
Chapter VIII

International Dimensions of Research

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International Dimensions of Research

Until the 1930's, the U.S. food and agricultural research system was concerned almost wholly with domestic problems. Immediately following World War II, however, changing world conditions caused agricultural research to be viewed in a broader international setting. There are several reasons why this viewpoint has become even more important over the past 30 years.

The United States is becoming increasingly dependent on the developing nations for a growing amount and diversity of food imports (largely noncompetitive) and raw materials. For these countries to continue to assist the United States they must have economic and political stability, and one way that the United States can assure such stability is to help them meet their own increasing food needs (caused by rapid population growth and rising incomes).

Another reason for strengthening the international research and technology base of poorer nations is to assist them in producing more of their basic food needs. This is in their own best interest, but is also of value to the United States to the extent that it enables the Nation to cut down on foreign food aid. Since the end of World War II, the United States has spent about \$30 billion to alleviate starvation among these nations (Furtick, 1981). Because of rapidly rising world population, decreasing self-sufficiency, and increasing commodity prices, the annual food-aid cost is rising sharply and could become an impossible burden for the United States and other donors.

Helping the developing nations to improve their economic standing will, in turn, aid in opening up vast foreign markets for U.S.-produced goods. Now, as never before, we need

added trade to offset the decline in balance of payments caused largely by burgeoning oil imports. Serious disincentives for the American private sector make expanded foreign trade difficult or unattractive.

Yet another reason for stressing expanded international involvement in agriculture is that there is much the United States could learn from agricultural research conducted in the rest of the world. Once the United States was far ahead of the rest of the world in the scope of agricultural research achievements; but in recent years, this status has declined significantly as the U.S. agricultural research system has languished and the systems of other nations have advanced. There is an increasing amount of research available, which the United States could draw on in meeting its own needs.

Finally, and perhaps foremost in the minds of many, provision of such assistance is the humanitarian thing to do, even where the United States secures no immediate benefit.

The world will not be a better place solely or simply because of agricultural research. But it plays a kingpin role in agricultural development, and agricultural development is of much greater importance to many nations than may be generally recognized in the highly urbanized U.S. society.

While there is great promise for the United States and others in a broadened international dimension in agricultural research, there is a long way to go before this potential is fully reached. Much will depend on the performance of two organizations—the U.S. Agency for International Development (AID) and the U.S. Department of Agriculture (USDA). At present, both face substantial, but differing, handicaps in carrying out this task.

This chapter traces the development of international agricultural research activities in AID and USDA, notes concurrent developments in the international agricultural re-

search system, and presents findings on the problems of current U.S. international participation

DEVELOPMENT OF U.S. INTERNATIONAL RESEARCH ACTIVITIES¹

Originally, neither USDA nor the land-grant colleges had any governmental charge or funding for international activities. But as the research capability of both groups grew, their scientists were increasingly called on by foreign governments and organizations. By the 1930's Americans had provided technical agricultural assistance on five continents.

All of this was done on an individual and ad hoc basis. Not until 1938 was USDA given legal authority to provide technical assistance in the Convention of Cultural Relations. In 1939, Public Law 355 established cooperative tropical experiment stations in Latin America to develop crops complementary (noncompetitive) to U.S. production. Funds were appropriated in July 1941, and the first program began with the signing of an agreement with Peru in April 1942. The onset of World War II delayed progress.

After World War II, the Marshall Plan provided the main vehicle for U.S. involvement in international agricultural matters. It is not known, however, how much assistance the plan provided directly to agricultural research in Europe. Subsequently, point IV, established in 1949, extended U.S. assistance to other areas. The early emphasis in point IV was on the transfer of American agricultural technology and establishment of extension services. In the early 1950's, the need for institutions of teaching, research, and extension was recognized, but it was still thought that technology could be directly transferred to developing countries.

By the early 1960's, it became apparent that U.S. technology simply was not immediately

useful to many tropical and semitropical developing nations. Adaptation was necessary, and this required an indigenous research capacity. This realization came slowly and unevenly, and many nonagriculturalists do not comprehend it to this day.

Meanwhile, some useful related activities had been carried out. Early in the 1950's, American foreign assistance agencies contracted with a number of American agricultural colleges to help establish comparable institutions in developing nations.² American colleges also provided training for foreign students, resulting in development of institutions and trained staff which could later contribute to research.

One of the most significant research developments at midcentury started quite differently. In the early 1940's following a visit by Secretary of Agriculture Wallace to Mexico, the Rockefeller Foundation sent a small team of prominent agricultural scientists to that country to see what steps might be taken to increase its agricultural production. A grain improvement program was begun in 1943 in cooperation with the Office of Special Studies of the Ministry of Agriculture. Dr. Norman Borlaug soon joined the program, and in 1959, he became head of Rockefeller's International Wheat Improvement Project. The wheat project was merged with a comparable corn program in 1963 to form the International Center for Corn and Wheat Improvement. Work sponsored by the Mexican Government was shifted to the National Institute of Agricultural Research in 1961 (Stakman, Bradfield, and Mangelsdorf, pp. 1-93).

¹This section draws heavily from vol. V of the Supporting Papers: World Food and Nutrition Study, pp. 91-127, and from Furtick, 1981.

²See Read for details on a highly successful program in India.

In looking back on the early post-World War II period in 1964, one observer stated:

Although our government has been actively engaged in technical assistance in agriculture throughout Latin America for two decades, the sad truth is that not a single first-class agricultural research center has been developed as a consequence of these activities. Mexico has done well, but not because of any technical assistance from the U.S. Government. . . . Japan has done exceedingly well on her own. But throughout South Asia, where we have both public and private commitments to assist agriculture, with few exceptions new agricultural research has been neglected (Schultz, p. 201)

Despite the strong dependence of U.S. agriculture on a steady generation of new technology, the U.S. technical assistance programs for nearly 20 years neither developed nor used new agricultural technology in the cooperating countries with any real degree of effectiveness (Moseman, 1970).

U.S. Agency for International Development

In 1961, the various scattered international assistance activities of the United States were combined into a new AID. This agency provided the link for much of the involvement of USDA and the States in developing countries for the next 20 years. However, AID had little to do with developed nations.

Origins of Research Component

The lack of a sound research component within the U.S. foreign assistance program was recognized when AID was established. Hence a research program with special budget support was initiated in 1962. In July 1964, a conference on international rural development concluded that greater support should be given to the research component by AID, in its own programs and within its contracts with U.S. agricultural universities. Although data are fragmentary, it appears that there was a substantial expansion in expenditures on agricultural research during the 1960's.

Prior to the formation of AID, agriculturalists involved in foreign assistance were grouped in one central Office of Agriculture in the Department of State. Senior members had line responsibility and could make budget decisions involving projects and programs. With the establishment of AID, however, many of the agriculturalists were dispersed to regional bureaus, and those that remained were given staff duties. With this dispersion came a decline in responsibility, in Washington and in the field. Some efforts were made to return to the pattern of the 1950's, but the proponents were outdone by the powerful regional bureaus which preferred to retain their new status.

There were other constraints. One was a congressionally imposed lid on the amount of money that could be spent on all forms of research, which continued to the mid-1970's. The other constraint was on commodities that were considered to be in surplus, such as wheat and rice.

The tide began to change for food crops in February 1966. President Johnson, in his "War on Hunger" message of February 10, emphasized the need to help countries in balancing agricultural productivity with population growth and to eliminate the surplus concept in food aid. On March 7, 1968, AID issued a new order that liberalized the commodity focus and made it possible to provide support for a broader range of research activities.

Despite the provincialism of the regional bureaus and the substantial difficulties of the period, the AID research specialists had a global vision. At a meeting of the Development Advisory Committee in the spring of 1967, the U.S. delegation presented a proposal for strengthening international collaboration in adaptive research with special emphasis on: 1) world centers patterned after the International Rice Research Institute, 2) regional centers to be concerned with the problems of major ecological regions, and 3) national centers for attention to localized problems (Moseman, 1970, pp. 93-94).

While this concept exceeded the realities of research in AID at the time, there was some followthrough. AID became involved in some program reviews of national agricultural research systems in several Asian nations. AID also began to provide funding to the International Maize and Wheat Improvement Center in 1969 and to three other international centers in 1970. A massive review of the new cereal varieties was held in the spring of 1969, and later that year, a Technical Assistance Bureau, which provided a needed focus on research, was established.

The Technical Assistance Bureau (to become the Development Support Bureau in 1977) and the regional bureaus sharply expanded their support for research in the 1970's. Three main avenues of support were used: bilateral, multilateral, and contracts with American institutions. The regional bureaus were involved in bilateral activities which were principally research loans supplemented by some grant funds. The Technical Assistance Bureau was involved in varying degrees with all three activities. It provided technical assistance in the bilateral loan activities and grant funding for multilateral and contract activities. The multilateral research activities involved the support of the international centers sponsored by the Consultative Group on International Agricultural Research (CGIAR) plus two other international research organizations, which are not members.

Although overall funding for research increased sharply over the period, only that portion funded by the Technical Assistance Bureau can be documented with much precision. The bilateral programs sponsored by the regional bureaus and country mission usually involved many other activities beyond research.

While the research funding levels rose in AID, research continued to have a relatively uncertain position in the organization and staffing of the agency. AID continued to be a general purpose organization run by generalists rather than by scientists. There were

relatively few trained agriculturalists and even fewer experienced agricultural researchers.

To provide a more clearly defined role for research, consideration was given in the late 1970's to establishing a separate—though companion—research agency, the Institute for Scientific and Technological Cooperation (ISTC). ISTC, however, did not receive congressional approval.

AID added a science advisor and allocated some funds to the National Academy of Sciences to cosponsor modest research projects in developing nations. There is some concern among AID research specialists that these projects could be counterproductive and divert less-developed-country researchers from projects of greatest importance to their country to those of interest to a few U.S. scientists, who may have little knowledge of the developing country. An attempt is being made to avoid this problem.

Research at the Country Level

AID support of research and related programs has not been consistent. By far the largest expenditure (though small in relation to total funds for AID food and nutrition programs) has been at the country mission level in response to requests by host governments. Even so, there has often been reluctance to fund research because most AID country mission administrative personnel do not have agricultural backgrounds. They tend to think, as was common in the 1950's and early 1960's, that all the answers are available from U.S. agriculture. Projects with more rapid payoff tend to be favored in order to show concrete results during their tour of duty (Furtick, 1981). This is unfortunate because of all the donors, AID usually has: 1) the best access to information in host countries, 2) a greater chance to affect local priorities, and 3) the largest reservoir of food and agricultural expertise. AID missions can readily work with most donors informally to ensure balanced programs with realistic objectives.

Research projects at the country mission level have usually been aimed at building or strengthening the research capacity of local research institutions. Such programs have usually been carried out through contracts with universities, interagency agreements with USDA, or private contractors. Increasingly, these activities have required close coordination with other bilateral and multilateral donors that may be supporting different aspects of the same institution. The effectiveness of these projects has been hampered by lack of qualified persons in the field missions, compounded by frequent transfers. This has made it difficult for AID to effectively serve the needs of the host countries. In addition, lengthy review and contracting procedures have made timely assistance difficult.

AID support for this research has long been handicapped by inadequate or inappropriate staffing (Furtick, 1981). Use of foreign service officers as project monitors between foreign service assignments has led to rapid turnover of administrative staff, frequently with little or no research training, resulting in delays and mismanagement. Some regional bureau staff have been suspicious of research as lacking impact and relevance; this has prevented competent planning and implementation. There has also been a chronic lack of adequate project evaluations during and after the contract period.

Centrally Funded Research

Centrally funded research covers the various activities that are not country specific. Many of the funded contracts are strictly research in nature. Others have a technical assistance component to provide educational and other activities to hasten use of the research results. (Centrally funded research at the international agricultural research centers is discussed in a subsequent section.)

Because AID does not have a research staff of its own, all centrally funded research has been contracted primarily to universities, consortia of universities, USDA, other Federal agencies, or in a few cases, to private research organizations. This research has in-

cluded grants that, as a result of insistence by the university community, have been contracted to universities with minimum restrictions on their use (Furtick, 1981). Their purpose was to strengthen research capability in areas where AID anticipated continuing requests for assistance and current capacity was inadequate to respond. These strengthening programs usually covered a 5-year period.

A major difficulty in use of expertise was that strengthening grants were centrally funded, and the regional bureaus were at odds with the central bureau. Further, the regional bureau management had little or no training in agriculture and did not understand or appreciate the role of science and technology in country development. In a few cases, this expertise was used by AID. However, with changing missions and regional personnel who had changing ideas and lack of expertise in agriculture, these resources were soon forgotten.

Other contracts have been aimed at solution of problems of multicountry importance such as specific pest and disease problems, biological nitrogen fixation by tropical legumes, and control of major weed problems. In some missions, these research activities have been used to backstop specific problems identified by AID country missions.

Title XII of the Foreign Assistance Act of 1975

Title XII of the Foreign Assistance Act of 1975 provided for the establishment of a Board for International Food and Agricultural Development (BIFAD). The purpose of the act was to more fully use the expertise of American land-grant colleges and universities in agricultural development programs. The congressional sponsors originally proposed to the Secretary of Agriculture that this program be made part of USDA. This suggestion was not accepted, and the program was incorporated within AID, but without separate funding. BIFAD members are appointed by the President, of which the first were appointed in late 1976. The legislation

requires that a majority be from universities and the others from outside government.

This legislation was viewed among some AID staff as an attempt by the universities to take over part of the AID functions (Furtick, 1981). A long struggle between AID and BIFAD followed. AID viewed the role of BIFAD as advisory to AID; however, the legislation gave it policy and oversight authority without AID representation. After the appointment of the first BIFAD, the implementation of title XII appeared to bog down in a jurisdictional wrangle between BIFAD and AID. The legislation created much of the problem because title XII did not carry new funding or provide BIFAD authority over existing funds. Thus, all programs and projects identified as title XII had to come from ongoing food and agricultural programs of AID. Without tearing down ongoing programs, programs to be established with university participation required either: 1) a long wait for new funds or 2) accepting ongoing programs or commitments as title XII activities. BIFAD was reluctant to become identified with programs for which it had not been involved in the planning and programing. The latter solution has been used primarily (Furtick, 1981).

Eventually under the current process, a large segment of both country AID mission programs and central AID programs will have had major title XII input and will be the result of joint AID-university interaction. This process is moving more smoothly. The long and often stormy period required to implement title XII has caused congressional impatience and provided ammunition to the program's critics. It has taken nearly 5 years for the program to become functional in the ways intended, but there are still many unresolved problems.

As developed, the title XII program has two main components: the Joint Committee for Agricultural Development (JCAD) and the Joint Research Committee (JRC). JCAD deals with education and technical assistance. At the country level, JRC has given particular at-

tention to developing collaborative research support programs (CRSPs). The concept of a CRSP is one of cooperation and collaboration in program development among the qualified scientists in the United States, national institutions in developing countries, and appropriate international agricultural research centers. Each participant must make a significant contribution of its own resources. Each program covers a specific area of research priority. The first of these projects is in effect; others are under development, and implementation will depend on availability of funds. As in the case of BIFAD, it took time to get this program under way and there were considerable problems. Initial administrative costs of such programs were substantial (Furtick, 1981).

Title XII has been promoted as providing the means for universities to commit themselves to long-term assistance in international food and agricultural development. Although many of the major universities have had multimillions of dollars annually from AID contracts for many years, contracts have usually been approached on an ad hoc basis. This has prevented the development of career tracks and promotion and tenure criteria for international activities. Moreover, it became hazardous for younger faculty members to accept assignments without jeopardizing their careers. The condition has made administrators reluctant to release senior faculty, because of the interruption in ongoing programs. This has often caused the universities to become hiring halls to fill contract obligations, rather than develop a pool of permanent faculty with international experience available for use in international programs.

BIFAD issued a major policy paper in 1980 on ways to overcome these deficiencies in the university system; it was entitled "Toward More Effective Involvement of Title XII Universities in International Agricultural Development." A companion document was adopted by the Executive Committee of the National Association of State Universities and Land-Grant Colleges (NASULGC) on Feb-

ruary 13, 1979, and distributed to all member universities; it was entitled "Statement of Principles for Effective Participation of Colleges and Universities in International Development Activities." These documents are excellent reviews of the problems and potential solutions.

U.S. Department of Agriculture

USDA, since its early history, interpreted the Organic Act of 1862 as limiting its role to the service of U.S. agriculture. Many dedicated employees, however, have individually contributed significantly to foreign assistance programs in recent years. USDA also has managed two international research and training programs. Some recent legislative and administrative changes have provided the basis for further involvement.

General Administrative Arrangements

Most of these individual contributions have been made through interagency personnel agreements (PASA in the case of overseas assignment; RSSA in the case of Washington assignment) to carry out AID programs.

Such assignments have distinct limitations for those involved, including jeopardy to promotion and retention of career assignments, and thus career development. Because PASA/RSSA's are not part of the regular agency budget, they have always been approached on an ad hoc basis, in spite of the relatively large size of this annual funding. Because there is no continuing agency funding base, there has never been a career track established for international research and development; thus, it has not been possible to develop a current pool of experienced international staff. Because these assignments are disruptive to regular ongoing programs, USDA administrators are reluctant to authorize qualified staff to take PASA/RSSA assignments. It is not surprising, therefore, that USDA employees are often hesitant to participate in international work under such circumstances.

To fill AID requests, USDA has sometimes turned outside the organization and hired in-

dividuals on a temporary basis—in effect acting as a hiring hall for AID. The PASA's have been popular with AID because of the rapidity of implementation in contrast to lengthy contract procedures required with universities and private contractors.

The result is that in the U.S. Government, AID has the money and USDA has the predominant agricultural expertise. USDA does not use its expertise in the planning and program development stage of AID programs, and is reluctant to release its experts for implementation. Thus, USDA has a limited pool of talent with overseas experience and no career staff for continuity.

The lack of USDA direct involvement in foreign assistance is the result of deliberate past administrative decisions by Secretaries of Agriculture. They felt this to be a conflict of interest with promoting domestic production and trade. An example was the proposal by the authors of title XII to place it under the jurisdiction of USDA. Because this did not find favor with USDA administration, it was placed in AID.

Many lower level USDA administrators have tried unsuccessfully to strengthen the USDA role in foreign assistance. Efforts have included detailed recommendations for implementing section 406 (tropical and subtropical agricultural research), involvement in title XII, and support of other international programs including the International Agricultural Research Centers (Furtick, 1981). These efforts were not favored in the USDA budget decision process until recently.

For many years, USDA had a small international program staff, but during the Carter administration, the various international programs were consolidated under a new Office of International Cooperation and Development (OICD) reporting to an Undersecretary of Agriculture. This has led to an international program advocacy group in USDA that could interact at the final budget decision level.

Special Foreign Currency Research Program (SFCRP)

One early activity was the SFCRP authorized by the Agricultural Trade Development and Assistance Act of 1954 (Public Law 480) as amended in 1958 and 1959. SFCRP did not, however, attain substantial proportions until the 1960's. It used local currencies paid to the United States for Public Law 480 sales to finance in-country research of mutual interest to the foreign nation and the United States. It was administered by the International Programs Division of the Agricultural Research Service (ARS).

Public Law 480 sales were initially made to a number of countries that are not now classified as developing nations. Thus in fiscal year 1965, out of total research expenditures of local currencies equivalent to \$7.16 million, 68.4 percent was made in countries not now classified as developing nations.

During the 1970's, there was a shift in Public Law 480 repayment terms from local currencies to dollars, which sharply reduced the number of countries with excess local currencies available for the purpose. Hence, SFCRP gradually became limited to just a few countries. By fiscal year 1975, the leading countries were Pakistan, India, and Egypt.

Although a large number of research projects have been conducted under SFCRP, no formal evaluation has ever been made. Thus, it is difficult to comment on the project's value to and impact on the host country or the United States. Some observers, however, feel that the program diverted less-developed-country researchers from tasks that might have been of greater national benefit. At the same time, the benefits to the United States, except for work done in Israel, are not well-known.

Tropical and Subtropical Research and Training Program (TSRTP)

A second research program was authorized under section 406(4) of the Food for Peace Act of 1966 as amended. USDA was allowed to

enter into research contracts or agreements with American institutions in the field of tropical and subtropical agriculture and to make the results available to friendly developing nations.

Authorization was provided to spend up to \$33 million a year. No funding was provided under the Food for Peace Act; it was to be obtained through regular USDA channels. USDA, in turn, evidently did not give the program high priority. No funding was obtained until fiscal year 1975, when \$500,000 was appropriated, partly to establish two research and training centers, in Hawaii and in Puerto Rico. Two principal objectives were set: 1) to provide tropical training and experience for USDA and land-grant college personnel by working on tropical research problems under tropical conditions, and 2) to provide foreign nationals with a place to learn techniques and methodology under tropical conditions from U.S. specialists.

As TSRTP evolved by the mid-1970's, the program centered on the University of Hawaii and the Federal Experiment Station at Mayaguez, Puerto Rico, designated as the Mayaguez Institute for Tropical Agriculture. In addition, some universities had projects financed by TSRTP funds. Coordination was provided by the International Programs Division of ARS. Funding levels were \$529,000 in fiscal 1976 and \$681,000 in fiscal year 1977,

Subsequently, the Hawaiian and Puerto Rican sites were renamed the Pacific Basin Center and the Caribbean Basin Center. Funding was raised to \$1.8 million in fiscal year 1978, to \$2.2 million in fiscal year 1979, and \$2.8 million in fiscal year 1980. Funding was shifted from the supplementary budget to the regular budget in fiscal year 1981.

As of early 1981, Furtick noted that:

Competition between universities and AR (USDA) scientists for the limited funding has at times hampered sound program development. It is currently being conducted more as a competitive grants program than as a cohesive program to establish overall tropical re-

search priorities and utilize the best scientific talents to solve critical tropical problems.

The program also appears to be domestic in orientation. This focus was brought out in a recent internal struggle for control of the program with another USDA agency (OICD): The Science and Education Administration “decided to give it a strictly domestic tropical agriculture focus and keep it” (Furtick, 1981).

Recent Legislative and Administrative Changes

During the 1970's, USDA became increasingly involved in bilateral programs and other activities that involved a research component. Many of these were with middle-income nations (not covered by AID), which paid the bills.

International scientific cooperative programs were developed under an agreement between USDA and NASULGC. The agreement was implemented through the establishment of an International Science and Education Council in 1974.

Under section 1458 of title XIV of the Food and Agriculture Act of 1977, Congress authorized USDA to: a) become involved in international research, extension and related technical programs in developing nations in collaboration with AID and land-grant universities, and b) work directly with the more developed countries that are ineligible for AID support.

As discussed earlier, to improve consolidation and administer existing and emerging international activities, OICD was established in May 1978. In early 1980, it absorbed some of the research activities formerly administered by the International Programs Office of ARS.

As of early 1981, the most relevant OICD programs were concentrated in two divisions: a) Scientific and Technical Exchange, and b) International Research. The latter division administers: a) SFCRP discussed earlier, b) research carried out under its binational program with Spain, and c) the Binational

Agricultural Research and Development Fund. The last program is carried out with Israel; it became operational in November 1978 and operates off the interest from an \$80 million endowment fund established by the United States and Israel, with a focus on subjects of mutual interest. In one sense, it is an outgrowth of the SFCRP, which once included Israel.

In fiscal year 1981, the International Cooperative Research Program was proposed by OICD for the International Research Division. It would have focused on problems shared with other nations, developed and developing. The proposal was not funded by Congress but was to have been resubmitted as part of the fiscal year 1982 budget (this was not done because of budget constraints). It would have called for initial funding of \$2.5 million, and would have included 15 individual research projects ranging in cost from \$50,000 to \$400,000. One would have involved cooperation with the international agricultural research centers and another would have involved programs between U.S. agricultural universities and other nations.

USDA maintains administration of certain in-house overseas research. Some USDA research programs have found it advantageous to maintain overseas laboratories. The subjects include controlling insect and weed pests, exotic plant and animal diseases, and improvement of storage and transportation procedures in shipping international products. In 1977, there were six such laboratories.

Private Sector Activities

Although the private sector plays a major role in domestic food and agriculture, particularly in developmental research, its activity has not been as significant in the international area.

One of the most important reasons is the size, stability and corporate experience of the private sector in the U.S. market. For example, the United States consumes most of the

world hybrid seed corn, nearly half of the world's pesticide production, and is the largest single consumer of fertilizer, machinery, animal health products, etc. By far the largest part of the remaining market for these products is in the other temperate zone, hard currency, industrial countries of Europe, Japan, Australia, etc. Why should the private sector devote energies to the developing world, largely in the tropics, where their current products often do not work well, where small farms predominate, where local infrastructure is inadequate, where governments are not stable, where illegal payments are a standard procedure, and where currencies are difficult to convert and repatriate? Yet, the potential of the future market is enormous; if it were ever fully developed, it would dwarf the domestic market.

European and Japanese private sectors have been much more aggressive in developing or modifying technology for the developing country market because of their relatively restricted domestic market, a history of trade as a way of life, and the variety of government incentives used for this purpose. These incentives include complete tax exemption for expatriates, aggressive marketing assistance as part of diplomatic initiatives, acceptance of the need for special payments to gain business, and allowance for these payments as deductible business expenses. They also provide export incentives and insurance against expropriations or losses from government instability.

In contrast, even the \$20,000 short-term and \$25,000 long-term overseas U.S. income tax exemptions were voided in recent years, but restored again beginning in 1982. * There have been limits on deductions of local tax payments and fringe benefits, ignoring the preponderance of services provided to resident U.S. citizens that are not enjoyed by those living overseas. When American firms decided to do business abroad where expatriate staff was required, they were largely turned to non-Americans to solve the tax costs that otherwise should have been added to salary. As noted, recent passage of the 1981 omnibus tax bill has alleviated some of these constraints.

Under current amendments to the Corrupt Practices Act, special payment to gain business abroad is a criminal offense. Thus, American firms have increasingly stayed in business by becoming subcontractors to non-American firms that make the illegal payments.

Less export assistance and fewer incentives are available to American firms than to their competitors. In addition, the imposition of special environmental protection restrictions on some products often makes the development of new products for overseas markets impossible.

*Effective January 1, 1982, the newly enacted tax law will free from U.S.—though not foreign—taxes income up to \$75,000 a year from working expatriates. The maximum also will rise by \$5,000 a year until 1986 when it reaches \$95,000. Housing allowances will become largely tax exempt.

THE EMERGING INTERNATIONAL RESEARCH SYSTEM

Although growth of the U.S. agricultural research system stagnated somewhat in recent years, much has been happening in agricultural research in the rest of the world. An international agricultural research network is evolving. It is perhaps not yet a system in a formal sense, but the major pieces are in place.

Structure and Growth of the System

The two main institutional components are: a) a group of international agricultural research centers and b) national agricultural research systems in developed and developing nations.

International Centers³

The international centers may be the best known component of the system. Most are sponsored by CGIAR. CGIAR sponsors 10 centers and three related programs (table 11). Several other centers exist outside the CGIAR system, including the International Fertilizer Development Center in the United States, the Asian Vegetable Research and Development Center in Taiwan, and the International Center for Insect Physiology and Ecology in Kenya.

Development of the international centers began in 1960 with the establishment of the

³Further details on these centers are provided by the Consultative Group.

International Rice Research Institute (IRRI) in the Philippines by the Ford and Rockefeller Foundations. This step was followed by establishment of three other centers later in the decade by the same groups. CGIAR was established in 1971 to secure and coordinate funding from other sources. Both the number of programs and funding grew sharply during the 1970's (tables 11 and 12). CGIAR had 31 donor members by 1980; 33 in 1981. The United States, through AID, is a charter member and provides about 25 percent of total funding (table 13).

In the relatively short period of their existence, the international centers have had an extraordinary effect on international agricultural research. While their focus is on tropical

Table 11.—CGIAR-Sponsored International Agricultural Research Centers and Programs

	Location	Year established	Core funding, 1981 (in millions)
Centers			
1. International Rice Research Institute (IRRI)	Philippines	1960	\$15,032
2. International Maize and Wheat Improvement Center (CIMMYT)	Mexico	1966	16,056
3. International Institute of Tropical Agriculture (IITA)	Nigeria	1968	14,038
4. International Center for Tropical Agriculture (CIAT)	Colombia	1968	14,275
5. International Potato Center (CIP)	Peru	1972	7,100
6. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	India	1972	10,375
7. International Laboratory for Research on Animal Diseases (ILRAD)	Kenya	1974	10,031
8. International Livestock Center for Africa (ILCA)	Ethiopia	1974	8,954
9. International Center for Agricultural Research in the Dry Areas (ICARDA)	Syria, Lebanon	1975	11,292
10. International Food Policy Research Institute (IFPRI)	United States	1975	2,305
Programs			
11. West African Rice Development Association (WARDA)	Liberia	1968	2,562
12. International Board for Plant Genetic Resources (IBPGR)	Italy	1973	2,925
13. International Service for National Agricultural Research (ISNAR)	Netherlands	1979	1,095

^aDoes not include special projects. Some contributions remained to be allocated to individual centers/programs.

SOURCE U S. Agency for International Development, 1981.

Table 12.—Total Core Expenditures on Centers and Programs Sponsored by CGIAR, 1972-80

Year	Millions of dollars
1972	\$20,060
1973	24,955
1974	34,525
1975	47,545
1976	62,870
1977	77,225
1978	85,280
1979	98,535
1980	118,565
1981 (prop.)	139,200

SOURCE: CGIAR Secretariat.

Table 13.—AID Contributions to international Agricultural Research Centers (in millions of dollars)

Fiscal year	CGIAR ^a	AVRDC ^b	IFDC ^c	Total
1970	\$ 1.679	\$0	\$0	\$ 1.679
1971	2.984	0	0	2.984
1972	3.770	0.600	0	4.370
1973	5.390	0.600	0	5.990
1974	6.805	0.600	0	7.405
1975	10.755	0.600	4.100 ^d	15.455
1976	14.870	0.600	5.100 ^d	20.570
1977	18.140	0.600	3.445 ^d	22.185
1978	21.400	0.600	3.800	25.800
1979	24.800	0.600	4.000	29.460
1980	29.000	0.600	4.000	33.600

^aCenters and programs sponsored by the Consultative Group International Agricultural Research (listed in table 11).^bAsian Vegetable Research and Development Center, Taiwan.^cInternational Fertilizer Development Center, Alabama.^dOf the total of \$12.6 million for the 3 years, \$8.8 million was for capital construction and equipment and \$3.8 million was for operations.

SOURCE: AID/DS/AGR.

and semitropical agriculture for the developing nations, they provide an international point of exchange for agricultural research in their respective fields—for developed country donors and developing country recipients. They are firmly in the mainstream of international research, and their research quickly becomes known and used in national research programs. They have also shown the need for further development of national research systems in developing nations.

The centers are excellent, productive research organizations. They have modern facilities and highly qualified staffs. Naturally they have their own difficulties and limitations. They are not, for example, designed to do basic research, which may be more effectively done in developed nations. But they

have created a new appreciation of the value of applied agricultural research.

National Programs

While the international centers may have taken center stage in recent years, the national (public) research programs of other developed and developing countries have expanded significantly. This expansion is documented in financial terms in table 14. From 1959 to 1974, total global expenditures (in constant dollars) increased three times. The largest increase was in Asia (excluding Japan). The smallest increase (excluding perhaps some small developing nation) was in the United States. In 1959, public research expenditures in Western Europe were less than half of those in the United States; by 1974, Western Europe exceeded the United States. Or to view the matter differently, in 1959, U.S. expenditures represented about 27.7 percent of global agricultural research expenditures; by 1974, the U.S. proportion had dropped by 10 percent to 17.9 percent. If privately sponsored research, which is of significant importance in the United States, were included, the situation might be somewhat different, but the same might be true of other developed nations.

Table 14.—Public Expenditures on Agricultural Research, Major Regions of the World, 1959 and 1974 (in millions of constant 1971 dollars)

Region/country	Expenditures ^a		Change
	1959 (millions of dollars)	1974	1959 to 1974 (percent)
Asia (excluding Japan)			
Japan	\$ 40.9	\$210.5	414%
Western Europe	57.7	260.4	451
Latin America	117.1	452.4	287
Canada, Australia, and New Zealand	33.9	129.4	281
U.S.S.R.	83.6	241.5	189
Eastern Europe	158.6	425.0	168
Africa	83.4	216.4	159
United States	52.5	115.4	120
World total	240.3	447.5	86
	\$868.0	\$2,498.4	188% ⁰

^aDoes not include expenditures on international agricultural research centers.SOURCE: Compiled from James K. Boyce and Robert E. Evenson, *National and International Agricultural Research and Extension Programs*, Agricultural Development Council, New York, 1975, pp21-31 (table 2.1) ("Constructed Time Series").

It would be useful to know what has happened since 1974; it is probable that the same general trends have continued. The increase in funding in the developing nations may have become even more pronounced as international assistance agencies, particularly the World Bank, have sharply increased the volume of lending for agricultural research (World Bank, p. 34). CGIAR, as noted in table 11, has recently established an International Service for National Agricultural Research to assist developing nations. Preliminary data gathered by Evenson indicate that a particularly sharp increase in research expenditures has taken place in Southeast Asia (Evenson, phone conversation, Jan. 28, 1981).⁴ U.S. funding during this recent period appears to have increased only slightly.

International Networks

As suggested earlier, national and international agricultural research programs are increasingly being linked in scientific networks at the commodity level. One example in which the United States is particularly active is the International Winter and Spring Wheat Research Networks. The United States is one of several developed-country members that provide or coordinate the transfer of germ plasm or some other needed technology. They also report on the results of multisite testing. In this way, participants can have prompt access to the results of international trials. The system is inexpensive and extraordinarily efficient.

Potential Value of the System to the United States

Few nations cannot benefit directly or indirectly from agricultural research done elsewhere. This is particularly true of nations with well-developed research systems that are able to adapt the research to their own conditions. Hence the United States, as one of the

world's largest generators and users of agricultural technology, should be in a position to contribute and gain as much as any nation. Considering the need to continually improve our agriculture in order to keep domestic food costs down and to maintain our competitive ability in foreign markets, this is a significant matter,

General Nature of Benefits

Direct benefits to U.S. agriculture include new and improved technologies that could either be put directly to use or be applied with some further modifications. The United States, like other nations, has borrowed agricultural technology for centuries. Over time, foreign borrowing may have played a smaller role. When the United States dominated world research, it was perhaps felt that there was less to learn elsewhere, but with the rest of the world now surpassing the United States in research growth, there will be much more that the United States might profitably use.

Similarly, the United States might do well to study the structure of research systems in other nations in order to identify useful ideas for our system. Despite an early interest in foreign systems (see footnote 1 on p. 30 in ch. III), the United States has paid little attention to them for the past 75 years. One of the papers prepared for this study has briefly reviewed six leading foreign systems and has identified several features that might be worthy of further study (Smith, 1980).

The existence of expanded research systems in other developed and developing nations should contribute significantly to the improvement of agriculture in those nations. From the point of view of the U.S. foreign-assistance program, this means that there is a larger research base from which to draw, both in the other developed nations and in the international centers, and a greater opportunity to profitably use it in the developing nations.

Improvement of agriculture in developing nations can benefit the United States in sev-

⁴The International Food Policy Research Institute has completed a study of research funding in developing Nations. The data are not quite comparable with Evenson's, but do confirm the growth in funding. See Oram and Bindlish.

⁵For details, see Kern.

eral ways. First, as it contributes to economic development, it will improve commercial export markets for U.S. agricultural products. Second, it will reduce the need for United States confessional food aid—which is getting increasingly expensive as U.S. surpluses disappear. Third, moderation of food prices in other nations may have a moderating effect on food prices in the United States. Fourth, the United States is a major importer of agricultural products that are not grown here; improvements in this area can mean lower costs to U.S. consumers.

Specific Examples

The assistance provided by the United States to international research has already found use in U.S. agriculture. One example is rice (Dalrymple, 1980).

Semidwarf rice originated in East Asia, and most of the varieties in use trace their origins to varieties developed at IRRI. These varieties, along with semidwarf varieties developed through irradiation of domestic varieties, were used as parents in breeding programs in the United States, particularly in California.⁶

Semidwarf rice varieties adapted for U.S. conditions are fairly recent and as yet have only been used in California. Semidwarf rice varieties are under development in the Southern States and may make a contribution there. Of the semidwarf area in California, half or more was recently planted with a variety (M9) of IRRI parentage (60 percent in 1979 and 50 percent in 1980). It in turn represented about 30 percent of the California rice area in 1979 and 37.5 percent in 1980.

California specialists estimate that the semidwarf varieties have increased yields 10 to 15 percent. California yields were at a record level in 1979 (6,520 lb/acre) and next-to-record level in 1980 (6,440 lb/acre). The 1979 yield was 11.1 percent above the previous high. California yields in turn were 41.8 and 46.3 percent above the U.S. average in 1979 and 1980.

⁶For details, see Rutger and Brandon.

A related example is semidwarf wheat varieties, which occupied over 30 percent of the U.S. wheat area in 1979 (Dalrymple, 1980). The United States has also benefited in irrigation technology from bilateral research with Israel: drip irrigation and the use of water containing higher salt concentration are two such areas.

The future will offer many further opportunities for the United States to benefit from research done elsewhere. The major constraint at present is the rather limited U.S. connection with the emerging international research system

Status of U.S.-International Linkages

The degree of U.S. involvement with the international research system varies somewhat with the direction of linkage and the groups involved. It is probably stronger on the giving than the receiving end, and AID probably has stronger connections than USDA.

The reasons are fairly simple: AID has a charge and funding to support this sort of activity; USDA as yet does not have a direct charge or funding to link into the system. The latter group has some AID-funded programs with certain aspects of the international system, but these are more in the nature of providing assistance; any return flow is a side benefit. A question might be raised as to how well AID does in terms of making use of American agricultural research knowledge overseas, but there can be little question that the United States is poorly organized to stimulate a return flow from the international system.

Much of what has been drawn from the international system to date has been a result of individual initiative and contacts of American scientists. They have generally received little encouragement or financial support from their administrators. Travel budgets are nearly always restricted when budgets are tight, and high-cost international travel is prone to be at the head of the list. Yet, only so much can be done at the international level by mail; ultimately the scientists must travel.

Other arrangements may have to be made, which present troublesome administrative problems or suggest less than complete fidelity to some immediate domestic problems. Thus, what has been accomplished in some cases may be in spite of the system rather than because of it.

Furtick has outlined the specific charge in the following terms (1981):

The need now is for the United States to link its scientific capacity into this major national and international research network to both contribute and gain from the new knowledge that they are generating.

With reference to the international research centers themselves, he states:

In spite of their importance, the United States to date has made only limited government effort to link its scientific community to these centers or build major linkages that will insure that new technology discovered by these centers which is useful to the United States will be rapidly transferred from these centers to the mainstream of U.S. science.

Finally:

The question is, how can we develop a sound partnership between our science and that of the rest of the world for mutual benefit? We are no longer going to be only a donor in the future, We will also become a recipient.

CONSTRAINTS ON INTERNATIONAL PARTICIPATION

It is not very difficult to list the many constraints on more effective participation in the international agricultural research system. It is much more difficult to provide realistic suggestions as to what might be done about it. Because of current economic constraints, additional resources in funding and staffing will be hard to obtain. In any case, the U.S. international research effort has not organized in a manner to make optimum use of available resources.

AID: Lower Income Nations

Although the United States may not have the commanding lead in agricultural research that it once had, it still harbors one of the largest agricultural research systems in the world. It also has a very large and perhaps better funded system of research on more basic but related scientific matters; however, little attention has been given to using this resource.

AID is the main outlet for assistance to lower income nations, but many legitimate questions have been raised about AID's ability to perform this task efficiently and effectively,

The Bask Problems

One of the major AID limitations in addressing international research is an inadequate number of appropriately trained professional staff. Records of the past 10 years show a dramatic increase in funding levels in the AID agricultural sector (\$270 million in 1971 to \$720 million in 1980) (Furtick, 1981). The relative share of the agricultural sector in AID-appropriated funds has gone from 19 to 50 percent since 1970. In addition, congressional and other mandates have proliferated the type of special issues that AID is expected to address in the agricultural sector.

AID's total employment level peaked in 1968. Since that time, the numbers in certain professional categories have been substantially reduced, particularly in agriculture. Between 1968 and 1976, the total number of AID's U.S. employees was reduced by 55 percent; however, during the same period, agriculturists were reduced 78 percent. It appears that the reduction in professional staff has been somewhat inversely proportional to funding increases.

As of 1980, with 50 percent of the resources, the agricultural officers composed

only 5 percent of the agencies' total personnel. There were 256 agricultural positions and more than 20 percent were vacant. Almost 80 percent of the agricultural officers are assigned overseas; and most of them act as program generalists/administrators. Many are older, and although about 75 percent have advanced degrees, mostly M. S., very few have had recent specialized technical experience. Very few have been released for in-service professional improvement in agriculture during their careers.

The lack of an agricultural career ladder and professional identification has made recruitment and retention of qualified personnel difficult. Recently, the pressure for recruitment has become more critical due to the large number of staff reaching retirement age. Understaffing and vacancies make adequate in-service orientation and training nearly impossible (TPCA, 1980).

The personnel system is inadequately designed to attract or retain agricultural scientists. There are two categories of professional staff: Foreign Service and General Service (GS). Foreign Service personnel are, as a result of recent congressional initiatives, clearly favored over GS personnel in top-level staffing and promotion. Most of AID's few trained scientists, however, are GS employees who can expect little or nothing in the way of promotion. As a result, about one-third of the staff of the Office of Agriculture in the Development Support Bureau is composed of agriculturalists on short-term loan from other Government agencies (particularly USDA) and universities. Most are not enhancing their careers by working for AID; AID, moreover, shows little gratitude.

The other key problem is organization of agricultural and research staff. Through early 1981, no one person or office was in charge of agriculture or agricultural research. Nor were any agriculturalists to be found at high administrative levels.* Those on the staff are

*This situation changed later in 1981 with the appointment of Dr. Nyle Brady, a prominent soil scientist and former Director General of IRRI, as Senior Assistant Administrator of the Agency for Science and Technology.

scattered throughout the agency, almost invariably serving in a staff capacity. They have no line authority and are not in a position to make budget decisions. Most are found in regional bureaus, where they are a distinct minority and hardly have time to focus on research. The situation is even worse in country or field missions, where there are usually only one or two agriculturalists, and sometimes none. Even in the central Office of Agriculture in the Development Support Bureau (DSB), research is only one of many activities and often seems to play a subordinate role. * DSB is considered a service organization by the regional bureaus, which often have quite different concepts of research,

Some improvements could be made in staffing and organization, but this will not be easy. The Foreign Service problem transcends AID; it permeates the whole State Department structure. The organization problem transcends agriculture and involves the whole AID structure. There are vested interests in both groups which would mitigate against change. Yet unless something is done about these fundamental points, other efforts to improve the scientific component of AID will be frustrated. It may be easier to modify the organizational structure than the personnel system.

Many observers think that AID needs to pull all its technical staff members together into one or more central bureaus with line authority and responsibility equivalent to those of the regional bureaus. Agriculture would be a major component of such a consolidation. Each of the major functional divisions, including agriculture, might have a research division. * *

Another alternative is to abolish the regional bureaus and establish technical operating bureaus around the major thrusts of

*DSB has subsequently been designated the Bureau of Science and Technology (S&T).

**A partial shift has recently been made in this direction with the designation of four technical directorates within S&T. Food and Nutrition is one of the four. Technical staff members from the regional bureaus will be allowed to become associate members of S&T. Agency-wide sector councils are being established. But in most other respects, the regional bureau structure remains the same.

AID programs as defined in legislation—i.e., food and nutrition, population and health, and natural resources and energy. These technical bureaus would be headed by technical career professionals. They would have responsibility for country as well as control programs of technical assistance, research, training, and institution building. The necessary continuing functions of the eliminated regional bureaus would be assigned to regional office positions under the Bureau of Program and Policy Coordination (PPC) or an assistant administrator with limited role and powers necessary for liaison with State and collation of normal desk functions.

Title XII

As previously discussed, title XII originated as an effort by the university community to set a framework within which university participation would be more compatible with university capabilities. The law created high expectations in the university community for substantial funds to build an international dimension in all interested universities. They expected to receive enough funds to institutionalize their hopes (Furtick, 1981).

The law provided everything needed except for new appropriations or authority over old appropriations. This condition has led to disenchantment for many in the university community, AID, and Congress. For those that have received significant funding at the country program level as a result of JCAD planning, it would probably have come to them anyway without the tortuous process involved (Furtick, 1981). However, "strengthening grants," averaging \$100,000 a year, have been given to some universities over which they can exercise major discretion in order to strengthen their basic international programs.

Those few universities that have been funded under CRSP, have received funds that would normally have been available under AID centrally funded research, but with fewer strings attached and not eroded by the high administrative costs levied by the title

XII process. They also would not have the high administrative and matching fund requirements that are built into CRSP implementation system (Furtick, 1981).

USDA: Middle- and High-Income Nations

USDA has inherited responsibility for dealing with AID-graduate or middle-income countries and presumably is to deal with high-income nations on matters relating to agricultural research. For a long time, USDA was not authorized funds to carry out this task.

Countries wanting our help had to pay for it. Since it was difficult to set up such programs without planning, which took considerable time on USDA's part and for which it had no funding, the situation sometimes got rather awkward. Some Federal money has recently become available for those initial expenses, but it is still a tight situation.

Essentially no funds are available for providing more general assistance. As noted earlier, a new International Cooperative Research Program has been proposed by OICD that would make it possible to initiate and expand activities in this area. The proposal is stalled for lack of funding.

TSRTP operated by USDA was also, as noted earlier, established in part as a vehicle to provide assistance to other nations. It does not appear to have been used for this purpose, and now has almost entirely a domestic orientation. Attention should be given to reviving the international aspects of the program.

The Role of States

Much of the agricultural expertise used by AID, and to a lesser extent by USDA, is provided by land-grant universities. Although often called on for assistance, the States for a long period had little voice in the process. They also had, with a few exceptions, no steady funds. With the establishment of BIFAD in AID, they gained a voice, and with

the establishment of strengthening grants under BIFAD's auspices, they gained limited funding.

A BIFAD staff member has prepared a project proposal that would facilitate cooperative research activities between U.S. research institutions and the international agricultural research centers (Nielson, 1981). As of the fall of 1981, the proposal was undergoing review. It is quite promising but has a long way to go in the administrative process before it becomes a reality. *

The International Research Network

As suggested, the United States might well do more to facilitate the acquisition and use of knowledge generated by the world agricultural research community. This matter has been given virtually no governmental attention. USDA is the logical agency to lead this activity. Such a program could well be carried out in USDA in OICD, in cooperation with ARS. OICD, in fact, sponsors a few activities that might be said to be of this nature, but they are limited to just a few countries. OICD's proposed International Cooperative Research Program would make it possible to establish a significant and broad-based program. Until such an effort is funded, the United States will continue to miss out on many of the benefits of the international agricultural research network.

Engaging the Private Sector

It is probably safe to assume that any overseas research conducted by American private firms will be used by them, as appropriate, in their domestic activities. The trick is to stimulate their overseas research; this may not be easy.

*There is some precedent for such activity. In mid-1981, Australia established a center for International Agricultural Research to fund research undertaken by Australian institutions to benefit developing countries (Australian ..., 1981).

The pattern, as previously noted, is for American firms to do some research in other developed nations, but very little in less developed nations because of the relatively limited market. Incomes are low and agriculture is generally not highly advanced. Until the potential market improves, American firms are not likely to invest much in research.

A more subtle problem is that private firms are more likely to do research on mechanical rather than on biological technology because of its patentability. It may not fit as well as biological technology, however, with developing country needs.

Finally, some recent changes in U.S. Government actions pertaining to payments to gain business and environmental regulations may further dissuade American business. This administration appears to be reconsidering these matters.

Private industry could play a greater role but the role may be more limited and selective than desired.

Coordination

If greater emphasis is ultimately forthcoming to strengthen U.S. participation in the international agricultural research system, there may well be need for a coordinating process. There is so little formal activity at present that this is hardly an issue.

AID has the additional problem that through early 1981 it did not have one person or office in charge of its agricultural research activities; hence it would have difficulty in designating a representative who could speak for more than part of the organization. This situation has recently started to change.

If AID, the prime Federal agency for assistance to developing countries, is restructured to strengthen its technical capability and accountability, it will be in a position to make a significant contribution to coordinating its efforts with others.

PRINCIPAL FINDINGS

- Benefits are derived in the United States as well as globally from U.S. assistance to developing countries in solving technical problems and helping overcome socioeconomic constraints to ensure adequate food production and consumption.

- AID and USDA are involved in international agricultural research and technical assistance, but from the developing country standpoint, AID is the prime Federal agency.

- Research and technical assistance to assist developing countries require an in-house capability in the technical disciplines and issues to be effective. Organizational structure, responsibilities, accountabilities, and procedures must reflect this fact.

- Through early 1981, AID was not organized or staffed to be effective in carrying out its responsibilities. Technical leadership was lacking in the decisionmaking positions. With 50 percent of the total budget in food and agricultural activities, technical personnel trained in these areas account for 5 percent of the total personnel. Few, if any, were in decisionmaking positions.

- The United States has much to gain as well as to give in the international research network. At present, no Federal agency has the specific responsibility for taking the lead in coordination and cooperation on methods, procedures, and actions necessary to accomplish maximum U.S. benefits.

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