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IMPLICATIONS FOR AGRICULTURAL ASSISTANCE
OF ALTERNATIVE ECONOMIC DEVELOPMENT PROSPECTS
IN THE YEMEN ARAB REPUBLIC

by

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Introduction and Summary

The most striking characteristic of the Yemeni economy is change. In less than twenty years Yemen has changed from a closed society, which the ruling Imam controlled by limiting entry from the outside world, into an open society where hundreds of thousands of Yemeni workers move out of and into the country each year, where a vast array of imported goods are available in village suks, and where modern western technologies are eagerly embraced and sometimes indiscriminately applied to Yemeni situations. It is difficult to find any aspect of the Yemeni economy that has not been affected by these sweeping changes. Yemeni agriculture certainly has not been sheltered from rapid change. Indeed, changes in the rest of the economy have forced change upon agricultural producers. The purpose of this report is to attempt to identify the forces which will determine whether rapid change will continue in Yemeni agriculture and the future directions and extent of that change.

Current economic conditions in Yemen are dominated by the opportunities for Yemeni to work outside the country and by the availability of imported goods within Yemen. These conditions have a dominant influence on Yemeni wage rates, employment, earned income, and production, including the volume and composition of agricultural production.

When workers are willing to migrate in response to economic incentives, the most important influence on wage rates and earned income is likely to be economic conditions in the receiving countries, conditions which are beyond the influence of events in Yemen. Domestic employment and production, on the other hand, can be affected by policies applied within Yemen.

The principal beneficiaries of production oriented assistance efforts are those who have sources of income from other factors in addition to their raw labor inputs. When job opportunities at relatively high wages are abundant,

poverty is attributable to large family size, poor health, age, preference, or lack of opportunity. Under these circumstances welfare programs, not assistance in raising production, are most likely to succeed in aiding the poorest of the poor.

Opportunities for foreign employment have dealt a double blow to Yemeni agricultural producers. Yemeni producers of internationally traded agricultural products have suffered from migration due to the resulting high wage costs and the favorable terms of trade (brought about by large remittances) which make imported goods cheap relative to domestically produced goods. As a result agricultural production has remained stagnant since 1973, in sharp contrast with nonagricultural output which has expanded rapidly in response to the sharp rise in the demand for nontraded goods fueled by rapid increases in income.

Whether differential growth rates between agricultural and nonagricultural sectors continue depends in part on whether the adjustment to the disturbance of 73-75 is largely completed. Evidence of recent convergence in sectoral growth rates suggests that the period of adjustment is nearing an end. In the absence of expanded opportunities for migration, the agricultural sector is the best candidate for the task of engine of expansion for continued economic growth. In particular, the prospects for increased agricultural production seem brighter than those for industry.

Under existing circumstances assistance to the agricultural sector is likely to be most successful if it concentrates on helping Yemeni farmers to economize on scarce factors, including labor and water, and in producing crops for which Yemeni producers have some protection from the rigors of international competition.

Plans for long term assistance efforts should be based not just on existing economic conditions but should also take into account possible future changes in those conditions. Among the alternative scenarios considered are changes in foreign assistance levels and changes in migration opportunities. Increases in wage rates on the Arabian Peninsula and increases in foreign assistance levels will tend to bring further increases in wage rates, further improvements in Yemen's terms of trade, and make it even more difficult for Yemeni agricultural producers to compete. Declining Arabian Peninsula wage rates, restrictions on migration, and decreased foreign assistance levels will lower wage rates, drive up the price of imported foods, and increase profit opportunities for Yemeni agricultural producers.

The precise effects of changes in real wages and in the terms of trade on the volume and composition of agricultural production depends heavily on the government's policy response to the loss of foreign exchange which will surely accompany deterioration in real wages and the terms of trade. Policy responses will largely determine the relative incentives for food exports, food import substitutes, and nonfood import substitutes. A very real danger for agricultural producers is that the government will attempt to use exchange controls or discriminatory tariffs to keep the price of imported foods low and, as a consequence, discourage agricultural production in Yemen.

The design of direct assistance to farmers is particularly sensitive to the underlying determinants of labor costs and composition of output. This is true when agricultural assistance takes the form of development of new seeds and plants and extension assistance with cropping patterns and other agricultural practices. The design of assistance in the form of improved farm water management techniques and training programs are, on the other hand, less sensitive to alternative scenarios.

Other scenarios considered are forced or self-imposed food self-sufficiency, gradual abandonment of preferences for a subsistence lifestyle and for local meats and cereals, and the deterioration of soil and water resources.

The most likely scenario is judged to be that of slightly declining real wages, a slight deterioration of Yemen's terms of trade and a slight increase in incentives for agricultural production. One cannot rule out the possibility of an abrupt deterioration of real wages and the terms of trade and sharp increases in agricultural incentives. While the implications of these forecasts for the volume of agricultural production are clear, the implications for the composition of agricultural production are clouded by an inability to predict the government's policy response to the loss of foreign exchange reserves and the response of Yemeni consumption patterns to declining real income. Thus it is difficult to recommend designs for agricultural assistance which are sensitive to the composition of agricultural output.

One possible approach to the design of agricultural assistance in the face of uncertainty about future events is to emphasize programs such as training and on farm water management whose success are less sensitive to uncertainty about future economic conditions. A second approach is to carry out a wide spectrum of agricultural research, which includes end products appropriate for a variety of environments, with the full understanding that some, perhaps most, of the products of research will not be economically viable in whatever environment happens to occur. Another component of the strategy is to build in capabilities for continuous program monitoring and redesign so that assistance efforts can be modified to reflect emerging conditions.

Prevailing Conditions: Wage Rates, Employment, Income, and Domestic Production
in an Economy Dominated by Internationally Mobile Labor and Goods

Economic conditions in Yemen are dominated by the international mobility of Yemeni labor and the mobility of international goods which flow into Yemen. This section identifies the expected effects of labor and goods mobility on Yemeni wage rates, employment, income and domestic production. Also identified are the implications of these results for the volume and composition of agricultural production in Yemen and for the design of an agricultural assistance program.

Employment opportunities for Yemeni are dominated by opportunities to work on the Arabian Peninsula. With the rapid growth of migration in the post-1972 period as Yemeni workers were lured outside the country by high wages, wage rates in Yemen have risen dramatically (see Table 10). In effect, wage rates in Yemen are determined by, and rise and fall in response to, wage rate changes on the Arabian Peninsula.

Even when wage rates are determined by outside influences, the levels of employment and production inside Yemen depend in large part upon local conditions. Since Yemeni wage rates are in effect determined by outside employment opportunities, the number of workers who choose to work in Yemen will be determined by the productivity of Yemeni land and capital stock and upon the demand for products such as services and specialized food crops (e.g., qat) which are unique to Yemen. Improved production techniques, and new products including fruits, vegetables, and qat which can compete with readily available imported goods, will result in increased employment in Yemen and reduced migration to jobs outside Yemen.

In an economy where unskilled labor is the single greatest productive asset, income of individuals is likely to be dominated by the level of the

wage rate. Thus, where labor is mobile, the most important influence on income is likely to be economic conditions in the receiving countries, conditions which are beyond the influence of events in Yemen. Under these circumstances relatively low family income can be traced directly to the lack of a sufficient number of able bodied males available to earn income for the family.

Assistance to the poorest of the poor in an economy with numerous job opportunities is not necessarily compatible with a commitment to increasing production and earned income. Since poverty can be attributed to a scarcity of available family workers, poverty must be attributed to large family size, poor health, age, preference, or lack of job opportunities. Only the latter can be alleviated by programs which increase production. If, for example, divorced women are discriminated against in village labor markets, special programs designed to assist these women as self-employed producers will help to raise their incomes. If farmers remain on the land to eke out a living because of a need to care for an ailing parent, to assist with management of family affairs, or because of a perceived inability to cope with problems which must be solved before outside employment can be found, a program of technical assistance to small farmers might allow them to increase their incomes¹. Even in these cases, however, abundant job opportunities nationwide will tend to ameliorate the plight of those with relative lack of opportunity. There is considerable evidence from many cultures that the relative position of those

¹ As a practical matter, when good jobs are abundant, it is very difficult to determine whether people remain in low paying jobs because of tastes or lack of opportunity. People who prefer the special diets, patterns of work and leisure, and traditional values associated with subsistence agriculture will choose to remain in the subsistence sector even if they knew how to find a job in Sana'a or Jeddah and if they did not suffer in those labor markets from discrimination. It is doubtful whether there exists data which would allow trained, objective observers to determine in many cases whether low income is due to tastes or to lack of opportunity.

who suffer discrimination because of race, caste, or marital status is most improved during periods when unskilled labor is scarce. When labor is scarce, employers find it extremely expensive to indulge their prejudices and consumers are less particular about who provides them with services. Also it should be noted that not everyone must leave their own communities to take advantage of expanded job opportunities. Migration by those most willing to relocate tends to create job opportunities in the sending communities, enabling those least willing to migrate to have access to either part-time or full-time high wage employment near home.

Consider the identity of the main beneficiaries of assistance efforts which raise production and earned income. Assistance which increases production (but which cannot alter wage rates) necessarily raises the incomes of immobile factors of production. For example, land rents rise as a result of natural resource conservation and the profits of entrepreneurs, including farmers, rise when they use more capital, more efficient technologies, or shift production to more profitable goods. Thus the principal beneficiaries of production-oriented assistance efforts are those who are likely to have sources of income from other factors in addition to their raw labor inputs.

Another point worth noting is that when employment opportunities are readily available, assistance programs are unlikely to make anyone significantly worse off. Anyone displaced from his occupation by the indirect effects of an assistance program will have access to other employment opportunities.

To summarize, when labor is mobile, job opportunities must be considered abundant. Under these circumstances, nonwelfare assistance programs are:

- (a) unlikely to affect the wellbeing of wage earners, a relatively large share of the population,
- (b) unlikely to lower significantly anyone's income, and

(c) likely to raise the incomes of owners of immobile factors and human capital, i.e., those relatively well off.

Labor mobility also has implications for the ability of Yemeni producers to compete in markets where goods are traded internationally. Migration and accompanying remittances result in abundant foreign exchange for purchasing imported goods. Yemeni producers of these internationally traded goods suffer doubly from migration due to the resulting high wage costs and the favorable terms of trade which make imported goods cheap relative to domestically produced goods.

The response of agricultural production to these shocks was to decline initially and then stabilize at approximately the production level of 72-73. Table 12 contains data on value added in 71-72 constant prices of the agricultural sector for the period 69-70 to 76-77. The data reveal a steady increase in production from 69-70 through 72-73 and a steady decline from 74-75 through 76-77. While national accounts data are not available for more recent years, production data on individual crops (see Table 4) reveal stability or moderate increases in output from 76-77 to 78-79. (If qat production were included, larger increases would result.) Revised data on fisheries output (see Table 8) reveals a sharp increase from 74-75 through 77-78. Recent data on livestock and forestries production is unavailable. Within the crops category there has been a substantial decline in production of sorghum/millet, barley, and cotton and sharp increases in production of maize, fruits, and vegetables.

The rate of growth of constant price nonagricultural value added accelerated between 72-73 and 76-77 to 13.4% annually in comparison with a 69-70 to 72-73 annual rate of growth of 9.0%. This rapid growth was led by the finance and banking sector with a 33% per annum rate of growth, construction at 17% per annum, trade at 14% per annum and government and industry at 13% annual growth rates.

It is apparent that increased work opportunities on the Arabian Peninsula after 72-73 had quite different effects on the agricultural and nonagricultural sectors. Agricultural output stagnated and nonagricultural production was stimulated to more rapid growth. As a result, agricultural output declined from 53% of Gross Domestic Product in 72-73 to 41% in 76-77.

Parallel events were occurring in sectoral employment. A World Bank Research Team has estimated that between February 1975 and February 1979 employment of Yemeni outside the country approximately doubled and nonagricultural domestic employment increased by 28%. During the same period agricultural employment declined by 13.5%. As a result of these changes agricultural employment declined from 57% of the national labor force to 40%.

The domestic production patterns of the last six years are precisely what one would expect when large increases in income are accompanied by greatly expanded availability of foreign exchange and on improved terms of trade. Rapidly expanding income results in large increases in expenditures. To the extent that consumers prefer goods readily available in foreign markets ("traded" goods in the jargon of the international economist), imports will rise and domestic producers of such traded goods as grains, meat, and cotton will find it very difficult to compete with foreign producers. Local producers of goods not readily traded internationally because of distance and time delays in delivery (i.e., "nontraded" goods) will experience a sharp increase in demand. The rapid expansion of the banking and finance, construction, trade, and government sectors fits this pattern well. A careful examination of industrial expansion reveals that its growth is largely attributable to expansion of soft drink bottling and ice cream and biscuit manufacturing, industries which receive substantial natural protection from imported goods. The change in the composition of agricultural production (declines or stagnation in

cereals, cotton, coffee, and meat and large increases in qat and fresh fruits and vegetables) also are consistent with anticipated patterns.

Whether differential growth rates between agricultural and nonagricultural sectors continue depends in part on whether the adjustment to the disturbance of 1973-75 is largely completed. It is reasonable to conclude that the process of adjustment to the disturbances of 73-75 is well advanced. As a consequence, there is reason to believe that growth rates for domestic agricultural and non-agricultural production will tend to converge, provided there are no further disturbances.

Differential growth rates can be expected to persist if foreign earnings and remittances continue to grow. If labor force growth in Yemen continues, if labor productivity in agriculture stagnates, and if real wages on the Arabian Peninsula remain constant or rise, there will be tendency for additional emigration. Additional foreign earnings and remittances will lead to further increases in the demand for nontraded goods, allowing those sectors to continue to grow. With agricultural productivity stagnant and induced demand for nontraded goods growing because of growing remittances, differential growth rates will continue. On the other hand, if remittances, the driving force in economic development over the last six years, stabilize and agricultural productivity is also stagnant, economic growth will end.

A key implication of this analysis is that continued growth of the Yemeni economy requires a leading sector whose rate of expansion will spill over into other sectors. One possible source of this growth is continued expansion of remittances. In the absence of continued increases in remittances, another engine of expansion is needed. Continued expansion is most likely to come from increased productivity in some sector which will allow that sector to lower prices and thereby expand its market share. If this expansion of production

replaces imports and/or if it can succeed in increasing exports, it can generate increases in aggregate production and income which will spill over into increased demand for nontraded goods, thereby stimulating additional production and economic growth.

There are several reasons why one might expect the agricultural sector to be the most likely source of productivity changes and growth in the Yemeni economy in the future. One reason is the large increase in productivity in the recent past. While value added in agriculture has apparently remained approximately unchanged in comparison with 72-73, there have been large declines in the agricultural labor force. Employment in agriculture declined 14% between 1975 and 1979 (and surely by more between 1973 and 1979 although this must remain conjectual since labor market estimates for Yemen were first made in 1975 in conjunction with the first census in modern times). Consequently, labor productivity in agriculture has shown substantial improvement in the last decade. Increased access to groundwater and modern diversion dams in wadis have surely contributed to this productivity together with more mechanization and improved agricultural techniques. This rate of innovation is likely to continue, particularly if judicious amounts of technical assistance are made available to Yemeni farmers.

The prospects for increased agricultural production seem brighter than those for industry. While there undoubtedly are some opportunities for industrial outputs which can substitute for imports, the vicious cycle of economies of scale coupled with the relatively small Yemeni market will surely limit those opportunities. Agriculture, on the other hand, seems less hampered by the existence of small units. Yemeni farmers have demonstrated their ability to use small plots to produce profitably fruits, vegetables, and qat.

It can also be argued that agricultural producers are better equipped than

industrial producers to use successfully the largely unskilled Yemeni labor force. Small amounts of technical assistance in agriculture are more likely to increase the productivity of Yemeni workers than would a similar amount of assistance in training workers for urban jobs. Management of industrial enterprises also requires a much larger change in Yemeni skills than does agricultural management, where small improvements in skills in areas already familiar to farm decision makers can result in large output increases. Then too there are substantial social costs associated with industrial expansion. Such expansion requires changes in lifestyle and large capital investments in housing and public services which would be unnecessary if workers remained in their villages. The relatively small amounts of capital required for increases in agricultural productivity (in comparison to industrial requirements) can more easily be generated by the imperfect capital markets which exist in Yemen. (For an analysis of Yemeni capital markets see Section 4.3 of the Baseline Study Field Report.) Many farm families have the option of sending temporarily a family member to Saudi Arabia to generate the funds needed for investment. For all these reasons, agriculture appears more likely than industry to serve as an engine of further economic growth. Growth in agriculture also seems more desirable to the Yemeni as evidenced by the tentative objectives established for the Second Five Year Plan.

As long as wage rates remain high and imported food is available at low prices, assistance to the agriculture sector is likely to be most successful if it concentrates on helping Yemeni farmers to economize on scarce factors, including labor and water, and in producing crops for which Yemeni producers have some protection from the rigors of international competition. Among the latter are fresh fruits and vegetables produced for Yemeni and western Saudi Arabian markets. Also included are lambs and poultry marketed live in Yemen.

In these markets distance and time delays provide substantial protection from competition with foreign markets. Technical assistance which allows Yemeni farmers to raise output per person and output per cubic meter of water will allow Yemeni farmers to economize on scarce resources and thus permit them to compete in markets for agricultural products.

It was suggested above that technical assistance to agriculture offers the best opportunity to increase production in Yemen. An alternative would be to support basic and vocational education programs which would increase the ability of the Yemeni to earn higher incomes anywhere on the Arabian Peninsula, including Yemen. It is conceivable that helping Yemeni to learn the three R's and technical skills like welding and auto repair will equip them to earn higher salaries outside the country than they could earn by remaining in agriculture in Yemen. An added advantage of this approach is that the skills can be utilized either in Yemen or elsewhere while payoffs to agricultural technical assistance are dependent on the assumption that those obtaining the skills will remain in agriculture.

Choosing between these alternative types of assistance is not easy. While plausible arguments for either can be made, it is impossible to quantify economic costs and benefits of each approach with sufficient accuracy to permit a choice between them. In addition, the two approaches have different implications for the nature of society in the future. The basic vocational education program equips recipients to live in an urban environment, perhaps outside Yemen. Technical assistance to agriculture has, on the other hand, a rural bias with emphasis on production in Yemen. Thus, in addition to possibly different conventionally calculated cost-benefit ratios, the two approaches are likely to encourage quite different patterns of social and economic development.

First Alternative Scenario: Decline in Opportunities for
Employment on the Arabian Peninsula

The preceding section identified some of the effects of an increase in opportunities for employment on the Arabian Peninsula. Included were rising real wages and an improved terms of trade for Yemen, diminished incentives for agricultural production in Yemen, incentives for introducing labor saving technologies, and a bias in agricultural production toward products which are most protected from foreign competition by distance and time delays in shipping. In this section we consider the implications of declining real wages (for unskilled labor on the Arabian Peninsula and/or a deliberate Saudi policy of reducing the number of Yemeni workers allowed to enter Saudi Arabia. There is evidence that real wages for unskilled labor on the Arabian Peninsula are beginning to level off. Some analysts believe that there is a significant probability that within the next five years the Yemeni economy will experience the effects of declining real wages earned by migrant laborers and/or limits on the number of Yemeni workers in Saudi Arabia¹. In this section we consider the implications for agricultural assistance of such an event. Here we consider only the equilibrium effects of declining real wages and ignore the implications of gradual versus abrupt changes in opportunities for migration, transitional balance of payments difficulties, and the possibility of imposition of exchange controls or changes in the effective protection afforded by tariff rates. The effects of these adjustment problems will form the basis for the next scenario.

¹ For the flavor of the debate over the future prospects for migration opportunities, see Near East Labor Migration: Implications for AID Policy, Proceedings of a Conference held in Washington, June 5-6, 1979. For further discussion of prospects, see Lee Ann Ross, "Current Trends in Yemeni Remittances and Migration," November, 1979.

Among the likely effects of declining opportunities for migration are

- (a) Falling real income for every individual for whom the sale of labor is an important source of income.
- (b) Increased needs for foreign assistance to support income.
(Note, however, that no form of assistance will affect the earnings of unskilled laborers as long as Yemeni wage rates are dominated by Arabian Peninsula rates.)
- (c) Increased unemployment during the transitional stage which may become permanent if some workers are unwilling to work for lower wages.
- (d) Expanding domestic production and employment as local producers take advantage of cheaper labor and the increased demand for locally-produced goods due to a deterioration in Yemen's terms of trade.
- (e) Increased agricultural production with special incentives for exportable and import substitute products. (For a list of Yemen's food imports, see Table 13. Among the most important are fruits and vegetables, cereals, meat, and dairy products.)
Indeed a brief review of the Yemeni economy reveals few potentially exportable products outside the agricultural sector.
For the foreseeable future all Yemeni imports must be financed by remittances, donor assistance, and agricultural exports.
- (f) A movement toward labor intensive crops and methods and reduced incentives for mechanization and consolidation of farming units.
- (g) A slowdown or reversal of the trend away from subsistence agriculture.
- (h) Increased production on marginal lands.

- (i) Reduced competitiveness of agricultural products which are dependent upon imported components such as tractors, fuel, irrigation hardware, chemical fertilizers and pesticides, baby chicks, and livestock feeds.

Agricultural assistance efforts appropriate for this scenario differ somewhat from those appropriate for the preceding scenario. This scenario requires more assistance to subsistence farmers and more emphasis on cereals and meat production. A farming systems approach to extension assistance must emphasize crops and technologies appropriate for a lower wage economy. Assistance for production of fruits and vegetables remains important because of export and import substitution possibilities. Assistance to farmers in economizing on water use is largely unaffected by the alternative scenario, since water will remain a scarce factor in either scenario.

Second Alternative Scenario: Decline in Opportunities for Employment on the Arabian Peninsula Result in Discriminatory Foreign Exchange Controls or Changes in Tariff Structure

As the preceding scenario indicated, falling wages on the Arabian Peninsula can be expected to result in lower income for all Yemeni workers, whether employed inside or outside the country. Reduced remittances and a deteriorating balance of payments can also be expected. The manner in which Yemeni authorities respond to the deteriorating balance of payments and the resulting loss of foreign exchange reserves can have a significant effect on the size and composition of agricultural production. These possible effects are identified in this section.

The implicit assumption of the preceding scenario was that loss of foreign exchange reserves did not change the relative incentives for production of

export goods versus import substitutes. It also assumed that the tariff structure which affects the distribution of production between agricultural and non-agricultural products remains unchanged. Balance-of-payments adjustment which avoids these complications could be achieved either by a devaluation of the Yemeni rial to halt the losses of foreign exchange reserves or by a monetary policy which allows the money supply to decline as foreign exchange reserves decline, a policy which will eventually result in lower domestic prices and balance-of-payments equilibrium via the classic price-specie-flow mechanism originally described by David Hume. Note, however, that the government may find it difficult either to devalue the rial or to allow the money supply to decline. Neither option is pleasant.

Achieving a decline in the money supply will be particularly difficult given the existing structure of government revenues. Declining wages mean less income and, ultimately, fewer imports. Government revenues, however, are heavily dependent upon customs receipts. Thus, declining wages will likely result in declining government revenues. The government will find it very difficult to bring about a corresponding decrease in government expenditures at the precise time that returning migrants will be clamoring for public sector jobs. The government will be pressed to create money to finance government deficits, an action which exacerbates the loss of foreign exchange reserves.

Devaluation will not be popular either. Devaluation necessarily results in higher import prices, including the price of imported food, and a further decrease in the standard of living. In the worst case, the decline in government revenues results in permanent government deficits and a continued increase in the money supply, which in turn results in higher prices, continuous balance-of-payments deficits and chronic currency devaluation.

Difficulties in controlling the loss of foreign exchange reserves may lead

to changes in tariff structures or to exchange controls which in turn affect incentives for agricultural production. In order to avoid the rise in imported food prices which results from devaluation, the government may attempt to deal with the loss of foreign exchange by imposing a system of exchange controls which gives preferential treatment to food imports or by resorting to higher import duties on nonfood imports. Either policy alternative reduces incentives for the production of agricultural products for both export and import substitute markets. By keeping the price of imported food artificially low, production of import substitutes is discouraged. By not allowing the rial to depreciate, potential producers of exportable goods are not encouraged. The net effect of either of these policies would be to encourage production of non-agricultural import substitutes as a method of solving the balance-of-payments problem. The implications of such a policy for agricultural producers are clear. Agricultural producers would face lower wage rates than that under the current high wage, high remittance scenario, but product prices would be similar.

Another possibility is that the government will resort to across-the-board tariff increases or to exchange control systems which treat all types of imports evenhandedly. These policies will create incentives for the production of import substitutes of both agricultural and nonagricultural products while creating few incentives for production for export markets. Yet another option is that the government will adopt a new tariff structure which tends to equalize tariff rates by raising rates on currently exempt categories (primarily food imports). Equalization of tariff rates would raise tariffs on food imports and result in especially strong incentives to agricultural producers of import substitutes.

A final consideration comes from recognizing that certain agricultural

producers rely heavily on imported inputs, including tractors, fuel, irrigation apparatus, chemical fertilizers and pesticides, and mixed feeds. Any changes in tariff structure or the imposition of discriminatory exchange controls could have drastic effects on profit opportunities if policy changes discriminate against imported inputs.

To summarize, the government's response to loss of foreign reserves is a key determinant of incentives for agricultural producers. Money supply reduction and currency devaluation tend to create comparable incentives for producers of import substitutes and exports. Since agricultural producers are likely to be more responsive to these incentives than are producers of non-agricultural goods, one can expect a substantial increase in agricultural production. Exchange controls and discriminatory tariff increases create few incentives for export producers and are likely to provide the greatest incentives to producers of nonagricultural import substitutes. Indeed, studies of alternative foreign trade regimes reveal that the government's approach to foreign exchange crises is one of the most important determinants of the size and structure of the agricultural sector¹.

An understanding of how the agricultural sector is affected by the government's response to loss of foreign exchange reserves is an important input into the design of agricultural assistance. One contribution of foreign assistance efforts would be to help Ministry of Agriculture officials understand that foreign trade systems which subsidize food imports can have devastating effects on incentives for domestic agricultural producers. The designers of assistance efforts must also recognize that different exchange rate systems can have very important effects on the volume and composition of agricultural production. If

¹ See, for example, the National Bureau of Economic Research Studies of Foreign Trade Regimes edited by J. Bhagwati and A. Krueger.

policy changes precipitated by foreign exchange crises are a realistic possibility, designers of assistance programs should attempt to predict what policy responses will be in order to develop in advance agricultural assistance efforts which will be most useful.

Third Alternative Scenario: Change in Assistance Support from Foreign Donors

Grants and low cost loans are an important source of foreign exchange inflows into the Yemeni economy (see Table 14). Most of these funds flow to the government, which uses them to finance construction projects and as general budget support. Since the construction and government services sectors absorb directly few imported components, the effects of an increase in assistance funds is to increase government expenditure levels and eventually to increase domestic employment and domestic production. This section explores the indirect effects on agricultural production of changes in the level of foreign assistance.

Changes in foreign assistance levels would affect Yemeni agricultural producers primarily through two channels, by altering the terms of trade and by domestic employment effects which may alter wage rates. Increased assistance brings in foreign exchange, improves the terms of trade, and therefore reduces the prices faced by Yemeni agricultural producers. Increased assistance flows also create more nonagricultural employment opportunities in Yemen. Whether this increased demand for construction workers and government employees raises the domestic wage rate depends on the elasticity of supply of migrants. If Yemeni workers will change location for the slightest change in Yemeni/Arabian Peninsula wage differentials, an increase in employment opportunities in Yemen will simply result in the return of migrants with no change in wage rates paid by Yemeni employers. If, on the other hand, the supply of migrants is not

perfectly elastic, increased opportunities for government employment will result in higher wages in Yemen and incentives for Yemeni workers to leave agriculture. In the latter case, agricultural production will be further reduced beyond the depressive effects of a change in the terms of trade. To summarize, increases in foreign assistance tend to have similar qualitative effects on agriculture and on the design of agricultural assistance efforts as do increases in opportunities to work outside Yemen.

Decreased assistance flows will have opposite effects on the terms of trade as those identified above. Reduced aid will also reduce domestic employment and perhaps also wage rates if the government responds to reduced aid by cutting government expenditures. Each of these changes will indirectly stimulate agricultural production.

Decreased assistance flows may also lead to the kinds of adjustment problems identified in the Second Alternative Scenario. If the government is slow to reduce expenditures by the same amount as the reduction in foreign assistance, government deficits will occur. If these deficits are financed by money supply changes and/or if the government is reluctant to devalue the currency, balance-of-payments adjustment problems are likely to occur. As was indicated in the discussion of the Second Alternative Scenario, the government's response to the adjustment problems can have profound impacts on agricultural producers and hence on the design of optimal agricultural assistance programs. These impacts depend on the nature of the government's response. For a detailed discussion of some key alternatives, see the discussion contained in the section entitled Second Alternative Scenario.

Fourth Alternative Scenario: Forced or Self-Imposed Food Self Sufficiency

Within Yemen there is concern about the country's heavy dependence on

food imports. One of the stated objectives of the First Five Year Plan is a reduction in dependence on food imports. It is conceivable that the YARG will take meaningful steps to achieve food self sufficiency. Another possibility is that political conflict could result in a cutoff of food imports and force Yemeni consumers to depend entirely on domestic food sources. This section explores the implications of these possibilities for the size and composition of Yemeni agricultural production.

Whether the movement toward food self sufficiency occurs because of subsidies to food producers, tariffs on food imports, exchange controls which discriminate against food imports, or outside forces which interdict food shipments, the effects on Yemeni agricultural producers will be similar. Food prices, especially for items currently imported (see Table 13 for a list of these products) will rise sharply. The net effect will be to greatly increase incentives for the production of import substitutes. Under these conditions agricultural assistance to producers of crops and livestock could be expected to have large payoffs in the form of increased agricultural productivity.

Fifth Alternative Scenario: Gradual Abandonment of Preferences
for a Subsistence Lifestyle

It is evident that substantial numbers of Yemeni have a strong affinity for the way of life associated with subsistence agriculture. Elements include preference for one's own milk, meat, and bread and for the work and leisure patterns associated with traditional agriculture. For many Yemeni farmers agriculture does not offer the best economic opportunity available. Agricultural activities on these farms continue because at least some family members prefer it to other viable alternatives. In this section we investigate the implications of the gradual loss of this affinity.

Suppose that with the passage of time and of generations, preferences for the traditional way of life centering around agriculture declines. The result will be abandoned farms, farm consolidation and/or more extensive farming practices with fewer manhours per hectare. Such a result will not necessarily mean reduced agricultural production. Since the farmers being replaced are the ones least likely to adopt efficient agricultural practices and to use capital intensive methods and those who take over their lands are likely to be the most progressive farmers, it is conceivable that agricultural production will rise. Certainly labor productivity in agriculture will rise and water will be used more efficiently. These more progressive farmers will better utilize extension services. They are also more likely to produce cash crops and to abandon the subsistence pattern of sorghum, a cow, sheep, and goats.

Sixth Alternative Scenario: Gradual Abandonment
of Preferences for Local Meats and Cereals

The previous scenario recognized that some Yemeni prefer the lifestyle associated with production primarily for their own use. There are other Yemeni working for wages who retain a strong preference for locally produced agricultural products. Some of these people assert that animals and grains from their own villages and regions "taste better" than imported products or products from other regions in Yemen. Still others prefer for religious or sanitary reasons to purchase live animals and have these animals slaughtered in their own presence. In this section, we investigate the implications of a gradual vanishing of these preferences.

Preferences for local products help protect local producers from nonlocal competitors. The result is price differentials in favor of local products, more incentives for local production, increased total domestic agricultural

production, and a bias in composition of output toward those products for which local preferences are greatest. Indeed it can be argued that strong Yemeni consumer preferences for domestically produced cereals, meat, and milk helps explain why Yemeni production of cereals and livestock has held up so well in the face of competition from the world's most efficient producers of cereal grains and meat.

A gradual abandonment of preferences for local products reduces and finally removes the protection afforded to local producers. The result would be reduced total agricultural output with a particularly sharp decline in production for those products (including sorghum, wheat, lamb, and poultry) which previously enjoyed the protection afforded by preferences for local products. In this event agricultural producers would require substantial assistance in the form of cost reducing innovations just to maintain current production levels.

Seventh Alternative Scenario: Deterioration of Soil and Water Resources

There exists a potential for substantial natural resource deterioration in Yemen. Recently available tubewell technology and the resources to finance well drilling have led to falling water tables and the possibility that limited water resources will be depleted. Rising real wages appear to have reduced efforts to repair terraces, creating the possibility of accelerating erosion and accompanying destruction of previously valuable capital assets. This section identifies the implications of these possibilities for total agricultural production, for the regional distribution of production, and for assistance efforts.

A reduction of soil and water resources will surely tend to reduce agricultural production. Soil erosion will impact the traditional agricultural

areas, the mountainous terraced areas where rainfed agriculture thrives. (The forces of erosion could conceivably extend to the lower wadi areas and extensively damage spate irrigation production there.) Depletion of groundwater, on the other hand, will impact the new agricultural areas where output per hectare is highest.

An obvious implication for assistance efforts is to assess whether deterioration of natural resources is a serious problem and, if so, to design efforts to slow down or reverse resource erosion. Proposals which address these problems have been developed by CID Design Teams. Among these proposals are a research design for assessing terrace erosion as well as the proposed water inventory, water policy, and watershed management demonstration activities described in the Agricultural Water Resources Draft Projection Identification Document. Another possible implication is that deterioration is irreversible and, therefore, assistance to the agricultural sector would be fruitless.

Summary of the Effects of Different Scenarios on the Volume and Composition of Agricultural Production

The preceding discussion of alternative scenarios may have left the reader bewildered by the array of possibilities. This section identifies similarities and differences among the scenarios in the patterns in the volume and composition of agricultural production which they generate.

There are striking parallels in the implications for the volume and composition of agricultural production among the Prevailing Conditions Case and the First, Second, Third and Fourth Alternative Scenarios. Both the Prevailing Conditions Case and the increasing foreign assistance aspect of the Third Alternative Scenario tend to reduce incentives for agricultural production and to direct remaining production toward output for which distance, time delays,

and preferences provide considerable protection from competition with foreign producers. The First Alternative Scenario and the decreasing foreign assistance aspect of the Third Alternative Scenario are the opposites of those cases. They create additional incentives for agricultural production and make it easier for Yemeni producers to export specialized products and to compete against foreign producers of cereals and livestock. The Second Alternative Scenario emphasizes that the volume and composition of increased production is heavily dependent upon the policy the government uses to deal with the problems of rising food prices and declining foreign exchange reserves. The Fourth Alternative Scenario (Forced or Self-Imposed Food Self Sufficiency) results in increased agricultural production with special incentives for producing import substitutes. These results are much like those of the Second Alternative Scenario when the government chooses to deal with the problem of declining foreign exchange reserves by increasing tariffs on food imports.

The effects of the Fifth, Sixth, and Seventh Alternative Scenarios have little in common either with each other or with other scenarios. They are indeed special cases which have unique effects on the volume and composition of agricultural production.

Summary of the Implications of Alternative Scenarios for Agricultural Assistance Efforts

A key implication of the preceding analysis is that different scenarios have differing implications for the volume and composition of agricultural production. Agricultural assistance efforts, whose success will depend on the economic and social forces which affect the volume and composition of agricultural production, should surely be based on whatever information is available about underlying economic trends. In this section we assess the sensitivity

of success of particular assistance programs to underlying socio-economic trends. Among the types of assistance considered are institutional support to the Ministry of Agriculture, particularly in the area of policy planning and analysis, support for agricultural secondary schools, for a university faculty of agriculture, and for short and long term out-of-country training, for water resource inventory and policy, and for direct assistance to farmers in the form of improved on-farm water management, technical assistance in selecting improved farming systems (including cropping patterns and optimal use of fertilizer and other factors), in identifying improved seeds and soil fertility practices, and watershed management.

If observers evaluate the success of particular programs by monitoring total agricultural output, program success will be assured for any of the scenarios which result in increased agricultural production. If performance is measured in this way (an hypothesis which cannot be rejected out of hand), program planners should concentrate on forecasting underlying socio-economic trends and then provide assistance only if their forecasts indicate that conditions are appropriate for expanding agricultural production.

A more subtle way to measure program performance is to compare what agricultural production for the appropriate scenario would have been with and without the program and use the difference to measure program performance. Even when performance is measured in this way, assistance programs are more likely to be judged successful if underlying conditions are favorable for agricultural production. One reason for this is that farmers are more likely to be receptive to improved agricultural techniques and cropping patterns when their economic situation is improving than when it is deteriorating. Another reason is that favorable conditions for agricultural production are associated with lower wages and fewer employment opportunities. Under those circumstances the

government will find it easier to attract and retain qualified employees, thus making institution building efforts more successful.

The design of direct assistance to farmers is particularly sensitive to the underlying determinants of labor costs and composition of output. This is true when agricultural assistance takes the form of development of new seeds and plants and extension assistance with cropping patterns and other agricultural practices. Those who offer extension assistance must be fully aware of cost conditions and relative prices of different outputs faced by their clients if they are to provide effective assistance. The value of newly developed seeds and plants also depends very much on the profit opportunities for those particular products. Direct assistance in the form of improved on farm water management techniques is, on the other hand, relatively insensitive to the relative prices of different outputs. Farmers will welcome and presumably adopt improved water management techniques no matter what crops they happen to be producing on irrigated land.

Assessing the Probabilities of Alternative Scenarios

It is apparent that the optimal design of agricultural assistance programs as well as their likely success when measured conventionally depends heavily upon the underlying socio-economic conditions which will prevail in the future. There is a considerable premium to be achieved from accurately forecasting future conditions. This section contains some tentative forecasts and offers some estimates of the reliability of those forecasts.

There exists considerable controversy over the future of work opportunities on the Arabian Peninsula. Underlying these controversies are major disagreements over future Saudi Arabian policies. Included are disagreements over the size and direction of Saudi development plans, over Saudi intentions to replace

Yemeni workers with lower cost Asian contract laborers, and over the possibility that Saudi Arabia for political reasons may decide to deport large numbers of Yemeni workers¹.

This author will offer three alternatives for the future of real wages on the Arabian Peninsula together with the author's subjective probability for each alternative. These are, for the next five years²,

- (a) little if no change in existing real wage levels and opportunities for migration. Probability = .4,
- (b) relatively slow but steady decline in real wages and opportunities for migration. Probability >.5,
- (c) a sharp decline in opportunities for migration, most likely precipitated by political events in Saudi Arabia. Probability <.1.

These estimates suggest that further increases in real wages are very unlikely, that the most likely event is slow but steady decline in real wages, and that one cannot dismiss the possibility that opportunities for migration will be abruptly cut off.

Likely changes in opportunities for migration are not the entire story. Complementary scenarios include the likely assistance levels of outside donors. In the absence of sharp declines in real income in Yemen, real assistance levels will decline as donors slowly adjust their allocations to the rapid increase in Yemeni income which has occurred during the last decade. Thus the most likely joint scenario is that both migration opportunities and real levels

¹ For a summary of these issues together with conflicting estimates of probabilities, see the Conference Proceedings on Near East Labor Migration: Implications for AID Policy.

² For a similar formulation, see Lee Ann Ross, "Current Trends in Yemeni Remittances and Migration," USAID/Sana'a, November 1979.

of assistance will decline slowly. If migration opportunities decline precipitously, real assistance levels might possibly rise to offset the depressive effects of loss of migration opportunities. This assumption is surely appropriate for all donors except one. It may or may not be appropriate for assistance from Saudi Arabia, the largest single donor. One can imagine circumstances in which Saudi Arabia would simultaneously expel Yemeni workers and increase assistance levels and still other circumstances in which the Saudis would expel Yemeni workers and halt assistance payments.

The combined probabilities for foreign assistance and migration opportunities have clear implications for incentives for agricultural production. The likely joint events are:

- (a) stable real wages and declining real foreign assistance, leading to slight increases in incentives for agricultural production,
- (b) slowly declining real wages and stable to slowly declining levels of real assistance which result in somewhat larger increases in agricultural incentives than specified in event (a),
- (c) sharply declining opportunities for migration which are partially offset by rising assistance levels, leading to sharply increased incentives for agricultural production.
- (d) a simultaneous cutoff of migration to Saudi Arabia and Saudi assistance, which results in very sharp increases in incentives for agricultural production.
- (e) each of (a) - (d) with incentives for increased agricultural production dampened but not entirely diminished by foreign trade regimes which attempt to perpetuate cheap food imports.

To summarize, the directional implications for agricultural production of likely future changes in real wages and assistance levels are clear. These

changes are quite likely to lead to increased agricultural production with the extent of the increase varying from slight to extremely large. The extent of the increase could very well depend on whether the YARG uses exchange controls and/or changes in tariff structures to dampen increases in food prices.

The implications of other possible scenarios (4th-7th) can be assessed more briefly. A movement toward forced or self-imposed food self sufficiency is rather unlikely, with a probability of less than .1. If this movement were to occur, it would result in greatly increased incentives for agricultural production. This author judges that gradual abandonment of both preferences for a subsistence lifestyle (Fifth Alternative Scenario) and for local meat and cereals (Sixth Alternative Scenario) are inevitable. These changes in preferences, however, are likely to occur slowly enough that they will be relatively unimportant to planners for the next five - ten years. Probabilities of serious deterioration of soil and water resources will not be estimated in this paper. Both matters are scheduled for further study in the near future, so assessments will be deferred until additional information becomes available.

The implications of these likely events for the composition of agricultural production are less clear. This is particularly true for relative incentives to produce exports versus import substitutes. As was indicated in the discussion of the Second Alternative Scenario, the government's policy response to the loss of foreign exchange reserves will be a critical determinant of these relative incentives. This author is unwilling to offer forecasts of what those policy responses are likely to be. In addition, there is some difficulty in forecasting exactly which import substitutes will expand most rapidly. Important imports include meat, wheat for human consumption, and a wide range of fresh and preserved fruits and vegetables. The problem is to determine whether consumption patterns will change as real income falls. Will Yemeni consumers go

back to eating sorghum bread or will they continue to insist on wheat bread, large amounts of animal protein, fruits, vegetables and qat? While we would dearly like to know the value of these important income elasticities, it is unlikely that they can be estimated from existing data series which reflect periods of rising, not falling real income.

Possible Approaches to Assistance Planning When the Future is Uncertain

The implication of the preceding section is that while there exists some information about future prospects for Yemeni agriculture, there is not nearly enough information to allow designers of agricultural assistance to identify precisely the payoffs from all the alternative assistance programs which are feasible. In this section we consider the problem of planning under uncertainty and examine the options which are available.

Consider the circumstances under which perfect information about future agricultural prospects would result in better design decisions for agricultural assistance programs. One circumstance is when net benefits are sufficiently sensitive to different information so that net benefits are positive under one information set and negative with an alternative information set. Under these circumstances the information used to design an assistance program will affect the "go, no go" decision. From a decisionmaking point of view, superior information is valuable (i.e., worth the use of valuable resources) in these circumstances.

Another circumstance in which information is valuable is when it allows one to choose between two designs with positive net benefits. For example, consider a choice between allocating resources between sorghum research and horticulture research. It is conceivable that under one scenario sorghum research yields the greatest net benefits while under an alternative scenario

horticulture research delivers maximum net benefits. The choice among different types of sorghum research may also depend on underlying socio-economic trends. Under some conditions sorghum varieties with high grain yields will be preferable while under other circumstances varieties with high fodder content will be most valuable. The optimal direction of breeding programs depends on, among other things, income levels, income elasticities for meat consumption, for sorghum for human consumption, and the level of protection from foreign producers which Yemeni farmers receive on grain versus livestock production. Accurate socio-economic forecasts makes it possible to choose intelligently among alternative research programs.

In general, superior information will contribute most to program design when long lead times are involved and/or when decisions are not easily (i.e., cheaply) reversed. Examples include research programs like plant breeding and fertilizer trials. If valid trials require three - four years for completion, one would want to test ranges of fertilizer applications which will be economically relevant given fertilizer prices five to ten years in the future. Also included are decisions by farmers to make large capital investment decisions which are costly to reverse, e.g., establishing orchards, enlarging fields, purchasing tractors, acquiring specialized irrigation equipment and structures, and major terrace construction and repair. If extensionists are to retain their credibility with farmers, they must be careful not to encourage the planting of orchards if the prices of fruit are likely to fall significantly before the orchard reaches peak production. Assistance to the YARG in policy planning and analysis will also benefit from superior forecasts if most YARG policy choices are decisions about the volume and composition of public investment.

The design of other types of assistance may not be so sensitive to medium to long range forecasts of socio-economic variables. Assistance to farmers in

choosing between planting tomatoes and sorghum is not likely to be sensitive to much more than the expected relative prices of tomatoes and sorghum for this year and to the farmer's confidence in the extension agent's ability to help him solve the problems of successfully producing tomatoes. While farmers would obviously prefer assistance which provides them with completely reliable one to two year price forecasts, they may not require such information before planting. Any farmer with cash crop experience has learned to cope with such uncertainties. Neither are education and training programs very sensitive to such forecasts. The objective of most programs is to teach principles and develop basic skills which allow the person to function efficiently in a wide range of environments.

Since uncertainty about future conditions is surely inevitable, it seems best to consider alternatives for decisionmaking under uncertainty. It is useful to consider two strategies. The first strategy could be characterized as one-for-all decisionmaking based on most likely alternatives. A caricature of this approach to program design consists of comprehensive studies which lead to cost estimates under most likely future conditions. The next stage is to design a program based exclusively on the scenario judged most likely to occur. At this stage the program is exhaustively set out in detail and launched with no further provision for monitoring and redesign. In effect the design team creates a detailed life-of-program workplan based on most likely future conditions, a workplan which is never altered. A second strategy is to deliberately design a program which recognizes that uncertainty exists. One component of the program consists of a wide spectrum of research, including end products appropriate for a variety of environments. The designers fully recognize that some, perhaps most, of the products of research will not be economically viable in whatever environment happens to occur. Another

component of the strategy is to build in capabilities for continuous program monitoring and redesign. Elements would include contractual flexibility to modify programs and a team of specialists with the skills required to continually monitor programs and the judgement required to determine when redesign is desirable. Finally, the program should be applied at the farm level by a team skilled in applying a farming systems approach to extension efforts. This includes the ability to adjust technical assistance to the current and prospective environments.

Agricultural Assistance as Insurance Against Possible
Events Which Will Reduce Yemeni Income

In all but one of the scenarios discussed above, disturbances leading to decreases in aggregate real income tended to be cushioned by increased agricultural production, and events generating increased income depressed agricultural production. The only exception to this pattern was deteriorating natural resources, which reduced both agricultural and total income. These patterns reveal that when economic conditions deteriorate, agricultural production contributes to stability by providing a floor below which total production will not decline. The insurance aspects of assistance to agriculture as helping to provide a floor for total production and earned income is considered in this section.

The goal of food self sufficiency as protection against foreign political and economic pressures illustrates the key role of agriculture. In the event that food imports were embargoed, food consumption would decline with the depth of the decreases determined by the responsiveness of the agricultural sector to the increased production incentives which are sure to appear. If an effective agricultural assistance program were already in place when the

embargo on food imports occurred, the inevitable decline in living standards would be cushioned.

Less dramatically but more realistically, an enlarged agriculture sector would also serve to cushion the depressive effects on the Yemeni economy of a reduction in work opportunities in Arabian Peninsula countries. A reduction in work opportunities would result in rising unemployment and a deteriorating terms of trade as remittances declined. The reduction in earned income and rising prices of imports, including food, due to the deteriorating terms of trade would deal a double blow to the Yemeni standard of living. The extent of rising food prices and unemployment would be determined in large part by the capacity of the agricultural sector to absorb returning workers and to use them to produce food. Appropriate agricultural assistance in advance of such an event would surely soften the decline in the Yemeni standard of living.

The role of agricultural producers in ameliorating the effects of a decline in remittances is not limited to their ability to produce import substitutes at reasonable prices. If remittances were to decline sharply, Yemen would be forced to increase exports in order to continue to pay for necessary imports such as fuel and other raw materials. The agricultural sector seems to possess greater export potential than any other sector of the economy, excepting, of course, the potential for exporting labor services.

Finally, the agricultural sector appears to have a lower import content than any other productive sector in Yemen. As a result its production costs will rise less in response to a deteriorating terms of trade than the costs of other sectors. For this reason as well as others mentioned above, expansion of the agricultural sector offers the best insurance against the most likely sources of income decline.