



CDIE WORKING PAPER NO. 112

Case Studies of  
A.I.D. Farming Systems Research & Extension (FSR/E) Projects

Case Study No. 10

Guatemala Food Productivity and Nutritional Improvement Project<sup>1</sup>  
(520-0232)

by

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<sup>1</sup>This CDIE Working Paper is one of the case studies prepared for a cross-cutting analysis of A.I.D. FSR/E projects, A Review of A.I.D. Experience with Farming Systems Research and Extension Projects (A.I.D. Evaluation Special Study, forthcoming). The 12 FSR/E projects reviewed in this series are:

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Guatemala Food Productivity and Nutritional Improvement Project  
(520-0232)

The Guatemala Food Productivity and Nutritional Improvement (FPNI) Project was submitted by USAID/Guatemala to AID/W in December 1974, and was approved, as a five-year project, April 29, 1975, for \$1,823,000. The FPNI Project was implemented by the Agricultural Science and Technology Institute (ICTA), a semiautonomous agency of the Government of Guatemala (GOG).

The FPNI Project was evaluated four times. An initial evaluation was conducted in October 1975 (Harpstead, et al., 1975); a second evaluation in January-February 1977 (McDermott, 1977a); and a third in February 1978 (Mann and Dougherty, 1978). Finally, a project impact evaluation was conducted in May 1980 (McDermott and Bathrick, 1982).

The project impact evaluation noted that ICTA was organized around a concept and style of operation that came to be called "farming systems research" (FSR). While the evaluation pointed out that ICTA makes almost no use of this term, ICTA's approach to agricultural research brings researchers into closer contact with the farmer-client than does the traditional research methodology. ICTA's approach, by helping researchers to know and to understand the farmer,

enables them to direct their research efforts to seeking technology improvements that are relevant to his system. Because ICTA was assigned the small farm operator as its exclusive client, it directs its efforts toward generating technology relevant to small farm systems. . . innovations are tested by small farmers in their system before being released or recommended for use on small farms. . . . Farmers collaborate in the process of research by employing recommended practices and by evaluating the results...as to appropriateness. Employing this approach, farmer confidence with new technologies results in considerable informal dissemination to other farmers even before information is released to extension workers and officially promoted. Accordingly, the traditional gap separating agricultural research and extension is significantly reduced (McDermott and Bathrick, 1982:3).

In reviewing this project, it is important to bear in mind that support for this project was provided by a number of organizations including USAID/Guatemala, the Rockefeller Foundation, and two International Agricultural Research Centers (IARCs)--the International Maize and Wheat Improvement Center (CIMMYT) and the International Tropical Agriculture Research Center (CIAT).

Concept - What was the basic technical idea underlying the project?

FPNI's origin may be traced to the late 1960s, when the GOG conducted a comprehensive assessment of the country's rural areas. The assessment indicated that food production was just barely keeping pace with growing demand and that rural incomes and farmer productivity were stagnating. Further, increasing amounts of foreign exchange were being used to purchase basic food imports including maize and beans. In 1979, in response to this situation, the GOG approved a five-year development plan (1971-75) that shifted public sector priorities from the agricultural export sector to the food crop sector (subsistence and commercial production for domestic consumption); and provided for restructuring the public sector agricultural institutions.

USAID/Guatemala assisted the GOG in carrying out this plan through a series of projects. One of these, Agricultural Development (No. 520-11-190-197.1), sought to improve the agricultural extension capabilities of the Ministry of Agriculture (MOA) and to assist in establishing an agricultural research institute (ICTA) responsive to small farmer technology problems.

As part of this plan, the MOA was reorganized and four new autonomous agencies were created:

National Agricultural Commercialization Agency (INDECA), to establish a national basic grains price stabilization program including the operation of grain storage centers;

National Agricultural Development Bank (BANDESA), to provide agricultural production credit and loans for farm capital improvements;

Directorate General of Agricultural Services (DIGESA), to provide technical assistance at the farm level in farm planning activities leading to preparation and supervision of production credit loans; and

Agricultural Science and Technology Institute (ICTA), to carry out applied and adaptive research programs aimed at increasing basic grain and vegetable yields.

ICTA was formally created in 1973. From the outset, the Rockefeller Foundation provided, through CIAT, four expatriate professionals to assist ICTA's staff in planning and implementing the Institute's research program. These individuals included an adjunct director (as staff advisor to ICTA's General Manager), a technical director, an experiment station specialist, and an agricultural economist (to serve as coordinator of ICTA's rural socio-economics "support discipline" team).

The FPNI Project impact evaluation in May 1980 reported that planning for the development of ICTA had taken two years and had involved five work groups including scientists from Guatemala and other Latin American countries. Experiences from other agricultural research projects such as Plan Puebla in Mexico were carefully considered. However, during ICTA's first two years, and prior to FPNI, ICTA's departmental organization on the basis of agricultural disciplines was reorganized into a national commodity program system which brought together the various scientific disciplines to focus on specific crops. Experiment stations were renamed "centros de producción" (production centers) and became ICTA regional headquarters. Farm-level testing of crop varieties and agronomic practices was initiated in three regions, following farm-level research guidelines developed by ICTA leaders.

These guidelines were flexible so that research methodologies could evolve out of the experiences gained in the field. ICTA planners also specified that [researchers] should determine farmer acceptance or nonacceptance by introducing...new technologies to farmers directly and incorporating farmer evaluations into the research effort (McDermott and Bathrick, 1982:4).

While organizational and other startup problems (e.g., frictions with DIGESA) were encountered during ICTA's first two years, the Institute stayed on course to address four specific problems that had been identified during the rural assessment: (1) lack of adequate technology for the small farmer, (2) inadequate farm testing of the technology being recommended, (3) lack of evaluation of farmer acceptance of a recommended technology, and (4) the researchers' lack of knowledge of farmer problems and their insufficient contact with the extension agents. ICTA's approach to addressing these problems was summarized in an ICTA-prepared statement outlining the Institute's philosophy and policy (A.I.D., 1975:Annex A, p. 2), as follows:

ICTA is a member of the governmental sector and determines its programs in collaboration with the Ministry of Agriculture, the National Planning Council, the Sector Planning Office, and other institutions in the Agriculture Sector.

The programs of ICTA are directed toward contributing to increased production and the welfare of the small- and medium-sized farmer.

ICTA scientists are not only responsible for developing technology but also for its utility and application.

ICTA believes that the appropriate technology can only be developed by studying the problems at the farm level and in consultation with the farmer, and by testing the technology with farmers before practices are recommended.

ICTA must concern itself not only with the technology of agriculture, but also the customs of the farmer and his family, availability of inputs and credit, markets, economic feasibility, infrastructure, and the general quality of rural living.

ICTA must coordinate its programs and activities with BANDESA, INDECA, DIGESA, and other groups related to the rural sector.

In late 1973, an AID/W Technical Assistance Bureau (TAB)-sponsored team visited Guatemala to explore the possibility of a project to extend the International Maize and Wheat Improvement Center's (CIMMYT) breakthrough research results in high lysine, high yielding corn. The team concluded that Guatemala would be an ideal site for a R&D project on high lysine corn, and that research findings from the country's lowland and highland areas could be applied in other countries. While the potential of high lysine corn was an influential factor in the design, approval, and authorization of the FPNI Project, this project component was eventually set aside because no genetic material suitable for the highlands was available. As a result, the FPNI Project focused on providing ICTA with continued TA for research on conventional maize (Guatemala's predominant food crop), other basic grains, and vegetables.

As defined in the PP (A.I.D., 1975), the goal of the FPNI Project was "to improve the quality of life of rural Guatemalans by increasing the quantity and nutritional quality of food available for consumption and by increasing small farmer incomes in the process" (PP, p. 1). The project purpose was to "improve the GOG's capability to develop, screen and introduce new and/or improved seed varieties, cultural practices and crop mixes while putting presently available improved farming techniques into practice." Specifically, the project sought to develop and strengthen ICTA's capability to carry out a field program of adaptive research on and farm-level testing of improved technology for basic food crops.

Carrying out this field program was the responsibility of ICTA's Technical Production Unit. This unit was organized by programs along commodity lines, with major emphasis on basic grains. For each commodity program, a Crop Research team was formed to carry out research planning and implementation for that commodity. These teams worked across regions and operated through eight experiment stations (centros de producción) located in five of the eight agricultural regions of the country.

Within each centro de producción, there were one or more Technology Validation (TV) teams. Each TV team carried out on-station experiments, as well as on-farm experimental trials (ensayos de finca). The teams also provided advice to farmers who cooperated in farmer tests (parcelas de prueba) designed to validate technology generated in experimental trials. According to the third evaluation, each TV team carried out experiments and tests for all crops being researched in the team's assigned geographic area.

These teams are not separate research groups, but rather, they execute the research activities agreed upon by the various Crop Research teams and the Director of Experiment Station serving that particular geographic area. The Technology Validation teams are under the administrative control of the Experiment Station Director for the region in which they are located, but collaborate closely with, and are under the technical guidance of the Coordinator of the Crop Research team and his staff for the experiments and tests for that crop. There presently are eight Technology Validation teams attached to the various research stations (Mann and Dougherty, 1978:16).

Technical backstopping for the TV teams was provided by commodity teams organized to develop, for each main ecological region, high-yielding crop varieties and related agronomic practices. The PP outlined the operational method, developed and adapted from the Puebla Plan in Mexico, for linking the production (TV) and commodity teams:

Close contact is maintained with the production teams so as to ensure adequate feedback as well as the transfer of research results. Each commodity group is responsible for providing necessary technical assistance in the production of foundation seed for varieties released for production. A key staff member of each commodity group is the production specialist who is highly experienced in the production of the particular crop concerned (A.I.D., 1975:7).

In addition to the above, the Technical Production Unit included five "support discipline" (disciplina de apoyo) teams that worked across crop lines and regions. The support discipline teams were rural socio-economics, soils management, training, communications, and registered seed production. These teams provided indepth expertise in their particular disciplines in support of the various crop (and animal) research programs, and carried out their own research activities where such work did not fit conveniently into a particular Crop Research program. To the extent that these teams carried out their own experiments, they operated through the regional staffs attached to experiment stations, and utilized the same system of station experiments, on-farm experiments, and farmer tests (Mann and Dougherty, 1978:17).

Agricultural research in the ICTA model is directed toward specific agro-ecological areas representative of a larger universe. Researchers focus on technologies that are profitable to and can be adopted by small farmers. The knowledge of various disciplines, such as plant breeding, entomology, economics, and sociology, is focused on a particular crop or the prevalent crop mix in an area. For example:

Social scientists contribute by studying how farmers make management decisions and how innovations can be introduced which are respectful of family labor constraints, customary behavior patterns, and cultural practices. Input/output budgets to assess the profitability of each recommendation are carefully developed and analyzed (McDermott and Bathrick, 1982:3).

Commenting on ICTA's research strategy, the PP noted that the strategy was not limited to improving crop varieties. The strategy "seeks to improve cultural practices...[by concentrating]...on the major constraints identified in the respective regions. The regional production teams make periodic assessments of the respective regions...to identify the major bottlenecks" (A.I.D., 1975:9).

Design -- How was this basic technical idea translated into a project?

The project design outlined in the PP identified the following as the major project outputs: development and availability to small farmers of improved varieties for corn, sorghum, and beans; a technology demonstration program underway for high quality vegetable production; and trained professional research and extension staff developed and on-board at ICTA.

The project inputs identified in the project design included TA, participant training, and commodities.

In the area of TA, project funds were to be used to finance the continuation of a four-person TA team to ICTA that had been initiated under the Agricultural Development Project. (This was a different TA team than the four-person TA team funded by the Rockefeller Foundation). It should be noted that ICTA's charter allowed foreigners to fill ICTA line positions.

The new project altered somewhat the position descriptions for two of the four on-going AID-funded TA positions. Further, FPNI called for three new positions (corn breeder, corn production, and a research coordinator with expertise in organizing and implementing multi-crop, integrated research and extension programs). The basic expertise provided by this mix of TA specialists was to fill research management and line positions within ICTA. The TA was to be provided directly to four of the major crop research programs (corn, sorghum, beans, and vegetables) and, through these programs, to the centros de producción and Technology Validation teams.

The design also provided for 12 person months of short-term consulting support.

The participant training component provided for ten years of graduate training in U.S. and/or Mexican institutions in such fields as plant breeding, plant pathology, entomology, and agronomy.

The PP also outlined other inputs that would be provided by other organizations. Of these, perhaps the two most important were provision of short-term TA, participant training, and genetic materials support by the IARCs (CIMMYT and CIAT); and continued provision of the four-person TA team funded by the Rockefeller Foundation.

Implementation - How was the project managed by the host-country implementing agency, the TA team, and USAID?

At the outset of FPNI, ICTA was understaffed with agricultural professionals, with four employees attending long-term training programs, and five scheduled to depart during 1975. During this period, ICTA was very dependent on expatriate TA personnel being provided by donors. When FPNI was approved in April 1975, the four TA positions being funded under the USAID/Guatemala Agricultural Development Project were absorbed into FPNI and three positions were added. However, there was a delay of two years before three of the seven positions were filled (Mann and Dougherty, 1978:20). In addition to the four Project-funded TA positions, the Rockefeller Foundation was providing four TA specialists.

The project impact evaluation noted that the quality of the TA provided and the way in which it was employed were important to the successful institutional development that took place. In this regard, the evaluation team observed that most of the FPNI TA personnel were in line positions, while all of the Rockefeller Foundation-funded TA personnel were in line positions.

For example, two leaders of the three original regional production teams were AID-supported contract personnel. One of them was later transferred into the position of technical director, where he supervised all technical operations. The other served as training supervisor as well as production team leader before becoming leader of the national sorghum program. Both were replaced as production team leaders by Guatemalans, and all teams in the newly activated regional programs were staffed by Guatemalans (McDermott and Bathrick, 1982:5).

The second evaluation (McDermott, 1977a) identified several problems facing the project. Perhaps most crucial was the fact that ICTA was losing personnel. During 1976, ICTA lost nearly 20% (27 out of 140) of its personnel. The explanation most often given was that ICTA's salaries were lower than those in the private sector. On the other hand, the evaluation pointed out that a person employed by ICTA gained training and experience that were in great demand in other parts of the agricultural sector. While ICTA had established a nine-month pre-service training school in El Oriente, in 1976 the school graduated only 14 students, which was just over half of the 1976 attrition that occurred in ICTA.

But the evaluation also found that one of ICTA's very strong points was its work on "the process by which technology innovation is induced by a public entity in a deliberate manner for a specific audience or clientele" (McDermott, 1977a:13). The evaluation noted that ICTA was relying heavily on technology sources (e.g., IARCs and U.S. universities) to access agricultural science and technology. ICTA's research strategy was to move technology (e.g., genetic material of corn) from these sources; to highly-controlled experiments at the centros de produccion; to on-farm, researcher-managed experiments; to on-farm, farmer-managed tests; and, for a successful technology, to dissemination by DIGESA and others.

ICTA did not work solely with new varieties; experiments were also conducted in the area of cultural practices (e.g., time and method of planting, weed control, and fertilization). These experiments, however, were conducted on farm rather than on the experiment station. It may be noted, however, that a later (third) project evaluation found that the project's primary emphasis was on varietal improvement. The evaluation stated that, while "some work has been done, and is continuing, on improved agronomic and cultural practices, this appears to have second priority both in terms of emphasis by AID funded technicians and by ICTA as a whole" (Mann and Dougherty, 1978:16).

During this process, the selection of research problems and the technologies to be tested were to be informed by the socio-economics research program (i.e., farm surveys, farm records, etc.). However, the evaluation noted that:

Gathering information is one thing. The use of the data and information in identifying problems and deciding on the most significant opportunity for technology development and application is another. Currently, there does not seem to be a standardized process (McDermott, 1977a:14).

An earlier example of the lack of such a standardized process was encountered by the first evaluation team in 1975. That team

noted some confusion among ICTA personnel in the distinction between on-farm experiments and field tests. It also noted a certain tendency to regard the field tests or on-farm tests more as demonstrations in the extension mode than as the final test of the technology generation process (McDermott, 1977a:15).

By the second evaluation in 1977, this confusion had apparently "to a very great extent" been cleared up within ICTA (McDermott, 1977a:16). The evaluation reported that ICTA had

cleared up some of its own internal confusion about (1) the distinction between ensayos de la finca and pruebas del campo, sometimes called parcelas de prueba, and (2) whether a prueba del campo is a part of the technology development process or extension work (McDermott, 1977a:8).

However, what was yet needed, the second evaluation stated, was to improve the linkage of ICTA with DIGESA and other diffusion agencies. On this count, the evaluation noted that:

There seems to be a clear recognition of the fact that ICTA simply cannot diffuse the technology alone. It needs DIGESA and others. This recognition did not exist in October, 1975 (McDermott, 1977a:8).

By 1977, the second evaluation found that ICTA was considering a prueba del campo as a farmer test of a technology, with a minimum of assistance and supervision by ICTA. But ICTA had not yet developed "vital linkages" with Guatemalan diffusion agencies such as DIGESA (McDermott, 1977a:19), nor was it clear how ICTA's recognition of the need for such linkages was "going to be translated into effective action" (McDermott, 1977a:8). The evaluation reported that "ICTA is now discussing the need to involve DIGESA and others in the pruebas, with the intent to let the extension people participate in such a manner that they become convinced just as the farmers do" (McDermott, 1977a:8).

The second evaluation commented favorably on ICTA's socio-economics program supported by the Rockefeller Foundation. This program was engaged in developing farm surveys, farm records, ecological area identification, analytical methodology for experimental data, evaluation of technology, and measuring farmer acceptability of practices under consideration for release as ICTA recommendations. While certain components (e.g., farm records) of the socio-economics program were "becoming of increasing value to ICTA" (McDermott, 1977a:12), the evaluation reported that many ICTA personnel (e.g., production team members responsible for farm tests) lacked confidence in some parts of the program (e.g., the farm surveys).

Yet the socio-economics program was producing information of importance to ICTA's overall research program. Consider the following example:

The economists...claim that increasing corn yields in the Altiplano will likely not increase corn production. The rationale is that corn is of primary concern only until there is enough produced for home consumption needs. If there is to be surplus production for the market, the farmers would rather grow another crop, wheat or vegetables. Thus, the vegetable project and the corn project may be quite linked (McDermott, 1977a:13).

Similarly, in a 1977 trip report, McDermott (1977b) reported that ICTA's socio-economic unit was

doing some innovative work in farming systems and farm management, both in substance and in analytical concepts and procedures. Analytically, "yields" are thought of not only on units of land, but also in units of the factor that is most limiting. Economists, for example, claim that in one area of the country, farmers exhaust their supply of bean seed before any other factor, such as labor or land, is exhausted. In these situations, yields are expressed per unit of seed. The technology or system most needed is one that maximizes production per seed unit.

McDermott (1977b:7) also noted that testing of cropping systems technologies by the socio-economics unit had found

that a change in the spatial arrangements of maize opens two new alternatives. In one experiment maize production was increased 40 percent with the same land input and a 20 percent increase in labor by increasing the population. Another alternative is to intercrop. In this same experiment corn population and yields could be maintained while making 40 percent of the land available for wheat. In a modification of the pattern, cabbage was produced in the wheat with no appreciable impact on maize and wheat yields.

Yet, as McDermott (1977b) also reported, the "farming systems-farm management work" of the socio-economics unit had "not been widely accepted in other ICTA programs." Some ICTA personnel considered the work on farming systems as "theoretical and outside ICTA's method of operation. The idea of anthropologists planting crops hasn't been accepted" (McDermott, 1977a:12).

By the time of the second evaluation (1977), ICTA was making plans to expand the regional production team concept by opening up new areas in the three regions in which it was operating, and by opening up new regions, one each in 1977 and 1978. ICTA had also come to place a greater emphasis on income and welfare criteria, as compared with production of basic food grains. The rationale was that even greatly improved yields of basic grains on small acreages would have relatively little impact on farm income; further, there were indications that once farmers satisfy family needs for corn, they produce other commodities, not a surplus of corn, because of price. With this realization, interest was growing within ICTA in alternatives such as fruits, vegetables, and livestock.

FPNI's third evaluation was conducted in early 1978 (Mann and Dougherty, 1978). Project funding, the evaluation noted, had been oriented largely toward varietal improvement research in corn, sorghum, and bean. However, with the high quality of the varietal improvement TA provided by the project, the evaluation team felt that an imbalance had developed in ICTA's ability to link information generation with information transfer. What ICTA needed at this stage of its institutional development was TA "to assist in improving the system of forward and backward linkages between the information generation and information transfer processes" (Mann and Dougherty, 1978:1). This linkages also needed improvement in order to speed up progress of work in improved agronomic and cultural practices as compared with variety improvement (Mann and Dougherty, 1978:1).

The evaluation noted that, while basic grains will continue to be a major part of small farmer production in Guatemala for many years, there was a "need to improve small farmers' incomes ...beyond that which can be achieved through improvement of basic grains production alone" (Mann and Dougherty, 1978:3). Thus, ICTA needed to mount more effective research programs in fruit, vegetable, and small animal production, and to allocate research resources to determine the production potential of crop and livestock alternatives that might have a comparative advantage under Guatemalan conditions.

The relationship between the USAID/Guatemala-assisted commodity programs and the Rockefeller Foundation-assisted socio-economic research program had considerably enhanced ICTA's research capability to respond more effectively to farmers' production problems. But the evaluation found that there was "little evidence of integrated efforts on the part of the commodity groups and the socio-economic group to deal with constraint alleviation within a whole farm/household context" (Mann and Dougherty, 1978:3). Here the evaluation commented:

The importance of this integration is especially pronounced in the Altiplano because of land scarcity and surplus family labor. Associated cropping is an important means whereby the farmer attempts to more intensively use the land available to him and at the same time to more effectively utilize the family labor supply (Mann and Dougherty, 1978:3).

The socio-economic team had done some work with associated cropping in the Chimaltenango region; however, the evaluation felt that "AID inputs to JCTA commodity programs should pay special attention to this problem by focusing more specifically on cross-commodity integration" (Mann and Dougherty, 1978:3).

The need for more effective research on "cross-commodity integration" was especially noted with respect to ICTA's vegetable research program. Given the potential for expanded production of cool climate vegetables by traditional small farmers in the Altiplano, the third evaluation concluded

that relatively more research resources should be allocated to cool climate vegetable research as compared to warm climate vegetables and to basic grains research. . . . Work with cool climate vegetables probably would give greatest emphasis to agronomic and cultural practices, and would require close integration with highlands research activities in corn, wheat and beans, since much vegetable production would likely be carried out in association, or in succession, with these crops (Mann and Dougherty, 1978:8).

Integration of the socio-economic unit with commodity specialists would enable ICTA "to maximize the inputs" of commodity specialists "toward more efficient utilization of all factors of production available to the small farmer" (Mann and Dougherty, 1978:3). But the evaluation cautioned that the integration of specialties and crops

cannot be achieved merely by seeking cooperation among the various crop research teams. Rather we consider the work in this area to be sufficiently important to justify establishment of a production research team that is specifically charged with research in associated and successive cropping (Mann and Dougherty, 1978:9).

Thus, while ICTA had initiated activities on a very narrow range of crops (basic grains), the requirement to improve production, productivity, and incomes of small farmers implied the need for ICTA to expand its scope of research to include (1) associated and successive cropping systems, (2) horticultural and fruits production, (3) large and small animal production, (4) cropping alternatives (potential new crops), (5) farm management and small farm production planning, and (6) techniques of technology transfer to large numbers of small farmers (Mann and Dougherty, 1978:11).

The organizational emphasis in ICTA's early years had been on the concept of the crop-specific program team. In view of the above considerations, the third evaluation felt that there was a growing need to give relatively greater emphasis to the formation of a wider range of support discipline (disciplinas de apoyo) teams that could work across commodity lines. While the evaluation team was not suggesting elimination of the crop research teams, the team was suggesting that at least some of the prueba de tecnología groups should begin to be up-graded into multi-disciplinary research teams, leaving the crop research teams to specialize in variety improvement work.

To support the proposed changes in programmatic emphasis, the evaluation recommended that the project's TA positions be expanded to include several new positions. Two of the proposed new positions were for a production agronomist (to work on the associated and successive cropping production research team) and an agricultural economist (to work on farm records and analysis of the whole farm/household firm). This latter position would be in addition to the agricultural economist position already being funded by the Rockefeller Foundation.

Evaluation - How was the project's performance measured or assessed?

The basic mix of TA specialists provided by the FPNI Project was directed at filling research management and line positions within ICTA. As the third evaluation of FPNI observed:

These are all line positions, i.e., none are advisory. In each case, these technicians have played a major role in program design and execution. In the case of sorghum, corn, and beans, emphasis is on screening and testing of imported and native varieties, and breeding activities designed to develop superior varieties in terms of yield, nutritional value, and other characteristics considered necessary for improvement of small farmer output[,] productivity and incomes (Mann and Dougherty, 1978:16).

As ICTA professionals in training completed advanced degree or

short course training, they returned to ICTA to assume positions in research and/or research management.

In their impact evaluation of the FPNI Project, McDermott and Bathrick (1982:12) noted that ICTA was one of the first national agricultural research institutions in the developing world to implement an innovative methodology for generating technology appropriate to small farm conditions. They observed that this methodology "fits within the broad framework of farming systems research" (McDermott and Bathrick, 1982:12). Further, they concluded that, within a relatively short period of time under the ICTA system, "significantly improved seed varieties and cultural practices acceptable to the small farmer were developed for maize, beans, and sorghum" (McDermott and Bathrick, 1982:12).

Assessing FPNI Project impact, the impact evaluation team noted the contribution which project-supported research had made to developing and testing improved crop varieties, and that this research capability and its product (improved seed) had provided a key input to the development of a privately controlled seed industry. Varietal improvement research and the improved seed delivery system, in turn, contributed to increased availability to farmers of high quality seed. This, in turn, resulted in increased yields of both maize and beans. Field data gathered from the coastal area indicated that 95 percent of the farmers were using ICTA-developed varieties in 1980, compared with less than 50 percent using improved varieties in 1975. More detailed information on the project's economic impact (e.g., yields) is reported in McDermott and Bathrick (1982).

Another indicator of project impact was farmer acceptance of improved practices. For each recommendation, ICTA calculates an Acceptance Index that represents the percentage of collaborators continuing to use a recommended technology in the year following the farmer test, multiplied by the percentage of the farmers' land on which they apply the technology. ICTA established 50 as the Acceptance Index required before a new technology would be considered as satisfactory. Examination of the 1979 Acceptance Indices for maize revealed that, in the highlands (where subsistence farming predominates), two out of five indices had reached 50 by 1979. In the coastal area (where small commercial farms predominate), indices for three out of four recommendations had surpassed 50 in both 1978 and 1979. This suggested "that increasing numbers of farmers who have collaborated in field testing of technologies recommended by ICTA are adopting these recommendations. Interviews with ICTA personnel and with individual farmers supported this impression" (McDermott and Bathrick, 1982:9).

Institutionalization - How did the project provide for the implementing agency to develop a sustainable capability to continue to perform the types of activities supported by the project?

The impact evaluation of the FPNI Project assessed the extent to which the project had been successful in establishing within ICTA an institutional capability to carry out technology development (McDermott and Bathrick, 1982). As stated earlier, the FPNI Project sought to "improve the GOG's capability to develop, screen and introduce new and/or improved seed varieties, cultural practices and crop mixes while putting presently available improved farming techniques into practice. Specifically, the project sought to develop and strengthen ICTA's capability to carry out a field program of adaptive research on and farm-level testing of improved technology for basic food crops.

The project impact evaluation team concluded that the FPNI Project had attained the project's purpose because:

1. ICTA used competent expatriate personnel to fill operational line management and technical positions within ICTA, while ICTA professionals were pursuing advanced degree training programs;
2. ICTA arranged for the selection and efficient phasing of the ICTA professionals who participated in advanced degree training programs;
3. ICTA developed an inservice training program; and
4. the GOG provided budgetary support.

1. TA Personnel

As earlier noted, the Rockefeller Foundation provided TA personnel through the contracting of an adjunct director (as a staff advisor to ICTA's General Manager), a director of the Technical Production Unit, an experiment station specialist, and an agricultural economist (who served as the coordinator of the rural socio-economics unit. Further, the A.I.D.-funded FPNI Project provided TA personnel to support the national commodity programs and regional production teams. One of A.I.D.-funded TA team members was eventually promoted to Director of the Technical Production Unit.

Over 70 percent of the FPNI Project's \$1.7 million budget was for the contracting of expatriate TA personnel who served in various line positions within ICTA. Over time, these positions included coordinators of the sorghum, bean, and vegetable commodity programs; director of pathology in the bean program; senior specialist and program geneticist for maize; directors of two regional production teams, one of whom directed inservice training; and later director of the Technical Production Unit. The evaluation reported that ICTA directors were unanimous in their opinion

that without this heavy injection of expatriate assistance, ICTA could not have benefited as quickly from the scientific work being done at the international centers and elsewhere in the world. It was also their opinion that the progress made in variety screening and testing for developing the new recommendations would not have been possible without this assistance (McDermott and Bathrick, 1982:Appendix E-3).

## 2. Advanced Degree and Short Course Training

The evaluation found that the "timing of arrival and departure for this assistance was programmed in relationship to simultaneous massive training so that expatriate line officers were replaced by trained Guatemalans" (McDermott and Bathrick, 1982:Appendix E-3). This approach enabled research to proceed, while the Guatemalans were obtaining advanced degree or short course training under FPNI Project or Rockefeller Foundation funding.

As earlier noted, there had been confusion early on (circa 1975) in the project about whether on-farm, farmer-managed tests (farmer tests) were a component of technology generation or technology diffusion. The first evaluation recommended that ICTA prepare a manual that would describe and set forth standardized procedures for implementing ICTA's model for technology development and transfer. While a draft describing the on-farm field tests had been prepared by the time of the second evaluation, ICTA still had not published a manual describing the total ICTA process. Subsequently, Waugh, Hildebrand, Fumagalli, and others (see Additional References) published numerous reports and articles describing the ICTA research methodology, although many of these were addressed to international audiences.

## 3. Inservice Training

The project impact evaluation reported that each year a group of 10 new hires is given a nine-month course on the theory and practice of the ICTA system. Graduates of this training are then moved into the vacant positions created by incumbents who had resigned from ICTA or been transferred or promoted to other positions within ICTA.

As a result of the knowledge transmitted through this inservice training program, when vacancies do occur, quick adjustments can usually be made. The new-comer usually arrives with a basic knowledge of what is necessary to get the job done (McDermott and Bathrick, 1982:Appendix E-6).

On the other hand, the evaluation expressed concern that other agencies of the public agriculture sector lacked a comprehensive understanding of ICTA's system for developing technology.

Team interviews suggest that personnel in DIGESA, BANDESA, and the Ministry of Agriculture's Sectoral Planning Office do not fully appreciate the difference between ICTA's techniques of informal diffusion and DIGESA's responsibility for formal dissemination of recommended new technologies. Most extension agents interviewed lacked knowledge of the functioning of the ICTA system and were unfamiliar with specific ICTA recommendations or their benefits (McDermott and Bathrick, 1982:11).

This problem, the evaluation suggested, could be addressed by expanding the short training course (Technology Institutional Liaison) which ICTA had developed for DIGESA. The evaluation concluded that "an increase in program understanding on the part of non-ICTA participants will require the development of new inservice training programs" (McDermott and Bathrick, 1982: Appendix E-7).

#### 4. Government Support

The project impact evaluation reported that GOG support for agricultural research had increased over ten-fold between 1969 and 1980. Further, GOG support to ICTA's annual budget had more than doubled since the initiation of AID support to ICTA. While the evaluation recognized that Guatemala's agricultural research budget was less than 2 percent of the value of the country's gross agricultural product, the increased budget had greatly strengthened ICTA's institutional capacity. For example, between 1976 and 1979, the number of M.S.'s employed by ICTA increased from 4 to 15, and the number of B.S.'s from 86 to 103.

With the exception of the rural socio-economics unit, all technical and support units were strengthened substantially. The field level technology validation unit was the most strengthened, increasing from 7 B.S.'s and 1 M.S. in 1976, to 38 B.S.'s and 3 M.S.'s in 1978.

However, by 1980, budgetary limitations had become "perhaps the biggest constraint affecting ICTA's capacity to maintain its present system and to permit its expansion" (McDermott and Bathrick, 1982:Appendix E-5). Indeed, since annual attrition rates had never been less than 10 percent, the evaluation team felt that the future of ICTA, particularly with the departure of expatriate advisors, would depend upon a reversal of the high attrition rate among advanced degree holders (McDermott and Bathrick, 1982:Appendix E-5).

As noted above, ICTA's rural socio-economics unit had not been substantially strengthened. Here the project impact evaluation reported:

Regrettably, one of the more innovative components of the project is the only one to have declined professionally. Resulting from their reluctance to be assigned to field offices and salary differences, most of the social science professionals trained by the highly regarded Rockefeller Foundation funded "advisor" departed from ICTA during 1979. The one remaining veteran left during 1978 to receive his Ph.D. but will be returning to the unit this year. Unlike the former staff which had occupied the central office, the new staff, composed of two economists and two agriculturalists (two of whom had prior ICTA field experience), has three of them assigned to Regional level offices on a full-time basis. Considering the vital role of this unit and the strengthening that has taken place ICTA-wide, this is the one unit that will require additional strengthening (McDermott and Bathrick, 1982:Appendix E-5).

Information from a recent ISNAR-sponsored case study on ICTA indicates a gradual demise of social sciences within ICTA's FSR program (Ruano and Fumagalli, n.d.). The rural socio-economics unit, initially headed by the Rockefeller Foundation-funded agricultural economist, started off as dynamic, innovative, and closely involved in FSR. The unit spearheaded the development of the famous sondeo and was actively involved in on-farm trials. However, with the expatriate's departure and a slow down in demand for diagnostic survey work, the unit declined. Basically, the unit's work became limited to classic farm management surveys carried out by technicians with minimal input or guidance from senior social scientists. Also, while all other programs and departments carried out planning and programming at the regional level, social sciences remained organized at the national level as a service unit. Finally, political unrest made it difficult to carry out social science research in the field.

Yet, as the impact evaluation team observed, around the world ICTA had come "to represent a new approach for agricultural research with agricultural planners and researchers studying ICTA as a model for possible replication" (McDermott and Bathrick, 1982:12). Based on their review of ICTA and the FPNI Project, the impact evaluation team summarized several "lessons learned" from the ICTA experience. Lessons relating specifically to institution building are:

1. The ICTA experience demonstrated the important role that a donor can play, over a long period, in developing and strengthening a country's public sector agricultural institutions. During the five years that preceded ICTA's creation, USAID/Guatemala worked with the GOG in planning and implementing the reorganization of the public agricultural sector. The Mission's early and sustained support to ICTA helped to ensure timely and appropriate assistance.
2. The FPNI Project demonstrated the potential role that A.I.D. can play in bringing relevant experience to bear (e.g., the IARCs) and in complementing the resources of other donors (e.g., the Rockefeller Foundation).
3. The Project demonstrated the importance of simultaneous investment in human, institutional, and technological resources and the comparative advantage A.I.D. has in institutional development. With the support provided by the FPNI Project and the Rockefeller Foundation, ICTA was able to implement its research program while Guatemalans were receiving advanced training.
4. The ICTA experience demonstrates the need, in an institution building project, to ensure that the institution has adequate authority and resources to carry out its mandate. The semiautonomous status of ICTA provided the institute with flexibility to plan and implement new programs, hire personnel, and make independent contractual arrangements.
5. ICTA's experience with a high attrition of advanced degree scientists is a concern shared by agricultural research institutes in many developing countries. However, where there are proven macroeconomic benefits to a country, as was the case in ICTA's experience, a government should consider special incentive arrangements to retain needed scientific expertise.

Beyond the "lessons learned" with respect to institution building, the ICTA experience also provided useful experience with respect to "farming systems research." These lessons are:

1. The Project documents the need for interdisciplinary

technological and sociological coordination in agricultural research projects that aim to develop improved technologies responsive to the multiple-cropping systems that characterize most small farm enterprises.

2. The FPNI Project demonstrated that to ensure small farmer participation in R&D, special programs need to be developed to ensure on-farm testing of potentially improved technologies and participation of farmers in that testing. "When such systems are in place, the ICTA experience shows that small farmers will assess the merits of the technology and gradually adopt it" (McDermott and Bathrick, 1982:14).
3. By 1980, the concept of "farming system research" had been "almost romanticized by some students of agricultural research. Yet that ICTA's approach to technology development demonstrated clearly that the unconventional approach clearly produced benefits in terms of generating improved technologies and practices acceptable to small farmers.

Further information on ICTA and the Institute's FSR program are reported in Waugh (1975, 1976), ICTA (1977), Fumagalli and Waugh (1977), Hildebrand (1976, 1977a, 1977b, 1980, and 1981), Gostyla and Whyte (1980), and Whyte and Boynton (1983). These references are included below under "Additional References."

### References

#### A.I.D.

- 1975 Project Paper for the Food Productivity and Nutritional Improvement Project (520-0232). (FD-AAA-947-B1)
- 1977 Project Appraisal Report for the Food Productivity and Nutritional Improvement Project (520-0232). (PD-AAA-947-F1) (See McDermott, 1977a)
- 1978 Project Evaluation Summary for Food Productivity and Nutritional Improvement Project (520-0232). (PD-AAA-947-G1) (See Mann and Dougherty, 1978)

Harpstead, Dale D., Ralph W. Cummings, Jr., Fernando Fernandez, J. Kenneth McDermott, and Edwin J. Wellhausen

- 1975 A Review: The Institute of Agricultural Science and Technology in Guatemala (ICTA).

- Mann, F., and D. Dougherty  
1978 Evaluation of Food Productivity and Nutritional Improvement Project (520-0232).
- McDermott, J. K.  
1977a Report of an Evaluation of ICTA.  
1977b Trip Report on Evaluation of ICTA, AID/W Technical Assistance Bureau/Office of Agriculture.
- McDermott, J. K., and David Bathrick  
1982 Guatemala: Development of the Institute of Agricultural Science and Technology (ICTA) and Its Impact on Agricultural Research and Farm Productivity. Project Impact Evaluation No. 30, U.S. Agency for International Development. (PN-AAJ-178)
- Ruano, Sergio, and Astolfo Fumagalli  
n.d. Guatemala: Un Estudio del Caso de la Organización y Manejo de la Investigación en Finca en el Instituto de Ciencia y Tecnología Agrícola (ICTA), draft case study sponsored by the International Service for National Agricultural Research (ISNAR), The Hague, The Netherlands.

#### Additional References

- Fumagalli, Astolfo, and Robert K. Waugh  
1977 "Agricultural Research in Guatemala." A paper presented at The Bellagio Conference, Bellagio, Italy, October 1977. Instituto de Ciencia y Tecnología Agrícola, Guatemala City, Guatemala.
- Gostyla, Lynn, and William F. Whyte  
1980 ICTA in Guatemala: The Evolution of a New Model for Agricultural Research and Development, Special Series on Agriculture, Research and Extension (ARE No. 3), Rural Development Committee, Center for International Studies, Cornell University, Ithaca, New York 14853.
- Hildebrand, Peter  
1976 "Generando Tecnología para Agricultores Tradicionales: Una Metodología Multidisciplinaria." A paper prepared for a Conference on Economic Development in Agricultural Regions: Search for a Methodology, Rockefeller Foundation Conference Center, Bellagio, Italy, August 4-6, 1976.

- 1977a "Generating Small Farm Technology: An Integrated Multidisciplinary System." A paper for the 12th West Indian Agricultural Economics Conference, Caribbean Agro-Economic Society, Antigua, April 24-30, 1977.
- 1977b "Socioeconomic Considerations in Multiple Cropping Systems." A paper for the Round Table Discussion on Agricultural Production Systems, XVI Annual Reunion of the Board of Directors, Interamerican Institute of Agricultural Sciences (IICA), Santo Domingo, Dominican Republic, May 18, 1977.
- 1980 "Motivating Small Farmer Scientists and Technicians to Accept Change," Agricultural Administration, 8(1980-81):375-383).
- 1981 "Combining Disciplines in Rapid Appraisal: The Sondeo Approach," Agricultural Administration, 8(1981):423-432.

## ICTA

- 1977 "Un Sistema Tecnológico Agrícola," Notica, No 26, July 1977, Instituto de Ciencia y Tecnología Agrícola, Guatemala City, Guatemala.

## Waugh, Robert K.

- 1975 Four Years of History. Institute of Agricultural Science and Technology of Guatemala (ICTA).
- 1976 ICTA - A Strategy for Agricultural Production Technology Development and Identification; Adaptation and Testing; the Initiation of Transfer and Application. A Paper for an International Seminar on Accelerating National Agricultural and Rural Development, University of Reading, England, September 5-18, 1976.

## Whyte, William F., and Damon Boynton

- 1983 Higher-Yielding Human Systems for Agriculture. Ithaca, New York: Cornell University Press.

## Annex A. Project Description Sheet.

This Project Description Sheet lists the core, operational, and generic constraints identified in this project, per the following codes: core (C), operational (O), and generic (G). A positive (+) sign after a constraint indicates that the project was effectively coping with the identified constraint.<sup>3</sup>

Core Constraints (C)

- C.1 Farmer Orientation
- C.2 Farmer Participation
- C.3 Locational Specificity of Technical and Human Factors
- C.4 Problem-Solving Approach
- C.5 Systems Orientation
- C.6 Interdisciplinary Approach
- C.7 Complementarity with Commodity and Discipline Research
- C.8 Technology Testing in On-Farm Trials
- C.9 Feedback to Shape:
  - a. Agricultural Research Priorities
  - b. Agricultural Policies

Operational Constraints (O)

- O.1 Stakeholder Understanding of FSR/E
- O.2 Agricultural Research Policy/Strategy Defining Role of FSR/E
- O.3 Long-Term Commitment of Resources
- O.4 Existing Research Capability and Shelf Technology
- O.5 Consensus on FSR/E Methodology
- O.6 Capability to Process Farming Systems Data
- O.7 Consensus on Criteria for Evaluating FSR/E
- O.8 Links with Extension
- O.9 Links with Agri-Support Services
- O.10 Links with Farmer Organizations

Generic Constraints (G)

- G.1 Project Management Structure
- G.2 Government Funding to Meet Recurrent Costs
- G.3 Staffing with Trained Manpower
- G.4 Management of Training
- G.5 Management of Technical Assistance
- G.6 Factors Beyond a Project's Control

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<sup>3</sup>An analysis of these constraints in 12 FSR/E projects appears in A Review of A.I.D. Experience with Farming Systems Research and Extension Projects, **A.I.D. Evaluation Special Study** (forthcoming), available from A.I.D.'s Document and Information Handling Facility (per instructions on last page of this report).

Guatemala/FPNI - Food Productivity and Nutritional Improvement (520-0232)

Initial Authorization: 1975 (for 5 years)

Goal: "Improve the quality of life and increase the income of small farmers. Increase production and improve the nutritive quality of basic food grains, beans and vegetables."

Purpose: "Improve the GOG's capability to develop, screen and introduce new and/or improved seed varieties, cultural practices and crop mixes while putting presently available improved farming techniques into practice."

Outputs:

1. Improved varieties of corn, some bearing high lysine gene developed and generally available to small farmers;
2. Improved varieties of sorghum with high protein content developed and generally available to small farmers;
3. Improved varieties of beans developed and generally available to small farmers;
4. Technological demonstration program for increased high quality vegetable production underway;
5. Trained professional research and extension staff will be developed and on-board in ICTA; and
6. Data on nutritive content of basic food products will be developed.

Implementing Agency: Agricultural Science and Technology Institute (ICTA).

TA Contractor: USAID/Guatemala (personal services contracts) and The Rockefeller Foundation.

Evaluations: Four -- in 1975 (Harpstead, et al., 1975); in 1977 (McDermott, 1977a); in 1978 (Mann and Dougherty, 1978); and a project impact evaluation in 1980 (McDermott and Bathrick, 1982).

Constraints: C.2 (+), C.4, C.5, C.6, C.8, O.1, O.3 (+), O.5, O.7 (+), O.8, G.2 (+), G.3, G.4 (+), G.5 (+).

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