

THE EMERGING WORLD FOOD SITUATION & *Challenges for Development Policy*

**PROPERTY OF
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE**

HD
9000.6
.16
no.1
copy 1

IFPRI POLICY BRIEFS 1

STAR 8339 3/5/79

IFPRI POLICY BRIEFS

make available in capsule form recent research findings drawn from larger studies conducted by IFPRI and others that may not yet be accessible to the general public. Prior to publication the briefs are normally presented at an IFPRI policy seminar where they serve as a basis for an interchange of views between research analysts and decisionmakers on policy issues of immediate concern. Thus, the format is intended to be abbreviated and nontechnical in order to contribute to public understanding of complex issues on which systematic information is often lacking.

The briefs that follow address issues of crucial importance to the development assistance community arising from a rapidly changing world food situation and its implications for access to food by low-income people in developing countries, particularly those of Sub-Saharan Africa. They deal specifically with the growth of food surpluses in the OECD countries and their significance for the Third World in terms of trade, food aid, and economic development. The policy seminar upon which these briefs are based was sponsored by IFPRI in cooperation with the Ministry of Foreign Affairs of the Netherlands which provided generous support.

FOOD SURPLUSES OF DEVELOPED COUNTRIES: POLICY IMPLICATIONS FOR DEVELOPING COUNTRIES • JOHN W. MELLOR

Keynote I

The perception of the global food scene has changed dramatically since the mid-1970s. Foodgrain stocks are now twice the level of the mid-1970s. Foodgrain prices have dropped 30 percent in the past few years, in contrast to doubling in the early 1970s. Real fertilizer prices have receded to the 1960s low, whereas they increased four-and-a-half times in the early 1970s. Although the current impression of glut may prove illusory, the present global food situation offers extraordinary opportunity to reduce hunger, poverty, and underdevelopment. However, to grasp that opportunity in today's complex world will tax our ingenuity.

DEVELOPING-COUNTRY FOOD DEFICITS

Developing-country net imports of cereals have grown dramatically from 15 million tons in the early 1960s to nearly 70 million tons in the mid-1980s. The rate of growth of net imports accelerated markedly in the 1970s compared to the 1960s, and as of 1984, that growth had not slowed. Developing countries are now the only growing market for cereals, and they already represent nearly half of all cereal imports. On the basis of a very conservative projection of past trends, imports of basic food staples (a somewhat broader category than cereals) will increase by 40 million tons over the next 20 years. And, a logical case can be built for an increase of 120 million tons. (This assumes that income continues to grow at the 1960-80 pace, livestock feeding practices change at the 1960-80 rate, and the incremental demand for livestock products is met from domestic production.)

Increasingly, the driving force for growing net imports of basic food staples by developing countries is rising real incomes in the context of high propensities to spend incremental income on food. A rapid rise in consumption of livestock products and the accompanying growth in feed use are major consequences of rising incomes. That explains the anomaly that the countries with the highest growth rates in basic food staple production also have rapidly increasing net imports of basic food staples. Rapid growth in agriculture stimulates rapid overall growth. Consequently, demand for food grows even more rapidly than the growth in supply. That is why it is to the advantage of food exporters to foster growth in agriculture in developing countries. It is the only widely reproducible means of achieving the rapid growth in incomes that fosters rapid growth in demand for food.

Only a few developing countries are net exporters of basic food staples. More are projected to become so during the next few decades. Two developing countries, Argentina and Thailand, have abundant land resources relative to their populations. Together they account for more than two-thirds of all developing-country exports of basic food staples. Undoubtedly, one or two other developing countries would fall in this category if they had more propitious agricultural production policies. While developing countries as a whole benefit from low prices of basic food staples in international trade, clearly the land-rich developing countries are major losers.

Many developing countries that are net exporters of basic food staples exploit their comparative advantage to export some agricultural commodities and to import others. Distortions of in-

ternational price relationships are potentially highly injurious to that group of developing countries.

A substantial number of developing countries projected to be net basic food staple exporters fall in the income group of less than \$500 a year of average per capita income. For a large share of their populations, caloric intake is grossly inadequate. For optimal economic growth and equity in these countries, it would be desirable to accelerate employment growth, and hence the effective demand for food, even if basic food staples have to be imported. Their clearest comparative advantage lies in mobilizing labor in labor-intensive activities. The poor countries that are incipient exporters of food staples tend to be large countries, suggesting that autarchical trade policies that small countries cannot even consider and misallocation of capital to large-scale, capital-intensive industry may be important causes of poor employment growth rates and hence slow growth in the demand for food.

DEVELOPED-COUNTRY FOOD SURPLUSES

As development proceeds, growth in agriculture becomes institutionalized. Agricultural research systems pump out a steady stream of productivity-increasing innovations, and they are quickly put into practice by sophisticated farmers, supported by complex farm-servicing institutions. Meanwhile, consumer demand for food becomes satiated and grows little or not at all, irrespective of income changes. Naturally, under these conditions, resources must be withdrawn from agriculture and exports increased, or surpluses will be generated. Western Europe has only recently reached this stage, shifting from a major importer to exporter in a little over a decade. The Soviet bloc, with a production growth record comparable to that of Western Europe, is still experiencing rapid growth in food consumption with rising incomes, but in the next few decades it will move out of that phase. Developing countries will, of course, continue to experience rapid growth in consumption as per capita incomes rise for a long time. The current global situation is unusual in having, concurrently, large populations in both the developed stage of large exportable surpluses and in the developing stage of larger excess demand.

Projections of exportable surpluses from developed countries are far less predictable than projections of the imports of developing countries. The latter are the product of relatively stable underlying processes of institutional change. IFPRI's past projections for developing countries have proved to be accurate indicators of future performance. For developed countries, the trends are far more volatile, and they probably respond much more quickly to major policy changes. To illustrate this volatility and unpredictability, projections similar to those for developing countries, using 1960-80 growth rates in production, project net exports for 2000 much larger than the most optimistic predictions of developing-country imports. But, when projections are based on the much slower production growth rate of the 1970s, exportable surpluses are eliminated by the year 2000! Despite such instability in past trends, it would seem only prudent for developed countries to pursue a vigorous policy of transferring resources out of agriculture.

POLICY ISSUES IN A WORLD OF ABUNDANT FOOD

Agricultural Productivity Growth

Because agriculture is the dominant production sector in developing countries, the key determinant of incomes of the poor, and the major opportunity for technological change, it must be the centerpiece of the development effort. That is, irrespective of the global food situation, foreign assistance must, along with national efforts, focus on the objective of stimulating agriculture. Similarly, global and national pricing and trading policies must provide favorable incentives to farm producers, in the context of cost-decreasing technological change.

Instability

Instability in food supplies and prices becomes a particularly serious political and economic problem for developing countries that commit themselves to an agriculture- and employment-oriented strategy of development. Production and consumption in these countries both become more dependent on the food sector than in alternate strategies. Their political systems are increasingly committed to agriculture, to employment, and to the real incomes of the laboring classes. In that context, developed countries need to examine the effects of their own policies on food supply and price stability.

In contrast to the need for stability, global food prices have become much more unstable in recent decades, and global food production has significantly increased in instability. Food aid could be a stabilizing item for food supplies of developing countries: in practice it has been further destabilizing. The International Monetary Fund Cereal Facility is a major innovation with great potential for stabilizing food availability in developing countries, but so far it has not demonstrated that potential.

Food Aid

Given that agricultural productivity in developed countries is growing far faster than they wish, it seems only natural to use the consequent surplus to immediately increase the food consumption of poor people who could not otherwise do so. In this case there would be no downward pressure on domestic prices in the recipient country because demand would increase commensurate with supply. Of course, government policy in the recipient country would have to be based on recognition of the key role of agricultural growth in overall growth.

Because development of agriculture requires a vast, innately labor-intensive rural infrastructure, the use of food to support labor-intensive rural development recommends itself. To be effective, such a policy must start with a commitment to massive infrastructure investment and proceed to provision of the resource requirements: both food as wage goods and also various nonlabor resources. Separate approaches to food for work and other elements of infrastructure investment are not likely to be efficient.

Trade in Labor-Intensive Goods

If developing countries are to increase employment and the effective demand for food rapidly, they must import large quantities of capital-intensive goods. They cannot do so unless markets are available for their own labor-intensive goods and services. Initially, agricultural commodities such as horticultural and livestock products are leading items in this category. Developing countries have been losing their market share of such commodities, but as soon as they increase their supply of these products, the trade openness of developed countries will become a major issue.

A FOOD AND EMPLOYMENT-ORIENTED DEVELOPMENT STRATEGY: NEEDS, PROBLEMS, AND OPPORTUNITIES • JOHN W. MELLOR

Keynote II

The time is propitious for a commitment to making agriculture central to development strategy and for accelerating growth in employment. A generally abundant global food situation helps assure stable food supplies for such a strategy. The current world trade difficulties encourage strategies in which growth in domestic demand is the basic engine of growth, with trade playing a critical but still subsidiary role. Knowledge of how to accelerate agricultural growth is now highly developed, and the need for accelerated employment growth is better understood than in the past. However, pursuit of an agriculture- and employment-oriented strategy is unlikely to succeed without knowledge of the complex, interacting roles of technological change in agriculture, commercialization, infrastructure investment, price relationships, and trade.

EMPLOYMENT AND AGRICULTURE

Agriculture has two major contributions to make to high rates of employment growth. First, employment growth necessarily increases the total wage bill in developing countries, the bulk of which—60 to 80 percent—is spent on food. Thus, if employment increases rapidly without commensurate increase in supply of food, food prices will rise rapidly. Governments will likely respond by adopting antiinflationary fiscal and monetary policies, which will serve first to reduce employment. (In a neoclassical world, rising food prices will drive up wage rates in terms of the output of labor and thus cause reduced employment, as capital is substituted for labor.) Imports of food can reduce upward pressure on food prices, but the quantities imported may be so large that the real exchange rate is reduced, pushing up the domestic relative price of food, even if the international price is unaffected. To say it more directly, the country will run short of foreign exchange and will curtail food imports, thereby raising domestic food prices. Thus in low-income countries accelerating growth in domestic food production is an essential part of a high employment growth strategy.

Second, agricultural growth facilitates a more even spread of capital over the labor force, creating more jobs. In the modern world, employment growth is constrained by lack of capital. Accelerated growth in agriculture through production-increasing technological change creates demand for goods and services that are efficiently produced with low capital-to-labor ratios. In Asia, small farmers spend 40 percent of increments to income on locally produced nonagricultural goods and services and about 20 percent on labor-intensive produced horticultural and livestock products. It is the link between agricultural growth and labor-intensive nonagricultural growth that needs to be encouraged and that offers so much potential for concurrently increasing the rate and efficiency of growth.

Analysis of time series data on poverty and agriculture over one or two decades show the two most powerful forces determining poverty to be per capita growth in food production and change in food prices. The first is a major determinant of the amount of employment. The second determines the purchasing power of a given level of income. Thus, to reduce poverty, the ideal is to increase food production and to lower food prices. How can incentives to produce more coincide with lower prices?

By reducing the cost of production through technological change. But, can increased food production from improved technology occur without depressing food prices? The answer is to stimulate sufficient employment growth in the nonagricultural sector to increase demand for food by as much or more than the increase in supply. Thus the critical interrelations between agriculture, employment, and poverty are clear, as well as the trade-offs between employment policy and price policy.

EMPLOYMENT POLICY

Three policy areas need improvement if high employment growth is to be achieved. First, change is needed in exchange rate and trade policies that now favor capital-intensive domestic industry and discriminate against labor-intensive ones. Overvalued exchange rates are a prime culprit, but subsidized exports for capital-intensive industries may be just as injurious. Of course, such policies also discriminate against agriculture.

Second, a shift away from striving for self-sufficiency in capital-intensive goods must occur. This means increased imports of essential products produced by capital-intensive means and a concurrent increase in exports of labor-intensive goods and services. An open trade regime and a favorable global environment for trade are essential to an agriculture- and employment-oriented strategy of development.

Third, far more attention needs to be given to infrastructure investment, particularly throughout rural areas, to facilitate widespread growth of labor-intensive industries. In this context, foreign aid becomes important, first, to financing the structural adjustment to a more open trading regime; second, to facilitating accelerated growth of infrastructure investment; and third, to ensuring the supply of trained people and increasing the efficiency of institutions to mobilize those people. Thus, the lower the level of development of trained people and institutional capacity, the narrower must be the priorities for development projects. Unfortunately, a narrow base of trained people leaves a developing-country government poorly prepared to contain donor pressures to expand the range of activities, so the need to set priorities and the capacity to do so tend to be inversely related.

AGRICULTURAL PRODUCTION POLICY

Because of the concurrent importance to employment growth of increasing effective demand by small farmers and of restraining food prices, cost-reducing technological change becomes the centerpiece of an agriculturally led development strategy. That becomes all the more important in a world in which policies of developed countries exert powerful downward pressure on world food prices.

The key elements of a cost reduction strategy for agriculture are agricultural research, providing increased yields per unit area of land and per worker; increased supply of inputs from outside agriculture so that insufficient inputs do not constrain production growth; increased integration of agriculture to allow greater specialization through better infrastructure; and price relationships that, within the context of cost reduction, provide

adequate incentives to mobilize productive resources and to innovate. Behind all of these is massive investment in education at all levels. Developing countries and foreign assistance donors have generally given too little priority to these areas to allow rapid growth in agriculture: efforts need to be redoubled in each of them.

The most glaring underinvestment is in rural infrastructure, a deficiency that not only prejudices agricultural growth but the structure of nonagricultural growth as well. Even in a country like Bangladesh growth of agricultural production is depressed

by a quarter or more over 25 percent or more of the area by grossly inadequate rural infrastructure. One of the most obvious ways of using today's huge surpluses of food in the developed countries is as wage goods to pay labor in developing countries for building infrastructure. An effective combination of food for wage goods and cash for the necessary complements to labor is needed.

The other glaring underinvestment is in high-level training of personnel for policy analysis, research, input supply, and other institutions of agricultural growth.

SETTING PRIORITIES FOR ACCELERATING FOOD PRODUCTION IN SUB-SAHARAN AFRICA • CHRISTOPHER L. DELGADO¹

Keynote III

Compared to the early 1980s, there is presently a consensus among most African governments, international organizations, and bilateral donors on the broad lines of policy reforms required to get food production in Sub-Saharan Africa (hereafter referred to as Africa) moving. The exchange rate, tariff, and pricing policies of the 1970s and early 1980s that were frequently prejudicial to agriculture in Africa have been or are being modified in response to the pressure of events. Yet compared to similar debates in Asia in the 1960s, considerable uncertainty remains as to the specifics of policy to move ahead. Both African governments and donor organizations have typically operated in such a way as to diffuse the collective effort over a large number of objectives. An agreed set of implementable priorities is lacking. Critical choices need to be made and continuously monitored in the following areas:

FOOD VERSUS EXPORT CROPS AND LARGE VERSUS SMALL FARMS

More than 80 percent of the cropped area in Sub-Saharan Africa produces food consumed within the region, which represents more than 60 percent of the value of all African crop production. Less than 5 percent of African food production comes from large plantation or estate-type farms. Yet debate over where to concentrate resources within these two sectors has diffused agricultural efforts in Africa. Development strategies must involve the three-quarters of Africa's population that still have smallholder agriculture as their main source of employment by raising productivity in smallholder food.

REGIONAL AND COMMODITY PRIORITIES

In the past, rapid growth in smallholder food production—be it in Kenya, Punjab, or the Ile de France—has largely been an increased response to already favorable conditions for one or two crops. Increasing productivity is difficult, but research that focuses first on areas where the technical constraints are lowest have the potential for greatest success. Such areas exist within Africa, even in the most arid countries; however, most African countries have diffused their resources over all areas, primarily in response to political constraints. Research efforts on commodities are similarly diffused. The Consultative Group on International Agricultural Research (CGIAR) involving between 15 and 17 percent of all agricultural research in Sub-Saharan Africa, is working on 12 commodities in the continent. Breakthroughs in Asia two decades ago came from intensive work on two commodities. This success was the result of interdisciplinary work organized along commodity lines. In contrast, research in Africa tends to be organized around problem areas such as soils, water, pests, and the like, and research teams rarely focus on one set of problems for very long. Roughly 70 percent of African food crop production and growth in production during the last 25 years has come from four sets of com-

modities: maize, cassava, millet/sorghum, and rice. The first three are currently of roughly equal importance to their contribution to consumption and production, whereas rice has grown rapidly from a very minor position to supply approximately 9 percent of African food crop production in the mid 1980s. Rice consumption has grown even more rapidly than production, especially in West Africa. By the year 2000, it is projected that rice may account for nearly 37 percent of West African cereals consumption, whereas imported wheat may account for 33 percent. While annual wheat and rice consumption per capita has increased by more than 16 kilograms in West Africa since 1961/65, per capita millet and sorghum consumption has fallen by more than 21 kilograms.

FERTILIZER: SHORT-TERM PRIORITY

Agricultural policy can achieve rapid successes in many areas of Africa by improving smallholder access to appropriate fertilizers. What is needed is the identification of the regions where fertilizer potential is underexploited and to understand why use is not greater. Sub-Saharan Africa accounts for only 2.5 percent of fertilizer use in the Third World, despite having 16 percent of the cropped area and 11 percent of the agricultural population. Current use is an average of about 7 kilograms/hectare, growing at 9 percent a year. The policy objective should be to boost this growth to 15 percent a year, which Asian experience at similar levels of economic activity suggests is feasible.

LONG-RUN PRIORITIES

Getting agriculture and, more generally, economic development moving in Africa requires a massive investment in social overhead capital that increases the capacity of smallholders to respond to price incentives.

- **Agricultural Research:** The fundamental question is how to raise average labor productivity in the rural areas to the level that it is competitive with returns to migration to the city. Although price and input subsidy policies can have a direct impact here, only technological change that reduces unit costs of production can achieve this in the long run. Increased funding in the 1970s led to an expansion of food crop research in the 1970s; however, disenchantment stemming from the diffusion of resources across tasks, areas, and commodities has led to substantial cutbacks in recent years. IFPRI research by Oram shows that while total research support per scientist averaged US\$103,000 in 1980, by 1984 this had fallen to US\$62,000, at the same time that national governments were increasing the number of scientists on permanent hire. In West Africa, national agricultural research approached the respectable level of 0.9 percent of agricultural GDP by 1980, but fell to 0.65 percent by 1984.

- **Rural Infrastructure:** With the exception of a few areas with substantial cash cropping activity, Africa's rural transportation and communications infrastructure is particularly poor by Third World standards. In the late 1970s large countries such as Nigeria and Zaire had from two to three kilometers of roads per square kilometer of agricultural land and million rural inhabitants, compared to Korea and Malaysia, which had 30 to 45 kilo-

¹This note draws heavily on the concluding chapter of a book edited by John W. Mellor, Christopher L. Delgado, and Malcolm Blackie, entitled: *Accelerating Food Production in Sub-Saharan Africa* (Baltimore, Md.: Johns Hopkins University Press, 1987). The important contribution of my co-editors is duly acknowledged.

meters according to the same criteria in the 1960s. IFPRI research by Koester shows that in the SADCC countries, half of the import parity price for maize, the principal staple, is due to intra-African transport costs. Domestic cereals prices are thus subject to large fluctuations, even with free trade. IFPRI research in Asia also suggests that the returns to infrastructural investment need to be assessed in terms of the increased employment and agricultural service provision that occurs, in addition to changes in transport costs.

● **Institution Building and Human Capital:** The importance of public goods in getting agriculture moving emphasizes the need to support institutions within African governments that can

continuously monitor the objects of policy choice and advise on them. Fertilizer is a good example. These institutions must be staffed by highly trained people that benefit from good information on which to base their decisions. World Bank research shows that at the beginning of the 1980s, donors as a whole spent US\$4 billion on technical assistance, comprised essentially of some 80,000 expatriates in Sub-Saharan Africa. Yet at the same time only 4 percent of lending by the World Bank at that time went to education. Despite significant efforts by national governments, there is still much to do, to improve decisionmaking and most of it should be done inside Africa, albeit with foreign assistance support.

Background Notes—1

Major changes have occurred in world cereal trade during the past two and a half decades. The volume of grains traded expanded from an annual average of about 95 million metric¹ tons in 1961-65 to 240 million tons in 1981-85. This increase is equivalent to an average rate of growth of nearly 5 percent a year. Relative to world cereal production the 1981-85 average represented about 15 percent in that period, compared to 11 percent in 1961-65. The relative distribution of trade among the cereals has also changed over time.

- Wheat declined in share from more than 50 percent in the early 1960s to about 45 percent by the early 1980s.
- Maize went from less than one-fourth to nearly one-third of total cereal trade between the two periods.
- The share of rice decreased slightly.
- The joint share of wheat and rice declined by nearly 10 percentage points in favor of coarse grains.

Cereal Trade of Developed Countries

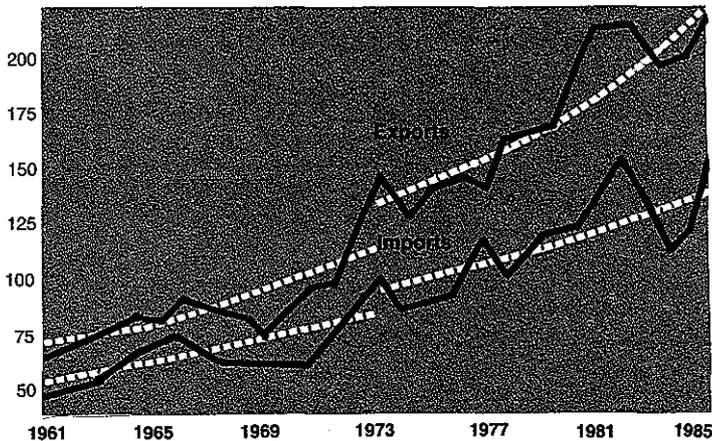
More than four-fifths of world cereal exports have come from the developed economies which also still account for the larger portion (55 percent in 1981-85) of world cereal imports. Developed countries increased their export trade by three percentage points but decreased their import trade by nine percentage points compared to the 1961-65 levels. Net exports for this group rose more than fourfold in 20 years.

- Between 1961-65 and 1981-85, annual exports of cereals by developed countries expanded by about 125 million tons, nearly two-thirds of which came from North America (United States and Canada) and more than one-fourth from Western Europe. In the latter period North America accounted for 54 percent of the world's grain exports, followed a far second by Western Europe with 19 percent.² Oceania (Australia and New Zealand) and the remaining developed regions accounted for 11 percent. Grain exports grew most rapidly in Western Europe at almost 8 percent a year.
- Forty-one percent of the world's total grain imports in 1981-85 was about equally shared by Western Europe and Eastern Europe/USSR and another 13 percent was accounted for by the "others" group of developed economies.
- Since 1961-65, average yearly grain imports of developed countries increased by 70 million tons, nearly half of which went to the Eastern Europe/USSR region whose import growth averaged a rapid 7 percent a year. Annual imports by Western Europe rose by only 14 million tons, representing a rate of 1.6 percent a year.
- The rate of growth of both exports and, especially, imports of these economies slowed between 1961-73 and 1973-85 (Figure 1). Increases in exports decelerated by one percentage point to 4 percent a year while the rate of increase of imports declined substantially from about 5 percent to less than 3 percent. Despite this slowdown, the share of world cereal exports by the developed countries stayed well above 80 percent.

¹All tons are metric.

²FAO data show that in 1979-83 cereal exports of the U.S. alone represented 46 percent of the world's total while those of the EC countries made up 95 percent of the share of Western Europe.

Figure 1
Trends of cereal exports and imports for developed countries, 1961-73 and 1973-85
Million metric tons



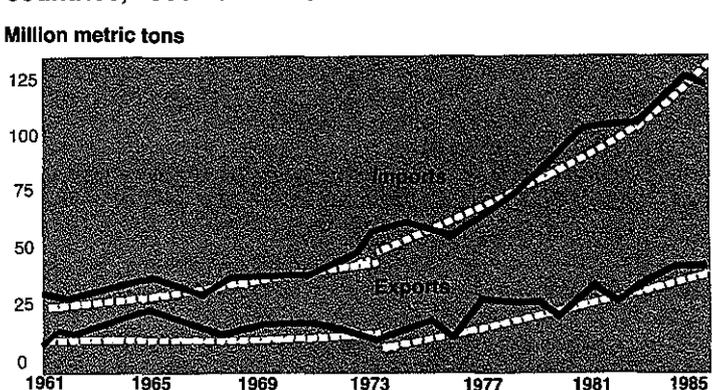
Source of basic data: FAO.

CEREAL TRADE IN THE THIRD WORLD

As implied by earlier cited data, Third World countries have contributed less than one-fifth of the world's grain exports, accounted for less than one-half of imports in 1981-85, and expanded their net imports more than fourfold since the 1960s.

- Growth of cereal exports by Third World countries averaged about 4 percent a year between 1961 and 1985; their cereal imports expanded at a faster rate of 6 percent annually.
- The growth rate of exports in the Third World increased from about 2.5 percent a year in 1961-73 to 6.5 percent a year in 1973-85, while their imports, whose growth averaged less than 4 percent annually during the first 12 years, expanded by 7 percent annually in the later period (Figure 2).

Figure 2
Trends of cereal exports and imports for developing countries, 1961-73 and 1973-85
Million metric tons



Source of basic data: FAO.

- Annual exports of developing countries increased by about 20 million tons during the past two decades. Exports by Latin America rose two and a half times, while those of Asia doubled; these regions respectively contributed 9 percent and 6 percent of world cereal exports during 1981-85.
- Of the grain imports of developing countries in 1981-85, Asia accounted for two-fifths, North Africa/Middle East for one third, and Latin America for one-fifth. Sub-Saharan Africa's share represented 10 percent of Third World imports or 4.5 percent of the world total.
- Cereal imports in North Africa/Middle East grew at almost 9.5 percent a year, in Sub-Saharan Africa at 9 percent, and Latin America at 7 percent. Sub-Saharan Africa's high rate could be partly attributed to the region's low initial import base. Latin America, the only net cereal exporter among Third World regions during 1961-65, became a small net importer of grain in 1981-85.
- IFPRI studies on food trends in the Third World showed that the group of developing countries that had the most rapid rates of growth (3.3 percent or more annually) of production of basic food staples during the 1960s and 1970s had a much faster rate of growth of food imports (most of which was cereals) during the same period.

SUMMARY

- World grain trade expanded at an average rate of nearly 5 percent a year between the early 1960s and early 1980s.
- The composition of world grain trade has been shifting toward

coarse grains, specifically maize.

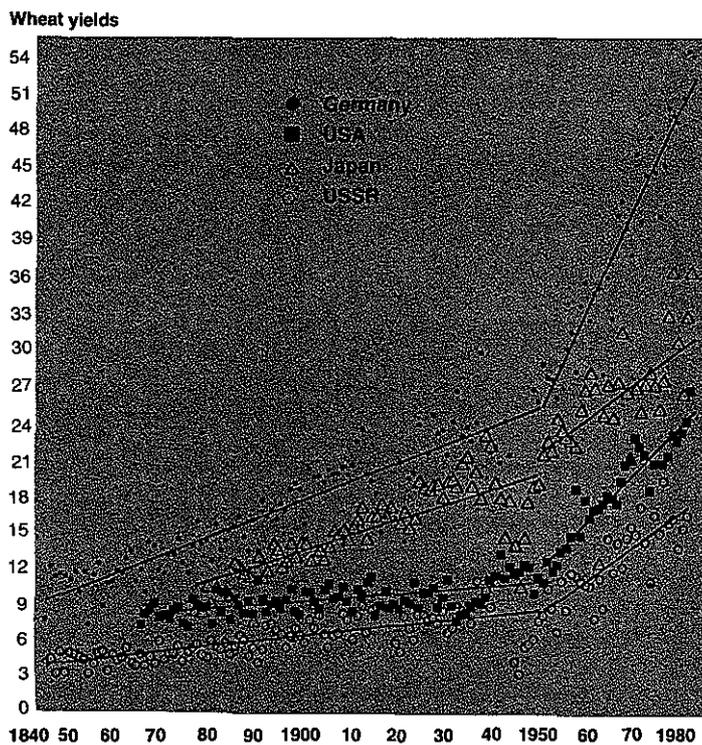
- Developed country grain exports, which have accounted for over four-fifths of the world's total since the early 1960s, expanded more than 5 percent a year during 1961-85.
- Twelve-year trends suggest that growth of grain exports by the developed world slowed during the second half of the period despite the rapid increase of exports by North America.
- Grain imports by the developing countries grew at a rate of 6 percent annually; increases were particularly rapid during the second half of that period when growth averaged 7 percent a year or nearly twice the average rate of increase during the earlier half.
- During the past two decades the increases of net grain exports of about two and a half times in both North America and Oceania, together with the disappearance of net imports of Western Europe, filled the fast expanding net imports of the other developed regions and those of all the regions in the Third World.
- Global trends of cereal exports and imports, showing the shifting composition of grain trade toward coarse grains and the rapid rate of growth of cereal imports in developing countries, highly complement IFPRI study findings regarding cereal feed use in the Third World. The projections made in that study indicate that with the rapid increase in the use of cereals for animal feed in developing countries, annual net deficits (and hence potential net imports) of these commodities could increase 40 to 80 million tons between 1980 and the end of the century.

Background Notes—2

The European Community (EC) and the United States (U.S.) are the main food suppliers in the world food market. They produce more than 50 percent of all cereals, soybeans, butter, cheese, and skimmed milk powder. Thus prospects for EC and U.S. food surpluses are the most important for world food markets. Because wheat and coarse grains are the most important internationally traded temperate-zone products, they are the focus of this note.

The U.S. has been a grain surplus producer for more than three decades, but the EC has become a major grain exporter only since the late 1970s. In both cases increased exports have been the result of unprecedented growth in yields (see Figure 1). These increases in yields as well as increases in area under cultivation have been the result of market forces and grain policies.

Figure 1
Growth in wheat yields in selected developed countries, 1845-1983

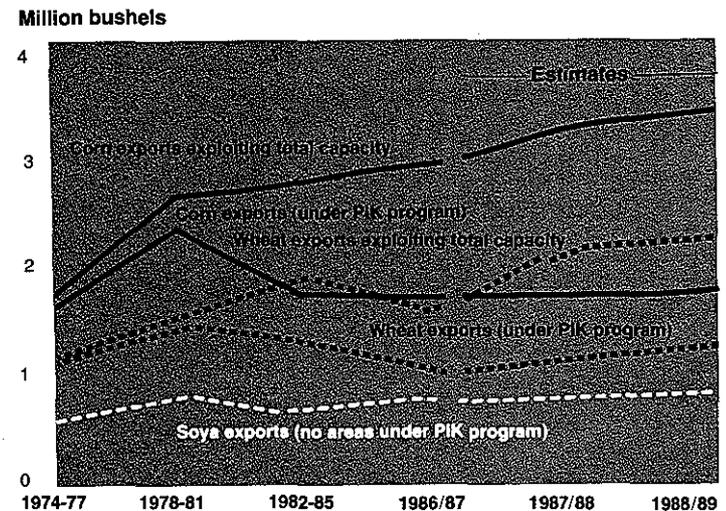


Grain policies of the U.S. have been more unstable in the recent past than those of the EC, primarily because of set-aside programs. The U.S. "payment-in-kind" program that was set into operation in 1983 has dramatically reduced the area under cereal cultivation. Set-asides in the U.S. were 78 million acres in 1983, dropped to 27 million in 1984, increased to 34 million in 1985, and in 1986 came to about 55 million. Thus U.S. grain policy has contributed to instability in world grain production and has tended to curtail world grain production.

In contrast, EC grain policies stimulated internal production by the creation of a favorable price climate. EC prices were above world market prices in all years except 1972-74 during the world food crisis.

Prediction of EC and U.S. food surpluses has to take into consideration internal production and consumption growth and assume the probable policy climate. Given the current U.S. policy to keep land out of production, and if the situation on world food markets does not change dramatically, the U.S. surplus environment will remain the same (see Figure 2).

Figure 2
Wheat, corn, and soybean exports of the United States, 1974-1989



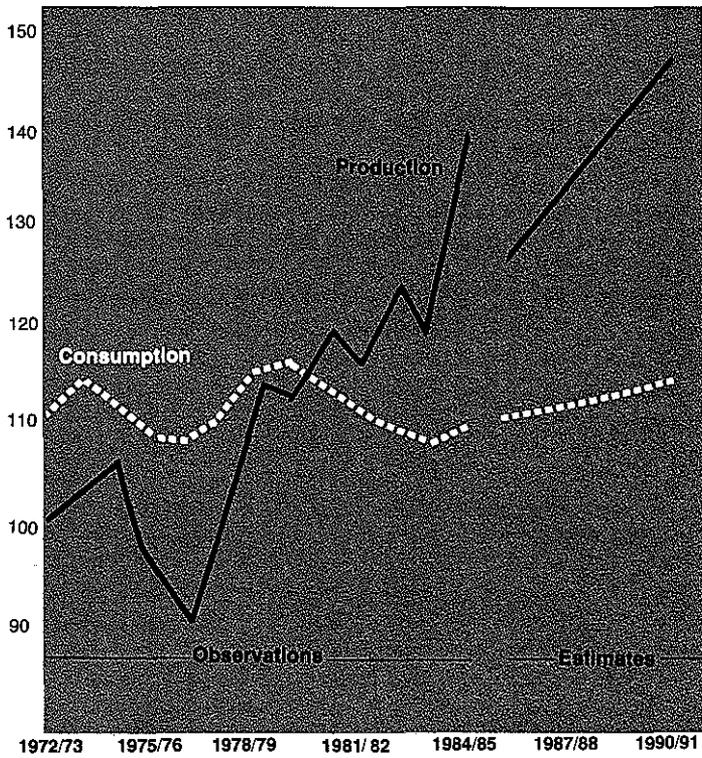
Source: FAPRI.

The EC exportable surplus is expected to remain constant to the 1990s (see Figure 3). It is questionable whether the EC can afford to expand exports by paying export subsidies as it has in the past. Recently, subsidies have been reduced. It is most likely that this trend will continue and may curtail production growth. Lower grain prices in the EC will probably not have significant market effects over the next three to five years because prices for alternative crops also will probably be lower, there will probably be an expansion of efficient farms with above average yields, and there has been a diversion of dairy to grain production as the result of the quota system for milk production since 1984.

The EC and the U.S. are restricting production growth because of low world food prices and because world food stocks are high. Thus it can be expected that world food markets will be fairly stable in the short run. An unexpected food shortage could easily be filled by an expansion of production in the U.S. and in the EC.

Figure 3
Growth of production and consumption of cereals
(excluding durum wheat) in the European Community

Million metric tons



Source: EC Commission.

Developing countries (LDCs) typically have open economies in which agriculture is of substantial, if not dominant, importance. For most LDCs, the conditions they face in world markets largely determine the options open to them in formulating their own development strategy. Conditions in the international commodity markets, and the financial and exchange rate markets, along with foreign assistance, delineate the external environment that will be a major determinant of the economic prospects for LDCs for the next decade. For many LDCs, agricultural trade is an engine of growth. They depend heavily on agricultural exports for their balance of payments and for income. Also, international trade is an integral part of food security for many LDCs that use food imports to supplement domestic output.

PROTECTIONISM VS. LIBERALIZATION

The degree of protection given developed-country agriculture is significantly greater than is given to manufacturing. In most LDCs however, agriculture is usually taxed and manufacturing is protected from import competition.

In world markets, trade in temperate region products and some tropical products, like sugar, is influenced most by the degree of protection those products are given in the developed countries. These industrialized countries are the dominant actors in most agricultural trade.

There are two dimensions of the direct external effects of farm policy in industrial countries: depressing effects on world prices and higher instability in prices. Indirectly, the threat of protection is an important deterrent to the opening of LDC economies. The current levels of protection and the unilateral and unpredictable nature of access to industrial-country markets affects the willingness of policymakers and producers in LDCs to assume the risks associated with a more trade-oriented strategy. The outcome is often an inward looking trade policy, at the cost of economic growth for most LDCs.

Developed country trade restrictions include both tariffs and nontariff barriers, which vary considerably in severity among countries and products. They tend to lower world prices by artificially reducing domestic consumption and raising domestic production in developed countries. As a consequence, the volume of exports from both LDCs and developed countries are reduced. Price and volume effects together could translate into a foreign exchange and welfare loss to LDCs. On the other hand, as importers of cereals, milk powder, and others, some LDCs have benefited from trade restrictions in these products in developed countries, as protection has led to lower world prices.

EFFECTS OF PROTECTION

A few studies have assessed the effects of agricultural protection in developed countries on world market prices, export earnings, and import costs, and the resulting welfare gains and losses of developed countries and LDCs. Although exact measurements are impossible to make, available estimates can provide a approximation of the extent of protection and its implications for the balance of trade of LDCs, both exporters and importers.

The Third World is not a homogeneous block of agricultural exporters shipping tropical raw materials to the industrial world.

There are many countries, many commodities, and importers and exporters of both tropical and temperate zone goods. Above all there are consumers and producers at different levels of income. It has been one of the objectives of the IFPRI studies on this topic to try to unravel the complex pattern of the incidence of agricultural protection in OECD countries on LDCs.

LDC EXPORT REVENUES AND IMPORTS

Results of a hypothetical 50 percent reduction across-the-board in tariffs and other trade barriers for 99 commodities in 17 developed countries belonging to the OECD indicate that LDCs' annual export revenue would have increased by \$6 billion in 1985 prices (Table 1). This increase in export revenues represents an 11 percent increase for LDCs as a whole and an 8.5 percent increase for low-income countries taken separately. These figures were computed using 1977-79 levels of protection and trade flows. Trade flows and OECD protection have increased since 1977-79, so that the benefits of liberalization would be substantially greater in 1985. A recent update of the study using 1979-81 levels of protection and trade flows, but restricted to sugar, beef, wheat, and maize, concluded that export revenues for LDCs as a whole would increase by approximately U.S. \$10 billion per year from removal of protection in OECD countries in those four products.

On the imports side, the increase in LDCs' imports' costs on cereals from trade liberalization and OECD countries would be substantial—on the order of at least \$1.3 billion per year for all LDCs.

Table 1
Change in export revenue, import cost, and efficiency for selected commodities of developing countries caused by a 50 percent decrease in OECD tariff rates, 1975-77

	Absolute increase		
	All developing countries	Low-income countries	Middle- and high-income countries
	(millions of 1985 dollars)		
Change in export revenue			
Sugar	2,108	994	1,114
Beverages and tobacco	686	181	505
Meats	658	38	620
Coffee	541	123	417
Vegetable oils	480	60	420
Cocoa	287	21	265
Temperate zone fruits and vegetables	197	68	129
Cereals and oilseeds	109	19	90
Other commodities	683	98	585
Total increase of all exports	5,856	968	4,887
Change in import costs			
Cereals	676	531	145
Other commodities	437	152	285
Total	1,113	683	430

Source: IFPRI.

GENERAL AGREEMENTS ON TARIFFS AND TRADE (GATT)

Ongoing work at IFPRI attempts to highlight the emerging issues of particular interest to LDCs related to agriculture in the GATT framework, particularly in the context of the forthcoming Uruguay Round. This Round offers a unique opportunity for greater integration of LDCs into the trading system under clearer and fairer rules for agricultural trade.

The question then is what should LDCs be seeking from the Uruguay Round. What can they offer; and what should they watch for that would probably be against their interests? Three sets of issues are considered here.

The first is direct actions to increase LDCs' market access. Ideally trade liberalization under GATT should emphasize nontariff barriers and should go beyond border regulations. Considering the importance of nontariff barriers, negotiations should concentrate less on reciprocity of trade flows and more on reducing domestic prices in OECD countries. A reduction of protection would reduce the need for specific rules on many current and future trade barriers.

The second is strengthening GATT rules and disciplines. Strengthening GATT procedures for surveillance and settling disputes is essential for LDCs. Selective safeguards by which

some countries can be singled out as targets for protective measures is extremely dangerous, as LDCs are weak in bilateral bargaining.

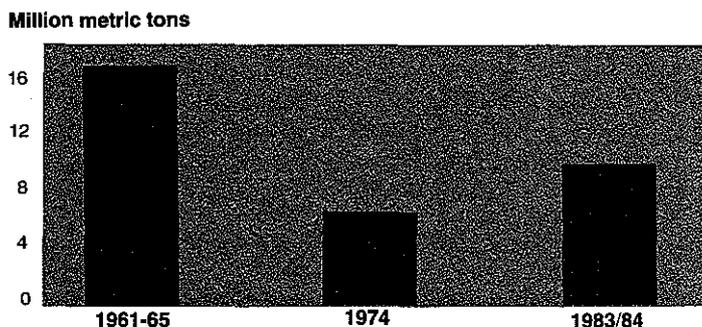
The last is reciprocity. Because of their limited clout in the world market, developing countries should be particularly interested in becoming active participants in an international system that could provide a framework of norms, rules, and procedures. As such, they must offer some "incentives" to the trading powers in order to be considered and become more influential.

These incentives could come from two fronts. First, LDCs must be prepared to reciprocate in trade concessions, which could take the form of trade liberalization in industrial products in their own economies. High industrial protection helps industry at the expense of agriculture. This liberalization could be a useful bargaining tool for LDCs, and in the process, could help promote their agriculture. This implies also that agriculture should not be negotiated separately from other sectors.

Second, rather than emphasize the North-South issues per se, a fresh approach would be to focus negotiations on specific issues of high priority to both developed and developing countries. In the process, LDCs should be prepared to distinguish the rights and obligations of smaller lower-income LDCs from those of middle-income LDCs, leaving trade preferences exclusively for the poorest.

After increasing to an average of 16.8 million tons in 1961-65, food aid in cereals fell sharply in the mid-1970s, reaching its lowest level of 6.3 million tons in 1974. During the next 10 years food aid gradually increased, reaching about 10 million tons in 1983/84 (see Figure 1). In recent years there has been a shift in the destination of food aid from Asia to Sub-Saharan Africa, where the need for assistance is growing rapidly. The share of this region rose from an average of 12 percent in 1972/73-1978/79 to 28 percent in 1983/84. The recent famines in many countries in that region have also resulted in an increase in the proportion of emergency food aid.

Figure 1
Total cereal food aid, various years

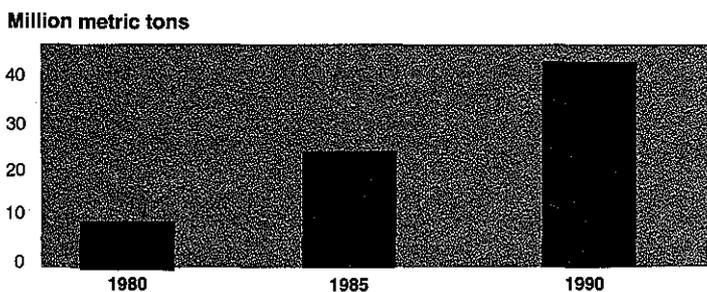


Source: USDA and FAO.

FOOD AID PROJECTIONS

Medium-term projections of demand-based food aid requirements made at IFPRI for 87 developing countries—assuming a continuation of past trends in income and production growth—show a sharp increase from a trend value of about 9 million tons* in 1980 to almost 23 million tons in 1985 and 44 million tons in 1990 (see Figure 2). These increases are in addition to increases in commercial imports of these countries from the trend value of 43 million tons in 1980 to 48 million in 1985 and 57 million tons in 1990. Sub-Saharan Africa's share of world food aid requirements is expected to rise to 43 percent by the end of the decade.

Figure 2
Estimated food aid requirements



Source: IFPRI.

*All tons are metric.

If world trading conditions improve as a result of improvements in developed country economies and declining oil prices, developing country incomes could grow at a faster pace than in the past. Changes in policies in the developing countries could strengthen this tendency as well as increase their rates of growth of food production. (Food aid can be a tool in this process.) As a result, commercial imports of these developing countries could grow more rapidly. Depending on whether import gaps then grow or contract, food aid needs may be less than IFPRI estimates indicate.

DEMAND FOR FEEDGRAINS

Increased income growth rates in developing countries, which raises the demand for animal products and thus the demand for feed, will affect the result. IFPRI research on 105 developing countries estimates that feed use of basic food staples will grow annually at a rate of 4.6 percent between 1985 and 2000, while food use will grow at a rate of only 2.1 percent. As a result, the share of feed in total domestic use of cereals would rise from 16 percent in 1985 to 23 percent in 2000. If incomes rise at a faster rate than assumed, both the aggregate demand for cereals and the proportion of the demand for feed may be even higher.

Several aspects of food aid may influence the situation. Donor food aid policies are more development-oriented than they were in the past. There is recognition that if food aid is not to generate dependency, it has to be used in a food-producing strategy. This strategy should focus on increasing domestic food production through appropriate measures and policies relating to prices, marketing, infrastructure, agricultural research, and extension services. This can be done through proper project selection and greater direction in the use of counterpart funds. Greater donor coordination in these areas is starting to occur with some success in countries like Mali and Senegal.

FAMINE AND THE ROLE OF FOOD AID

In the case of food aid for famine relief, for example, although there was a massive response to the recent acute famines in Sub-Saharan Africa, assessments showed that, in general, food aid was not as effective as it could have been. It was very costly and was frequently used to feed people in camps situated long distances from their homes. In addition, rehabilitation after the famine received too little attention relative to relief during the famine.

This raises issues of famine-preparedness and famine-prevention. Famine preparedness is concerned with dealing with famines when they occur. It involves early warning systems, food stocks organizational arrangements, improving port facilities, and strengthening internal transport arrangements.

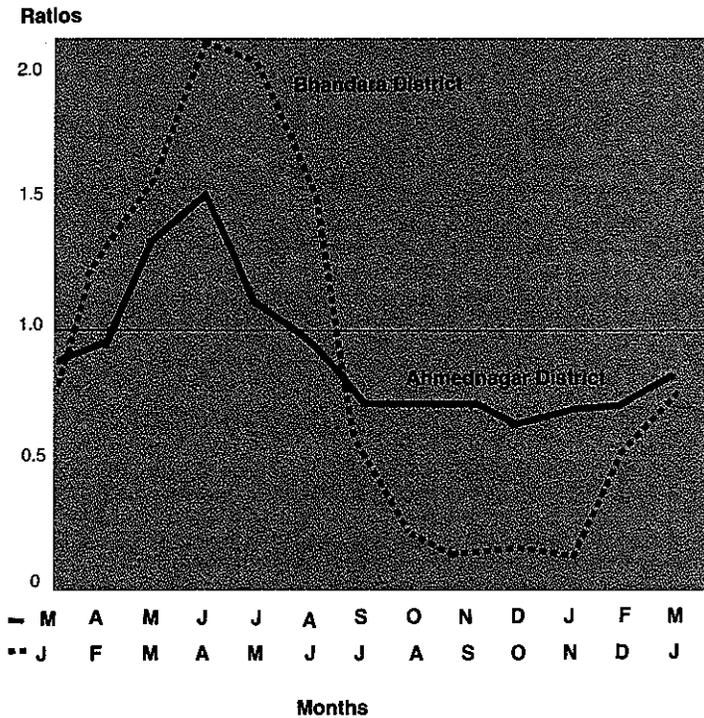
Famine prevention is concerned with the sources of famine and how to deal with them. In general, development is the answer to famine. However, since famines occur in specific parts of many countries, famine prevention may require an area-specific approach. For this purpose, studies involving mapping of areas on the basis of famine-proneness and resource potential are being initiated at IFPRI in order to focus on ways to realize this potential and thus prevent famine by using food aid effectively.

Development in general and famine prevention in particular require greater mobilization and conservation of water resources. More broadly, they require strengthening infrastructure. Seasonal fluctuations in agricultural employment provide an opportunity to use labor during normal years to create rural infrastructure while providing seasonal food security. The arrangements and institutions created for this purpose could be made flexible enough to expand in times of famine to provide employment, income, and food where the affected people live. Famine relief could thus become an effective instrument for famine prevention.

FOOD AID EMPLOYMENT SCHEMES

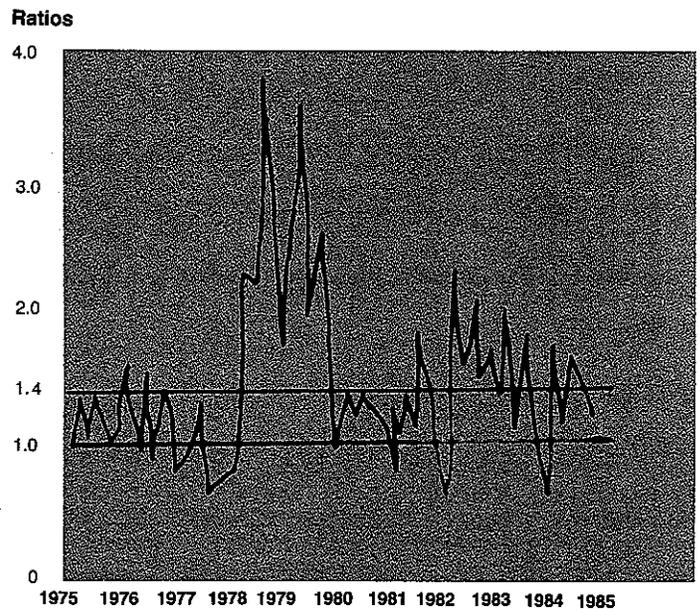
A food aid employment scheme has been in operation in all districts of Maharashtra in India for 12 years. Employment provided under the Employment Guarantee Scheme (EGS) shows normal seasonal fluctuations (Figure 3). In famine years the volume

Figure 3
Normal pattern of seasonal employment fluctuation under EGS, 1975-1985, Maharashtra



of employment under the scheme is a large multiple of expected normal seasonal and trend employment (see Figure 4). Although irregular factor ratios of less than 1.4 may be expected in normal years, much higher ratios will prevail in famine and near-famine years. Data on employment under the scheme can also be analyzed to provide an operation-based early warning system. The assets built under the scheme have helped to raise long-term levels of output, employment, income, and food consumption as well as to reduce (or prevent increases in) fluctuations in these variables in the face of rising population. The experience of this scheme can be drawn upon in looking at the famine-development interface in other parts of the world. Food aid can be used to support such a scheme in famine-prone areas anywhere.

Figure 4
Volume of irregular employment (after removal of trend and normal seasonal components) under EGS, 1975-1985, Ahmednagar District



Emphasis on production growth alone using "efficiency" criteria is not sufficient for rural development and improved standards of living and welfare for the vast majority of the low-income population. Mounting food surpluses worldwide, and in some low-income countries, in the midst of widespread deprivation and poverty raises some difficult questions. Why has demand for food by the poor not kept pace with production growth? A quite different question is what policies related to accumulating food stocks can promote employment and consumer demand, given different national circumstances? There is a potential not just for increasing the incomes and food consumption of the poor, but for stimulating demand and production of consumer goods and manufactures as well.

Unleashing the food production potential can be instrumental in eliminating the demand constraint on food consumption by increasing the availability of off-farm products and services needed for sustained growth in agricultural production. The new agricultural technologies (without economies of scale) raise employment both in crop production and post-harvest activities. In addition, the associated increase in demand for goods and services for both production and consumption also stimulates employment growth in the nonfarm sector. Because the poor participate in these forms of employment and consequently allocate the major part of their increased income to increasing the quantity of food they consume, this process can help bridge the consumption gap for the poor. IFPRI's research in North Arcot, India and in Bangladesh, illustrates the conditions necessary for its effectiveness.

NORTH ARCOT, INDIA

- Between 1951 and 1984, paddy production grew at an average rate of 2.6 percent per year. Ninety-three percent of this change in production was attributed to a shift to high yielding varieties.
- This agricultural growth produced large economic multipliers. Agricultural commodities generated about 4.5 times the gross output and about 1.5 times the household income through intersectoral linkages. Both multipliers were higher than those for nonagricultural commodities. During the 1970s, average real household income rose 1.4 times and more than doubled for the landless households.
- Nonfarm income rose faster than farm income, especially for the landless. The marginal budget share for food was greater than 70 percent for this group, and its food consumption increased dramatically within a decade, with both calories and protein consumption 1. times higher in a comparable agricultural year.

BANGLADESH

IFPRI research in Bangladesh illustrates the role of food aid in facilitating both relief and employment-oriented growth efforts and the significance of infrastructure development in this process. The food-for-work program in Bangladesh generates seasonal employment when lows in agricultural employment coincide with rising food prices during the dry-season months of February, March, and April. Projects generate employment for

construction and repair of physical infrastructure, including roads, irrigation and drainage canals, and flood protection embankments and related structures. During the dry season, when construction projects are in operation, the program provides about 1 million jobs and raises seasonal food consumption of both low-income participants and nonparticipants in the project areas to levels above the annual consumption level for the total population in the country.

- There has been additional potential for benefiting the rural population after projects are completed. Projects that improved water control also improved agricultural production and yields. Land under HYV rice increased by 37 percent, from 41 to 56 percent of cultivated land. Labor use in crop production increased by seven days per acre, a 10 percent jump, and wage rates rose by 12 percent. There was no difference in adoption rates of HYVs by size of farm.
- Growth in nonagricultural employment increased by 33 percent. Because the seasonality of nonagricultural employment ran counter to that in agriculture, the overall effect was to even out seasonal fluctuation.
- Real household incomes were higher by 20 percent overall and by 33 percent for the lowest income group.
- Nutrient intake of children of all ages increased significantly, although the landless and lowest income groups faced greater consumption fluctuations, possibly due to a higher dependence on agricultural employment and the lower levels of human capital. More than 80 percent of hired workers in agriculture were illiterate, whereas in other sectors about 60 percent were. Workers with some education are more likely to be able to obtain nonfarm employment: for example, of those with some secondary school education, two-thirds were hired outside agriculture.
- The greater the access to roads, markets, and related infrastructure, the greater the degree to which the water control measures were beneficial, particularly in increasing nonagricultural employment. There was also parallel growth of public and private sector activities in North Arcot.

INHERENT AND POTENTIAL PRODUCTION CAPACITY

On the question of location of infrastructure, there is a distinction between the inherent production capacity and the potential capacity for incremental production in various areas of a country. The potential is determined by a combination of a broader national development strategy, as well as the country's sectoral and regional policies, and the socioeconomic and agroecological characteristics of the area itself. For instance, construction of the Tazara railroad in Zambia was justified on national security grounds to link its populated and productive line-of-rail with outside markets. It has provided the potential for agricultural growth in surrounding parts of Northern Province through which it passes. Similar policies of regional balance that are translated into other nonagricultural investments may also influence both the agricultural potential and incremental public infrastructure investments needed for its nonfarm linkages to be significant.

CONCLUSION

Although it is necessary to generate policies that effectively pursue the goal of broad participation in the agricultural and economic growth process, short-run supplementary measures may also be necessary to provide incremental consumption for the severely malnourished groups through forms of targeted programs. In most cases, these targeted programs, such as food-for-work, school feeding, or preschool feeding and day-care, can also be geared to provide long-term development effects in addition to the obvious short-run benefits provided.



Background Notes—6

EFFECTS OF TRADE AND EXCHANGE RATE POLICIES

Agricultural production incentives in many developing countries have been affected negatively by the underpricing of farm products relative to what domestic producers would have received in the absence of government trade interventions.

- International trade of the staple food grains is frequently under government monopolies aimed at regulating domestic prices.
- For export crops, producer prices are being depressed relative to world prices by explicit export taxes, production levies, and discriminatory pricing practices of government marketing boards.
- Import restrictions that promote industrial import substitution through direct controls and protective tariffs result in a substantial overvaluation of the domestic currency, thus discouraging agricultural products because of the relatively high degree of tradability of agricultural output.
- In developing countries whose foreign exchange earnings from oil exports increased dramatically in the 1970s, profitability in agriculture and other tradable goods sectors has fallen sharply due to the induced appreciation of the domestic currency.
- The expanded foreign borrowing of some of the oil-importing developing countries to finance trade deficits incurred during the 1970s and 1980s has had a "spending effect" that directly benefitted some industries more than the agricultural sector. This borrowing also supported exchange rates in the face of the sustained large trade deficits.

IFPRI research documents the antiagricultural bias of the effects of relative incentives due to trade and exchange rate policies in selected developing countries.

- In Nigeria, the "oil syndrome" adversely affected production in both food and export crops as the naira appreciated by more than 50 percent between 1973 and 1980. Agriculture's share of output fell from 49 percent to 22 percent between 1970 and 1982 (see Figure 1).
- In Zaire export crops were implicitly taxed at higher rates than food crops during 1971-82 due to trade restrictions.
- Colombian coffee and other agricultural exports were taxed heavily in the 1970s as industrial import substitutes were being protected by tariffs and industrial exports were being selectively subsidized. Exchange rate appreciation induced by the coffee boom in the late 1970s further reduced incentives to produce noncoffee agricultural tradables.
- In the Philippines various sources of exchange rate overvaluation effectively lowered the domestic agricultural price relative to home goods by about 20 percent and relative to nonagricultural products by about 25 percent during 1975-80, contributing heavily to the observed drastic fall in the two agricultural price indexes (see Figure 2).

Figure 1
Shares of output by sector, Nigeria, 1970-1982

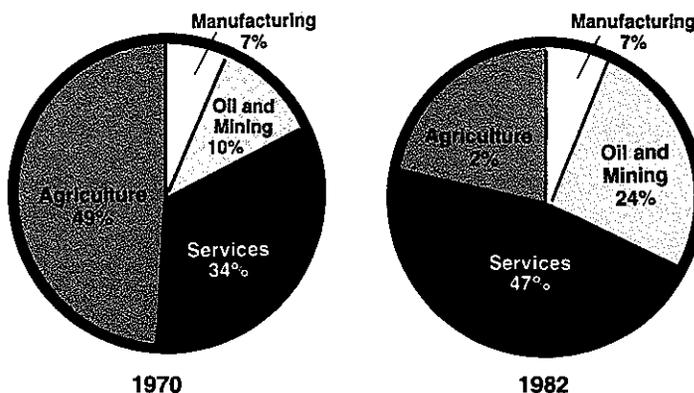
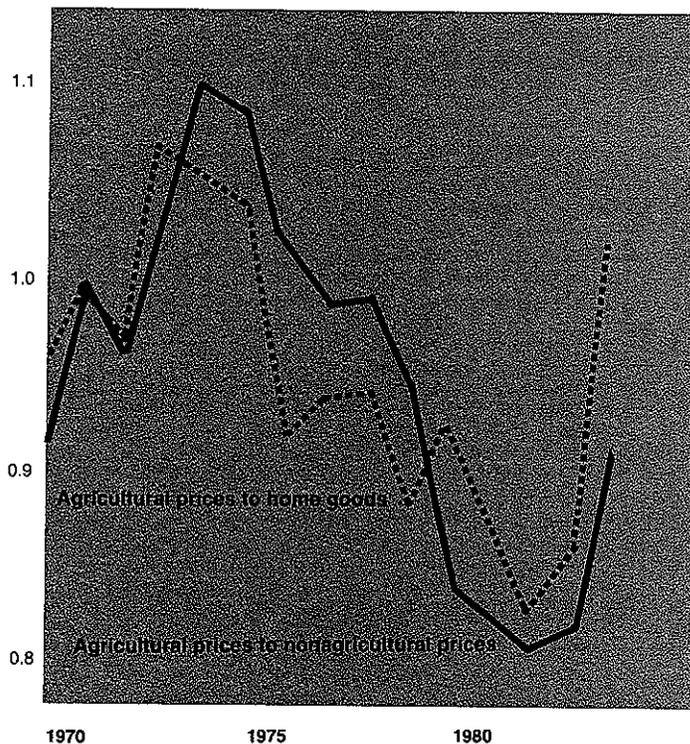


Figure 2
Relative price indexes—agricultural prices to home goods and agricultural prices to nonagricultural prices, the Philippines



There is substantial scope for improving trade and exchange rate policies in many developing countries. Removal of trade policy-induced domestic price distortions would result in a significant rise in rural incomes. Two examples illustrate this.

- In the Philippines, agricultural crop income could have been higher by about one-fourth to one-third in the 1970s through more efficient allocation of existing resources.
- Simulation results from a dynamic, general equilibrium model for Argentina that allows for intersectoral flows indicate increases of between 30-40 percent in 20 years, in per capita agricultural and nonagricultural output resulting from trade liberalization and exchange rate management.

ALLOCATION OF CAPITAL RESOURCES

In many developing countries, the effects of direct government interventions in foreign trade and of the macroeconomic policies that influence the real exchange rate result in a substantial overall net tax on agriculture. In effect a disproportionate share of the burden of subsidizing consumption of the urban population has been shouldered by the rural sector. In the Philippines the effective resource transfer out of the agricultural sector in 1980 has been estimated to be at least 6.6 billion pesos or about 2.5 percent of GNP. The resource transfer into agriculture due to government spending amounted only to 3.5 billion pesos in 1980.

The "surplus" extracted from agriculture has also helped finance capital formation in the rest of the economy which, in theory, accompanies structural transformation during development. However, past capital allocation in many developing coun-

tries has used the agricultural surplus to finance large-scale, urban-based industries inefficiently producing capital-intensive goods demanded by only a small segment of the population. Such industries are not the users of domestic resources that can contribute to the maximization of employment and income multipliers called for in the agriculture- and employment-based development strategy.

Agriculture is more in need of public investment support than industry is. Historical evidence indicates that large investments were required for the agricultural development of the now-developed countries. Among the East Asian countries, the incremental capital-output ratio in agriculture tended to be high in the early phase of infrastructure investment, declined in the middle phase when biological inputs were the main source of productivity growth, and rose again in the final phase of extensive agricultural mechanization. In the contemporary context, the opportunities for rapid productivity growth in agriculture can be exploited only if the substantial capital requirements for the development and diffusion of new technologies as well as the establishment of rural infrastructure are met.

In a predominantly agricultural economy it is unavoidable that the agricultural sector will be taxed. However, instead of export taxes and tariffs that distort relative production incentives, a more efficient means of taxation should be used. Land, income, and consumption taxes are the most appropriate. Under the agriculture- and employment-based development strategy, such revenues from agricultural taxation would finance needed public investments in the rural areas in order to raise farm productivity and foster the development of rural industries.

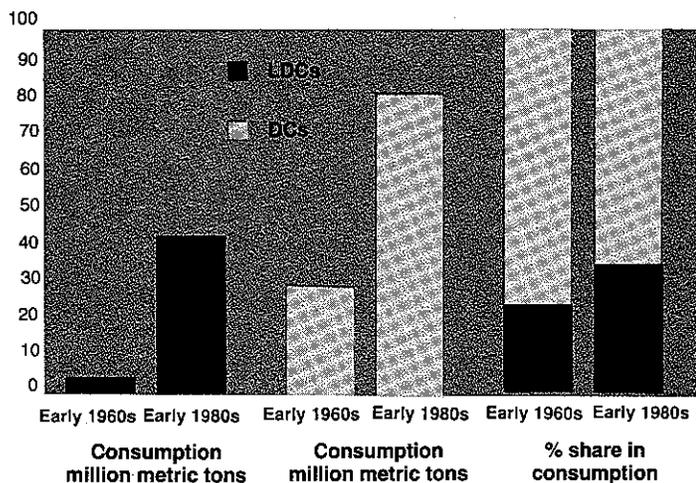
The alleviation of mass poverty in developing countries (LDCs) ultimately depends on dynamic expansion in employment opportunities for the poor. This requires rapid growth in their food production. Technological progress in agriculture is crucial not only for overcoming the land constraint, but also for lowering the unit costs of wage goods production.

TECHNOLOGICAL CHANGE IN THE DEVELOPING WORLD

The new fertilizer-responsive varieties of cereals offer an opportunity for technology-based growth in food production. By 1982/83, the new varieties of rice and wheat had spread to 123 million hectares (53 percent of area under the two cereals) in the developing world. Similarly, fertilizer consumption increased from 5 million tons* in the early 1960s to 43 million tons in 1983/84, raising the share of LDCs in the world totals from 14 to 34 percent (Figure 1). The relative importance of LDCs in the growth of world fertilizer consumption has increased spectacularly since the late 1970s. Between 1978/79 and 1983/84, LDCs contributed 73 percent to the growth in world fertilizer consumption.

Largely as a result of technological change, the total production of cereals in the developing world increased from 470 million tons in the early 1960s to more than 900 million tons in 1984 and 1985. About 90 percent of the increase in production since the mid-1970s was due to growth in yields. When viewed in a historical perspective, these are impressive achievements for a period of two decades, especially if the lessons emerging from the experience are learned.

Figure 1
Growth of fertilizer consumption between the early 1960s and the early 1980s



Source: FAO data.

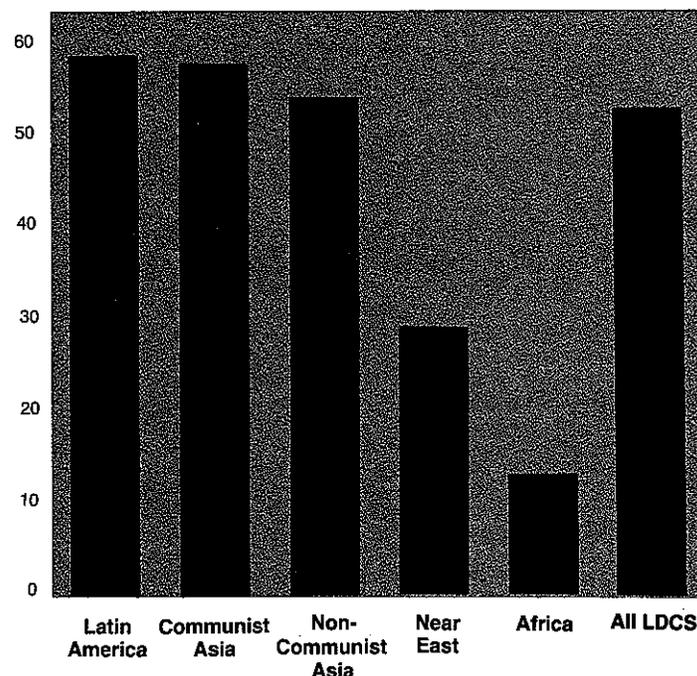
*All tons are in metric tons.

IMPACT OF TECHNOLOGICAL CHANGE

The full potential of technology-based growth in food production has not yet been realized. New varieties of rice and wheat have spread more rapidly than those of other foodgrains. Developing countries of Asia and Latin America have fared better than those of Africa and the Near East (Figure 2). Per hectare yields have risen less rapidly than expected even in countries where a fairly high proportion of land was sown with the new varieties and there was a substantial increase in the use of modern agricultural inputs. Consequently, after an initial significant decline, the unit cost of food production in real terms has not continued to fall, as the experience of India illustrates (Figure 3). For these reasons, perhaps, the technology-based growth in food production has not realized its potential in generating employment-oriented growth processes. Its impact seems to have been more in the area of breaking the yield barrier for a few major crops, reducing the dependence on imports of cereals, and, perhaps, halting the aggravation of absolute poverty.

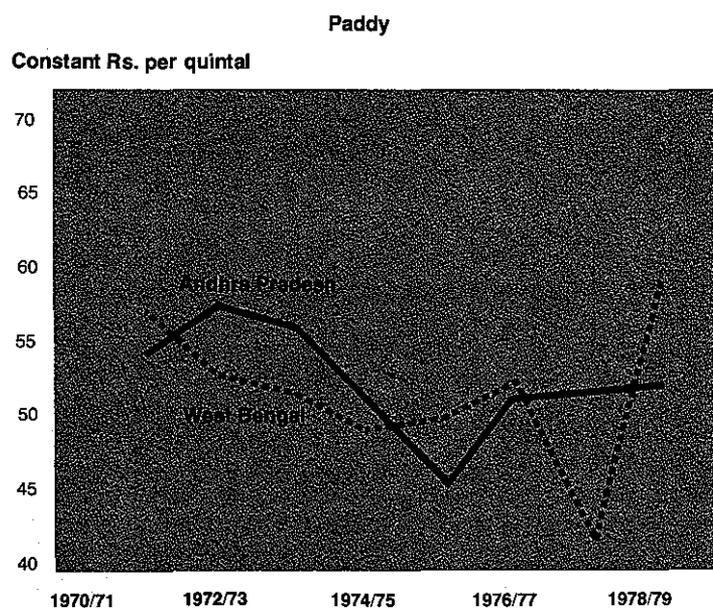
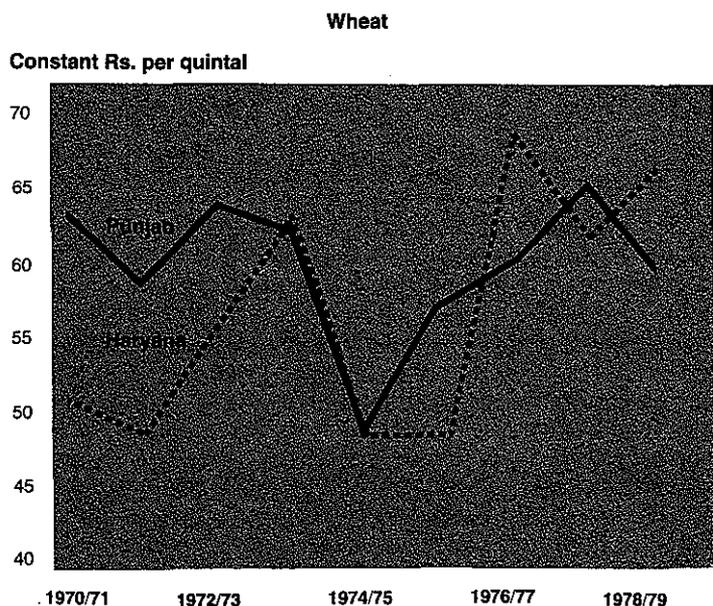
Technological change will have to continuously expand employment opportunities to reduce mass poverty in a sustainable manner. This will depend on further development of the technology and on meeting the policy requirements of cost-reducing technological progress in agriculture.

Figure 2
Percent of rice and wheat area sown to high yielding varieties in developing world, 1982/83



Source: USAID estimates.

Figure 3
Real cost of production of wheat and paddy in some
states of India, 1970/71 to 1978/79



Quintal = 100 Kilograms

Source: Estimates of Kahlon and Tyagi.

fusion arising from a low level of socioeconomic, institutional, and infrastructure development. Thus public policies associated with the technologies are as important as the technologies themselves. Deficiencies in these policies lead to partial realization of the technology's potential which, in turn, constrains dynamic expansion in employment opportunities. Past experience suggests a few broad conclusions.

- The impressive spread of the seed-fertilizer technology is an outcome of varieties developed by both international agricultural research centers and national research systems. The latter are crucial in developing varieties and the technology packages of agronomic practices suited to local agroclimatic conditions. Public policies play a critical role in the development and workings of the national research systems. Lacunae in these policies are a typical feature in the developing world.
- The performance of the new varieties is influenced not only by their genetic potential under cultivator's field conditions but also by the level of development of agricultural extension, credit, input supply, and output marketing systems. Deficiencies in these systems are common in the developing world. They have been mainly responsible for the suboptimal realization of the potential.
- Sound development of the above systems has been constrained by a variety of factors. These include a scarcity of fiscal resources, a lack of trained manpower, complexities of the tasks involved due to the widely dispersed nature of agriculture, low and uncertain income flows of farmers, the small volume of business for inputs in the initial stages, and inadequate development of complementary physical and institutional infrastructure. Insufficient attention to removing these constraints has sometimes produced unfavorable consequences for both the equity and efficiency aspects of technological change. This, in turn, has led to fruitless controversy on the desirability of technological change itself.
- Macroeconomic policies for prices, trade, exchange rates, the sectoral allocation of resources, and development of the non-agricultural sector have influenced the pace of technological change in agriculture. These policies have been governed more by foreign exchange constraints, short-term sociopolitical compulsions, and the ideological preferences of national governments and foreign aid agencies than by considerations of cost-reducing technological progress in agriculture.
- Thus technology-based growth in agriculture has sometimes become too dependent on price support and input subsidy programs. This has constrained the budgetary resources of the governments required to undertake many tasks on which realization of the full potential of new technology depends.
- The growing food surpluses of the developed world have strengthened the pressures for price support and input subsidy programs in LDCs. Ideally, the surpluses should make it easier to combat mass poverty through employment-oriented sound economic development in the Third World.

All this indicates a need for enhanced research on technology policies based on opportunities provided by breakthroughs in agricultural research and real world constraints in the developing world. Now more so because we have before us the developing world's two decades of experience in technology-based growth in food production.

POLICY REQUIREMENTS OF TECHNOLOGICAL CHANGE

In the developing world, technology-based growth in agricultural production is an enormously complex and multifaceted task. In addition to the development of appropriate technologies, the task involves removal of constraints on technology dif-

Infrastructure enhances the mobility of goods and services, people, and information. This, in turn, stimulates the process of specialization and commercialization, the transfer of technology, changes in consumption and savings behavior, utilization of rural resources, and the implementation of public policies—all at substantially reduced costs.

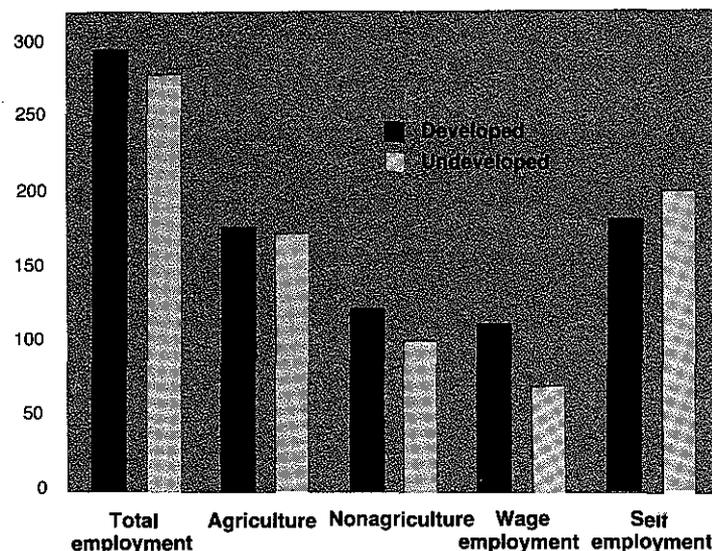
NONFARM INCOME AND EMPLOYMENT

Increasing agricultural and industrial production is, of course, necessary for increasing nonfarm employment and income. Of critical importance is the strategy—the way in which production increases are brought about. Infrastructure is the key element of an agricultural and employment-oriented strategy. A comparative study of Korea and Taiwan, which had the same growth paths and historical backgrounds but achieved vastly different levels of rural nonfarm employment and income, shows different degrees of infrastructure development. In Taiwan, about 80 percent of rural income is received from nonfarm sources, compared to less than 48 percent in Korea. Seventy percent of farm households in Taiwan had access to electricity even in 1980, compared to only 13 percent in Korea. Density of paved roads in Taiwan was 76 kilometers per 1,000 square kilometers in 1962 and 215 in 1972, while in Korea it was less than 10 in 1966 and still below 50 in 1975.

A comparative study of villages in Bangladesh with different levels of infrastructure development is similarly revealing. Employment was found to be higher in areas with developed infrastructure (adjustments were made for structural differences like farm size and family size and technological differences) (see Figure 1). Two points are important to note.

Figure 1
Employment effect of infrastructural development in Bangladesh (normalized for other factors)

Man days per worker per year



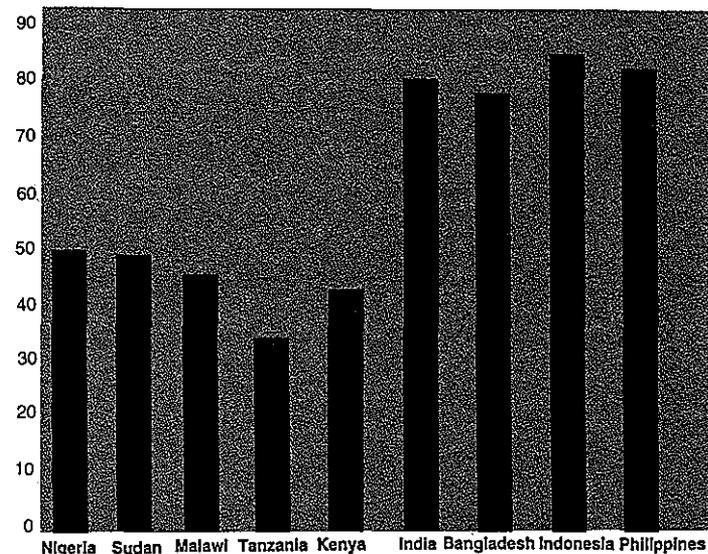
- First, the total effect on employment was modest—an increase of only 8.5 percent in villages with developed infrastructure compared to those without, reflecting the need for the poor to be employed most of the time in order to survive. The increase in total employment occurs mostly in noncrop agriculture and nonagricultural activities. An increase in total employment in terms of productivity was about 29 percent higher in villages with developed infrastructure. It implies that low productive activities are significantly replaced by high productive jobs.
- Second, the effect of infrastructure on the wage-labor market (as opposed to family labor) was significant. The development of infrastructure led wage employment to increase by 54 percent both in agricultural and nonagricultural activities. Consequently, there was a replacement of self-employment by wage employment.

PRICE INCENTIVES AND MARKET DEVELOPMENT

Infrastructure can greatly reduce marketing costs within a country and can create a comparative advantage in international trade. A study found that African farmers received 30-50 percent of the price paid by final users, while Asian farmers received 75-85 percent, which shows the disadvantage of African farmers vis-à-vis Asian farmers, in their incentives to produce and in the strength of competition in world trade (see Figure 2). Half of this price difference is due to the difference in infrastructural development of the two continents. Asian countries, on average, have 30-40 kilometers of road network per 100 square kilometers of land area, compared to only 2 to 5 kilometers per 100 square kilometers in Africa.

Figure 2
Producer-consumer price spreads for cereals: a comparative picture—selected countries of Asia and Africa (weighted average 1975-1980)

Producer price as percentage of consumer price



The price and market development effects of infrastructure in Bangladesh indicate that the price of fertilizer is 9 percent higher in villages with underdeveloped infrastructure than in villages with developed infrastructure and that the wage rate is lower by 25 percent. The difference in paddy price is minor (see Table 1). Thus labor and fertilizer markets are different than paddy markets, and infrastructural development is more effective in improving labor and fertilizer markets than rice markets.

Another intervillage comparative study in Zaire shows that villages with poor infrastructural access produce relatively more cassava for home consumption and less rice and maize, which are generally marketed. The price relation with distance from main market centers indicates that for every 10 percent increase in distance, prices of farm products decline by 5 percent and prices of nonfarm products increase by 6 percent.

Table 1
Effect of infrastructure on prices, Bangladesh, 1981/1982

	Less-developed infrastructure	Developed infrastructure	Difference
Rice/paddy (Tk/ko)	237	225	12%
Fertilizer price (Rp/ko)	210	190	9%
Wage rate (Tk/day)	15	22	25%

Source: Raisuddin Ahmed.

TRANSFER OF TECHNOLOGY AND INPUT USE

The diffusion of modern agricultural technologies throughout Africa has been limited compared to the impressive progress that has been made in Asia; this is partly due to the poorer infrastructure in Africa. The Bangladesh study shows that the intervillage differences in the use of modern inputs and labor, arising solely from the difference in infrastructure, is substantial (see Table 2). Although the price of fertilizer was only 9 percent higher in the underdeveloped villages, fertilizer use was 64 percent higher in villages with developed infrastructure than in villages without. Similarly, even though the wage rate was 25 per-

cent higher, the intensity of use of labor in crop production was 12 percent higher in developed than in underdeveloped villages. Farmers in villages with developed infrastructure allocated a higher proportion of land to high-valued crops (vegetables and fruits) compared to underdeveloped villages, and the increase in their incomes solely due to this different combination of crops was about 14 percent.

Table 2
Effect of infrastructure on use of inputs, Bangladesh, 1981/1982

	Less-developed infrastructure	Developed infrastructure	Difference
Area under paddy (ha)	13	12	6%
Fertilizer (kg/ha)	296	313	64%
Labor (Days/ha)	26	29	12%

Source: Raisuddin Ahmed.

POLICY IMPLICATION

The allocation of public resources does not generally reflect adequately these developmental effects of infrastructure development partly because of their indirect nature. Most countries of Asia and Africa spend only about 5-15 percent of their development expenditures on transport and communications—the principal forms of infrastructure—and this is spent mostly in urban areas. Bangladesh spent only about 9 percent of its development budget on transport and communications in 1983/84. Out of this, only 3 percent was spent on rural feeder road development, even though 40 percent of the Bangladesh villages are currently five or more miles from a hard-surfaced road. In many African countries development of rural feeder roads does not yet have a place in the public budget. This is true for many other elements of infrastructure.

Political and institutional mechanisms play crucial roles in the allocation of resources for the development of rural infrastructure. Professionals and policymakers should bring into sharp focus indirect contributions of infrastructure so that its development gets the high priority in resource allocation that it deserves.

This note, based on a study of research systems in three countries—Kenya, Malawi, and Senegal—highlights some major issues affecting research investments, resource allocation, and strengthening national research systems.

RAPID GROWTH IN RESEARCH INVESTMENTS

Funding for agricultural research in real terms has more than doubled in Kenya and Senegal and has tripled in Malawi (see Figure 1). Kenya and Malawi spent more than 1 percent of agricultural GDP on research in the early 1980s, Senegal spent about 3 percent. The number of scientists increased in all three countries: by 264 percent in Kenya between 1972/73 and 1981/82, by 500 percent in Malawi from 1972/73 to 1984/85, and by 246 percent in Senegal from 1976/77 to 1984/85 (see Figure 2). The proportion of research staff filled by nationals has risen from 48 percent to 89 percent in Kenya, 47 percent to 78 percent in Malawi, and 28 percent to 53 percent in Senegal.

Figure 1
Research expenditures in Kenya, Malawi, and Senegal

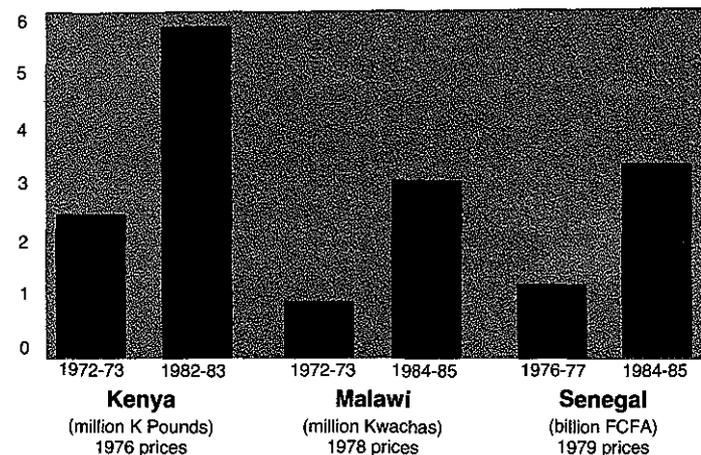
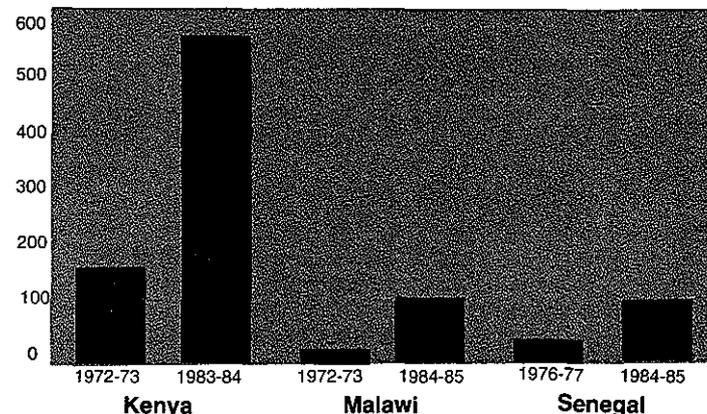


Figure 2
Number of agricultural scientists in Kenya, Malawi, and Senegal



QUALITATIVE DEFICIENCIES LIMIT THE EFFECTIVENESS OF RESEARCH RESOURCES

During the last five years the availability of operating funds per scientist declined in real terms. Some specifics highlight the problem: funds at the Bambay research station in Senegal declined by 8 percent; in Chitedze, Malawi they decreased by 52 percent; and in Kenya they decreased by 59 percent at the National Agricultural Laboratories and 29 percent at the Kitale Research Station. The effectiveness of research is even further limited by year-to-year and midseason fluctuations in recurrent grants and cumbersome financial procedures governing the release of funds and procurement.

The share of national researchers with B.S. degrees has remained above 50 percent in Kenya and 60 percent in Malawi, during the last 15 years. Nearly 73 percent of the researchers in Kenya have less than 4 years of experience, in Senegal 46 percent have less than 3 years of experience. There are also problems of high turnover rates, particularly in Kenya and Malawi. Finally, the forces of expansion have led to a breakdown of the organization and management structure.

RESEARCH RESOURCES WIDELY DISPERSED

In all three national research systems, commodity research has been greatly extended during the last 10 to 15 years. In the 1950s in Kenya, research focused on export crops (tea, coffee, pyrethrum), maize, and wheat. The research system now includes a number of horticultural crops, cotton, sugarcane, grain legumes, roots and tubers, millets, and oilseeds. Malawian research began with research in tea, groundnuts, and maize in the 1960s and now includes rice, wheat, grain legumes, groundnuts, tea, tobacco, cotton, tree crops, millet/sorghum, and roots/tubers. In Senegal, groundnuts, millets, and cowpeas were important in the 1960s; rice, maize, vegetables, soybeans, and sorghum are now included.

- Also, additional resources have been used to establish research stations and substations in different agroecological zones within these countries. The number of research stations doubled during the 1970s in Senegal and Malawi; Kenya added four new research stations and upgraded a large number of substations and experimental sites.
- This trend toward greater commodity and regional coverage has stretched what is already a subcritical deployment of research resources. There were less than 15 researchers in 6 out of 18 major stations in Kenya, 7 out of 10 in Malawi, and 4 out of 8 in Senegal. In Malawi, less than five researchers were assigned to work on rice, wheat/barley, millet/sorghum, and roots/tubers. In Senegal the situation is the same for crops other than groundnuts, vegetables, millets, and rice. In Kenya, which has over four times as many researchers as the other two countries, less than five researchers work on rice and oilcrops.

MAJOR FOCUS ON BIOCHEMICAL TECHNOLOGY, ON-STATION RESEARCH

The focus of research in the 1970s was on high-yielding technology. Only in Senegal was serious research done on labor constraints. Also, with a few exceptions, research did not consider on-farm testing and trials on farmers' fields and, in Kenya and Malawi, even district trials were neglected.

STRENGTHENING NATIONAL RESEARCH SYSTEMS

By the late 1970s most African countries and donors recognized the need to rationalize and strengthen national agricultural research capacity. Current thinking on how to accomplish this is best illustrated by agricultural research projects supported by the World Bank in Senegal and Malawi and under consideration in Kenya. The main features of these projects are:

- establishing a coordinated, long-term, system-wide perspective on external assistance;
- rationalizing the organizational structure of coordinated, multidisciplinary research;
- improving the quality of researchers (through training) and the supporting infrastructure;

- concentrating research resources on fewer commodities at a smaller number of research stations;
- emphasizing on-farm testing and farming systems research; and
- linking international centers, regional research networks, and relevant research institutions outside the country.

There are three relevant issues to consider:

1. In all cases reorganizing the organizational structure takes a long time (often 7 years or more) and the intervening period is characterized by uncertainties about status and salaries, the placement of researchers, the location of research stations, the choice of crops, and so forth.
2. Although it is usually assumed that research on export crops (under separate institutions in Kenya and Malawi) is adequate, and food crop research needs support, a large research effort is needed on smallholder production of export crops as well.
3. The projects place great emphasis on farming systems research; the proposals envisage deployment of about 20 percent of researchers in Malawi and over 40 percent in Senegal on adaptive, on-farm research. One wonders whether the demonstrated merit of this approach warrants such heavy commitments.

Population growth is increasing the pressure on land resources in many areas of Africa, leading to intensive use of land and a subsequent fall in soil fertility. The shifting cultivation mode of production in sparsely populated zones is destroying large areas of forest, presenting a threat to the ecology of this region already prone to desertification.

LONG-TERM YIELD STABILIZATION

Many studies in tropical Africa have found that mineral and organic fertilizers coupled with appropriate land management will maintain and improve the long-term productive capacity of land. Applications of even small amounts of fertilizers or manures have been observed to stabilize yields. FAO studies have shown that fertilizer trials on various crops result, overall, in substantial responses (see Table 1). In addition, fertilizer use has been found to be effective over the long term. In the forest region of Ghana, crop yields were maintained for almost 20 years on continuously cultivated land by application of small amounts of mineral fertilizers.

Table 1
Fertilizer response for selected crops and areas

	Kg. of crop per kg. of fertilizer
Maize	
Kasaï, Zaire	19.9
Western Province, Kenya	14.6
Sorghum	
Butare, Rwanda	11.9
Eastern Province, Kenya	12.5
Cassava	
Coast Province, Kenya	24.7
Potato	
Gikongoro, Rwanda	22.9
Central Province, Kenya	35.1

Source: FAO.

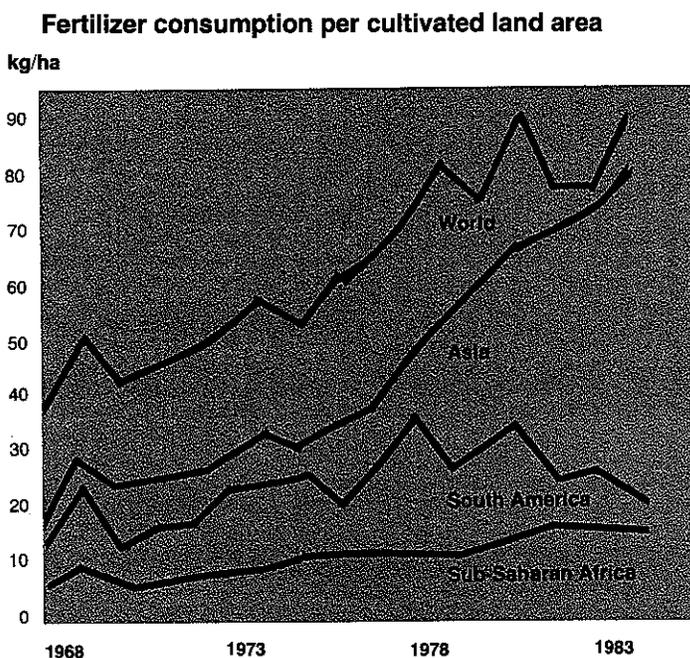
IMPROVED LABOR PRODUCTIVITY

Labor productivity, or output per unit of labor, has been low in Africa because of the lack of capital inputs such as fertilizers, improved seeds, pesticides, irrigation; and low managerial and technical skills. One area that fertilizer studies in Africa have tended to overlook is the effect of fertilizer on labor use and productivity. A trial conducted in Yangambi, Zaire shows that a technically optimum application of 400 kilograms of NPK per hectare increased the labor employment by about 50 percent and the average product or productivity of labor in cassava production by 22 percent. IFPRI research in Zambia shows that the effect of fertilizer use in raising the labor productivity of smallholder food producers is striking. Conclusively, if properly used, fertilizers can stabilize farm fields and increase land and labor productivities. Fertilizer use can also influence farm labor use positively.

EXPANDING FERTILIZER USE

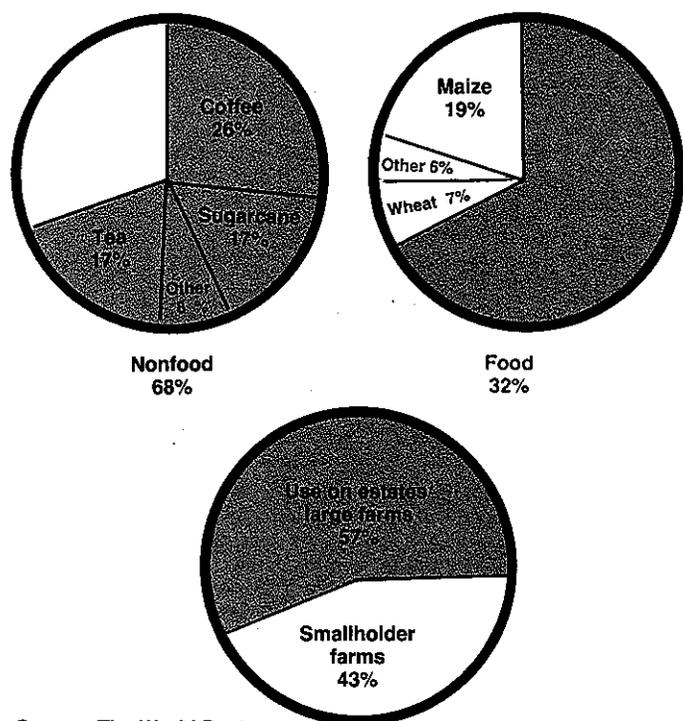
Despite this general recognition, the use of fertilizer in Sub-Saharan Africa remains very low and has been growing only 9 percent a year, much less rapidly than in other parts of the world (see Figure 1). Even in countries where remarkable efforts have been made, fertilizer use is still concentrated on large commercial farms, nonfood crops, and high potential/relatively well-developed areas. For example, World Bank data for Kenya estimate that the gap in fertilizer use between recommended and actual rates of application was 150,000 tons of fertilizers (100,000 tons for maize; 50,000 tons for tea and coffee, key export crops), which is nearly equivalent to Kenya's current fertilizer consumption. This suggests that Kenya should double its fertilizer use on these crops. Large farms and estates in Kenya control 30 percent of the cultivated land and 25 percent of the farm output but claim about 58 percent of fertilizer consumption. Major nonfood crops, including coffee, tea, and sugar, account for nearly 68 percent of total fertilizer use, maize accounts for 19 percent, and all other crops account for 13 percent (see Figure 2). Fertilizer use in Kenya is concentrated in the central Rift Valley and parts of the Eastern provinces where cash or commercial crops are grown.

Figure 1
Fertilizer trends, 1968-1984



Source: FAO Fertilizer and Production Yearbooks, various years.

Figure 2
Fertilizer allocation, Kenya, 1982/1983



Source: The World Bank.

DEVISING A FRAMEWORK FOR FERTILIZER POLICY

The design of an appropriate fertilizer policy framework remains a serious task for policymakers in Sub-Saharan Africa. This framework should:

1. increase fertilizer use by crops;
2. reduce and eliminate the gap between recommended and actual rates of fertilizer application;
3. accelerate the rate at which new lands are fertilized;
4. increase the diffusion of fertilizer on small-scale farms and low potential areas;
5. improve farmers' technical skills; and
6. increase the economic potential of fertilizer use.

Currently, the ability of policymakers in most African countries to devise this framework is largely constrained by a lack of knowledge about how key policies influence the supply and demand of fertilizer and other technology carrying inputs. Controversy about government fertilizer subsidies is partly a result of this limited knowledge. To provide policymakers with the data needed for effective action, research on fertilizer use will have to be comprehensive. Key variables affecting the supply and demand of fertilizer have to be identified and their impact examined. On the supply side, the research should concentrate on:

- fertilizer production, import and donor policies;
- fertilizer delivery systems; and
- credit for those involved in the production, importation, and distribution of fertilizer.

On the demand side, factors affecting fertilizer response and profitability as well as those affecting the availability of fertilizers at the farm level have to be closely examined. Specifically efforts should concentrate on:

- research to improve fertilizer response in specific locations;
- dissemination of research findings and the improvement of farmers' technical skills;
- provision of credit to farmers to purchase fertilizers and hire additional labor; and
- appropriate fertilizer pricing policies and output marketing policies.

This research program would provide a great deal of information that could help policymakers formulate policy for accelerated growth in fertilizer use.

RURAL SERVICES AND AGRICULTURAL DEVELOPMENT: A COMPARISON OF ZAMBIA AND INDIA - SUDHIR WANMALI

Background Notes—11

Rural services such as postal and transportation facilities; credit and banking institutions; veterinary services; seed, fertilizer, pesticides, and agricultural machinery distribution facilities; and market centers for agricultural produce are essential for the development of agriculture. IFPRI research in Zambia and India has examined the link between service provision and agricultural development. The absence of services is one of the major causes of poor production performance in the smallholder sector of Zambia. In areas of India where these services are widely available, agricultural production has improved. Details of the spatial—geographic and economic—characteristics of services in Zambia and India are compared below and illustrated in Table 1.

Service use is governed by several factors besides income. These include the distribution of services within the towns and villages of a region, the distribution and density of population, the nature and use of the road network, and the actual size of the region in question.

Table 1
Service provision and use

	India 1982/83	Zambia 1985/86
Number of Services	84	85
Area Served (Service)	24 Km	824 Km
Travel on foot	5%	60%
Uses of Services/Year/Household	31	6

Source: Sudhir Wanmali.

DISTRIBUTION OF SERVICES

- In Zambia, most of the 85 different types of rural services in the study region are located in one town. Less than one-third of these are also available in five other district service centers. On the average Zambian villages typically have access to two services only.
- In the Indian case, the two towns of the study region each had almost all of the 84 services considered. An additional 20 service centers provided up to two-thirds of the total services. And up to one-third of the total services were also available in villages of the study region.
- In India, a key factor that contributes to the better provision of services is its higher rural population densities (14 times higher than those in the rural tracts of Zambia) as well as an even distribution of this population. In addition the actual size of the region within which all the rural services are provided is about 2,000 square kilometers in India and about 70,000 square kilometers in Zambia.

ACCESS AND USE

- In Zambia, on average, all rural services are located 15 kilometers from the sample households and are used about 6 times a year.
- In India, services are 10 kilometers from the sample households and are used about 31 times a year.

- In Zambia and India, there are important differences in the interservice patterns. In particular, use is the highest for retail services (36 uses per household annually) in Zambia, whereas in India the highest rates of use are for transportation (20) and marketing services (100) in addition to retail services (104).
- The transportation system, including the road network, is also poorer in Zambia than in India. Almost 60 percent of the households in Zambia travel on foot to service centers, whereas in India only 25 percent do. In Zambia, of all the modes of transport used for obtaining services, the share of mechanized transport is 11 percent; in India it is 45 percent.
- In India, as the size of landholding increases the rates of participation in the use of services also increases. Even the landless in the study region seem to derive benefits from a rural service delivery system whose access has improved considerably since the late 1960s (see Table 2). Data on this from Zambia are still being collected.

Table 2
Service use by household categories in India

Services	Landless	Small farmers	Large farmers
	(percent)		
Agricultural machinery	0	24	47
Agricultural inputs	0	73	93
Credit & banking	16	21	16
Marketing services	1	8	10
Retail services	42	45	59
Veterinary	23	64	95

THE PLANNING OF RURAL SERVICES: LESSONS FROM INDIA

- Greater distances imply less use of services, and higher rural incomes can positively influence service use.
- In India, higher rural incomes were the result of a government policy of simultaneous provision of irrigation, electrification, roads, and rural service centers to facilitate the use of modern agricultural technology within the rural farming population.
- The location of the services in India was planned based on analysis of the demographic, functional, and spatial characteristics of the region's settlement system. The private sector was influenced in its decision to provide complementary rural services by the initial government investment in such services.
- Approaches to the solution of problems of agricultural development in Sub-Saharan Africa in general and Zambia in particular will require interdisciplinary research and simultaneous action on agricultural research, technology diffusion, input distribution, and the development of rural infrastructural services.
- More research needs to be done on these aspects before Sub-Saharan African countries can expect to identify the options available for appropriate planning of agricultural development.



Background Notes—12

Recent research indicates that there is potential for growth in the trade between LDCs and for benefits from integrating their food markets.

IMPROVED FOOD SECURITY

Regional integration of food markets through trade can be a means of improving food security in LDCs by stabilizing domestic consumption. Instability in consumption is one of the major measures of food insecurity and, as Figure 1 illustrates for Sub-Saharan Africa, instability in cereal consumption is closely related to instability in production. But fluctuations in cereal production are greater on the national than on the regional level. In the case of the Southern African Development Coordination Conference (SADCC) countries, the instability index for the region was 9 percent for the period 1960-80, but as high as 68 percent for individual countries (see Table 1). A group of countries like SADCC could save as much as US\$67.8 million or 42 percent of corresponding import costs if they were to stabilize their food import bill at a regional instead of national level. This could be accomplished by regional stockpiling schemes or by strengthening trade with each other.

- Regional stockpiling will result in savings in storage costs if instability in production for a group of countries is smaller than for individual countries.
- Regional integration of food markets could also mean less restrictions on border trade, which could contribute to improved food security in three ways. First, trade flows could compensate for fluctuations in national production and, thus, could help stabilize consumption at the national and regional levels. Second, regional trade flows could substi-

tute for national stockholding and in specific cases for overseas trade, which would result in higher income in the countries. Lastly, regional trade is a prerequisite for adjusting the production pattern within a region to produce a comparative advantage.

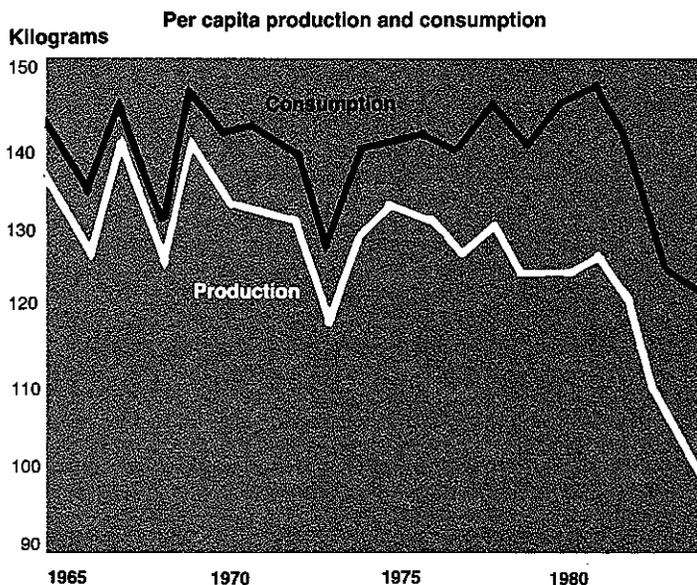
Table 1
Instability in cereal production, SADCC countries, 1960-1980

Country	Production share within region	Instability index
Angola	0.08	10
Botswana	0.01	69
Lesotho	0.02	20
Malawi	0.16	12
Mozambique	0.10	13
Swaziland	0.01	26
Tanzania	0.20	8
Zambia	0.16	13
Zimbabwe	0.25	22

Source: Ulrich Koester.

Note: The instability index for the region was 9 and that for the rest of the world was 2.4.

Figure 1
Production, consumption, and imports of cereals in Sub-Saharan Africa, 1965-1984



Source: The World Bank.

Note: Consumption is calculated as production minus net trade.

PRODUCTION PATTERNS

Because of their relatively small populations, liberalizing food trade among African countries could result in greater benefits through the development of efficient internal production patterns. African countries currently trade with overseas countries, but they trade little with their neighboring countries. This could be understood on economic grounds if neighboring countries were similar in their present and potential production and export patterns, but they are not. SADCC countries have highly specialized exports, with the major export product varying greatly from country to country and accounting for more than 50 percent of total earnings for most countries. The same agricultural products that are exported outside the region are imported by other SADCC countries. This clearly indicates that there is a potential for intraregional trade even without change in the present production pattern.

Adjusting the national production pattern could give further benefits because the comparative advantage differs among neighboring countries. Comparative advantage is determined not only by national conditions of production, which may be similar for neighboring countries, but by transport costs as well. Local transport costs to and from ports make up a large part of trade costs for bulky staple foods, particularly for landlocked countries. Research on potential trade in maize and wheat between Zambia, an importing country, for the years 1979 to 1981 and Zimbabwe, an exporting country, for the same period revealed that these countries together could have benefited by US\$14.5 million in 1977/78 prices by trading bilaterally instead of with their overseas trading partners.

BENEFITS OF STABILIZATION

If the consumption pattern changes significantly over time, specialization will generate even more benefits. Increasing demand for livestock products and poultry is a case in point. Because production of pork and poultry is only marginally tied to land endowment, prices for inputs and the final product are most important for selecting the location of production units. In developed countries, livestock industries tend to be located where feed prices are the lowest because transport costs are more important in determining the regional price patterns of feedstuffs. Thus market integration can contribute to reduced costs for expanding livestock production within a region.

Other positive allocative effects can be expected in the food processing sector from exploitation of economies of scale. Most developing countries rarely use their full productive capacity because the domestic market is too small. Market integration among these countries could use resources more efficiently in those industries, leading to significant benefits as the demand

for processed food grows over time. Similar economies of scale could also be gained in the production of agricultural inputs, such as fertilizers and farm machinery.

Integrating food markets regionally may result in high benefits, but it is not easy to exploit the potential for three reasons:

1. Reducing or abolishing trade barriers will make it necessary for individual countries to give up some of their autonomy in determining their food policy.
2. Countries will have to develop an institutional framework, especially if they start joint actions, like regional stockpiling, which guarantees that benefits are evenly spread and cost sharing corresponds to expected benefits.
3. A full integration of regional food markets can only function if countries solve their foreign exchange problems. It is not likely that countries will be able to provide the prerequisites for a sound regional integration, but they may be well advised to start with joint actions, like regional stockpiling and trade agreements that allow for trade at international prices.

The absolute poor in Sub-Saharan Africa constitute about 25 percent of the population. These are about 90 million people who, according to World Bank estimates for 1980, consume fewer calories than required to avoid serious health risks. Calorie consumption has proven to be a useful measure of poverty. The absolute poor who live in the rural areas increased by about 50 percent during the last decade. In Asia the share of the absolute poor in the total population decreased, while in Sub-Saharan Africa it increased.

RURAL POVERTY: INCOME, CONSUMPTION, HEALTH

Seventy-seven percent of the population in Sub-Saharan Africa lives in rural areas. Poverty in Africa is still largely a rural phenomenon. Most of the poor are subsistence farmers. Thus policies for the rural economy, particularly on food and agriculture, have a direct effect on poverty.

Absolute poverty in the African subsistence farm sector is characterized by:

- low real income combined with low cash income. This cash income frequently depends upon one primary source;
- insufficient food consumption combined with high seasonal fluctuations in consumption;
- inappropriate access to services, such as health services (or the ability to acquire them), resulting in high morbidity, infant and child mortality, and low life expectancy.

High adult morbidity adversely affects labor productivity in agriculture. IFPRI research reveals that in Gambia 61 percent of women farmers interviewed in the rainy season were ill during the preceding month. Monitoring over a one-year period showed women farmers in Western Kenya, on average were ill 28 percent of the time. Lack of food, morbidity, and low labor productivity perpetuate and reinforce each other and may lead into a vicious circle for the poor. IFPRI research in Zambia shows that low food output in one year may lead to reduced food crops in the next.

SUBSISTENCE FOOD

Staple foods produced on the small farm figure prominently as a major income source and the largest share of calories consumed in poor rural households. Farm households in Zambia typically buy only 4 percent of their staple food. In Gambia, farm households buy 3 percent in the dry season but 18 percent in the rainy season. Yet, food income and cash income are to be increased together to raise food consumption and facilitate the effective demand of the poor for services (including health) for which cash is needed.

OFF-FARM INCOME AND CASH

The importance for the poor in rural Africa of off-farm nonagricultural income sources is frequently underestimated. The rural poor in Sub-Saharan Africa typically obtain 30-40 percent of their income from nonagricultural sources (see Table 1).

Table 1
Income of poor rural households in Sub-Saharan Africa from nonagriculture

Country	Nonagricultural income in percent of total income (including subsistence)
Burkina Faso	37
Kenya	33
Gambia	31
Rwanda	26

Source: Preliminary survey results.

The integration of Africa's rural poor in the cash economy is frequently underestimated. In Western Kenya farm households typically receive 53 percent of their income in cash. In Gambia this figure is 45 percent, and in Rwanda it is 46 percent.

Poor rural households spend the bulk of their cash income on food, especially for ingredients to complement the staples. In Rwanda they spend 74 percent on food, in Northern Nigeria they spend 79 percent. This leaves little for other essential expenditures. Therefore, in order to reduce the cost of effectively getting access to services such as health facilities, clean water, and food supplies in times of crisis, these services must be moved closer to the rural poor. Improved infrastructure is crucial for poverty alleviation in rural Africa.

COMMERCIALIZATION VS. SUBSISTENCE

A poverty-oriented policy toward the subsistence sector should not choose between "commercialization" or "increased subsistence." The current subsistence farm sector not only has to feed itself but the growing urban communities as well. The more employment that can be generated in rural areas, the less burdensome will be the urbanization process as the labor force grows. This provides the big challenge for Africa. The population of working age is expected to more than double over the coming 20 years in Africa. The challenge actually is to generate increased employment jointly with increased labor productivity. Technological improvements in agriculture can provide the key input for addressing this challenge.

POLICY REQUIREMENTS

A policy of alleviating poverty in subsistence agriculture requires:

- The new technologies introduced into most African environments must be labor-saving and thus must focus on increased labor productivity. This usually does not mean tractors but tools for people and animal traction.
- New crops and technologies must take into account the complex patterns of production seasonality and the pro-

cessing of existing food crops at any location in question. They determine the opportunity cost of labor, which is the key for adoption of new technologies in Africa and requires investment in local applied agricultural research capacities.

- The introduction of new technologies must not require large amounts of working capital on the part of the farmer. Otherwise adoption is prevented due to liquidity constraints and very high time preference rates of the poor in the subsistence economy. This is especially true for women farmers who lack access to credit to finance technological change. This can lead to the exclusion of women farmers from control over new technologies, as shown by an example from Gambia (see Table 2).
- The marketing channels of inputs and outputs of newly introduced crops must not be risk-prone.
- New technologies and crops must take into account the agricultural resource base and environment and assure that soil fertility and the sustainability of (subsistence) agriculture is not at risk.
- Poverty alleviation policy in subsistence agriculture requires provision of resources (including skills) to the poor to invest in self-sustaining development, not welfare provi-

Table 2
New technology and control over fields by women in rice in Gambia

Technology levels in rice	Yield per hectare (in tons)	Percent of fields controlled by women
Improved irrigation	2.6	10
Irrigation	2.0	50
Improved rainfed	2.2	30
Traditional	1.3	85

Source: Preliminary survey results.

sions. Temporarily, poverty alleviation requires direct transfers that may end up in food consumption. This is not necessarily inappropriate. Consumption, improvement of health, and production are inseparably tied together in subsistence agriculture. They have to move together, especially in the initial risky phases of increased market integration.

PROPERTY OF
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE