A recipe for meeting the world food crisis

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CAED Report 28
CENTER FOR AGRICULTURAL AND ECONOMIC DEVELOPMENT
IOWA STATE UNIVERSITY of Science and Technology
Ames, Iowa, 1966
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To search for mysteries in explaining increased farm productivity has become fashionable in recent years. Why these mysteries exist is itself a mystery. Knowledge is already at hand to explain how farm productivity is increased. The important ingredients are rather obvious; the factors to stress are evident.

What is less obvious is how to overcome the political, cultural, intellectual restraints which prevent nations from boosting agricultural productivity. These restraints, for example, maintain price relationships which discourage the substitution of capital for land and labor; they discourage the supplying of new knowledge, the improving of lease arrangements and the improvement of the general environment within which agriculture functions.

Economic theory as well as practical experience tells us what factors must be applied in agriculture to boost productivity. We have ample evidence that we can use the same principles for applying inputs regardless of whether farmers are highly educated or not. Of course, in practice we have to recognize that farmers lag in reacting to improved conditions—for example to increased supplies and lower prices of inputs, to higher farm commodity prices and to increased knowledge. It is too much to expect that
farmers would react instantaneously to changes in the economic environment or that they should simply increase the food output because officials wish them to. There are no examples of an overnight transformation of agriculture.

Even in the United States, sometimes taken as the hallmark of agricultural development, adjustment to improving production conditions has lagged. It took a good 25 years for agriculture to become mechanized after efficient tractors and tractor-drawn farm equipment were developed. It took nearly 50 years after the creation of the facilities and a moderate increase in the supply of knowledge for U.S. agriculture to become highly oriented to science. It will be another 20 years before existing knowledge is rather fully exploited. The process of mechanization in Japan was somewhat shorter. But all countries have conditions which cause farmers to react rather slowly to change. Most typically, this is because there is little demand outside of agriculture for some productive factors used in farming; the supply of such factors used in agriculture is relatively fixed, or as economists say, highly inelastic. Thus such factors remain in farming use rather than being replaced by new capital technology or migrating to other economic sectors. New technology replaces them only when the supply conditions change or their productive life and services are depleted.

As mentioned previously, no new scientific breakthrough is required to explain the conditions which will cause farmers to use more and different resources and to increase farm productivity. The knowledge is already at hand; there are many practical examples of success. If enough farmers are encouraged to react, productivity in a given country or area can be increased. Increasing the productivity of agriculture means using more capital; it means substituting one form of capital for another or for land or labor; it means increasing total farm output. These changes are encouraged only if certain conditions exist: the prices of the productive resources and of farm products, and the farmer's
tenure situation must be favorable—and the farmer must be promised sufficient payoff from a long-run investment in his enterprise.

If you increase the support prices for U.S. farmers, they put more resources in agriculture and boost output. If you supply knowledge and provide satisfactory price relationships for Japanese farmers, they use more fertilizer and invest in tractors. Provide a favorable price outlook and Greek cultivators convert from cereals to long-term investments in citrus groves. Provide an adequate investment horizon and degree of certainty and Polish cultivators invest in orchards and buildings in the midst of a socialized economy. Provide packing facilities with a market and Ethiopians sell off cows which they have long "hoarded." Provide a supply of resources and adequate price incentives and selected villages of Indian cultivators move towards Japanese-type farming technology. At every point over the world where sufficient data are available it has been found that farmers respond to changing farm product prices and farm input prices. The mysteries of agricultural development are small indeed. More mysterious and complex are the "outside" policy, planning, political and cultural processes which prevent changes needed for increased farm productivity.

U.S. Example

If one wanted to find the most efficient plan for increasing agricultural productivity, he would look to the United States. However, the way U.S. farms are organized is in part determined by the state of the nation's economy. Thus U.S. farms should not be entirely used as the model for agriculture in other countries. Our highly industrialized economy provides productive new capital inputs at prices which favor their substitution for both labor and land. Hence, mechanical technology is favored over labor technology, and economies of scale encourage the operation of fewer but larger farms. Our public programs have
been highly consistent with economic theory which specifies what is needed to boost farm productivity. The United States isn't noted for planning. Yet the long stretch public programs for American agriculture have been the most consistent and successful in the entire world—including socialist countries where the crux of life is government planning. In the United States our planning to boost productivity and modernize agriculture was often unwitting; the public did not always know that the instruments used were highly adapted to agricultural progress. But they were! Several instruments conducive to a flow of resources into agriculture and a greater output of farm products were emphasized.

First, a large supply of productive resources was provided for farmers and resource prices were kept low. More land was acquired and given to farmers or sold at low prices. Farmers responded to this incentive by applying more and more labor and land to farming. When there was no more additional land to be farmed, the nation turned in other directions to increase the supplies of farm inputs and to reduce the price of these inputs. Through public research and educational facilities more and more technical knowledge was generated and put into use. This complemented the new capital inputs, thus making possible more productive capital technology. Public facilities were created which increased the supply and lowered the price of capital and credit and encouraged much greater use of those resources. Bureau of Reclamation and Soil Conservation Service programs reduced the cost of irrigation, fertilizer and lime and similar specific capital items. The lower prices encouraged a spurt in the use of these inputs or technologies and helped increase farm output. Other government programs raised and stabilized farm commodity prices, and thus encouraged farmers to use more resources and new capital technologies. In addition, farm tenure systems, though not ideal, stabilized cost and return relationships, promising farmers a profit. Of course, farm productivity did not climb at the
same rate throughout the United States in the last half century. The increases generally varied in proportion to incentives provided through resource and capital prices, the available knowledge, the tenure restraints, the relation of farm costs and returns, and farm commodity prices.

So a recipe for increasing farm productivity is available, if some still seek it. It is:

- Lower the prices and increase the availability of productive resources.
- Increase and stabilize farm commodity prices.
- Blend in a farming system that takes into consideration the marginal productivity and prices of inputs, and also farm commodity prices in determining what bundles of inputs to use. This mixture can be brought to a boil in a container of commercial farming, and not successfully in a purely subsistence environment outside the market economy.

Here, a word of caution is given the cook. The recipe won't be completed immediately. There'll be a delay depending on how much of the ingredients are used—also on the extent to which a very few specific cultural factors exist. For example, a new "state of mind," must be created; cultivators who previously were oriented to producing to subsist in the year ahead must be induced to produce for the market. Families must be acquainted with the principles of managing credit once it has been put in their hands.
This recipe has been tested and proven successful over many parts of the world—so much so that it is doubtful that anyone will ever come up with a better one. Hence, to achieve agricultural development, the urgency is to create the conditions implied above. There is no mystery to the process. If a mystery exists, it is to explain those conditions which prevent governments and planning agencies from manipulating the above instruments—from using the recipe.

Agriculture has failed to respond as hoped or expected in many countries. But the reasons are often obvious. Too frequently priority has not been given to agricultural development. The leap to a modern industrial economy, including steel mills and an international airline operated at a deficit, has been given precedence over farm improvement. Just as frequently, prices in underdeveloped countries have not encouraged the use of new and more capital resources such as fertilizer, insecticides and improved seed varieties. Input prices have been kept too high and output prices have been kept too low. Capital has not been put into the hands of subsistence farmers so they can produce for the market economy.

In planning industrial development too little attention has been given to inputs such as fertilizer for agriculture; the importance of providing such inputs in the quantities and at the
prices which favor their use in agriculture has been overlooked. Frequently, countries have neither a supply of such inputs nor the facilities to move and store them. Moreover trade policies of underdeveloped countries often have rejected the idea of importing such needed inputs at low prices; instead they have favored development of their own industries and used their foreign exchange for that purpose.

For a number of reasons, farm product prices have been too low. The emphasis has been on low prices for the consumer. While this policy may be needed, a better policy would be producer prices which favor growth in output but subsidize consumers at lower prices—somewhat along the lines of British price policy.

In many countries the acceptance of foreign loans or aid funds tied to the import of cheap farm commodities has acted in a similar manner to dampen prices and lower the payoff from improving the country's own agriculture. U.S. surpluses shipped under various labels have had the same effect, although frequently they have been needed as an "ace in the hole" during bad weather and other short-run disasters. In a few notable cases, export taxes which serve as a major source of government revenue deprive the farmer of the portion of the world market price he would otherwise receive. Ethiopia, where the bulk of exports is represented by farm commodities, is an example.

The argument is not against adequate and cheap food for consumers—rather it is against low farm prices and low incentive for farmers. It is not against industrialization; it is against an inadequate supply to farmers of industrial inputs which represent modern technology and a high payoff in terms of farm output. It is against systems that fail to generate and supply knowledge and provide productive inputs to farmers. In backward agricultures, the inputs necessary in the mix typically are complementary. It is rather futile, as
has been done in many countries, to establish an extension education machine when there is no new or adapted research knowledge to go with it. It is unproductive to supply credit when fertilizer, insecticides and improved seeds are not physically available--or to supply fertilizer when adapted crop varieties are lacking. It takes no new theories or mysterious explanations of the agricultural development process to know that at some level these resources complement each other--that when the supply of one is limited the productivity of others is adversely affected.

The United States, in its policy and aids to many developing countries, needs to do an about face--just as the developing countries need to do regarding the aids they accept from the United States and other countries. The price to farmers of resources used in agricultural production is so low in the United States that our farm output burdens the nation. A much greater portion of these resources, including both physical materials and the persons with the "know how" to generate and communicate knowledge, should be diverted to other countries. The result could be that U.S. farmers would have to pay higher prices for these resources and the prices farmers in other countries pay would be lower than at present. United States agricultural policy now causes higher commodity prices and output at home and lower commodity prices and output abroad. However, a shift to the export of subsidized or low-cost resources would tend to discourage production in the United States, and encourage it in other countries. In general, less developed countries need to turn more in the direction of the input sectors and knowledge supplies which are so highly advanced and low in cost in Western countries. Over the next decade this certainly needs to have priority over "home development of industry" for numerous countries.

There is, of course, a relation between the development of non-farm
sectors which fabricate farm inputs at low prices and the economic progress of agriculture. The price to farmers of these inputs can be low only if the agriculture of the country provides a sufficiently large market for capital items. At the outset, in many countries, the small market for capital inputs can be supplied initially at lower prices from foreign sources. Development of local industrial sources on a sufficient scale can come at a later time when agriculture has advanced in technology and capitalization to merit such local industrial development.

Priorities in the Farming Sector

There are other priorities in modernizing a country’s agriculture. Situations can be outlined which help specify when agriculture should be given priority over industry in development and vice versa. Let us examine some cases:

**Case I** - Farm output is low; diets are miserable; hunger prevails. Both the agricultural and industrial sectors are characterized by labor unemployment or underemployment, and export possibilities are unfavorable for farm products. At this stage, priority needs to be given to improving agriculture, but not all facets of agriculture. Crop biology should be given precedence. The capital items required are improved seeds, fertilizer, insecticides—and irrigation, where it is not costly and has a high short-run payoff. These capital inputs serve as substitutes for land. Emphasis should not be given mechanization and labor substitutes. Investment might be made in boosting production of staples, the demand for which is about constant regardless of consumer income. Little priority should be given to investment in producing livestock or other products in which consumption varies considerably according to people's income level and consumption is chiefly by high income people. A good many
nations fit this category, particularly those which face another decade or two of increases in farm labor and population because industrialization cannot proceed rapidly enough to keep pace with the birth rate. More countries would fall in this category if the world food crisis ever moved to the intensity now being projected by numerous people.

Case II - Food supplies are adequate for the basic items of diet. Agricultural labor is highly underemployed. Labor even may be migrating to other countries. Here, no priority should be given to any aspect of agricultural development, except as the returns from investing more in farming equals that to be obtained from investing in nonfarm sectors—and where export potentials exist. Otherwise, priority should be given to industrial development to create jobs for the unemployed on farms and in towns. Examples of this category include regions such as southern Italy.

Case III - Food supplies are adequate, a high level of employment exists in nonagricultural sectors, incomes are relatively low in agriculture and underemployment abounds in agriculture. Industrial development should be further emphasized to expand nonfarm employment opportunities for those migrating from farms. However, some special emphasis could be given even here to the development of agriculture. As capital becomes relatively cheaper than labor, it would substitute for labor. Production of livestock and other products for which demand increases as consumer incomes rise should be encouraged. Too, a most important investment may be in helping human resources move out of agriculture. There are many examples of countries which fit into this category in various degrees. Even included here are broad reaches of American farming. Also included are Southern Europe, Eastern Europe and a majority of countries in Western Europe.
Other categories could be presented. But enough have been suggested to indicate that there is no universal rule or condition which can specify all priorities for industrial development over agriculture or vice versa. In very few cases, no priorities should exist for agriculture. In others, the urgency is to employ resources and exports which stimulate the output of food from basic plant food sources or export crops. At other stages of development, the urgency steps up to livestock and mechanization. The important thing is to "get at" the development of agriculture. There are few, if any, good examples where a nation has invested too much in agricultural development relative to industrialization.

True, there have been large mistakes in agricultural investment. Examples are extension services without research knowledge to communicate, fertilizer plants without distribution and storage facilities, machines without spare parts, infeasible irrigation projects, and mechanization in countries where relative prices of capital and labor specify a labor technology to be most appropriate.

But overinvestment is sensible agricultural development as a whole is hard to find. True, what is needed is balanced development. If we have sufficient knowledge of the production and supply possibilities of the major economic sector, of the resource demand situation peculiar to each industry, of consumer demand and what people is society desire, we can specify just what is needed for balanced development. But in the absence of this information the possibility of error certainly is in the direction of investing too little in agriculture in backward countries. Perhaps the United States provides the single clear-cut example of overinvestment drawing forth too productive an agriculture. Other countries, in a food supply pinch, would prefer this error to their own error of underinvestment in agriculture.
Priorities in Other Nations

In the less developed countries emphasis should be on applied research, except where fundamental knowledge is lacking for conditions unique to the country. Fundamental knowledge is the least-cost import and requires only a good set of journals and translators. On the other hand, good applied research, which adapts modern technologies to the conditions of the country, typically is lacking. Often developing countries overemphasize fundamental research and underemphasize applied research because of the preferences of the returning graduate student. After completing his study in the United States, the returning graduate student finds greater status in speaking to his colleagues abroad through the scientific journals than in developing applied technologies for his country.

We have already mentioned that distorted investment occurs when elaborate extension or advisory services are established in the absence of knowledge to extend. Again, "balance" is required in investing in these two activities. When a country's agriculture is backward, the government must give priority to research. This is true because the major inputs of agriculture are land and labor. Capital represents too small a proportion of the total to provide an adequate market for capital inputs. Hence, agricultural private concerns do little research. When agriculture is highly developed, the major inputs are capital items from nonfarm sources. Thus industry turns heavily to agricultural research as a means of further expanding the demand for new farm technologies. These new technologies are chemicals in the form of fertilizers and seeds, steel in the form of machines, etc. At this stage, the public need not place such high priority on agricultural research, since the momentum will be carried forward by the private sector.
At low levels of development, priority should be on crop biology. Emphasis of farm engineering needs to come at a later stage of economic development, when the relative prices of labor and capital encourage mechanization. Similarly, high priority should be given to improving the livestock sector through research only at higher stages of development and per capita income.

**Farm Scale**

Increasing the size of farming units also should be directly related to economic growth. Massive units such as the collective farms of Eastern Europe are consistent neither with the stage of economic development in these countries, the economies of scale which can be realized, or the relative prices of productive inputs. Large scale units should have no particular priority at low stages of economic development. Certain economies may possibly be realized where there are fewer and larger farms to which knowledge is communicated. Aside from this, however, the most profitable scale of operations is directly related to the stage of economic growth in the country and to the relative prices of inputs. At low stages of development, when capital is in short supply and has a high price relative to labor, the best resource mix in farming is a large amount of labor and small amount of capital. Under a labor technology, costs cannot be cut by increasing the size of the farm. Most of the cost economies from using modest capital items are largely exhausted as soon as the bullock team, horse or camel which provides the power are fully employed. High stages of development, where capital prices are relatively lower than labor prices, call for a resource mix made up largely of capital. Economies can then be realized by operating larger farms.
Other Aspects of Priority

In establishing priorities for the development of agriculture, several other factors must be considered. If we wished most rapid development and could neglect human welfare, we would concentrate efforts on commercial farmers and forget subsistence farmers. In some countries, of course, the majority of farmers fall in the latter category. Their scale of operations must be extended so they produce beyond family requirements. Their product must enter the market so that they are influenced by price. A generation may be required before many traditional subsistence farmers are converted to the "market state of mind." But their sons may react much more rapidly.

Similarly the supply of consumer goods which trickles out to remote villages often needs to be materially increased--and the price of such goods reduced. If such goods are lacking or too expensive, the villager's incentive to sell their farm commodities on the market is reduced. Typically, modern consumer goods are much more expensive in the villages than in the cities.

If increasing the food supply were to take precedence over all else, governments could operate their own commercial farms, which would serve as an example for the rank and file of cultivators. Such farms could help "sell" improved farming practices, for persons with little education tend to act on the basis of quantitative evidence rather than on the basis of deductive or theoretical evidence. Similarly, the government might "hire" a large number of representative farmers to follow prescribed farm plans and adopt improved technology. If the development posed really has a payoff, it should permit cultivators to increase their income as well as hire a managerial supervisor to lead a group of farms. If the development suggested will not cover these two costs, it undoubtedly (a) has too low a payoff to be considered in a
developing country or (b) inputs are priced too high and output too high. Finally, for a rapid spurt in output, the possibility of giving franchises to experienced foreign farmers could be considered where land is not too limited. A franchise of perhaps 5 or 10 years would assure these foreign farmers sufficient payoff under an appropriate set of prices. Thus the food supply could be increased while farming "know how" was being spread to native cultivators. A good example of the latter possibility is in Ethiopia, where Dutch farmers have developed highly efficient sugar operations. While the technology used may not be adapted to large numbers of the country's farmers, the operations have been successful in rapidly increasing the output of one commodity. Other countries have sufficient land to justify borrowing this technique. A short-run franchise could prevent concern over the threat of colonialism.

**Priorities in Meeting World Food Needs**

In view of the widely discussed food crisis, both developed and underdeveloped countries may have to place greater priority on food production. Some have suggested that developed countries ought to step up their food output and ship surplus food to the underdeveloped countries. However, from these popular demands and the broad humanitarian desire to prevent hunger and starvation, programs could arise which have very bad results. Thus we need to examine the possibilities in terms of realistic and logical priorities.

It is obvious, of course, that the world must face up to this pending food crisis. At current compound rates of growth, world population is projected to double in less than 35 years. World population took 1500 years to double from the advent of the Christian era to the year 1600. It took three more centuries, from 1600 to 1900, for world population to triple to 1.5 billion persons. But at current rates of increase, it will double again in
35 years; in Central and South America it will double in 25 years. Obviously, this rate of growth cannot go forward unchecked. Even if food could be supplied, there soon would be no standing space. This point seems to have escaped those who argue that the solution to the world's pending food crisis is simply to increase food output.

The food situation is deteriorating mainly in the underdeveloped countries. Food production has moved ahead much more rapidly than population and food demand in highly developed countries. Accordingly, the import-export pattern in food has been reversed between highly developed and underdeveloped countries. Prior to World War II, there was one general trade pattern: Western Europe was the only importing region, and the rest of the world exported to it. There were six grain exporting areas: North America, about 5 million tons; Latin America, about 9 million tons; Eastern Europe, 5 million tons, and each of three other regions--Asia, Africa and Oceania (New Zealand and Australia)--small quantities. Western Europe has maintained its position as an importer. To meet greater population needs it buys about the same amount of grain as in the immediate prewar period.

But mammoth changes have taken place in trade among other world regions. Only North America and Oceania remain major exporters. Asia and Africa have become net importers along with Latin America and Eastern Europe. Prior to World War II, the net annual flow of grains from the less developed regions was about 11 million tons. Now, annual shipments of grain from developed countries to less developed countries are about 25 million tons.

Role of Agriculture in Developed Countries

At the current rate of population growth and projections for the future, and without alternative solutions, the world's food situation could deteriorate
materially in another dozen years. Then, shouldn't the United States plow up the land idled under various programs? Shouldn't it develop more irrigated land and put it into crops in order to ship food to the countries with poor diets and rapidly growing populations? Will not the mushrooming world population cause food to be in short supply and high priced even in the United States? Without an exhaustive study of the situation the answer to these questions would appear to be an unreserved "yes." But the answer to the world's population and food crisis is more complex than this. Even to produce surplus food and give it away over the world is not an easy task. While the world food situation will help lessen the problem of surplus capacity in the United States, our agricultural capacity is not the answer to the world's pending food and population problem. Universally, people and societies abhor suffering from hunger and malnutrition. All possible efficient steps should be taken to eliminate these problems on a world wide basis. However, it also is possible to use rash policies which discourage development of food production and bring misery to people later.

In the advanced countries knowledge and technology have been able to hold birth rates in check and to increase food output faster than population growth. Moreover, investments in capital processes and technical knowledge may give rise to large food supplies from non-agricultural resources before limited farm resources restrain output and boost the real price of food in these countries. The pressing short-run problem, a span of the next three decades, is in the less developed countries. Most but not all of these countries are only recently independent nations able to determine their own national policies. The balancing of the demand and supply of food is one of the major problems that most of them must solve in the next decade or so. The threatening world food crisis, with population growth rates thrust sharply
above food growth rates, is perhaps three decades away. But for individual
countries in the above category, it is only a decade or so away. Balancing
food needs and production involves investment both in modern farming and in
population management.

Actually, the problem is not a simple one of balance. Food output and
consumption will be balanced in three decades even if it means twice as many
people subsisting on a miserable 2,000 calories per day. The basic problem
is more to manage food supplies and populations so they are balanced at levels
allowing adequate diets and human welfare. Investments of both types are
required. Investment to increase the knowledge and improve the technology
of birth control is no less important, and certainly pays a much higher re-
turn in the long-run than investment in expanding the food supply.

How does agriculture fit into this complex in highly developed countries?
Cannot the abundance of food and the potential of greater output in these
countries be channeled to the food-deficit countries, thus warding off the
crisis and even helping
to lift the level of hu-
man well-being? This
would be a simple solu-
tion—if it were possible.
And it would satisfy the
sincere humanitarian in-
terests and intentions of
the many individuals,
groups, organizations and
nations. But it is un-
realistic as the major
answer to the world's
pending food crisis.
To be certain, the agricultural resources of the United States and other developed nations have an important and significant role to play. But it is not in providing the increased food needed for an uncontrolled increase in the world's population over the next half century. It is obvious that world population cannot go forward forever unchecked. Present rates of increase would soon absorb all of the untapped food producing potential of both developed and undeveloped countries. Then, when the world could boost food production no more, there would be even greater masses of people to starve or live in hunger and misery. Human suffering would be multiplied and the negative effect could well be greater than if excess food stocks were withheld as a check against population growth. Ethical questions even arise as to whether societies should provide more and improved health and medical services to decrease mortality rates without parallel investments to increase the food supply for the greater number of persons who are thus kept on hand to consume.

Blind increases in production in the advanced countries, to be converted to food handouts for less developed nations, will not solve the world's population problem. To an extent, they can even discourage improvement of local agriculture and growth of food supplies in less developed countries. If food from advanced countries is thrown onto the market without price safeguards, it will be less profitable for farmers in the less developed countries, where population is large and food production is small, to adopt improved methods. Such food can lessen the urgency and lower the motivation to increase productivity in these countries. In the last decade food aid from the United States has diverted too much attention and investment from the more fundamental long-run problems of birth control and population management and agricultural improvement in less developed countries.
As mentioned previously, to produce farm products in advanced countries and send it as gifts or handouts is not the long-run answer to the world population and food problems. This approach would only postpone the "day of reckoning" by 10 or 15 years. First, on the side of food supply, the advanced countries do not have a large enough land area to meet an unlimited increase in future world population. In terms of available land area and unexploited production potential, a more fruitful course is to expand farm output in the less developed countries. This approach not only would provide greater resources for production but it would give the developing countries either greater certainty of food supplies, under the ever-uncertain tides of world politics, or greater freedom in selecting their own national goals. Even apart from political considerations, investment should be made to increase agricultural productivity where it is most economic and returns the greatest payoff. In the short-run, the payoff often will be greater in countries such as the United States with a highly developed agriculture and an under-utilized capacity.

This is true because of the educational and organizational restraints involved in short-term improvement of agriculture in most less developed countries. But over the long-run, the payoff is almost certain to be greater in improvement in agriculture in developing countries which are endowed with favorable resources but tardy in technological development. These countries are using resources or inputs at low levels; thus the production response from applying additional units of an input should be much greater than in developed nations where resource combinations are more nearly ideal. Of course, some developed nations have a clear long-run comparative advantage in food production, and in some less developed countries industry has clear advantages over agriculture. In such countries further developments should
follow these lines, with trade stimulated by appropriate international, commercial, fiscal and investment policies.

It is high time that proper priority be given to agricultural improvement in developing countries where resources are favorable and populations are pressing. These countries must invest more in the complex of resources needed to boost food output--and do it efficiently. They must develop realistic plans which recognize the hard facts before them. This would be true even if the goal and need were only one of lifting, to humanitarian levels, the diets of today's populations. Too many countries, as history is beginning to reveal, have minimized agricultural investment in attempting to leap-frog into advanced industrialization.

But even investments in agricultural development will not ward off a threatening long-run world food crisis stemming from population growth. Only investments in knowledge and the technology of birth control can do so. This investment is basic if calamity is to be averted. It is the only long-run solution to the problem of population versus food supply. Moreover, compared with agricultural development, such an investment will return much more in bringing population and future food requirements into a realistic and humanitarian balance. But it, too, is an investment which does not have immediate payoff. Effective population control programs require considerable time to be effective. They will provide the appropriate payoff only with sufficient time and effort to bring knowledge to less literate parents, to overcome fears and superstitions and to provide birth control methods that are certain and cheap.

Direct Contribution

The excess capacity of the United States and other developed countries to produce food can be used effectively to meet short-run emergency problems
in the world. As mentioned previously, the payoff in the short run from investing in more seed, fertilizer, tractors and fuel for these purposes will be quicker and greater in advanced countries where farmers already have the "know how" and only need to turned loose to produce. The short-run return is much lower in the less developed countries. In them there may be a lag of up to 10 years between when knowledge is generated and farmers act. Even then, the emphasis in our aid programs should be on providing stocks to meet weather emergencies and similar calamities--on helping lift a few countries out of the "squeeze" they now find themselves in--on "getting the show under way" in the less developed countries. Food aid from the United States perhaps should be used only where the receiving countries agree to invest appropriately in both the improvement of their own agriculture and in birth control.

Here is exactly where the agricultural resources of the United States can make their large and basic contribution to the world food problem. The opportunity and need is less in producing food to ship as gifts to less developed countries. It is more in furnishing the resources which serve as ingredients in getting development under way. These resources may include fertilizer, seeds, insecticides and similar inputs--or the plants and other resources to produce these inputs. In some cases they may include investment funds, although international aids have caused
such finds to become less needed than some other things. More important than these resources are research, education, management and organization, which can exploit technical knowledge adapted to the developing countries' conditions and get new technical capital adopted in those countries.

In these, the United States has excelled. The United States increased the supply and lowered the prices of resources—and simultaneously, bolstered commodity prices. Sometimes it even subsidized the cost of inputs. It provided capital and organized a system to channel advanced technical knowledge to producers. These actions encouraged the use of inputs, the expansion of farm output and development of agriculture. They are essential for agriculture development anywhere in the world; adapted to local conditions they will be most effective in advancing agriculture in the less developed countries. Part of this mix is necessarily management and organizational ability to successfully implement action programs and knowledge. In typically less developed countries, organizational and management experience and ability are perhaps even more scarce than capital.

These intellectual resources, rather than food, are the large contributions which can be made from the experiences and capabilities of our agriculture. As pointed out earlier, we have growing opportunity to divert some of our public resources; in our highly developed economy private industry is assuming more of the responsibility of doing research and communicating knowledge to agriculture.

Underdeveloped countries must improve their own agriculture if they are to meet their food needs in the next decade and half. But they must control population growth if they are to meet their food problem during the next quarter century. Our food can help meet the emergency in the first case—but it can have little bearing on the second.