coconut oil, tobacco and cotton, using 1980-81 as the base year, are 60.5 in 1995 and 70.5 in 2000. For coffee alone the indices are 68.1 and 68.5, respectively, and for cocoa 46.4 and 51.3 (World Bank 1988b). In other words African producers of cocoa will have to more than double their output to be able to maintain their 1980-81 export earnings in real terms. Similarly, by the year 2000, African producers will have to increase coffee exports by more than onethird the volume in 1980-81 in order to earn the same amount of revenue in real terms. For all products, a 30% increase in output will be required to achieve the same earnings as in 1980-81.

The proposition that Africans can pay for food imports through increased earnings from export commodities not only lacks a social face but makes no sense economically. The tremendous effort required to increase the production of exports sufficiently to maintain 1980-81 levels of revenue would be far better expended in transforming Africa's food production. If the continent can increase output of its major staples by 30%, not to talk of doubling it (as it is required to do in cocoa), food self-sufficiency could become a reality, in spite of relatively high rates of population growth. No policy could be more human-centered and have more favorable social and economic impacts. The present trend of adopting policies that are biased against the food sector and favor the production of export commodities must be reversed. Action must be taken to overcome the systematic neglect suffered by the food sector, particularly in terms of investment and research. For it is from this sector that the majority of Africans, particularly women, derive a living.

The transformation of food and through it the alleviation of poverty in sub-Saharan Africa cannot be accomplished unless something is done about the problem of low agricultural productivity in the absence of technological change (consisting mainly of improved varieties, higher and more consistent use of modern inputs, increased irrigation, and improved farm implements). Low levels of investment and research are major contributors to the slow pace of technology adoption. Though ultimately the responsibility for solving these problems lies with the farmers themselves, governments can help them by adopting policies that will increase the momentum for change and facilitate the achievement of sustainable growth in food production.

Surely, these policies cannot consist of generalized currency devaluations and high interest rates. A major drawback to the former is that it coincides with the current policy of favoring exports by lowering export prices in foreign currency and raising the prices of imports in local currency. At least in the foreseeable future, the inputs required to transform the food production sector will have to be imported. If they are to be kept affordable for smallholders, public policy must move away from generalized devaluations toward a discriminating exchange rate policy that favors high-priority inputs required for food production. The problem with the high interest rates required under structural adjustment programs is that they have fueled inflation and discouraged productive investment, while encouraging speculation. It is not surprising that there has been a marked trend toward disinvestment in adjusting countries. To encourage the transformation of food production requires a policy of differential interest rates for this sector.

It is also important that a policy of producer price supports be put in place to ensure that the changes are sustainable and that a large measure of food selfsufficiency can be achieved by the year 2000. This policy will naturally be extended to a few well-selected food commodities that constitute the staple diet in Africa. These are cereals—maize, sorghum, wheat, millet, and rice—and roots and tubers—cassava, yam, and potato. The relative importance of each of these crops varies from one part of Africa to another. Therefore, each country will have to decide which are the most significant for the purposes of food self-sufficiency and, therefore, to which it should extend the policy of producer price supports.

This approach should provide food producers with large enough incentives and incomes to enable them to adopt new production techniques and thereby increase and sustain food production.

Indeed, guaranteed stable producer prices have, in the long-run, the surest possibilities of maintaining the momentum of technological change in the food sector. . . . An assured level or remunerative prices for unlimited quantities will lead to increased production of more profitable products. Increased production almost inevitably results from a greater use of capital inputs. (ECA 1991)

Furthermore, by raising the profitability of agriculture, producer price supports will stimulate capital investment in this sector. Such an approach is essential if Africa is to succeed in alleviating poverty generally and in rural areas particularly and if it is to adopt a human-centered development strategy for achieving socioeconomic transformation. By enabling the continent to become increasingly self-sufficient in food production, a policy of producer price supports will eliminate the spectre of hunger and famine, give the vulnerable and poor more equitable access to food, and considerably reduce seasonal food shortages and the associated price instability.

In the various parts of the world where this policy has been applied successfully, it has most commonly taken the following forms: 1) market price support, 2) two-price schemes, 3) stabilization schemes, and 4) intervention buying and selling of food commodities to prevent prices from falling below or rising beyond guaranteed levels. It is not within the scope of this paper to discuss each of these options in detail. Suffice it to say that each country will have to determine which approach or combination of measures it should adopt in light of its own circumstances.

A HUMAN-CENTERED DEVELOPMENT STRATEGY

The foregoing discussion of the African food crisis and of the measures required to overcome it underscores the multidimensional, holistic nature of a human-centered development strategy. An approach that makes the human condition its foremost concern requires no special effort, no plastic surgery, to give it a social face. Above all, it is concerned with the alleviation of poverty and may be described as a blueprint for achieving this end.

The publication of the World Bank's Poverty Reduction Handbook and Operational Directive in April 1992 has given rise to hopes that the Bank has decided at last to abandon its futile effort to give structural adjustment a social face and to focus once again, after 12 years of neglect, on the task of alleviating poverty. This challenge was at the center of the Bank's policy during the 1970s under the presidency of Robert McNamara. It is heartening to hear, in the words of Lewis Preston, the Bank's new president, that "sustainable poverty reduction" will become "the overarching objective of the World Bank" and the benchmark by which its "performance as a development institution will be measured." Those of us who have been urging the Bank to take such a step can now chant our Nunc Dimitis.

As Reginald Green (1992) has stated, the content of the *Handbook* is "sensible and sensitive and, above all, is based on the acceptance that, to date, structural adjustment has largely failed to reduce poverty or seriously improve the social situation in Sub-Saharan Africa." This failure is at the center of the controversy between the Bank, on the one hand, and the ECA, UNICEF, and US Congressional study team, on the other. It is also the reason that the ECA came out with the African

The maladjusted macroeconomic framework can never be put right as long as excruciating poverty persists.

Alternative Framework to Structural Adjustment Programmes for Socio-Economic Recovery and Transformation (AAF-SAP) in July 1989.

Poverty is pervasive in Africa. According to the World Bank, the proportion of people living below the poverty line on this continent is projected (even on the basis of optimistic assumptions) to remain well over 40% and could easily reach 50% or more, while the proportion in all other regions of the Third World is expected to fall-in many cases to single-digit figures. What Africa urgently needs then is not to put the war against poverty on hold but to embark on a program of socioeconomic change, while continuing to adjust macroeconomic policies and to give them a social face. The maladjusted macroeconomic framework can never be put right on an enduring basis as long as excruciating poverty persists. The resolution of problems, such as disequilibria in balance of payments, structural budget deficits, persistent inflation, and so forth, should not be viewed as a precondition for long-term development. Rather, these problems can be resolved only in the context of such development. To break the vicious circle of poverty, African

governments must apply measures that will enable their people to develop and sustain an indigenous capacity to bring about political, social, and economic change. The excessive external dependence of national economies; their internal socioeconomic disarticulation; the fragmentation of the regional African economy; the lack of an appropriate political, economic, and social institutional framework; and the alienation of people from their governments are due to the failure of political leaders to remain sensitive and accountable to the people. And their tendency to marginalize the people and their organizations in the formulation, execution, and monitoring of policy accounts for the persistence of poverty, the narrow production base, environmental degradation, and lopsided development. Maladjusted macroeconomic policies are merely the symptoms of more fundamental structural problems. To bring about sustainable change, we must attack these problems at their roots. And the place to start is with a transformation of the food sector.

CONCLUSION

In concluding I would like to express my satisfaction that this workshop has focused on some of the major elements of such a transformation. President Carter's opening address and all of the subsequent sessions have dealt substantively with issues that are integral to the alleviation of poverty through changes in the food sector. If these issues can be resolved within a holistic, human-centered development strategy that mobilizes people and empowers them economically and politically, then the forward march will have begun for Africa and the world. The current food crisis is a reflection of the structural disequilibria and paralysis from which the entire African economy suffers. Sub-Saharan Africa is today paying dearly for its failure to discard its unenviable colonial inheritance and to push earnestly for structural transformation of its economy, society, and polity. I believe we have paid more than enough for this failure during the past three decades, particularly in the last one. Let us now push forward in the daunting but more rewarding task of socioeconomic, structural transformation, which, being human-centered, cannot but have a social face.

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A TURNING POINT IN AFRICAN AGRICULTURE?

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Although only a brief overview of this paper was presented at the workshop, we have included it in these proceedings to provide a description of the World Bank's evolving strategy for supporting agricultural development in sub-Saharan Africa.

The mass media of the western world have recently told wrenching stories of starving Africans. Particularly frightening are the scenes of massive starvation in Somalia. Ethiopia, Liberia, Sudan, and parts of southern Africa are also faced with serious food shortages. Extreme poverty, hunger, and disease are, of course, not new on this

About 40% of Africans today are not adequately fed.

continent. The Sahelian region was the scene of similar catastrophes during the 1970s, and Angola, Mozambique, and Zaire have found themselves in much the same state at some point in their postcolonial histories. It should come as no surprise that the institutions created to reduce poverty and hunger, such as the donor agencies of the industrialized countries, the World Bank, and the United Nations family of international organizations, are criticized as being ineffective in Africa.

The facts are no less discouraging than the images that appear in the press. While African agriculture has grown at an average rate of 2% per annum for the past 25 years, population growth in the region has risen from an average of about 2.8% per annum in the 1970s to about 3.1% today. Because agriculture has expanded more slowly than population, a food gap has developed, which is partly filled by imports and food aid, but still causes many people to go without. About 40% of Africans today are not adequately fed. To make matters worse, agricultural exports have declined, limiting the continent's ability to pay for equipment and inputs needed in agriculture and industry. In many African countries, the growing numbers of people in the countryside are rapidly converting forest into farmland, causing considerable environmental damage in the process. Widespread soil erosion and deforestation are reported from virtually every country in the region.

The most promising solution to these problems is to develop African agriculture. About 70% of the continent's population depends directly on this sector both for food and cash income. Agriculture creates a little over 30% of the gross domestic product in the average African country. By and large, the region's most important industries are agroindustries, which process its diverse agricultural products. The main ones are maize, sorghum, millet, rice, coffee, tea, cocoa, palm oil, meat, dairy products, wood, fish, root and tuber crops, fruits, and vegetables.

Clearly, if every African country could develop a vibrant agriculture, its people would be better fed, and it could generate

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a surplus for processing and export. An expanding agriculture would generate additional income and employment. With higher earnings, farmers would buy more, stimulating the development of industries for producing farm inputs and consumer goods. Of course, growth in agriculture and agroindustry is not a sufficient condition for greater prosperity in Africa. But it would go a long way toward accomplishing this goal, particularly if combined with reduced population growth and measures to assure that the benefits are distributed widely.

DIVERSE EXPERIENCE IN AGRICULTURAL DEVELOPMENT

Finding the key to agricultural development in Africa requires that we take a closer look at its diverse experience. Countries in which the agricultural sector performs poorly have certain characteristics in common. In Angola, Ethiopia, Liberia, Mozambique, Somalia, Sudan, and Zaire, for example, social and political turmoil has greatly limited the effectiveness of projects directed at achieving agricultural and economic development. Under the circumstances, farmers naturally retreat into subsistence production. Commercial agriculture collapses because of the risk of confiscation, the difficulty of trade, the insecurity of money, and the limited availability of inputs and equipment.

Countries that are relatively stable politically but maintain rigid government control of agriculture have done only slightly better than those described above. Policies that are inimical to agricultural development include overvalued exchange rates, price controls that reduce the amount farmers receive for their commodities, government monopoly on agricultural trade (which has usually constrained this trade and made it more expensive), and restrictions on private investment in agricultural processing and marketing. A further hindrance is poorly conceived services for providing farmers with technical advice. These services are usually managed by government, sometimes with donor assistance. In most cases they have proved to be highly susceptible to corruption and have nearly always been ineffective. Countries where these policies and approaches have prevailed include Benin, the Central African Republic, Congo, Gabon, Malawi, and Zaire and until recently Ghana, Nigeria, Tanzania, and Zambia, among others. In those countries education, roads, water supply, and health have been neglected as well, diminishing the ability of the rural population to benefit from technical innovations in agriculture.

Fortunately, there is another Africa, one that is progressing but receives much less attention in the media. In Kenya, for example, agriculture has grown at an average rate of 3 or 4% per annum for the last 25 years-faster than in most industrialized countries. Burkina Faso and Togo have also done extremely well. Several other countries, such as Ghana, Nigeria, Tanzania, and Uganda, have achieved spectacular improvements in agriculture during recent years. In each case the changes have been rooted in more effective government policies, such as maintaining exchange rates at reasonable levels, keeping budget deficits down, raising the quality of public sector investments, allowing the private sector to participate freely in agricultural markets, and improving infrastructure, education, and health in rural areas. The governments of these countries have also improved the ability of agricultural research and extension to provide farmers with usable technology. This in turn has permitted greater crop vields, thus reducing the pressure for farmers to bring new land under cultivation through destructive forest and bush

clearing. Cooperatives and other organizations have encouraged farmers to participate more actively in the rural economy. Countries that have implemented better policies and made wiser investments have attracted donor support for these efforts. Since the World Bank's agricultural projects work best in these countries, we are among those making a contribution. Even the foreign private sector is starting to invest more in these countries, though still on a small scale, bringing valuable know-how and access to markets in the industrialized world.

One type of agricultural project that is giving good results in the African countries where sound economic policies have been established is that aimed at strengthening agricultural extension. Under such projects a public sector service is created, in which trained African agriculturalists teach farmers how to apply improved techniques for producing crops (including basic staples as well as fruits and vegetables) and raising livestock. Independent studies of two extension projects financed by the World Bank in Burkina Faso and Kenya indicate that the rate of return on investment is about 100% and that tens of millions of people are benefitting. Currently, the Bank is funding 27 such projects in Africa. Increasingly, they are aimed at reaching women, who are the continent's principal food producers.

Another promising type of project creates and maintains rural savings and loan associations. Rural people in Benin, Burundi, Cameroon, Rwanda, and Togo, among others, have established their own cooperative banks (similar to credit unions in the USA), where they can make savings deposits and obtain credit both for investment (e.g., in processing and marketing activities) and consumption. Many donors are assisting in this endeavor, including the World Bank, the US Agency for International Development, and the French and Swiss governments.

This experience has shown that donors can work together quite effectively, when they have committed and competent African partners. Notable examples of successful investment assisted by donors (including the World Bank) are the cotton industry in much of francophone West Africa, dairying in Kenya, maize production in parts of Tanzania, and rubber production in Cote d'Ivoire. There are examples of successful private investment as well. Approximately 120 private companies now market, process, and export horticultural products in Kenya. Though many are foreign, increasingly they are African firms, benefitting from contacts with foreign companies.

LESSONS FROM SUCCESS

Based on the experience of countries where these successes are occurring, we now know what it takes to develop African agriculture. The first requirement is stable political and social institutions. Democratization also helps and should be pursued, both because it is a desirable end in itself and because it mobilizes large numbers of people to participate in building institutions and making economic decisions. Another essential ingredient is a favorable economic policy environment that allows market incentives to be passed along to farmers and encourages the private sector to invest in agricultural production, processing, and marketing. The creation of such a policy environment is what we refer to as structural adjustment, an initiative supported by the World Bank, in partnership with other donors, in many African countries. Increasingly, structural adjustment is accompanied by measures designed specifically to reduce poverty by stimulating agricultural development and creating employment.

Successful experience in recent years offers other lessons as well. One is that Africans will have to manage the development process themselves. All foreigners can do,

Donors and private voluntary agencies must learn to work together rather than in competition.

whether they are private voluntary organizations or donors, is provide financing and technical assistance in support of African development strategies. Another lesson is that emergency relief is at best a stopgap measure for helping desperate people through a crisis. Certainly, when disaster strikes, the international community must be ready to intervene quickly and efficiently. (For example, the World Bank is currently assisting in large-scale drought recovery projects in Malawi, Somalia, Zambia, and Zimbabwe.) But we must avoid providing so much relief as to create dependency. A third lesson is that donors and private voluntary agencies must learn to work together rather than in competition to

support African development strategies. Moreover, they must provide assistance more selectively, concentrating on those areas where the chances of success are good and their African partners are strongly committed to development. This approach must be balanced, however, with a humanitarian commitment to helping people in extreme distress.

Finally, it should be obvious from the foregoing discussion that none of the simplistic solutions one hears about is, by itself, adequate for the task at hand. It is not enough simply to apply Asia's Green Revolution technology for cereal production in Africa, to better organize food aid, to provide more scholarships for Africans to study in developed-country universities, or to reduce population growth. These are but individual components of a more complex but realistic solution that will take many years to achieve. Asia's progress over the past 20 years in overcoming the obstacles to development may provide useful indicators about a brighter future for agriculture in Africa. If we fail now to take the steps needed to secure that future, experience in Africa suggests that the disasters will grow worse and more frequent.

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