

From Technical Assistance to Cooperation: A Comparison of French and American Agricultural Science Policies for the Third World

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Abstract

This paper examines the respective science policies of France and the United States with respect to the Third World. The French approach is characterized by several central scientific agencies. These agencies employ large numbers of scientists who spend their careers working on issues of relevance to the Third World. Included are such agencies as ORSTOM, CIRAD, and the Institut Pasteur. In contrast, the U.S. approach contains few full-time professionals and draws instead on university scientists as mainly short term consultants on particular projects defined by the Agency for International Development and other non-profit agencies.

The differences in approach are correlated with vastly different historical backgrounds and political climates for foreign technical assistance. Despite these differences, both nations are moving away from the older technical assistance models toward scientific cooperation with developing countries. There are also clearly expressed needs for institutional changes to allow for more flexibility and efficiency and more long term support. Although they are rarely seen in that light by either the French or the Americans, both systems play roles that are often complementary.

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Introduction

Science and technology are hallmarks of contemporary Western civilization. Western societies are permeated with scientific and technical values and much of the rest of the world now strives to copy the technologies that have made Western material culture what it is¹. Thus, it is not at all surprising that the United States, as a scientific and technical (S&T) power, should have attempted to spread science and technology around the world. Nor is it surprising that France as a former colonial power and an important S&T power has considered the development of science in the former colonies as a moral obligation and an altruistic mission "for the benefit of all humanity."²

In this paper, we examine the particular role that scientific and technical assistance has played in American and French foreign aid programs. Even if the US has recently curtailed its aid, the two systems remain major donors on the international scene. While the focus is clearly put on agricultural science policies, these policies are examined in the overall framework of both systems. As we will see agricultural research is receiving a significant share of the overall support in both systems. The agricultural sector has furthermore been a major source of political strength for the entire aid appropriation and for science and technology programs in particular, both at the national and international levels.

While a brief historical overview is attempted, the history of these efforts is beyond the scope of this paper³. The main objective is to compare current institutional structures and programs, and negotiations for change, as well as to analyze possible new directions of both systems. In the comparison a particular attempt is made to show the extent to which both systems are complementary as well as to stimulate critical analyses that might serve in improving both systems.

I. The French System⁴

¹We do not pretend here that the western science and development model is not being criticized. Yet, alternatives to western science have tended to be partial and often self-defeating, and it is difficult to see a full fledged alternative to western science emerging (Jamison, forthcoming).

²Colonial science is, however, supposed to serve a large spectrum of objectives including the advancement of knowledge, the development of the colonies for the benefit of the metropolis and the particular interest of the colons. See for example Sarrault (1931); Martonne (1932); Folliet (1932); Goudineau (1991)..

³A comprehensive history of US and French scientific and technological assistance has yet to be written. For a detailed account of the legislative history of US foreign aid see "Historical Overview of US Foreign Assistance Legislation" available from the USAID information and documentation center in Rosslyn, VA. On the development of French colonial science see Bonneuil (1992).

⁴For a more detailed analysis and discussion of the French system see Gaillard (1990).

Brief historical background

The institutionalization of French tropical S&T activities took place at the end of the 19th century. In tropical medicine, the first laboratory of biological medicine was created in Saigon in 1871 and the first one overseas "Institut Pasteur" was inaugurated in Algiers on the 1st of November, 1894. The first botanical gardens were established in Africa at the beginning of the 20th century. At this time, the development of industrialization in Europe increase the demand for raw materials and accelerated important changes in colonial policies. Following a period of commercial coastal activities, a strategy of occupation and use of the land was developed. This in turn required the establishment of technical services in the French colonies. Thus, a groundnut experimental station was established in Bombay, Senegal in 1921.

The necessity to provide the colonies with a research organization was brought forward at several scientific congresses held in France during the years preceding WWII. the Office de la Recherche Scientifique Coloniale (ORSC to be renamed ORSOM and then ORSTOM) was created in 1943 with the main objective of supporting agricultural research (Gleizes, 1985). ORSTOM's research areas were then rapidly diversified to include natural sciences, human biological sciences, social sciences, engineering and communication sciences. At about the same time, several commodity oriented (e.g. oilseeds, cotton, fruits, etc.) agricultural institutes were also created modeled on the French rubber research institute (IFC) created in 1936. The headquarters of these institutes was (and is still) located in France. Personnel was almost exclusively French expatriates and very little attention was paid to research capacity building in the colonies. The end of the colonial era did not immediately change this situation. In most cases, the activities of the French institutes continued on the same line in the frame of bilateral agreements. Later on, with the training of an increasing number of national researchers, most of the French-speaking African States have progressively established National Research Institutes (Gaillard and Waast, 1988).

To cope with this progressive nationalization, in 1970 France restructured the specialized institutes within an umbrella organization named the Groupement d'Etudes et de Recherches pour le Développement (GERDAT), composed of former GERDAT institutes, was created in 1984. The same year, ORSTOM, while keeping its old acronym underwent a reorganization and was renamed Institut Français de Recherche Scientifique pour le Développement en Coopération. With the reform of these two specialized institutes (CIRAD and ORSTOM) French scientific cooperation is "aiming at maintaining a balance between basic and applied research" through an interdisciplinary approach of the problems"⁵.

The institutional structures at the beginning of the 1990's

According to the Ministry of Research France is spending 2.2 billions FF (approx. US\$ 400 millions⁶ and is mobilizing close to 5000 people working on Third World research⁷, out of which some 3000 are scientists. The main course of the system has been set by three Ministries (Research, Cooperation and Foreign Affairs), which have traditionally relied on a number of institutions (ORSTOM, CIRAD, IPOM) for implementation. Important efforts have also been made during the last decade to mobilize the entire French S&T potential to work on problems relevant to the Third World through competitive research grant programs. Excluding Indochina, French tropical research remained only African until the early 1960s. Research activities in the French overseas Department and

⁵Response of the Ministry of Research to a parliamentary request.

⁶1 US.\$ is approx. 5.5 FF in June 1992.

⁷Communication on French research activities for development by the Ministry of Research (18 August 1988).

Territories (DOM-TOM⁸) only developed in the early 1970s. In Latin America, French researchers started to form visible critical mass only in the late 1970s and early 1980s. The implantations in Asia have been (and still are) very limited and not very important. Thus, despite a redeployment in the other geographical areas, the continent of Africa remains the first beneficiary. Agricultural research with more than half of the total resources is by far the most important research area. It is followed in order of importance by environment and health. The other areas which have been promoted mainly during the 1980's are receiving a much smaller share of the national effort. They include mainly engineering, development studies and urban research.

French participation in the Consultative Group for International Agricultural Research (CGIAR), although still limited to about 1% of its overall budget, has steadily increased through the 1980s. Closer relations have also been established between CIRAD, INRA and ORSTOM, and the CGIAR centers, involving information exchange, researcher exchange programs, complementary projects and joint studies. France has also contributed to the creation and participates in the main activities of the Special Program for African Agricultural Research (SPAAR).

Three Ministries. French colonial history still affects the respective responsibilities of the different Ministries responsible for international development research activities. Thus, the world is divided into two categories of countries: the former French colonies in Africa (known as countries "du champ") and the others (countries "hors champ"). The former are under the responsibility of the Ministry of Cooperation and whereas the latter come under the Ministry of Foreign Affairs⁹. The Ministry of Cooperation spends about 2% of its budget for S&T activities. The Ministry of Research is responsible for the budgets allocated to all French research public institutions. For the specialized research institutions for development through cooperation such as ORSTOM and CIRAD, the budget is developed in consultation with the Ministry of Cooperation. Within the Ministry of Research there is a special department responsible for research activities in cooperation for development. To these three ministries one could add a fourth one, the Ministry of the DOM-TOM, to the extent that research activities in the DOM-TOM are concerned.

In order to give a new impetus to S&T cooperation between France and the developing countries, the Ministry of Research took the initiative of launching a countrywide reflection on research activities in cooperation for development. The results were presented in the Berque Report (1982). One of the main outcomes of this report was the launching of a National Program (Programme Mobilisateur n 4), "Research and Technological Innovation for Development," under the co-trusteeship of the Ministry of Research and the Ministry of Cooperation. This program was in operation until the end of 1985. With the change of government a new triennial plan (1985-1988) for Research and Technological Development was adopted. In this new plan the importance of research in cooperation with the Third World was reaffirmed but, at the same time, budget allocations for that purpose in the RCD Department within the Ministry of Research decreased significantly. A new (less ambitious) interministerial coordination mechanism was set up in 1990: The National Research Coordination Committee for Development.

Three specialized institutions. Among the specialized institutions, the two main institutions are ORSTOM and CIRAD. CIRAD is the only French research institute specialized in tropical agricultural research for development. It defines itself as "an applied research body ... (which) must produce useful results for development" (CIRAD, 1991). With an annual budget of 900 millions FF and close to 1000 researchers and technicians, CIRAD mobilizes about 2/3 of the French resources for agronomic research. Technical fields such as agronomy and soil sciences

⁸France has 5 overseas department (DOM): Guadeloupe, Martinique, Réunion, Guyane, Saint-Pierre-et-Miquelon; and two main overseas territories (TOM): New-Caledonia and French Polynesia.

⁹An attempt to integrate all cooperation activities into one Ministry of External Relations was made in 1981 by the new socialist government. This, however, was reversed after 1986 when the right returned.

predominate whereas the social sciences are a tiny portion of the professional staff. Close to half of this staff work in France (45%), the remainder being shared between Africa (37%), DOM-TOM(10%), Latin America (5%) and Asia (3%).

With a slightly higher number of researchers and slightly lower budget than CIRAD, ORSTOM carries out research activities in a much greater number of scientific disciplines and research areas. It is organized into five departments of which the "Environment and Agricultural Activities" department is directly involved in agricultural research. With slightly more than 1/3 of the scientific staff and the budget, it is the biggest department within ORSTOM. More than half of ORSTOM staff work in France (52%), the remainder being shared between Africa (22%), DOM-TOM (14%), Latin America (8%) and Asia (2%). In addition to a wider scientific spectrum and a more fundamental research approach, ORSTOM distinguishes itself from CIRAD by its strength in the social sciences (about 1/4 of the total scientific staff). Furthermore while both are public establishments they have slightly different mandates. ORSTOM is a scientific and technological body while CIRAD is defined as industrial and commercial. One of the implications is that while ORSTOM gets close to 100% of its budget from the Ministry of Research, CIRAD has to complement the government subsidy (63% in 1990) with self-generated income and additional grants.

The third specialized institution is the Overseas Pasteur Institutes. With close to 100 scientific staff and a budget of about 30 millions FF, they carry out research in parasitology (malaria, trypanosomiasis, bilharzia), bacteriology (tuberculosis, leprosy, plague), and virology (yellow fever), as well as on sexually transmitted diseases.

Institutions partly concerned with Developing Countries. The main mandate of these institutions is to work on national scientific problems but part of their activities is devoted to Third World Research. Thus, efforts made in this direction by CNRS are, although difficult to evaluate, far from negligible. They tend to concentrate in the area of research training mainly through collaborations with the Maghrebian countries. The participation of many Maghrebian Ph.D students and PostDocs in the work of CNRS laboratories is also substantial and must be considered as an important gain for CNRS and a way to continue promoting research collaborative links between France and Maghrebian countries.

Another institution whose Third World research activities are important is the Institut National de Recherche Agronomique (INRA). It is estimated that about 150 fulltime equivalent INRA scientists (about 10% of the total staff) carry out agronomic research activities in or for the Third World. Half of these activities, however, are concentrated in the West Indies (Guadeloupe and Martinique) and French Guyana where INRA has its own centers. Other main partners include by order of importance Argentina, Brazil and Mexico in Latin America, the Maghrebian countries, as well as China and India.

In addition to CNRS and INRA there are numerous dispersed laboratories belonging to universities and other higher learning institutions as well as a number of other institutions including: IFREMER (National Research Institution for Sea Exploitation), INSERM (National Health and Medical Research Institute), CEA (Nuclear Energy Agency), AFME (French Agency for Energy Conservation), and BRGM (Geological and Mining Research Bureau). Most of the latter institutions, except for some higher learning institutions, are not directly involved in agricultural research.

Negotiation for change

While the French system is often judged favorably abroad¹⁰, in France it receives many critics. Paradoxically,

¹⁰"The systematic use of science in support of economic development has been carried further and has been more rationally organized in France than anywhere else" (Solo, 1975). "The French bilateral R&D Programme for Development (...) can claim to be one of the most successful ... and is much admired by scientists in other countries" (D. Williams, 1982).

the most virulent of these critics are former or current officials within the ministries or institutions¹¹ concerned. Most of them do recognize the importance and the potential value of the system which occupies according to the French Ministry of Research "the first place in the world in relative value and the first place in absolute value". But the very fact that France still has many research centers abroad (particularly in French speaking Africa), and an important number of specialized researchers having a unique knowledge of local conditions, constitutes the strength and the weakness of the French system. In contradiction to most of the other developed countries France does not have a mechanism to directly support national research systems (NRS) and research teams in the developing countries financially. Heavily engaged in financing French research centers in Africa, France is not in a position to derive enough resources for strengthening NRSs in the developing countries. A major bottleneck which limits collaborative scientific efforts between France and its developing country partners is the lack of sustainable funding for NRSs. To cope with this problem, the Ministry of Cooperation has set up a special fund for implementing collaborative agreements between African and French researchers. A forum of partners on the conditions of sustainable research in Africa was also organized by ORSTOM in 1991 and mechanisms to support collaborative partnerships have been strengthened.

Future Directions

Despite the gradual transfer of the French centers to national authorities and the progressive integration of French researchers in national research systems in Africa, too many African researchers -- partly because they have not developed the capacity to negotiate -- are collaborating with "French" projects. We feel that the massive presence of French researchers in a number of French-speaking African countries such as Senegal, constitutes a risk of retarding the emergence of national scientific communities. The situation is, however, progressively changing with the gradual transfer of the French centers to national authorities. But again, partly due to the absence of sustainable funding, this transition may prove to be problematic¹²

A transition from technical assistance to scientific cooperation will only be possible if NRS can become true partners. French researchers are certainly eager to share their skills and experience with their partners in developing countries but more should be done to provide improved services to the latter in a number of essential areas such as training of personnel, access to scientific information, access to scientific journals to publish their results, participation in research networks, and institutional management. As for the French researchers their participation in these overall activities should be rewarded and they should not be promoted solely based on their scientific achievements¹³.

¹¹This became particularly obvious during the interviews we conducted in France during May and June 1989.

¹²One of the first and most prestigious ORSTOM center (Adiopodoumé, Ivory Coast) was to be transferred to an international research center. Today, the center is empty and kept by the army. An agreement is still to be reached between the donors and the host government on the mandate of the new center and its funding. In other cases like the Congo, where a regional center has been planned to be set up, things are going more smoothly.

¹³The criteria for evaluating researchers at ORSTOM are being reconsidered. In addition to evaluating scientific achievements; the peer review committees have been given new evaluation criteria including implementation of research results and diffusion of scientific knowledge in general, research in partnership with developing countries' scientists, research training, research supervision and management. But the peer reviewers, being scientists themselves, not surprisingly tend to consider scientific achievements (in particular number of publications in refereed journals) as the most important (and sometimes sole) criterion.

The splitting of the Third World, the recent rapidly shifting political environment, and the need for a scientific comparative approach demand a geographical re-deployment of the French scientific cooperation. Most decision makers in the specialized institutions tend to agree with this proposition but the French government and particularly the Ministry of Cooperation still want the efforts to be focused in Africa. The distinction between the countries "du champ" (former colonies in Africa) and of the rest of the world, i.e., the countries "hors champ," is anachronistic and relies heavily on the definition of the geo-scientific policies of the specialized institutions⁴. Despite the reforms implemented since 1981, "the instruments of our cooperation, empirically shaped, have remained the same". In the area of agricultural research, the reform of the institutions has permitted a closer collaboration between CIRAD, ORSTOM and INRA, but not as much as one would have hoped¹⁵.

France is also working together with her European partners at strengthening European alliances. To create a new north-south scientific partnership it is important to transcend the strict bilateral dimension. Collaboration between European and Third World institutions has already been enhanced since the early 1980s through the Science, Technology and Development program of the European Community (EC). The idea of a European Association is also envisioned so as to establish between member countries joint channels of scientific cooperation with developing countries. The establishment of a European Foundation to support research activities in Africa has also been proposed by the French government to the EC. For various reasons, this project is not likely to be implemented in the near future though efforts are being made to revive it in France. Such a Foundation would nicely complement the French System, by providing her partners, i.e., the national systems, with some of the necessary means to become true partners.

II. The American System

Brief historical background

The development of the Marshall Plan (1948-52) represents a watershed in American thinking about foreign assistance. Europe, devastated by the war, would be given very large sums of money and some (very limited) technical assistance to get it back on its feet again. This was seen as in the interests of the U.S., as a prosperous Europe would be a market for American goods. It became also clear as the Plan developed that political objectives were foremost¹⁶.

¹⁴The position of the institutes varies slightly. Whereas ORSTOM has clearly reaffirmed that its first priority is Africa with a deployment towards English-speaking Africa, CIRAD clearly stated in its recent strategic plan that its vocation is to contribute to the development of tropical and subtropical regions wherever they may be.

¹⁵A coordinating body CIO (CIRAD-INRA-ORSTOM) has been established. This coordination is particularly useful for clarifying and unifying the French position particularly with the international centers and networks, with which a number of agreements have been reached.

¹⁶The report entitled "European Recovery and American Aid" prepared in 1947 by the President's Committee on Foreign Aid, chaired by then Secretary of Commerce Averell Harriman stated that: "We all know that we are faced in the world today with two conflicting ideologies. If these countries by democratic means do not attain an improvement in their affairs they may be driven to turn in the opposite position."

By the early 1950's, while the Marshall Plan was still in effect and following the announcement of President Truman's point IV program, the U.S. turned its interest to the developing nations, many of which had only recently been granted independence by the colonial powers. American interest shifted for very complex and overlapping reasons involving (1) a concern that communism might spread throughout the developing world, (2) a desire to find new markets for American goods, and (3) a humanitarian concern for the impoverished peoples of the Third World. With the establishment of the Mutual Security Act of 1954, all U.S. foreign assistance programs, including economic, military and security programs were recodified thus forming the major components of the U.S. foreign assistance current programs.

American scientific and technical assistance has had three thrusts historically. First, American private foundation personnel began work in developing nations, with a clear and specific emphasis on creating a Green Revolution to counteract the potential Red Revolutions that had occurred in several places. Second, in its early days, the predecessors of the Agency for International Development (AID) and the agency itself had their own scientific and technical expertise upon whom they could draw to carry out programs. Finally, AID drew on the expertise of the Land-Grant Universities¹⁷ (LGUs) to help provide technical training and what later became known as Institution Building projects.

The Foundations. The Ford and Rockefeller Foundations began to invest in the improvement of agriculture in developing nations during WWII. The approach of the Rockefeller Foundation was quite similar to that it had taken earlier in the century, first with the creation of an agricultural extension service in the United States and then in its support for molecular biology.¹⁸ That approach consisted of providing support for a large number of scientists many of whom were directly hired by the Foundation. The best known example is probably the support given to develop what is now CIMMYT in Mexico in 1943, where the Foundation supported numerous scientists and developed a strong interdisciplinary research program. The Ford Foundation also invested heavily in agriculture, but it tended to support scientists in other institutions rather than to create its own agencies and to focus more attention on extension and on "rural poor people" of the Less Developed Countries (LDC). The foundations have the great advantage of being able to take the long term view¹⁹, maintaining programs of far longer duration than government agencies and providing scientists with excellent facilities and benefits.

Government. The forerunners of AID developed a model not unlike those of the Foundations. Even before the end of WWII, Americans had provided some assistance to the development of cooperative experiment stations in Latin America (Moore, 1943). However, unlike the Institution Building efforts established later, these focused largely on export crops. The Point Four program of Harry Truman was the first major effort to assist developing nations. It assumed that Western science, technology, and institutions would be sufficient to solve the problems of Third World (Morss and Morss, 1982).

¹⁷The Land-Grant Universities were established during the Civil War. Each state was granted a piece of federally owned land, the proceeds from the sale of which would be used to endow a university that would teach students "agriculture and the mechanic arts." Hence, the expression "Land-Grant University."

¹⁸For a history of the Rockefeller Foundation's work on molecular biology, see Kohler (1978), Kohler (1980), and Yoxen (1983).

¹⁹For example Ralph Cummings, Sr. spent 10 years in India developing the Rockefeller programs there. Lele and Goldsmith (1989) report that he spent six months just sizing up the situation before proposing any specific activity with India. No government agency could afford that luxury.

In 1961, Kennedy inaugurated the Alliance for Progress which was the first attempt to transform the image of aid²⁰. One administrative structure in the State Department to be known as Agency of International Development was established. At this time, Congressionally imposed restrictions limited the type and amount of research that AID was permitted to undertake. In addition, AID staffing patterns were changed such that less technical expertise remained within the agency. By the late 1960s, centrally funded AID expenditures for agricultural research had dwindled to about \$3.5 million forcing cuts in training and other research related programs (Crawford and Barclay, 1982).

In the early 1970s, as a response to strong criticism of the agency, the thrust of development policy shifted again with emphasis being placed on helping the "poorest of the poor." This shift to a focus on poverty did represent a radical change in the objectives of AID programs, though in practice there was much lip service paid to it. The "New Directions" mandate focused attention on small farmers and income distribution, though it, too, often became merely a justification for anything done in rural areas. Moreover, the emphasis was placed on rural development activities and research was seen as only marginally relevant to that. Only with the passage of the Foreign Assistance Act of 1975 was the ceiling on research expenditures removed. However, to this date, the agency contains few technically trained staff²¹.

The 1970s also saw the meteoric rise (and fall) of Farming Systems Research (FSR). FSR was probably the most important attempt to transcend the single-commodity, production oriented research that had been the central focus of both AID programs and those of the International Agricultural Research Centers (IARCs) since their inception. Despite a number of limitations and criticisms, AID-financed research using the FSR approach has raised a significant number of important new questions, forcing many scientists to rethink not only their research in the Third World but in the U.S. as well.

During the 1980's the Reagan administration started to explore the possibilities for creating research-oriented foundations in developing countries. This was much in line with the professed policy of the administration of privatization of services. Simply put, the idea was that by creating research foundations in small Latin American nations, stable funding of agricultural research -- difficult at best under financial stress -- might be achieved. However, a study for the Latin America and Caribbean Bureau (Sarles, 1987) suggests that when such foundations are established, there is often little or no control of their agenda by any democratically elected authority. More recently in the framework of the Inter-American Scientific Cooperation Act of 1991, the establishment of a Mexican-U.S. science foundation is envisioned using debt-swaps as an endowment.

Universities. Soon after the announcement of Point Four Program of President Truman, John Hannah, President of Michigan State University and of the National Association of State Universities and Land Grant Colleges (NASULGC), offered the services of the LGUs to further the objectives of Point Four. At that time, however, workers in the U.S. Colleges of Agriculture had essentially no experience in technical assistance. With the prospect of federal support for such activities, efforts were made to provide technical assistance as it was requested. But efforts remained unfocused and no clear goals were developed.

²⁰Among the key components proposed by Kennedy were: "a unified administration and operation; unified country plans instead of a series of individual, unrelated projects, long-term planning and financing; increased emphasis on development loans repayable in dollars; self help as a criterion for assistance; and separation of economic assistance from military assistance." (USAID, 1989?: 15).

²¹Except perhaps in the early 1980's when the Bureau of Science and Technology was established. Efforts were made to attract top technical talent. However, many of this Bureau's initiatives were blocked by the AID regional bureaus.

In response to this, the Institution Building (IB) approach was born. It was assumed that the problems of developing nations stemmed in part from a lack of modern institutions, particularly agricultural research and extension institutions. Since the LGUs were seen by many as the very model of scientific institutions, it was logically soon argued that the Land Grant model had to be transferred to developing nations²². American confidence in its institutional forms, and in their transferability, led to the insistence that the Land Grant model had to be adopted in its entirety. For example, in attempting to transfer American models to India, Agriculture College Dean, Harold W. Hannah used the metaphor of a blueprint (Hannah, 1956). A 1968 review of some 68 university contracts, many of which were IB contracts, concluded that insistence on the Land Grant form had impaired many IB projects. The report went on to note that, "It is unfortunate that alternative models have not been experimented with more imaginatively by U.S. university teams" (Committee on Institutional Cooperation, 1968:111).

In the late 1970s the Collaborative Research Support Programs (CRSPs) were created. These were consortia of LGUs organized around one or a small number of crops. Two exceptions were those relating to soils and to farming systems and a new one is now being launched on sustainable agriculture. The idea behind the CRSPs was to create truly collaborative and interdisciplinary programs with scientists in developing countries. A novel aspect of the CRSPs was and remains the involvement of social scientists in them from their inception (McCorkle, 1989). Unfortunately, the CRSPs have had to contend with the fact that science in developing nations is often unevenly developed, such that the mix of disciplines obtainable in the U.S. is not matched by the developing nations. Moreover, for reasons to be discussed below, the CRSPs have not been appreciated by the field missions and they have had mixed results. At their inception, they tended to attract scientists who saw in them significant sources of funds, but who had only a minor interest in international work. They also required some time to mature such that the scientists involved learned how to cooperate with their counterparts in Third World. In recent years many problems have been rectified by better review procedures involving scientists from the developing nations themselves.

The Current Structure of Scientific and Technical Assistance.

AID has some 4700 directly hired civil service employees (down from a peak of 17,500 in 1968). About 52% of the agency personnel are located overseas at a given time, and just slightly less than half of them are foreign nationals (Hamilton Report, 1989). The agency also has contracts with some 7700 other persons at any one time. A significant portion of these persons are engaged in some form of scientific or technical work²³. Among agricultural scientific personnel, about 25% of these "other persons" are employees and the rest are from private consulting firms. Fully 45% of consultants are hired on contracts of two months or less (AID, 1984).

AID is organized along both regional and functional lines. Three regional bureaus cover Latin America and the Caribbean, Asia and the Near East, and Africa. In recent years two nations, Israel and Egypt, have received the lion's share of total assistance. Other nations such as Pakistan, Turkey, and the Philippines have also received very large shares of the pie. In contrast, Africa and most nations of Latin America have received relatively little. Thus, the Asia and Near East bureau has been favored heavily.

²²It should be noted that the Land Grant model was, and remains, somewhat of a fiction, masking a wide array of institutional forms. In addition, proponents of the Land Grant model often forgot that LGUs were not themselves entirely responsible for the rapid growth of American agriculture. Farmer organizations that lobbied for research, private seed, chemical, and machinery suppliers, and others also played significant roles. However, they were usually so taken for granted by Institution Builders, that they were overlooked.

²³Since we do not know the exact portion these figures are however difficult to compare with those on the French system.

Each regional bureau contains a "desk" responsible for coordinating affairs relating to a particular country in the region. It is through these regional bureaus that country missions are administered by Washington. Regional bureaus also have small science and technology advisory staffs within them. In addition, functional bureaus are responsible for various substantive concerns. Of most concern to us here is the Science and Technology (S&T) bureau renamed Bureau for Research and Development (R&D) in 1991, which contains within it a division responsible for agricultural issues. Unlike the regional bureaus, R&D has no formal linkage to the national programs; however, it does have funds for regional and global initiatives and may use these funds to encourage the development of certain types of programs at the regional level or projects at the mission level. In addition, and unlike the regional bureaus, R&D does have some considerable technical competence. Occasionally, it uses this competence to prepare papers on issues of general concern to the Agency. A very significant and fixed share of R&D funds goes to support the programs of the Consultative Group for International Agricultural Research (CGIAR). Given the essentially static funding for AID, annual inflation, and earmarked countries such as Egypt and Israel, the flexible portion of the agriculture budget has been shrinking each year, much to the chagrin of most persons in the R&D bureau. The tendency to earmark has been on the rise during the 1980's.

Negotiations for Change.

As is true of most organizations, the structure of AID gives a misleading idea of its operation as an agency. There are essentially three types of assistance provided by AID: Security,²⁴ Food, and Development. The State Department and its allies strongly support security assistance while a segment of the public supports food aid on humanitarian grounds. Commercial interests support those portions of all programs that further their interests. Development Assistance tends to fall through the cracks as it has few identifiable supporters. The result of this is that development objectives are often given short shrift. Moreover, given that scientific and technical assistance are by definition long term activities, they tend to suffer the most when AID projects and programs are canceled, scaled-down, or reoriented.

In addition, while AID was at one time intended to be an autonomous agency, it is housed in the State Department and is fully integrated into the foreign policy bureaucracy. As a result, AID tends to tailor its programs to the diplomatic objectives set by the State Department (Rossiter, 1985). AID faces other constraints from its external environment (e.g., Congress, special interest groups) over which it has little or no control. In addition to these broad conflicts that cut across all types of aid programs, there are other conflicts that are specific to scientific and technical projects. Specifically, AID and the university community frequently do battle with each other over the nature and scope of these projects. This, in turn, is a function of the response of AID officials to its highly bureaucratic structure.

Being rewarded in large part for spending money (and not on the outcome of the approved projects), AID mission staff will tend to develop projects which have the greatest chance of being approved quickly in Washington. The high turnover of mission staff designed to prevent them from "going native", also puts pressure on staff to get projects developed and approved quickly and insures that no one in a given mission is there at both the inception and completion of a given project. Another consequence is the lack of an institutional memory. At the same time, the mission directors, who tend to be noticed for doing something novel and successful, have an incentive to stop everything when they arrive on the scene and attempt to redirect the mission's program. This almost invariably leads to hostility between the staff and the director²⁵.

²⁴Security Assistance can and does include military support, but it may also include other items deemed desirable from the point of view of American foreign policy.

²⁵Apparently, this is a problem that is not limited to the U.S. Mosley (1987) cites a Canadian official who makes the same argument for Canadian assistance programs.

The LGUs march to the tune of yet another drummer. When seeking AID funding, universities are at least as concerned about the quantity of the overhead generated (about 1/3 of a given contract) as they are about the substance of the project. Some of this money is used to support necessary services on the campus in direct support of international programs; much more of it is used to underwrite the general university budget. In many cases, faculty who do get involved with international development activities risk losing status in the eyes of their colleagues who see such activities as second-rate science or not even science at all. Such perception may also translate into a reduction in more substantive rewards.

In recent years, AID has attempted to enroll universities in longer term relations through the CRSP. Consortia have been organized around particular commodities of relevance to the Third World (e.g., sorghum, cowpeas, small ruminants, etc.). Within each consortium projects are developed by groups of scientists in collaboration with Third World counterparts. These projects are then funded for work in specific countries. One of the dilemmas faced by the CRSPs, however, is that AID missions often see them as threatening. First, they take money that would otherwise be in mission budgets and give it to U.S. scientists. Second, teams of scientists associated with CRSPs require the time and resources of AID missions -- time that otherwise would be spent in developing mission projects. Thus, some missions have blocked CRSPs from operating in a given nation²⁶.

The CRSPs are also plagued by two internal problems. First, they are supposed to be collaborative in nature. Yet, AID desires to see them operating in the world's poorest nations. Not surprisingly, these nations have few or no scientists with whom American scientists might collaborate. Thus, AID often criticizes scientists for not working in a truly collaborative mode. Second, CRSPs are supposed to be interdisciplinary in character. Both natural and social scientists are to be represented. Only in this way, it has been argued, can the research achieve the critical mass necessary to move it from the research station to the farmers' fields. Yet, LGUs do little domestic interdisciplinary research (Busch and Lacy, 1983). Therefore, CRSPs all too often simply divide the available funds among the various disciplines rather than develop truly interdisciplinary programs. This weakens the overall effectiveness of the program.

Future Directions.

American bilateral assistance to developing countries has always been the object of sharp critics and renewed proposals for philosophical and institutional changes. During the last 3 decades no less than 10 major reports have reexamined the situation and proposed recommendations²⁷. Four of these reports were published during 1988 and 1989²⁸. They represent the recent flurry of concern about AID which is partly due to the very large portions of the total AID budget spent in Egypt and Israel and the overall disarray in the agency. There is also a feeling on the part of some that while AID may have served its role well in the past, a changing world demands a changing agency. For example, the report by the late administrator Alan Woods (1989) argues that the debt crisis in the Third World, the growing concern about the environment, the communications revolution, and the U.S. fiscal deficit demand a rethinking of development agency goals. To these, one could also add today the rapidly shifting political environment which has brought an unexpected end to the cold war.

²⁶It should be noted that AID missions have to approve the visit of members of CRSP teams. They can and do delay visits when they see them as not in their best interests.

²⁷For a more comprehensive insight on eight of these reports see Weiss (1990).

²⁸Schmuckler, Berg and Gordon (1988), Woods (1989), The Phoenix Report (1989) and The Hamilton Report (1989).

Most of these reports stress that the foreign aid legislation is cluttered with obsolete, ambiguous and contradictory policies and argue for more clearly defined objectives and responsibilities, more flexibility, fewer conditions²⁹, restrictions and earmarks, more accountability for results and better coordination among different parts of the U.S. aid efforts. Many reports also argue for a clear separation of responsibilities: programs requiring large funds transfers should be left to international institutions; military assistance should be administered by the Defense Department; political and security assistance should be handled by the State Department³⁰. They also argue for more long-term commitment and funding [see in particular Gardner Report (1964); Hannah Report (1969); The Phoenix Report (1989)].

Most of the recent reports say little about science and technology. Some of them, however, argue for continued support to agricultural research (Woods, 1989; Smuckler, Berg and Gordon, 1988). This latter report also reiterates an argument made several years earlier by the Office of Technology Assessment (1984) that the U.S. should use its LGUs to increase food production in Africa³¹. The more recent reports recommend the abandonment of the old idea of aid and its replacement with the idea of mutual gain through cooperation (Smuckler, Berg and Gordon, 1988; The Hamilton Report, 1989). Most of the reports also rightly stress that only programs that respond to American national interests are likely to receive support from Congress. They also note that American national interest lies in a healthier, more prosperous Third World. Among these reports, those which were prepared by independent commissions (external to the AID organization), repeatedly proposed the creation of an autonomous and decentralized agency (more or less modelled on the National Science Foundation), staffed with technical personnel, and operating through a simplified procurement system and collaborative approach to development assistance. None of these proposals or any other alternatives have been acted on to date³². They have been opposed by "the Congress "who want only one Agency to deal with, and by AID managers who want undivided authority and responsibility" (Weiss, 1990).

The creation of such an autonomous agency was close to being implemented following the 1979 U.N. Vienna Conference on Science and Technology. As part of the preparation of this conference, President Carter announced in a speech in Caracas the creation of the Institute for Technical Cooperation (IFTC), a semi-autonomous organization under a new umbrella organization, the International Development Cooperation Agency. However, although it formally exists, and despite extensive lobbying efforts by the Carter Administration, funds have never been appropriated by the Congress for its implementation³³. The conditions allowing long-term investments in

²⁹The Hamilton report indicates that current legislation specifies not less than 288 reporting requirements (second only to the Department of Defense). It further sets forth 33 objectives, and 75 co-equal priorities.

³⁰The Carlucci Commission, however, argued for a clear connection between security and development assistance so that development assistance motivated by security considerations would also be oriented to development ends (1983).

³¹Some efforts have been forthcoming in that direction under the Plan for Supporting Agricultural Research and Faculties of Agriculture in Africa (AID, 1985).

³²The only exception is the Babb Report (1977), who became the basis for AID's implementation of the "New Directions".

³³The only vestige left from the IFTC/IDCA proposal is the research grant program in Science and Technology Cooperation (PSTC) originally administered by the Office of the Science Advisor to AID which in turn has been reabsorbed into the Office of Research of the Bureau for Research & Development.

science and technology having not been fulfilled, it is not surprising to see that renewed calls are made for the creation of an independent Foundation for technical assistance and research. The most recent one linked to the sustainable development debate. It proposes to establish a semi-independent institute or a foundation for sustainable development associated with a reconstituted and revitalized (and perhaps renamed) Agency for International Development (EESI task force, 1991; Speth, 1992).

French and American Programs and Approaches Compared.

It is clear from the above discussion that the French and American scientific and technical assistance programs are different. They, however, play roles that are often complementary, though they are rarely seen in that light by either the French or the Americans. Consider some of the issues:

1. The French can draw on a scientific staff of over 5000 persons who are full-time civil servants. These people have focused their careers on scientific and technical issues that pertain to developing nations. They can be stationed in a given developing nation for ten or more years to work on a highly specific project. In contrast American scientists are drawn into overseas work on short term consulting assignments. A two-year term is considered long by American standards. This means that scientists barely have enough time to assess the situation before their contract has ended. Moreover, unlike the French scientists who are civil servants, there are few rewards, other than a modest salary increment, for spending time overseas.

2. American scientists can be brought in in groups to focus on a particular issue or problem. They are often part of a larger team that is charged with building institutional capacity locally. This means that, in principle, those scientists who do go overseas for a particular project will be motivated to work as a group to improve a particular situation. In short, the American approach permits the formation of a critical mass rapidly. In contrast, the French approach provides much more freedom to individual scientists to develop their own programs as they see fit. At its best this means that excellent scientific work is conducted by individual researchers or small groups. At the same time, this may lead to fragmentation and large numbers of very small programs scattered around the world.

3. Much of CIRAD research is organized around tropical cash crops. In contrast American research is nearly entirely focused on food crops and appears to have moved in recent years from wheat, rice, and maize to crops grown by the poorest of the poor (e.g., cowpeas, sorghum, millets, etc.). Thus, American agricultural research is complementary to French research. The commodity focus of both groups has often led to simple solutions that do not take into account the multi-commodity world which farmers inhabit. Neither the Farming System Research approach now common among U.S. researchers nor the Systèmes Agraires approach of the French are well-integrated into commodity studies. Both tend to ignore the larger economic and sociopolitical context within which production takes place.

4. While American scientific and technical assistance is intimately linked with foreign policy, French assistance is much less influenced (particularly since the 1980's) by the prevailing political winds. This is undoubtedly a function of the administrative structure of CIRAD and ORSTOM which permits them to operate as quasi-autonomous entities. This has the advantage of permitting them the latitude, with a few exceptions, to complete ongoing projects irrespective of changing diplomatic relations with the nations involved. In contrast, the U.S. system has the great disadvantage of tying diplomatic and development concerns too tightly together. The result is that scientific and technical projects -- which are long term by definition -- suffer.

5. The French system is unique in that foreign assistance is delivered through two ministries and two major scientific cooperation agencies. This is a holdover from colonial days and is dysfunctional in many ways, most obvious of which is that the two ministries can and do develop different policy positions on similar issues. The lack

of a uniform policy suggests (perhaps wrongly) a paternalistic policy towards the former colonies. It also has little substantive basis.

Similarly, France maintains two research organizations, CIRAD and ORSTOM, ostensibly because the former focuses on applied and the latter on basic research. It is debatable whether this distinction was ever a valid one; certainly today, in an era of biotechnology and "high tech," the distinction between basic and applied research is unsupported by the evidence.³⁴ A single, broad-based research agency that served the entire world would be more effective and probably more efficient as well.

6. Both the U.S. and France are faced with the dilemma of a scientist population that sees major difficulties in serving overseas. In the French case, this has led to the current situation in which an overly large portion of ORSTOM and CIRAD scientists are more or less permanently based in France itself. While some scientific backup in France is undoubtedly necessary to the maintenance of the scientific networks, the numbers belie a much more serious problem related to the aging of the scientific population. In most cases, scientists are reluctant to remain in the field once their children attain a certain age.

In the U.S. case, the results are the same though the issues are different. Specifically, after forty years of foreign assistance programs, there are still few rewards given (and sometimes even penalties paid) to scientists for spending time in the developing nations. Such time is often seen as time spent away from good laboratories and libraries, when contact with colleagues and the literature is reduced, and at the time in one's career when scientific productivity (as measured by journal publication) is likely to be at its highest. This situation is compounded by the fact that LGUs are financed largely by state funds and that state legislatures want to know how the research conducted overseas can possibly be of benefit to the state. Thus, many of the best scientists, who might contribute the most to Third World development, never engage in overseas activities.

7. Although France and U.S. have, during the last decade, developed means to deal with developing nations as partners in the international scientific community, all too often both nations find themselves recruiting their own scientists to do jobs for which host country scientists are already trained. This causes resentment on the part of host country nationals and perpetuates a dependent situation. Moreover, given the increasing difficulty that both nations are experiencing in getting their best scientists to spend time overseas, serious consideration needs to be given to the possibility of supporting Third World scientists, at least insofar as they participate in collaborative projects. Whether institutional support should be provided is a more complex issue; clearly, a lack of national support suggests that agricultural research occupies a low priority among national policy makers. External financing is unlikely to rectify that problem.

8. Neither nation has yet developed an effective strategy for dealing with the problems posed in Africa. Despite long term French presence and considerable American investment, Africa has yet to develop an adequate research infrastructure. To some extent this is due to the small size of most African nations and the lack of much infrastructure at the time of independence. However, France, the U.S. and other donors must take part of the blame, as they have tended to put overly large sums of money into particular projects creating research systems that are simply unsustainable. They have also tended to overload small nations with numerous aid projects. Local officials have little time and limited expertise available to coordinate their projects either. Yet, the problems plaguing Africa are likely to continue and even worsen in the very near future (Eicher, 1989). With the establishment of coordinating institutions like SPAAR and CORAF³⁵ tangible progress have been made but much

³⁴For a brief history of the distinction between basic and applied research, see Daniels (1967). For a recent critique of the distinction, see Latour (1987).

³⁵CORAF is a Coordinating body for African Agricultural Research. It has been established by the French speaking African countries and France. Efforts are not being made to extend it to the rest of Africa.

remains to be done. In particular, a more sustainable funding mechanism yet remains to be created.

9. In France, even if public opinion is more and more tending to question the effectiveness of foreign aid, a majority of French citizens still support some sort of foreign aid program which includes scientific and technical assistance. This is not the case in the United States where foreign assistance is constantly under attack. While documentation is hard to come by, it appears the greater French support has several components, not all of which would be replicable in the U.S. context. First, France had a colonial empire and many Frenchmen still alive remember that empire well. Second, France is concerned about the promotion of French culture. Finally, French aid is seen as beneficial by French industry. They see it as a way to build new markets that will later yield handsome dividends in trade volume. On the other hand, many if not most of the sub-saharan nations where France expends the bulk of its aid, are net losses to France, though not necessarily to French industry. While the first two aspects of French support for aid cannot be duplicated in the U.S., it is puzzling that American industry only supports aid to the extent that it represents a direct market for their capital goods. Greater wealth among the peoples of the Third World as a potential source of increased commerce is not apparently convincing to American business.

In short, American agricultural research for international development tends to be short term, focused on food crops, and conducted by university scientists who are not civil service employees. American research is project-oriented while French research is scientist-oriented. Yet, both nations now find themselves at a crossroads as a result of changes of a global nature. Assistance must be replaced by technical cooperation. New incentives must be found to encourage the long term commitment of scientists to the problems of Third World development. New ways to insure that developing nation scientists are treated as equals need to be developed. New sustainable and more independent funding mechanisms for supporting national research systems and scientists need to be developed. New agricultural strategies are necessary to increase food production while preserving sustainability. In particular, the chronic food problems of Africa need to be overcome. Perhaps by examining each other's programs and uniting their forces together with other donors and the less developed countries, both France and the United States can better respond to the challenges that the next century is sure to pose. Finally, while the above suggested revised policies might partly compensate for weak national institutions, they will never replace the LDC's themselves assessing the importance of S&T activities in their national priorities and taking the necessary steps to support them.

References

Agency for International Development. 1984. A Characterization of Scientific Personnel Accessed for A.I.D.'s International Development in Food and Agriculture. Columbus: Ohio State University College of Agriculture.

Agency for International Development. 1985. Plan for Supporting Agricultural Research and Faculties of Agriculture in Africa. Washington, DC: Agency for international Development.

Berque, J. (1982), Recherche et Cooperation avec le Tiers Monde, Rapport au Ministère de la Recherche et de l'Industrie, La Documentation Française, décembre 1982.

Bonneuil, Ch. (1992), Des savants pour l'Empire, la structuration des recherches scientifiques coloniales au temps de la "mise en valeur des colonies françaises" 1917-1945, ORSTOM, Paris, Coll. Etudes et Thèses, 125 pages.

Brass, Paul R. 1982. "Institutional Transfer of Technology: The Land-Grant Model and the Agricultural University at Pantnager." Pp. 103-63 in Robert S. Anderson, Paul R. Brass, Edwin Levy, and Barrie M. Morrison, ed. Science, Politics, and the Agricultural Revolution in Asia. Boulder, CO: Westview Press.

Busch, Lawrence. 1988. Universities for Development: Report on the Joint Indo-U.S. Impact Evaluation of the Indian Agricultural Universities, A.I.D. Project Report No. 68. Washington, D.C.: Agency for International Development.

_____ and William B. Lacy. 1983. Science, Agriculture and the Politics of Research. Boulder, CO: Westview Press.

Committee on Institutional Cooperation, 1968. Building Institutions to Serve Agriculture: A Summary Report of the CIC-AID Rural Development Research Project. West Lafayette, IN: CIC, Purdue University.

CIRAD (1991), The CIRAD Strategic Plan, Paris, 82 pages.

Crawford, Paul R. and A.H. Barclay, Jr. 1982. AID Experience in Agricultural Research: A Review of Project Evaluations. Washington, DC: Agency for International Development, Program Evaluation Paper No. 13.

Daniels, G.H. 1967. "The Pure Science Ideal and Democratic Culture," Science 156(June 30):1699-1705.

Eicher, Carl K. 1989. Sustainable Institutions for African Agricultural Development. The Hague: International Service for National Agricultural Research, Working Paper No. 19.

Esman, Milton J. 1972. "The Elements of Institution Building." Pp. 21-39 in Joseph W. Eaton, ed. Institution Building and Development. Beverly Hills: Sage.

EESI (1991), Partnership for Development: A New U.S. Agenda for International Development and Environmental Security, Report of an Environmental and Energy Study Task Force, Washington, D.C.

Gaillard J. (1990), Les Politiques d'aide à la recherche pour le développement du tiers monde: de l'assistance scientifique et technique à la coopération?, Cah. Sci. Hum., Vol. 26 (3), ORSTOM, Paris, pp. 407-427.

Goudineau Y. (1991), L'altruisme et la science, de la bonté des sciences coloniales à l'excellence des sciences du développement, Journées des Sociologues de l'ORSTOM, 17-18 septembre 1991, pp. 53-64.

Hamilton Report. 1989. Presentation of the Task Force on Foreign Assistance to the House Foreign Affairs Committee. Washington, D.C.: photocopied.

Hannah, Harold W. 1956. *Blueprint for a Rural University in India*. New Delhi: Indian Council of Agricultural Research.

_____. 1966 *Resource Book for Rural Universities in Developing Countries*. Urbana, IL: University of Illinois Press.

_____ and Robert G. Caughey. 1967. *The Legal Basis for Universities in Developing Countries*. Urbana, IL: University of Illinois Press.

Hansen, Gary E. 1990. *Beyond the Neoclassical University: Agricultural Higher Education in the Developing World. An Interpretive Essay*. Washington, DC: Agency for International Development, Program Evaluation Report No. 20.

International Service for National Agricultural Research. 1987. *Guidelines for Strengthening National Agricultural Research Systems in Sub-Saharan Africa*. Washington, D.C.: World Bank.

Jamison A. (forthcoming), *Modern Science in Perspective and the Search for Alternatives, in The Uncertain Quest, Science, Technology and Development* (Sachs, Sagasti, Salomon, eds.), The UNU University.

Kohler, Robert E. 1978. "A Policy for the Advancement of Science: The Rockefeller Foundation, 1924-29," *Minerva*. 16: 480-515.

_____. 1980. "Warren Weaver and the Rockefeller Foundation Program in Molecular Biology: A Case Study in the Management of Science." Pp. 249-293 in Nathan Reingold, ed. *Sciences in the American Context*. Washington, DC: Smithsonian Institution Press.

Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers Through Society*. Milton Keynes, England: Open University Press.

Lele, Uma and Arthur Goldsmith. 1989. "The Development of National Agricultural Research Capacity: India's Experience with the Rockefeller Foundation and Its Significance for Africa," *Managing Agricultural Development in Africa*. Washington, D.C.: World Bank.

Lipton, Michael and Richard Longhurst. 1989. *New Seeds and Poor People*. Baltimore: Johns Hopkins University Press.

McCorkle, Constance M., ed. 1989. *The Social Sciences in International Agricultural Research: Lessons from the CRSPs*. Boulder: Lynne Rienner Publishers.

Moore, Ross E. 1943. "Tingo Maria," *Agriculture in the Americas*. 3(6): 107-08.

Morss, Elliott R. and Victoria A. Morss. 1982. *U.S. Foreign Aid: An Assessment of New and Traditional Strategies*. Boulder, CO: Westview Press.

Mosley, Paul. 1987. *Foreign Aid: Its Defense and Reform*. Lexington: University Press of Kentucky.

Murphy, Josette. 1983. *Strengthening the Agricultural Research Capacity of the Less Developed Countries: Lessons from AID Experience*. AID Project Report No. 10. Washington, D.C.: Agency for International Development.

Office of Technology Assessment. 1984. *Africa Tomorrow: Issues in Technology, Agriculture, and U. S. Foreign*

Aid: A Technical Memorandum. Washington, DC: Office of Technology Assessment.

ORSTOM (1990), Le Projet d'Etablissement, Paris, 36 pages.

Phoenix Group. 1989. Reforms Needed in U. S. Assistance to Developing Countries. Washington, D.C.?: International Trade and Development Education Foundation.

Rossiter, Caleb. 1985. The Bureaucratic Struggle for Control of US Foreign Aid: Diplomacy vs. Development in Southern Africa. Boulder: Westview Press.

Russell, Harry L. 1927. "Agricultural Education in the Orient and Australia." Pp. 108-24 in Proceedings of the 40th Annual Convention of the Association of Land Grant Colleges. Washington, D.C.

Sarles, Margaret. 1987. Recommendations for Supporting Agricultural Research Institution-Building in Latin America and the Caribbean. Washington, DC: Agency for International Development, Bureau for Latin America and the Caribbean.

Smuckler, Ralph H.; Robert J. Berg; and David F. Gordon. 1988. New Challenges, New Opportunities: U.S. Cooperation for International Growth and Development in the 1990s. East Lansing, MI: Michigan State University, Center for Advanced Study of International Development.

Solo, R.A. (1975), Organizing Science for Technology Transfer in Economic Development, Michigan State University Press.

Speth, J.G. (1992), A New U.S. Program for International Development and the Global Environment, WRI, Issues and Ideas, Washington, D.C.

Streeter, Carroll P. 1969. A Partnership to Improve Food Production in India. New York: The Rockefeller Foundation.

USAID (1989?), Historical Overview of U.S. Foreign Assistance Legislation, Rosslyn, VA.

Weiss, C. (1990), Lessons from Eight "Reforms Commissions" on the Organization of Science and Technology in U.S. Bilateral Development Assistance, A Report prepared for the Task Force on Development Organizations of the Carnegie Commission on Science, Technology and Government, New York, 22 pages + annexes.

Williams, D. (1982), Plan by objectives for putting into operation activities of scientific and technical nature for the benefit of developing countries 1984-1987, Commission of the European Communities XII-1168/82EN, Brussels.

Woods, Alan. 1989. Development and the National Interest: U. S. Economic Assistance into the 21st Century. Washington, D.C.: Agency for International Development.

Yoxen, Edward. 1983. The Gene Business: Who Should Control Biotechnology? London: Pan Books.