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Farming Systems Research

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& Extension Activities

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in Guatemala

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*A Results Inventory*

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Office of Arid Lands Studies  
University of Arizona  
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FARMING SYSTEMS RESEARCH AND EXTENSION  
ACTIVITIES IN GUATEMALA  
A RESULTS INVENTORY

by

Billie R. DeWalt  
Professor and Chair  
Department of Anthropology  
University of Kentucky  
Lexington, Kentucky 40506

and

Robert Hudgens  
Agronomist and Program Officer  
Winrock International Institute for International Development  
Petit Jean Mountain  
Morrilton, Arkansas 72110

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## TABLE OF CONTENTS

Acknowledgements . . . . .	i
I. Introduction . . . . .	1
Early Agricultural Research in Guatemala . . . . .	1
The Establishment of ICTA. . . . .	3
ICTA - Changes through Time. . . . .	5
Concept. . . . .	6
Design . . . . .	7
Implementation . . . . .	9
Evaluation . . . . .	11
Summary. . . . .	14
II. Program Impact or Output. . . . .	15
Introduction . . . . .	15
Institutionalization . . . . .	15
National Program Financial Support . . . . .	18
Training . . . . .	22
Networking . . . . .	28
Program Content. . . . .	29
Internal Linkages. . . . .	35
III. Lessons Derived from the ICTA Case Study and Constraints to the Implementation of FSR/E in ICTA. . . . .	37
Reasons for the Successes of ICTA. . . . .	37
Internal Constraints to Doing FSR/E. . . . .	40
External Constraints on Doing FSR/E. . . . .	43
Generic Constraints to Implementing FSR/E Projects . . . . .	46
IV. Conclusions and Recommendations . . . . .	50
People Interviewed . . . . .	52
Appendices . . . . .	54
Appendix I . . . . .	55
Appendix II . . . . .	58
References . . . . .	59

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## I. INTRODUCTION

Personnel from the Instituto de Ciencia y Tecnologia Agrícolas (ICTA) [Agricultural Science and Technology Institute] in Guatemala in the 1970s were among the leaders in developing ideas, concepts, and methodologies for what became known as farming systems research (FSR). To give just one example of the influence of ICTA, the term sondeo, originally coined to describe the rapid assessment procedures used by the institute in Guatemala (see Hildebrand 1979), has been incorporated into the vocabulary of farming systems practitioners all over the world. Ideas like that of "recommendation domains," procedures for doing on-farm research, and the necessity of understanding small farmers' conditions were all part of the methodology developed at ICTA during the 1970s. In their influential text, Shaner, Phillip and Schmehl (1982) used ICTA as one of the prime examples of an FSR approach in developing countries. During the immense burgeoning of literature on and use of the farming systems research approach in the 1980s, however, there has been little indication about how the FSR approach at ICTA has fared.

We will show in this report that the farming systems research is still an important aspect of work at the Instituto de Ciencia y Tecnologia Agrícolas in Guatemala. The institutionalization and sustainability of the approach, however, has not been without problems. Political violence in the country, economic crisis, changing leadership of the institute, and other factors have meant that ICTA has gone through some very difficult periods. Through these, the goals, ideals, and philosophies of some of the founders of ICTA have managed to persevere. Our purpose here will be to detail the major successes and failures of ICTA, to show what kind of institution has developed from this historical process, and to suggest what the future of ICTA and its approach might be.

We found it impossible to understand ICTA and its approach without having some awareness of how it arose in historical perspective. Accordingly, we will first present a brief history of previous agricultural research efforts in Guatemala, then turn to a discussion of how ICTA came to be created in 1973. We will discuss the several stages through which ICTA has passed before discussing the current status of FSR in the institute. To assist the reader in keeping track of the events and processes we describe, Appendix I is provided as a summary.

### Early Agricultural Research in Guatemala

There are two recurring themes present in the early development of agricultural research in Guatemala. The first of these is the role played by institutions and agencies of the United States in establishing joint efforts on agricultural research in the country. The second has to do with the relative autonomy of these research efforts. That is, there has been a continuing ambivalence within the country about whether the institution that carries out agricultural research should be under the direct control of the central government or whether it should carry out its operations with little interference and control by the government.

The modern history of agricultural research in Guatemala begins about 1930. Systematic agricultural research began with the Instituto Químico Agrícola Nacional [National Institute of Agricultural Chemistry]. This organization did very effective work on characterization of soils and their fertility.

In the 1940s, the U.S. Department of Agriculture began working with the Quinine Cultivators Association. Quinine was in demand to control malaria which was affecting allied forces during World War II. Out of this cooperative effort, other research efforts began on maize, beans, rice, wheat, coffee, and rubber. In 1944-45, these efforts were formalized with the founding of the Instituto Agropecuario Nacional (IAN) [National Agricultural and Livestock Institute]. Three experiment stations were established to facilitate the research. Perhaps more importantly, the IAN began the process of training Guatemalan agricultural researchers. Between 1945 and 1950, eighteen individuals were sent to Mexico and the United States for training (see Ruano and Fumagalli 1988:13). These individuals were to become the foundation for the research efforts that developed in later years.

In 1953, a government commission appointed to determine the future of agricultural research in Guatemala recommended the creation of an autonomous institute of agricultural research. The existing Instituto Agropecuario Nacional was replaced by the Servicio Cooperativo Interamericano de Agricultura (SCIDA) [Interamerican Cooperative Agricultural Service]. The United States provided technical cooperation and financial support. Three new experiment stations were established and one of the three existing stations was moved to a new location. More Guatemalan technical scientists were sent to the United States for training, and some links began to be established with the agronomy faculty of the University of San Carlos (see Ruano and Fumagalli 1988).

The short history of SCIDA was marked by continuing conflict over its potentially excessive dependence on external funding and by questions about the degree of autonomy it should be permitted. As the Guatemalan government became more and more restive about the functioning of SCIDA, the United States began diminishing the amount of funding going to the organization. Finally, in 1959, the government decided to assign control of the service to the Ministry of Agriculture. SCIDA disappeared and was replaced by what was again called the Instituto Agropecuario Nacional.

During the 1960s, regional efforts in Latin America concerning the status of agricultural research again raised the question in Guatemala about the kind of institution that should be carrying out technology investigation and dissemination. In 1964, the Economic Commission for Latin America (ECLA) and the Interamerican Institute for Cooperation in Agriculture did an analysis of the agricultural research organizations in Central America. A variety of commissions and study groups were then formed to try to coordinate research efforts in the region. Among these efforts was the formation of the Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios (PCCMCA) [Central American Cooperative Program for the Improvement of Food Crops], an organization that still holds an annual conference for agricultural researchers in the region. In 1967, the Guatemalan Ministry of Agriculture reorganized its research efforts and

created the Dirección General de Investigación y Extensión Agrícola (DGIEA) [General Direction of Agricultural Research and Extension].

As Ruano and Fumagalli have pointed out (1988:18), SCIDA, IAN, and DGIEA were all based on a model of agricultural research similar to that of the land grant university system in the United States. In Guatemala, however, university resources and support were not available. Along with the change and instability that characterized the period, continuity in the research efforts were impossible. In addition, although research and extension were both incorporated within the same institution between 1954 and 1973, there was little real communication or interaction between the two.

#### The Establishment of ICTA

The elections in Guatemala in 1970 brought a new government to power. Part of the goals of the new government was to undertake a reorganization of the public sector. The country was being increasingly faced with a scarcity of basic commodities to feed its growing population. Accordingly, the new government identified agricultural research as an important part of the effort to revitalize agriculture in the country. The same questions then arose as to the structure of the institution that should undertake this effort, the relative degree of autonomy it would be permitted, the financing of the institution, and the model of research on which to base the organization.

Several of the Guatemalan scientists who had been trained under the IAN and SCIDA programs had worked with and were influenced by the research efforts of the Oficina de Estudios Especiales (OEE) [Office of Special Studies] in Mexico. The OEE was an organization created by the Mexican government and the Rockefeller Foundation in 1943 to spread the success of U.S. agricultural efforts to Mexico. The OEE was the organization that was responsible for the "miracle" wheats that became part of the Green Revolution in world agriculture (see Hewitt de Alcantara 1976; DeWalt, 1985; 1988). It involved a collaboration of U.S. scientists with Mexicans who were trained to eventually take over the research efforts. The OEE split in the early 1960s with its international mandate assigned to the Centro Internacional para el Mejoramiento de Maiz y Trigo (CIMMYT) [International Center for the Improvement of Wheat and Maize], while the Instituto Nacional de Investigaciones Agrícolas (INIA) took over domestic research in Mexico.

The scientists who returned to Guatemala began working to spread the benefits of the OEE basic research efforts in maize and wheat to their own country. For example, during the period between 1959 and 1970, the experiment station at Labor Ovalle in Quetzaltenango in the Guatemalan highlands developed a program to adapt germ plasm from OEE to local conditions. The researchers worked not only on the experiment station but also gave small quantities of promising seed varieties to local farmers to try on their own fields. These kinds of trials eventually came to be called parcelas de prueba (on-farm trials). The new varieties successfully raised production among the largely indigenous, extremely small land holders from sixteen thousand to forty-five thousand tons on an area of thirty-five thousand hectares (Ruano and Fumagalli 1988:19). This success led to the idea of using similar methods to spread these benefits to other resource-

poor cultivators of maize, beans, and other crops.

The elections in Guatemala in 1970 brought a new government to power. One of the initiatives of the new government was to undertake a reorganization of the public sector because an assessment of the country's rural areas revealed that food production was just keeping pace with growing demand, that rural incomes and farmer productivity were stagnating, and that increasing amounts of foreign exchange were being devoted to importing basic foods like maize and beans. Accordingly, the new government identified agricultural research as an important part of the effort to revitalize agriculture in the country. In 1969, a five-year development plan (1971-75) had been approved that was designed to shift public sector priorities from the agricultural export area to greater emphasis on food crops. Public sector agricultural institutions were to be restructured. The USAID/Guatemala project, Agricultural Development (No. 520-11-190-197.1), was designed to assist the Ministry of Agriculture in improving its agricultural extension capabilities and in establishing an agricultural research institute responsive to small farmer technology problems. The same questions then arose as to the structure of the institution that should undertake this effort, the relative degree of autonomy it would be permitted, the financing of the institution, and the model of research on which to base the organization.

With the change of government in 1970, one of the scientists trained in Mexico (Ingeniero Agrónomo Mario A. Martínez) became vice minister of agriculture and another (Ingeniero Agrónomo Astolfo Fumagalli) became director general of agricultural research. These two contacted Bob Culbertson, the director of the USAID mission, about their desire to create an institution to further spread the benefits of the Green Revolution to Guatemala. Culbertson had been in Pakistan when the new wheat varieties made such an impact there, and he enthusiastically agreed to help Martínez and Fumagalli implement their plan. He set up a meeting in New York with the Ford and Rockefeller foundations to seek financial support for the new institute. Martínez and Fumagalli argued strongly that the new international agricultural research centers then being established could eventually lose contact with the farmers who were their clientele. What was needed to prevent this from happening were strong national institutions that could adapt the basic technology created in the international centers to farmers' needs and to local conditions. Rockefeller expressed interest in the plan and agreed, along with USAID/Guatemala, to finance a series of working groups that would develop work plans, budgets, and the philosophy and methodology of a new research institution. The third of these work groups produced what became known as the Green Book; this contained all of the guidelines to be followed in the creation of ICTA and was the document eventually presented to the Guatemalan national secretary of economic planning for approval.

Martínez was named minister of agriculture in 1971, so that the plans became even more possible to carry out. Early in 1972, Rockefeller agreed to support two foreign scientists to work in the institute as soon as it began operations. In October, the Instituto de Ciencia y Tecnología Agrícolas was established as an autonomous entity by the Congress of the Republic of Guatemala, and ICTA began its operations in 1973.

## ICTA -- Changes through Time

Like all other institutions, ICTA has changed substantially during the fifteen years of its existence. Our work in Guatemala revealed that there are three stages or periods into which ICTA's history can be divided.

The first period lasted from the founding of ICTA in 1973 until 1978. In referring to this period, ICTA personnel refer to it as an exciting time. There were many new ideas being developed regarding agricultural research, there was substantial stimulation from the foreign technical assistance team that comprised part of the institute, external financial assistance meant that salaries were good, vehicles and equipment were available, and there were opportunities for Guatemalan scientists to obtain training in a nine-month course established at Jutiapa for new technical personnel recruited into ICTA as well as advanced degree programs at institutions in Mexico and the United States. Many new strategies of agricultural technology generation and diffusion were conceptualized in a revolutionary mood full of optimism and creative energy. It was during this period that ICTA pioneered the role of social scientists in agricultural research. Much of the terminology and aspects of on-farm research methodology (e.g., the "sondeo" or rapid rural appraisal, farmer-managed trial plots, farm registers) that was incorporated almost ten years later into what is now known as Farming Systems Research and Extension (FSR/E) was the product of intense introspection as resources were mobilized in a comprehensive campaign of on-farm research. Some of the people with whom we talked about this period focussed on the intellectual stimulation and characterized it as an "age of enlightenment"; others, citing the resources that were available, identified it as the "fat cow" (vacas gordas) stage.

The second period, characterized as the "dark age" (periodo oscuro) by many in ICTA, began in 1978 with a change in government. The new military dictator selected a series of outsiders to be the director general of ICTA. These individuals did not share the same philosophies and goals of the past directors of ICTA and much of the human capacity that had been created was gradually dissipated. In an effort to "Guatemalize" the institute, these directors created conditions that led to the departure of all the members of the foreign technical assistance contingent. Fewer Guatemalans were sent outside the country for training (none were sent in 1980 and 1981), and the training program at Jutiapa was discontinued. As morale deteriorated, many of those who had been previously trained abroad left the institute for jobs in other agencies or in private companies. Conditions external to ICTA also severely affected the institute. The political violence occurring in the country made it impossible to work in some regions. The financial crisis led to cuts in salaries and operating expenses, a situation that was further aggravated by the eventual devaluation of the quetzal in relation to the dollar. The dark period of ICTA lasted until 1983, when another change in government resulted in the return of Ing. Astolfo Fumagalli to the directorship of ICTA.

Although poor political and economic conditions in the country continued, the return to the original goals and philosophies of the institute led to the rebuilding of many of ICTA's programs. One functionary in the institute refers to current efforts as a nuevo arranque (a revitalization period), an attempt to return ICTA to its place of former

glory.

In the following pages, we will discuss the concept, design, implementation, and evaluation of ICTA. Our comments will largely refer to conditions during the "age of enlightenment" period. This material should be thought of as a supplement to the report prepared by Kerry Byrnes concerning the Food Productivity and Nutrition Improvement Project (520-0232). The period covered is approximately the same, but his report covers ICTA's involvement in a specific project. Our comments refer to the institution as a whole. The second part of the report will be about the program impact or output. There we will focus largely on the revitalization period, the third stage of ICTA's history.

Concept -- What were the basic ideas underlying the Institute?

There were several important ideas that guided the early years of ICTA's development as an institution. In brief form these can be outlined as follows:

- 1) ICTA directed its programs to increasing the productivity and the welfare of small and medium-sized farmers. It was felt that there was a lack of adequate technology available for the small farmer because most previous agricultural research in the country had emphasized export crops. This lack of research attention had led to declining productivity of basic food crops, stagnant incomes for small farmers, and an increasing need for the country to import food staples.
- 2) ICTA concentrated its efforts on food crops like maize, beans, wheat, rice, and sorghum. These were the predominant crops cultivated by the farmers with small and medium-sized landholdings, the primary clients for the research efforts.
- 3) ICTA took on-shelf technologies created by the international research centers (principally CIMMYT and the Centro Internacional de Agricultura Tropical [CIAT]) to test and adapt these to local conditions. There was substantial recognition that the technology transfer process could not occur directly from these international centers to farmers, especially small and medium-sized farmers. If the Green Revolution technologies were to be spread to Guatemala, these technologies had to be evaluated under local conditions. The USAID-supported Food Productivity and Nutrition Improvement Project (520-0232) was explicitly designed to assist Guatemalan government institutions to accomplish these purposes. The project purpose was to improve the 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."
- 4) ICTA emphasized the necessity for researchers to become aware of the constraints and problems faced by farmers. Appropriate technology could not be created without such awareness. ICTA's research strategy was not to be limited to improving crop varieties but was also to address other constraints facing farmers.

- 5) ICTA stressed that technologies needed to be tested on the farms for which they were being created and that farmer evaluations of the technologies were essential. Technology found to be successful on research stations was often found to be inadequate when actually utilized by farmers. The key idea was that agricultural research needed to be tested under the conditions where the technologies would ultimately be used. Consultation with farmers at each stage in the technology development process was essential.
- 6) ICTA saw that the technology of agriculture had to fit within the social, cultural, economic, marketing, and infrastructural conditions of the farmer. Crop production occurred within a much larger cultural context and this context had to be understood for appropriate research to occur.

Design -- How were the basic technical ideas translated into projects?

The successful launching of ICTA as a research institute was aided substantially by a superb group of foreign agricultural scientists recruited to provide technical assistance. The Rockefeller Foundation agreed in 1972 to finance two scientists to work in the institute when it was created by law. CIAT administered the funds for these positions and was charged with responsibility for recruiting individuals to fill the positions. USAID/Guatemala also agreed to finance two individuals for the maize program. CIMMYT was given responsibility for recruiting the scientists for these two positions. Other foreign scientists were provided under the terms of other contracts and projects. Appendix I provides a listing of the fourteen foreign scientists who eventually worked with ICTA.

ICTA has made excellent use of the high-quality technical assistance and external funding from USAID, the Rockefeller Foundation, and CIAT and CIMMYT. Much of the success was probably due to incorporating these individuals directly into the hierarchy and norms of the organization. The ICTA charter permitted foreigners to fill line positions. Thus, rather than having a technical assistance team outside the organization directing the efforts of ICTA, the relationships that were established have been based to a large degree upon teamwork -- individuals with different sets of expertise were all joined in a common effort toward a shared goal.

A second element in the design of the organization was the creation of four regional centers. These were to serve the highlands, the south coast, the southeast, and the northeast of the country. The four regions differed in terms of their ecological conditions, the ethnic composition of the population, and social and agricultural factors. These were the most densely populated regions of the country and were targeted as priority areas for research. As resources permitted, it was planned that ICTA would establish a presence in several other regions of the country.

These regional centers had already existed as experiment stations for the previous government agencies charged with the responsibility for research. With the creation of ICTA, however, they were renamed production centers (centros de producción). This was to reflect their status as regional headquarters for ICTA's research activities that would reach out into the countryside to involve farmers in the process. The establishment

of these centers meant that ICTA developed along relatively decentralized lines. A substantial portion of the technical expertise of the institution was located outside of Guatemala City, with only administrative personnel and those individuals with national responsibilities located in the capital.

A third design element related to the organization of scientists who worked in ICTA. Initially, the scientists were organized along disciplinary lines, but after two years ICTA was reorganized around commodities. This reflected the need for a team approach to solving the problems and constraints of each particular crop. Several disciplines, however, remained from the previous organizational structure. Most notable among these, especially during the early years of ICTA (prior to 1978), were the Technology Validation (TV) teams and Socioeconomics.

Each production center included at least one technology validation team, which was responsible for on-station experiments as well as on-farm experimental trials. These teams were under the administrative control of the production center director but coordinators of each commodity research team provided them with technical guidance. The commodity research teams provided technical backstopping for the TVTs and often designed the on-farm trials to be performed. By 1978 there were eight TVTs attached to the various production centers (Mann and Dougherty 1978:16).

The socioeconomics team was one of five "support disciplines" that also included soils management, training, communications, and seed production. The socioeconomics team was not attached to any production center but operated on a national level. The socioeconomists were responsible for doing research on such topics as identifying problems from the farmers' perspective, showing how farmers make management decisions, determining how agriculture fits within the larger cultural context, and doing input/output analyses to determine the feasibility of recommendations developed as a result of ICTA research. As we will see, the technology validation and socioeconomics teams became some of the more unique aspects of the organization and operation of ICTA.

The fourth design element consisted of an intensive concentration on training for ICTA scientists. One part of this included on the job training provided by the foreign scientists who were part of the ICTA organizational structure. These individuals provided training by actively participating in the on-going operations of ICTA. Eventually these foreign scientists left the organization and their places were taken by Guatemalans.

Another aspect of the training involved sending ICTA personnel abroad for post graduate degrees. Between 1973 and 1979, thirty-five scientists were sent abroad for training, principally to Mexico and the United States (Ruano and Fumagalli 1988: Annex 5). While some of these individuals left ICTA after fulfilling their contractual obligations, the continuing replenishment with trained individuals was an important stimulus for the the continuity of research within the organization.

Because ICTA was attempting a new type of organization of agricultural research, it also established its own training center. The purpose of the center, established at Jutiapa in 1976, was to take recent graduates from the country's universities and to provide them with an intensive

introduction into the methods being utilized within ICTA. Approximately ten individuals per year were to be trained in a kind of "boot camp", learning research techniques as well as absorbing the philosophy and ideology of ICTA. So that the new "recruits" appreciated the farmers' constraints and perspectives, each student was required to farm a plot of land using his own resources and his own ideas concerning which crops to plant and which agricultural practices to perform.

Finally, perhaps the weakest link in the design of ICTA had to do with its interinstitutional linkages within Guatemala. Although the founders of ICTA had hoped that the institution's responsibilities would include both research and the dissemination of that research, the legislation creating ICTA left intact the extension system -- the Dirección General de Servicios Agrícolas (DIGESA). The result was that ICTA could develop and promote technology, but the actual transfer of technology would be left to DIGESA (see Facultad de Agronomía, Universidad de San Carlos de Guatemala 1986:11). The other important government's institution with which ICTA needed to coordinate was the Banco Nacional de Desarrollo Agrícola (BANDESA) -- the source of the credit that could be used to adopt new technologies developed as a result of research.

Almost everyone agreed that the coordination among these three agencies was very poor during the first decade of ICTA's existence. There was little communication between ICTA and DIGESA, so that research results were not passed to the extension system for dissemination to farmers. DIGESA personnel frequently relied more heavily on technologies developed by private companies or international centers or by their own technicians rather than on the results produced by ICTA. Credit programs from BANDESA rarely were coordinated with DIGESA or ICTA. Similar problems of communication with other government agencies such as the agrarian reform institute (Instituto Nacional de Transformación Agraria), the institute to promote commercialization and stabilize prices (Instituto de Comercialización Agrícola), and the forestry institute (Instituto Nacional Forestal) were also experienced.

#### Implementation -- How was the program executed by ICTA?

An important part of the implementation of ICTA's research strategy was the development of many of the techniques and ideas that eventually came to be known as Farming Systems Research and Extension. In order to understand the FSR/E content of ICTA, it is important to recognize when their on-farm research methodology developed relative to the time in which it occurred elsewhere in the world. When ICTA was conceived as the single public sector research institution in Guatemala in the early 1970s, none of the FSR/E terminology and research concepts commonly used today were in existence. In fact, ICTA's development of a systems perspective was evolving simultaneously with the efforts in Nigeria and the International Rice Research Institute that would ultimately result in the FSR/E approach. The term "farming systems research" is not found in ICTA documents of the period, though the research approach they were developing was quite comparable to this perspective.

The ICTA pioneering effort in adaptive on-farm research was flexibly structured to allow research methodologies to evolve with field experience.

The concepts initially incorporated into ICTA were based more on the 1960s Green Revolution strategy for agricultural development of the 1960s (i.e., improved germ plasm and agronomic practices for staple crops) than on a farming systems perspective for technology generation of later decades. Nevertheless, ICTA applied conventional scientific reasoning to on-farm research to identify and determine priorities for addressing technical production problems, to design and test potential solutions under farmer conditions, and to disseminate the findings both to farmers as recommendations and to commodity researchers for further investigation under controlled on-station conditions. The resulting diagnostic, design, testing, and dissemination steps are applicable for research on all subsystems.

During the early stages of on-farm research, ICTA experimented with several new concepts. In translating ideas to field practice, substantial discussion centered on terminology. Much of this terminology related to the technology validation and the socioeconomic teams, probably the most innovative aspects of the ICTA experience. From this exercise, terms such as "on-farm experiments" (ensayos de finca), "field trials" (pruebas del campo), and "trial plots" (parcelas de prueba) arose. Among the most important aspects of ICTA's implementation of on-farm research methodology are the following.

#### Sondeo

Perhaps the most recognizable contribution of ICTA to later FSR/E terminology is the "sondeo." Sondeo refers to a method by which an interdisciplinary team interviews farmers and later meets to discuss and to reach a general consensus on the priority problems of the zone. This methodology is a rapid informal appraisal that permits biological and social scientists to exchange perspectives and work together to establish research priorities for a given region. Obviously, the method is less precise in quantitative terms, and therefore should be followed by a detailed formal survey.

#### Farm register

A second methodological procedure that has been adopted to on-farm research activities elsewhere is the "farm register." Farm registers are used to obtain detailed information on costs, inputs, prices, etc., using a sample of twenty-five to fifty farmers per region. This information serves as the basis for economic analyses of on-farm trials and for evaluation of changes due to adoption of technology. The farm registers utilize simple forms on which the farmers make daily records for each crop and record labor (family or hired) inputs. These data are supplemented by later observations on planting distances, population densities, and other traditional agronomic practices. Farm registers insure repeated contact between researcher and farmers, help monitor changes in farmer practices, and are useful for the exchange of ideas.

#### Trial plots (farmer managed)

On-farm research managed experiments use the existing farmer practice as a check plot (i.e., experimental control). At first, ICTA also supplied all agrochemical inputs and seed for the farmer-managed "trial plots." ICTA

eventually came to the conclusion that farmers should purchase all necessary inputs, including those supplied by ICTA. Farmers who had made an investment of their own were likely to take better care of research plots and to give a franker and realistic appraisal of the results of the trials.

Trial plots represent the first stage of the technology transfer process because management decisions are made by the farmers themselves. Trial plots usually emphasize single component technologies, rather than carefully designed technology packages, which would require credit to pay for all inputs simultaneously. ICTA researchers note crop yields and farmer opinion after the season. Rainfall data are collected to estimate risk factor. Follow-up studies are then conducted to see to what extent the farmers use the new technologies in subsequent seasons.

#### Index of acceptability

The "index of acceptability" was derived from these evaluations as a means for quantifying the adoption potential of a new technology. The index represents the percentage of collaborators continuing to use a recommended technology one year after their participation in test plots, multiplied by the percentage of the farmers' land on which the technology is applied. These two factors are sometimes found to vary widely. For example, in the case of the high-yielding, disease-resistant "Tollocan Solala" potato variety, it was found that 75 percent of the farmers used the new variety in subsequent years, but only on 10 percent of the potato acreage because of low market price and experiences with frost damage.

Technologies with a low index of acceptability are recycled into on-farm experiments after the cause for the lack of acceptability has been determined. Technologies with an index of acceptability greater than 50 percent are passed to DIGESA for dissemination. Unfortunately, ICTA has only been successful in measuring the level of acceptability of its technology rather than the actual rate of adoption, which are also vary with such factors as the heterogeneity of the agricultural community. The speed of the transfer of technology and the actual direct impact of ICTA technology on microregional production await further socioeconomic evaluation.

#### Evaluation -- How do we assess the performance of ICTA?

ICTA has been successful in developing an institutional philosophy and on-farm research methodology, which has proven applicable to a wide range of crops. ICTA was among the first national research institutions to define the role of social scientists in agricultural research, and ICTA originated many evaluation techniques by which to measure technology from the farmers' standpoint. Technology validation at the community level aided diffusion and involved the farmer directly in the research process. Agricultural research, which is typically "commodity driven" in Latin America, became "farmer driven" through the work of technology validation teams and socioeconomists. ICTA's positive contribution to agricultural sector growth is widely recognized, but how can this success be quantified?

Because the ICTA mandate for basic grain research was very specific, it is difficult to quantify the effect of ICTA on subsistence food production or improvements in family income. Production statistics are based on

marketed products, and incomes in the ICTA target group of small and medium-sized farms seldom derive solely from food crops. Other parameters, such as the number of improved varieties released (e.g., twenty-three improved maize varieties and fourteen wheat varieties), are biased toward genetic improvement research and may be misleading without accompanying information on the adoption of new varieties by farmers. Whereas the socioeconomic support discipline of ICTA conducted numerous studies of the acceptability of new technologies, long-term adoption studies were not undertaken, or at best have not been documented adequately.

#### Short-term successes

In order to establish credibility, it is apparent that ICTA showed a preference for high impact and high adoption potential interventions, such as improved varieties and the accompanying increase in use of inorganic fertilizers. This can not be criticized in light of the ICTA basic grains mandate and the importance of both maize and beans in the nutrition of resource-poor farmers in Guatemala. Many national research programs have given priority to "big ticket items" (i.e., areas of technological intervention such as varietal improvement, which require few changes in the traditional farm management and have high potential payoff in terms of yield increments).

In fact, the International Agricultural Research centers (IARCs) have been actively promoting crop "tech-pacs" (technological packages of improved varieties and a complementary set of agrochemicals and management practices) in the Green Revolution mode throughout Latin America since the early 1970s. IARC short-term technical assistance in germ plasm improvement, in-service training, and networking has been instrumental in the widespread acceptance of this approach to research. In this sense, the tremendous germ plasm resources of the IARCs can be viewed as "shelf technology" awaiting immediate adaptation by national agricultural research programs. ICTA has made substantial use of these on-shelf technologies.

#### Institutional realignment

Unfortunately, the on-shelf technologies promoted by ICTA were more appropriate for microclimates conducive to monoculture maize production and for producers more capable of purchasing inputs, obtaining credit, and marketing production surpluses. In short, production increases were skewed toward large-scale commercial producers in production environments unlike those of resource-poor farmers. However, it should be stressed that once this trend was recognized, ICTA undertook a realignment of institutional activities in accordance with its original aspirations to develop and validate technical innovations acceptable to small-scale producers.

The fact that ICTA has been slow to deviate from its mission to improve basic grain production has led to criticism that it has not adequately addressed research needs from a farming systems standpoint. In this respect, two projects funded by USAID, Guatemala Highlands Agricultural Development (520-0274, T-037) and Small Farmer Diversification Systems (520-0255) have been a positive influence in putting pressure on ICTA to diversify its research efforts to cash crops. However, severe budget reductions, personnel turnover, and the currency devaluation have prevented ICTA from

taking a more active role in the diversification efforts. There is some evidence that ICTA is attempting to widen its horizons to include horticultural crops, nontraditional enterprises, and animal production, but staff and budgetary limitations continue to constrain interdisciplinary cooperation and the development of the FSR/E capacity of the institution. At present, we believe that not enough attention is being given within ICTA to upgrading the Technology Validation teams to allow multidisciplinary research on all farm subsystems.

#### Yield increases

Although crop acreage has increased during the fifteen-year ICTA life span, crop yield increases (Table 1-1) indicate a successful generation and transfer of production technologies. Maize yields increased 35 percent from 1974 to 1985, while rice yields increased 52 percent during the same period. However, much of this increase undoubtedly came from large and medium-sized farms in geographical areas of high productivity and may reflect favorable climatic conditions. Nevertheless, increases in target crop yields are one of the few parameters that permit certain generalizations regarding research effectiveness, particularly the research/extension linkage and the feedback of information from on-farm to on-station research.

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Table 1-1. Yields of basic grain crops, 1974-86 (in metric tons per hectare)

Year	Maize	Rice	Beans	Wheat	Sorghum
1974	1.14	1.54	0.67	1.13	0.80
1975	1.27	1.71	0.63	1.13	1.61
1976	1.05	0.91	0.28	1.24	1.50
1977	1.12	1.57	0.25	1.30	1.44
1978	1.40	2.20	0.81	1.47	1.45
1979	1.64	1.28	0.93	1.76	1.66
1980	1.31	2.09	0.86	1.40	2.16
1981	1.40	2.10	1.08	1.28	2.03
1982	1.58	2.77	0.96	1.74	2.41
1983	1.31	3.83	0.62		2.08
1984	1.37	2.81			
1985	1.71	2.82			

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Source: Facultad de Agronomía, Universidad de San Carlos de Guatemala, INAP, and IICA, 1986.

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#### Development of an effective domestic seed industry

There is convincing evidence that a major effect of ICTA has been in the development of a domestic seed industry. In 1977 the institute began a major effort to remove restrictions on the production and sales of improved seeds in the country. ICTA encouraged private industry to become involved in the production of these improved seeds using as a foundation the basic germ plasm being produced by the institute. Table 1-2 shows the marked

progress that has been made since 1974 in the availability of improved seed for basic grains in the country, the gradual replacement of imports by domestically produced seed, and the declining role of ICTA seed relative to that produced by private companies. Maize and rice seed produced initially by ICTA and then by private companies using ICTA materials have been especially successful. Most sorghum seed is still imported.

Table 1-2. Availability and Origin of Basic Grain Seeds Used in Guatemala 1974-85 (in metric tons)

Year	Availability	Imports %	National production	
			ICTA %	Others %
1974	497	65	28	7
1977	1954	54	30	16
1980	2679	42	9	49
1983	2955	27	3	70
1985	2400	15	1	85

Source: ICTA Seed Program.

### Summary

This section of the report has focussed on the precursors of ICTA, the founding of the institution, some of the external and internal factors that affected its functioning, and its early success in implementing a farming systems research and extension methodology. In the following sections, we will be concerned with documenting how effectively this approach has been institutionalized within Guatemala and whether it is likely to be sustainable in the future.

## II. PROGRAM IMPACT OR OUTPUT

### Introduction

ICTA, like the country of Guatemala, went through some very trying times between 1978 and 1985. The political violence in the country, economic crisis, the devaluation of the quetzal, and other factors would have made it difficult for any institution to make much progress during those years. In addition, ICTA had three directors during that period who were outsiders to the institution and who were relatively unsympathetic to the goals of the organization. With the reappointment of Astolfo Fumagalli in 1983, ICTA began to become revitalized. As we will show in the following section of the report, one of the impressive things about ICTA is that, even during the dark period, enough of the philosophy and ideology of the original founders remained intact so that there was a possibility of restructuring the institute.

In 1985, a new director of ICTA was appointed but this change was symbolic of the changes that have occurred in the organization. This individual was one of the original people trained during the 1970s. His professional formation then occurred within ICTA and he rose from the ranks of the scientists to become the director general. Under his guidance, a Plan of Agricultural and Livestock Research for the period 1988-92 has been prepared to carry ICTA through the end of its second decade in existence. Before commenting on the future plans, however, we will discuss the current status of ICTA.

### Institutionalization

In considering the acceptance of farming systems research and extension in countries around the world, it is usually the case that FSR/E has been added on to an existing research and extension system. Thus, in many cases it is unclear whether the approach will survive once AID and other externally financed projects disappear. In the case of Guatemala, ICTA was established on the basis of a research methodology that included many of the precursors of what ultimately came to be known as FSR/E.

Despite the turmoil that has affected the country and the institution, it is impressive that there has been substantial continuity in the goals of ICTA. The key guiding principles established when the organization was established were a) to do research on technology to benefit the country's farmers with small and-medium sized landholdings; b) to work first with basic grains in the most densely populated and resource-poor regions of the country; and c) to try to involve the farmer as an active participant in the generation, validation, and transfer of technology. ICTA has not wavered in its commitment to the on-farm research that these goals imply. This approach has been institutionalized for the fifteen-year history of ICTA and is likely to remain so in the future.

Because ICTA's establishment preceded the establishment and definition of the Farming Systems Research and Extension methodology, we were not concerned with measuring how closely ICTA's procedures follow that methodology. ICTA's approach is an example of what Sands (1988) has defined as "on-farm client-oriented research":

... a research strategy designed to help research meet the needs of specific clients, most commonly resource-poor farmers. It complements and is dependent upon experiment station research. It involves a client-oriented philosophy, a specific research approach and methods, and series of operational activities carried out at the farm level. These activities range from diagnosis and ranking of problems through the design, development, adaptation, and evaluation of appropriate technological solutions. Farmers are directly involved at various stages in the process.

There are several ways in which the institutionalization of the FSR/E perspective can be documented. One is by considering the basic research methodology of ICTA. It contains several important features that are similar to FSR/E projects elsewhere:

- o An interdisciplinary collaboration between social and biological scientists in defining problem priorities, zonal characterization, and technology evaluation.
- o The importance of agrosocioeconomic information to characterize major farming systems and client groups before field experiments are initiated.
- o Direct farmer participation in technology screening.
- o Feedback of information on the farmer's situation and evaluation of new technology to research planning and programming.
- o Close collaboration with extension personnel in the dissemination of agricultural technologies throughout local farming communities.

A flow diagram illustrating this process is the introduction presented in the promotional brochure that ICTA uses to explain its operations to the general public and to other scientists. This illustrates the central place that the on-farm client-oriented research (OFCOR) plays within the organization.

A second indication of the institutionalization of FSR/E within ICTA relates to the amount of research that is done on farmers' fields. In 1987, ICTA reported that 2,395 trials were conducted in such situations, about 70 percent of the total done by the institute (ICTA 1987:19).

Third, the disciplines that conduct the on-farm trials receive a substantial portion of the ICTA budget. Table 2-1 presents information on the percentage of the 1986 budget received by the major programs in the technical unit (Unidad Tecnica) of the organization. [The technical unit of the organization receives about 89 percent of the total budget of ICTA. The administrative unit receives about 7.5 percent and the programming unit receives about 4 percent.] As is shown below, Technology Validation and Socioeconomics, the two main components of OFCOR, received about 30 percent of the total budget. The Technology Validation component was by far the largest program within ICTA. Ruano and Fumagalli note, however, that the proportion of ICTA's budget going to OFCOR activities has declined from about 38 percent in 1981 to only 21 percent in 1986 (1988:36). In large part, this is because during the past few years ICTA has substantially

increased the amount of funding for two large commodity programs -- one in vegetable production and the other focussing on livestock.

Table 2-1. Budget distribution by program in ICTA, 1986 (Technical unit only).

Program or discipline	000 quetzales	%
Technology Validation	1297.8	26.7
Other disciplines and programs	1196.6	24.6
Vegetables	460.3	9.5
Animal Production	396.8	8.1
Maize	307.5	6.3
Fruits	230.1	4.7
Wheat	208.7	4.3
Beans	201.1	4.1
Rice	167.6	3.4
Socioeconomics	157.2	3.2
Sorghum	135.7	2.7
Oilseeds	107.4	2.1
<b>TOTAL</b>	<b>4866.8</b>	<b>100.0</b>

Source: Programming Unit, ICTA -- cited in Ruano and Fumagalli 1988:35.

Finally, there has been a further strengthening of the institutionalization of the FSR/E perspective through a project begun in 1986 that is being funded by the Interamerican Development Bank and the International Fund for Agricultural Development. This new effort is the Project to Generate and Transfer Agricultural and Livestock Technology and for Seed Production (PROGETTAPS is the acronym in Spanish). ICTA, DIGESA (the agricultural extension service), and DIGESEPE (the livestock extension service) are all involved in PROGETTAPS.

The emphasis of this new project is on technology transfer but the model by which this is to be accomplished is very similar to the OFCOR methodology already used by ICTA. A former technical director of ICTA, who received Ph.D. training in farming systems research at the University of Florida, is serving as one of the primary consultants for PROGETTAPS within DIGESA. He has written several documents outlining how farming systems research methods can be used in the technology transfer process (see Ortiz, 1988; n.d.).

The methods being emphasized in PROGETTAPS are the following:

- 1) It is thought that the technologies being transferred are relatively simple, are profitable, and will have high indices of acceptability. Thus, there is a greater stress on the promotion of technology with less emphasis being accorded technical assistance.

- 2) There is joint participation among the researchers of ICTA with the technicians from DIGESEPE and DIGESA in the generation, validation, and transfer of the new technologies.
- 3) Rural leaders, recruited from the community, are trained to handle the new technologies. These leaders have technology validation trials on their own plots and these serve as demonstration plots for groups of farmers they organize to receive the new technologies.
- 4) A Modular System is being used in which researchers and extension workers are linked with ten rural leaders, each of whom is responsible for twenty to forty agriculturalists. The idea is to use a multiplier effect to reach as wide a group of farmers as possible.
- 5) There is active participation of agriculturalists throughout the process of technological innovation.

Nearly everyone we interviewed reported that PROGETTAPS had substantially improved the coordination among the three agencies. Our field visit to Quetzaltenango confirmed that there was very effective coordination and communication among the researchers and extension workers. These individuals made common plans for validating technological alternatives, shared vehicles and equipment, and worked as a team with rural leaders from the communities. The rural leaders with whom we met were very positive about their role, talked knowledgeably about the technologies being transferred, and said that farmers in the community were actively adopting these technologies. Many of the farmers were participating in the on-farm trials of new technologies.

Thus, our conclusion is that the farming systems perspective has become institutionalized within ICTA and is now being actively spread to the two extension services in Guatemala. Communication problems that had existed in the past are now being addressed. The activities of each of the six institutions that are part of the Ministry of Agriculture and Food (including the agricultural development bank and the marketing institute) are coordinated at the regional level by COREDAS (Comites Regionales de Desarrollo Agri'cola) and at the subregional level by COSUREDAS (Comites Subregionales de Desarrollo Agri'cola). COREDAS and COSUREDAS, which are staffed by the regional and subregional directors of each of the six organizations, do joint planning and monitoring of on-going activities in the agricultural sector.

The lack of communication among ICTA, DIGESA, and DIGESEPE that had caused problems in earlier times is being directly addressed by PROGETTAPS, and the project's approach seems to be working. In the regions we visited, teams made up of individuals from all three agencies were working well together.

#### National Program Financial Support

Another aspect of the institutionalization of any approach is whether the national government will commit sufficient financial resources to

continue a project or program. Guatemala has been beset by financial difficulties during the past decade or so, and these financial problems have definitely affected ICTA staff and operations. These problems have not meant that ICTA has retreated from its commitment to farming systems research, as we will show in this section.

Table 2-2 below indicates the amount of the budget that Guatemala has committed to agricultural research compared with other countries in Central America and the Caribbean. Guatemala spends a comparatively small amount, compared to the contribution that agriculture makes to its economy, on agricultural research. In terms of the amount of dollars per investigator, however, Guatemala ranks first among all of the countries. This indicates that the amount of support, in terms of salaries and money for support services, is comparatively better in Guatemala.

Table 2-2. Total funds spent annually on agricultural and livestock research in several countries of Central America and the Caribbean.

Country	Total spent in 000 US \$ (average for 1980-85)*	Percentage of gross agricultural product	000 US \$ per investigator*
Panama	2709	1.17	19.0
Costa Rica	1236	0.26	15.0
Nicaragua	1587	0.42	17.8
Honduras	1469	0.15	9.6
El Salvador	1688	0.21	19.8
Dominican Republic	1680	0.19	16.5
Guatemala	3767	0.22	21.6

Source: From data in the ISNAR/IFARD investigation of national systems of agricultural and livestock research, 1985.

\* Figures expressed in constant dollars relative to 1975.

Table 2-3 gives some indication of the financial problems that beset ICTA in the early 1980s. As is indicated there, financial support from the central government fell substantially between 1982 and 1985. During this period the value of the quetzal in relation to the dollar also fell by more than 50 percent. The consequences of the falling budget included a stagnation in salary levels, inability to replace aging equipment, a lack of

Table 2-3 gives some indication of the financial problems that beset ICTA in the early 1980s. As is indicated there, financial support from the central government fell substantially between 1982 and 1985. During this period the value of the quetzal in relation to the dollar also fell by more than 50 percent. The consequences of the falling budget included a stagnation in salary levels, inability to replace aging equipment, a lack of many basic supplies, and a declining morale among the personnel in the organization. Many of the individuals who had come back to ICTA with advanced degrees left the institution during this period to work in private industry.

In 1973-75, the first three years of operation of ICTA, 80 percent of the budget came from the Guatemalan government; AID and the Rockefeller Foundation each contributed 10 percent. Table 2-3 indicates that this proportion has been maintained over the years; revenues from the central government made up well over 75 percent of the total budget until 1986. Money provided from PROGETTAPS substantially increased the percentage of the budget coming from loans in 1986. That year was the first time in the history of ICTA that the national government did not provide at least 75 percent of the budget. The previous low of 74 percent of the budget was in 1974 when a large amount of loans from USAID were used to help in establishing the institute (Facultad de Agronomia [Universidad de San Carlos de Guatemala, INAP, and IICA], 1986:46). The loans from PROGETTAPS were quite important in allowing ICTA to replace vehicles and to undertake some construction. Nevertheless, taking into account the devaluation of 1983 and the subsequent inflation, the 1986 budget did not have the purchasing power of the budget of 1983. It is important to note that ICTA has been one of the institutions of the State that has had privileged treatment, perhaps in recognition of its services, since its budget reductions have been less than others in the Agricultural Public Sector and of other government sectors (Ruano and Fumagalli 1988:37).

Table 2-3. Sources of financial support for ICTA, 1981-86 (in thousands of quetzales)

Year	Central Government	%	Loans	%	Donations	%	Other sources*	%	Total
1981	4,343.9	85.6			45.5	0.9	683.1	13.5	5,072.5
1982	4,466.0	85.5			49.0	0.9	705.0	13.5	5,220.0
1983	4,214.9	84.7	538.8	10.8	52.5	1.1	167.7	3.4	4,973.9
1984	3,876.4	81.2	311.2	6.5	88.1	1.8	502.7	10.5	4,778.4
1985	3,220.0	76.1	289.5	6.8	108.7	2.6	613.6	14.5	4,231.8
1986	4,273.6	60.0	220.8	31.0	174.0	2.4	470.0	6.6	7,125.6

\* Principally sales of products from field trials, germ plasm, etc.

What is impressive with regard to the ICTA budget is that, with the exception of 1985, the institution has always been able to maintain a decent balance between salaries and operating expenses. (The budget problems in 1965 were created by a 25 percent budget cut imposed on the agency.) In many other countries, the vast majority of the budget goes to pay salaries leaving nothing for operating expenses. In contrast, ICTA has generally been able to maintain more than 25 percent of the budget to use for operating expenses (see Ruano and Fumagalli 1988:35).

Another difference between the budget of ICTA and that of research organizations in many other countries is that the percentage of the budget being consumed by the central administration is actually falling. As is shown in Table 2-4, the percentage of the budget allocated to the central offices of ICTA in Guatemala City has fallen substantially since the founding of the institute. From 76 percent in 1974, it has fallen to just below 35 percent, with more resources flowing to the regional centers. Although ICTA now has operations in seven of the eight zones in the country, it still concentrates the majority of its efforts in four of these zones. With the restrictive budgets of the last several years, the institution has decided to concentrate its efforts in those regions where it can make a difference rather than trying to maintain operations in all areas. (Nothing has yet been established in Region III, thus it does not appear in Table 2-4.)

Table 2-4. Percentage distribution of the ICTA budget

Year	Central Administration	REGIONS						
		I	II	IV	V	VI	VII	VIII
1974	76.0	6.6	1.1	5.6	1.7	6.6	2.4	--
1978	43.2	10.1	0.7	15.5	10.8	12.5	7.2	--
1982	36.7	11.9	--	11.8	14.8	10.7	10.7	3.4
1985	34.9	20.3	--	12.6	12.2	9.2	7.5	3.3

As we have already mentioned, FSR/E remains a significant component of the budget of ICTA, though it is declining as more commodity programs are established. The 1988-92 plan for the organization aims to strengthen the socioeconomic component. It also plans to establish more technology validation teams beyond the fourteen already in existence. Several of these technology validation teams would operate in areas of the country not now covered by substantial ICTA research programs. Some of the 5 percent annual budget increase being requested from the central government is earmarked for these two areas (ICTA 1988a).

Thus, we conclude that in terms of national financing, ICTA and its FSR/E programs are on relatively good footing. The country does not allocate a substantial portion of its budget to agricultural research. What it does allocate, however, seems to us to be spent well. The money does not all go just to pay the salaries of a bloated bureaucracy, but at least a quarter of it is generally dedicated to operating expenses. A substantial portion is spent in the regions in which the actual research is done, and, even though this has declined somewhat in recent years, one-fifth of ICTA's budget supports the technology validation and socioeconomic programs.

### Training

When ICTA was established with the help of the Rockefeller Foundation and USAID, one of the primary goals was to train professional research staff for the institute. With the exception of several years during ICTA's "dark period," training has been a significant area of emphasis. There are two components of this training that we will discuss in this report -- post-graduate training abroad and ICTA's own Training Course in Agricultural Agricola).

Training abroad began as soon as ICTA was established. The founders of the institute, USAID, and Rockefeller all recognized the necessity of securing training for Guatemalans so that an effective research and extension organization could be established. In part, this training was undertaken so that those foreigners funded with grant and loan funds would be eventually replaced by Guatemalans. In 1973, four individuals were sent abroad for training. Table 2-5 shows the history of post-graduate training since that time. The number of individuals sent abroad increased to a high of ten in 1977 before the political changes within ICTA began to take effect. The three directors between 1978 and 1983 all adopted a policy that did not support training outside the country. In 1980 and 1981 not one individual received post-graduate training. The economic situation since then has not been conducive to the training of large numbers of individuals. Only with the advent of the Highlands Agricultural Development Project, the Small Farmer Diversification Project, and the PROGETTAPS project have significant amounts of money become available for training. Between 1985 and 1987, six individuals per year were selected to pursue post-graduate degrees abroad.

Table 2-5. ICTA post-graduate degrees, 1973-87

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Year	People sent abroad
1973	4
1974	2
1975	1
1976	5
1977	10
1978	6
1979	7
1980	0
1981	0
1982	3
1983	2
1984	2
1985	6
1986	6
1987	6

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There is currently a commission on grants within the institute that has the responsibility of planning what training needs to be done and for selecting the individuals to be sent abroad. This commission takes into account the needs expressed by program and discipline coordinators, the experience and abilities of the individuals who apply for training, and the goals and needs of ICTA.

Table 2-6 shows the disciplines in which individuals have received post-graduate degrees. What is indicated there is that there has been an attempt to spread training into the different programs and disciplines. ICTA administrators note that there has been substantial difficulty in identifying programs in which the technicians in the technology validation area can receive appropriate training. Several individuals were sent to CATIE for training in cropping systems or farming systems but they expressed dissatisfaction concerning the kind of training they received there. Several technicians already working in Technology Validation expressed the belief that, if they were to be selected to go abroad for training, they would have to do so through one of the commodity programs. Even though they were very positive about the activities in which they were engaged in technology validation, they felt that their ability to rise in the hierarchy of ICTA would depend on their switching to one of the other programs or disciplines.

Table 2-6. Post-graduate degrees obtained by technicians in ICTA, 1973-86.

Specialty	Number	Percentage of total
Plant Breeding	13	24
Agronomy	10	19
Entomology	4	7
Administration	4	7
Plant Pathology	4	7
Soils	4	7
Plant Physiology	3	6
Livestock Production	3	6
Agricultural Economics	2	4
Irrigation	1	2
Horticulture	1	2
Seed Production	1	2
Communications	1	2
Anthropology	1	2
Rural Sociology	1	2
International Agriculture	1	2
TOTALS	54	

Source: Ruano and Fumagalli 1988, Annex 4.

Another problem that is illustrated by the information in Table 2-6 is that only two individuals have been trained in socioeconomics and both of these individuals received their training in the period between 1973 and 1979. Both have subsequently left the institute. The problem is that ICTA has had a difficult time identifying anthropologists or rural sociologists to work in the organization. One problem was that, during the political violence in the country between 1978 and 1983, the social science programs at the university were decimated; many faculty members were killed or had to go into exile outside the country. Students did not choose these careers because the government considered the training they were receiving as being influenced by communism and therefore subversive. Now that universities are hiring new faculty to staff these disciplines, many of the graduates of the programs are being hired immediately as professors. In addition, most social science graduates do not see the interface between their disciplines and agriculture, and it is not difficult to understand that ICTA has found it impossible to staff these positions. The institute has a commitment to improve its capabilities in this area but needs to think of innovative ways to recruit individuals for the positions. One way that it might do so is to identify promising individuals working in Technology Validation who have the ability to relate well to people in the communities. These technicians could then be sent to Mexico, the United States, or another country to receive formal training in the social sciences.

Like organizations in other countries that have invested heavily in training individuals to work in agricultural research and extension, ICTA has lost a fairly large number of them to jobs in international organizations or the private sector. Table 2-7 shows the number of

individuals completing degrees in each program and the number who are still employed in ICTA. What is indicated there is that 53 percent of the individuals receiving Master's or Ph.D. training have already left ICTA. Although we were not able to determine when these individuals left the organization, we were told that there was a very high rate of loss during the "dark period" between 1978 and 1983, the years in which morale in the agency was at a low ebb. The relatively low salaries, lack of equipment, and other problems caused by inadequate budgets still affect ICTA so that loss of trained personnel continues.

Administrators in ICTA, however, were all very insistent that the loss of these individuals should not be seen as completely negative. They reported that many of these individuals were working in positions within Guatemala in which they were applying many of the lessons and philosophies they had learned while in ICTA. Our conversations with some of those who had left ICTA confirmed this. Some were working in high positions in the government, in universities, or in other institutions within the Ministry of Agriculture and Food. All of them talked very positively about ICTA and many of them talked about the necessity for on-farm research, the need to do research that would benefit small and medium-size landowners, and the need to have farmers participating in the research and extension process. These individuals still showed substantial loyalty toward ICTA.

Although there are still complaints about the economic situation of ICTA, morale within the institute is quite high. We were extremely impressed with how widely the philosophy and goals stated by ICTA were shared among the personnel. There was real pride concerning the capabilities and the accomplishments of the institute. Without this high degree of esprit de corps, we are sure that the number of people leaving ICTA would be much higher.

Table 2-7. Number of Master's degrees completed by ICTA personnel and the number of trained individuals still working in ICTA by program (to 1986)

Program or discipline	Degrees completed	Still employed in ICTA	Currently in graduate programs
Maize	6	2	
Beans	10	6*	1**
Sorghum	5	2	
Wheat	2	1	
Vegetables	1		2
Oil Seeds	1	1	
Fruits			1
Technology			
Validation	9	3	4
Soils	1	2	2
Seed Production	1	1	
Socioeconomics	5	1	
Animal Production	1	0	1
Planning and Administration	3	5	1
Others	4	2	
TOTALS	49	26	12

Source: Personnel Office of ICTA.

\* One of these individuals has a Ph.D.

\*\* This individual is studying for a Ph.D.

One reason for this high level of commitment to the organization, we believe, comes from ICTA's own training program for new technical personnel. The CAPA program was established at Jutiapa in 1976. The purpose of the program was to take recently graduated individuals from the universities and to give them training that would enable them to function as effective researchers. The theoretical knowledge that these individuals learned in the university is immediately put into practice. CAPA functions as a sort of "boot camp" that not only provides minimal knowledge of research methods but also the ten months of training provides an effective means for providing new technical personnel with a form of "indoctrination" into the goals, philosophy, and ideology of the organization. Trainees learn the technological system of ICTA, its administration and handling, the context in which the institute operates, methods and techniques of communication, data analysis, experimental designs, and all of the aspects of conducting on-farm experiments. It also teaches them how to write reports, how to communicate in public, and how to do farm registers.

The decision was made to establish the training headquarters at Jutiapa because it is one of the most difficult areas of the country for agriculture. There is a six-month dry season, and even during the "wet"

season, rains there are quite erratic. Many farmers spread their risks by intercropping maize and sorghum, sometimes including beans in the multiple cropping system. One unique aspect of the CAPA course is that each trainee is required to use his own resources to farm some land in the region. The trainees are put in the farmer's shoes and quickly learn the difficulties faced by agriculturalists since most lose money on their "small farm."

In recent years, ten trainees a year are selected to attend CAPA courses. ICTA is a very desirable institution in which to work -- in 1986, seventy-three recent university graduates applied for the ten positions. As is shown in Table 2-8, during the nine years in which CAPA has functioned, almost 100 individuals have graduated from the course and gone to work for ICTA. Of these, about two-thirds are still with the institute.

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Table 2-8. People who have attended the course on agricultural production (CAPA), 1976-86

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COURSES	Participants beginning course	Graduates contracted by ICTA	Still in ICTA
9	109	97	95

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Source: Ruano and Fumagalli 1988:47.

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Over the years there have been several attempts to involve individuals from other parts of the Ministry of Agriculture and Food in the CAPA training program. In 1988, largely because of the collaboration going on within the PROGETTAPS program, four individuals from DIGESA were selected to attend CAPA along with five individuals contracted by ICTA. These individuals are divided into three teams of three persons and are working on research projects in three different communities near Jutiapa. They are already learning to collaborate with one another, a lesson that should carry over once these technicians become permanent employees of their institutes.

Because of the strong linkages between ICTA and international centers and universities (see Networking), there are also many opportunities for personnel to attend short courses on a variety of different topics. Ruano and Fumagalli have estimated that ICTA itself has trained about 170 people in short courses of its own and that another 322 individuals have attended short courses in the international agricultural research centers, the U.N. Food and Agriculture Organization, the United States, and other foreign universities (1988:47).

We found that ICTA was an organization with a substantial degree of professionalism. This comes from the generally high level of educated individuals staffing the institute. Although there is much room for improvement, ICTA, with the exception of the 1978-83 period, has continued to improve in terms of employing better-trained personnel. This can be seen in Table 2-9.

Table 2-9. Number and academic level of personnel in ICTA

Level of study	1973	1975	1980	1986
Postgraduate	9	20	16	25
University	34	68	143	152
Technical university	--	--	2	9
Middle level	76	191	148	150
Primary level	36	85	73	64
TOTAL	155	364	382	400

Source: Planning Division, ICTA

In conclusion, we found that ICTA has continued to place a high priority on improving the capabilities of its human resources. Substantial investment goes into training, especially to inculcate new technicians with the importance of the FSR/E perspective. Although personnel turnover has been high, they have retained more people in times of trouble than sister organizations in neighboring countries because of the personal commitment people have made to ICTA.

### Networking

ICTA was established in an international context because some of its initial funding came from USAID and the Rockefeller Foundation. In addition, some of the Rockefeller money was channeled through the Centro Internacional de Agricultura Tropical (CIAT) and CIMMYT so that ICTA was immediately plugged into the network of international agricultural research centers. The success of the institute in developing what eventually came to be known as an FSR/E approach also brought it substantial international recognition. Although many of its linkages were cut during the "dark period" of 1978-83, ICTA has redeveloped a substantial network at the international level.

The institute maintains permanent linkages with CIMMYT, CIAT, and the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE), all of which maintain small offices in the same office building with ICTA. Permanent lines of communication and joint projects also are carried out with the International Potato Center (CIP), the International Crops Research Institute for the Semi-arid Tropics (ICRISAT), the International Institute for Cooperation in Agriculture (IICA), and several U.S. universities, including Cornell (through the Bean/Cowpea Collaborative Research Support Program (CRSP)), North Carolina, Texas A & M, New Mexico, Oregon, Utah, and Florida (ICTA 1987:31).

ICTA has received assistance from the development assistance agencies of Canada, China, Switzerland, and the United States. The PROGETTAPS program is being carried out with financing from the Banco Interamericano de Desarrollo (BID), and FIDA. In recent years, ICTA has begun working with USAID programs in the country. These have not always gone smoothly because USAID has been promoting diversification into fruits and vegetables for small farmers. This focus has run counter to some of the premises on which ICTA was founded (i.e., to work with food grains) but the institute has been training personnel to work in fruit and vegetable production and is expanding its capabilities in this area.

At the local level, the primary linkages are with the Nutrition Institute for Central America and Panama (INCAP) and the Universities of San Carlos, del Valle, and Rafael Landivar. The latter provide university training for most of the technicians hired by ICTA. ICTA has an exchange program with the University of San Carlos that allows professors to become more involved in research using ICTA's laboratories and fields, and allowing ICTA researchers to get practical experience in teaching. ICTA researchers also teach part time at the other universities as a means of earning a supplement to their salaries.

ICTA also has close ties to several private companies in the country. Cerveceri'a Centroamericana (a beer producer) and Quaker Oats support the wheat program to do research and extension on barley and oats, respectively. Gremial Nacional de Trigueros (the National Wheat Producers Association) provides ICTA with Q0.10 for every 100 pounds of wheat produced to strengthen the work at the Labor Ovalle (Quetzaltenango) research station.

In terms of networks for FSR/E, Guatemala has maintained strong linkages with the University of Florida and its Farming Systems Support Program (FSSP). The former head of the socioeconomic program (Peter Hildebrand) went to Florida after leaving ICTA and became a key figure in the FSSP. He maintains strong ties to ICTA and some students from Guatemala go to Florida for graduate training with him. Other strong FSR/E ties are to CATIE because some of ICTA's key personnel (including its current director) were trained there.

ICTA is a leader in Latin America in terms of promoting the FSR/E approach to agricultural research and extension (even though it may not be labelled as such). Especially since 1985, the director general, subdirector, other administrators, people formerly associated with the institute, and many of the technical staff have been participating in national, regional, and international meetings in which they present papers detailing ICTA's approach. It was our impression that this renewed contact with other programs would not only be very beneficial in terms of promoting the FSR/E approach but also in terms of exposing ICTA to more current ideas and approaches within this framework.

### Program Content

As we have mentioned earlier, the research strategy that ICTA began developing in 1973 included the development of many of the techniques and ideas that eventually came to be known as Farming Systems Research and Extension. When ICTA was conceived as the single public sector research

institution in Guatemala in the early 1970s, none of the FSR/E terminology and research concepts commonly used today were in existence. It is probably unfortunate that the "dark period" of the institute occurred during the period when farming systems research and extension blossomed as an approach on a global level, because at that time ICTA was isolated from further developments and refinements of that methodology. It is only since 1985 that ICTA is beginning to regain momentum in adapting FSR/E to its own institutional setting.

As we noted earlier, ICTA was established as a participatory on-farm research scheme aimed specifically at developing improved production technologies for the basic grains (maize, beans, wheat, and rice) and validating the relevance of these technologies in the production environment of target group farmers. In a society in which maize is the starch staple food crop and beans provide the majority of the protein in the diets of lower-income groups, this relatively narrow mandate was understandable, especially during an initial period of institutional organization. The emphasis on basic grain production also reflected a policy goal of the National Development Plan 1971-75 for food security through increases in crops yields and decreases in crop losses through improved food storage technologies.

When researchers in other countries began to struggle with the formulation of appropriate research techniques to expand the outreach of government research and extension services to low-resource farmers, they looked for case studies of on-farm research that were already in operation. It is for this reason that ICTA experiences were given special attention by the international research community. Even though the term "farming systems research" has entered the ICTA vocabulary only recently, ICTA has demonstrated the institutional capacity to conduct FSR/E and has in fact contributed to the FSR/E concepts and research procedures employed elsewhere in the world.

In a recent study of FSR/E programs throughout the world, Sands (1988) identified six main types of FSR/E applications. In hindsight, the ICTA experience with its rather limited focus on basic grains can be classified as "Farming System Adaptive Research." However, given the Green Revolution undertones of ICTA research and the major influences of the International Agricultural Research Centers (IARC) on ICTA activities, it may be more appropriate to apply the CIMMYT vernacular of "on-farm research with a farming systems perspective" to the kind of work done in Guatemala.

The research strategy developed by ICTA was unique in its time. It combined strong national commodity research programs with TVTs distributed in the regions being served by the institute. The TVTs were also supported by five centrally located disciplinary support teams for rural socioeconomics, soils, training, communications, and seed production. Research priorities were based on a diagnosis of farmer resources, cultural traditions, and production constraints. The institution placed highest importance on farmer participation in the technology development process.

The TVTs linked on-station research with the farmers. The number of teams has increased from nine teams in 1982 to fifteen teams in 1988. However, this number is still below that which is needed to adequately cover

the national geographical area. Personnel attrition from the TVTs is estimated to be 15 percent per year, and it is usually the brightest and best trained people that leave, often moving to commodity programs. Although some problems were encountered due to the lack of national coordination of the TVTs, these difficulties have been corrected in recent years. Recently, for example, a national coordinator for the TVTs has been appointed. The greater coordination that this will provide should enhance their ability to create linkages with the discipline programs to better address soil conservation, cropping system interactions, and integrated pest management issues.

More serious obstacles have been experienced in the imbalance in training opportunities between technicians of the TVT and those involved in the more favored commodity programs. A certain amount of jealousy and erosion of morale among TVT technicians is apparent. This is worrisome because the higher professional status of the commodity scientists has resulted in a gradual shift of priorities from the original farmer focus to a more traditional commodity basis. In fact, the continuing expansion of the TVTs has created a personnel demand that recruitment and the CAPA has been unable to meet. In 1987, for example, CAPA produced only seven graduates for twelve TVT openings. Nonetheless, farmer participation in technology testing has continued unabated, and the interaction of the TVT and socioeconomic discipline has been strengthened in the last three years through the PROGETTAPS program. In 1986, 34 percent of ICTA research was research-managed on-farm experiments, 37 percent farmer-managed trial plots, and 21% commodity research, including regional multilocation testing trials.

PROGETTAPS has probably been the most important new initiative in terms of breaking ICTA's dependence on the methodologies and ideas formed in the 1970s. We have already discussed, for example, the way that PROGETTAPS has structured increased communication among ICTA, DIGESEPE, and DIGESA.

In addition, for the last three years, PROGETTAPS has been employing farmer-representatives elected by the community for doing on-farm demonstrations and technology transfer. The farmer representative program is modeled after a similar effort by World Neighbors. At present 20 percent of these farmer representatives are women who, like their male counterparts, serve a multiplier effect for DIGESA efforts in agricultural extension, overcome language barriers in highland areas, and are closely identified with the local communities. This not only results in a greater farmer outreach but also provides the basis for "artisan (microregional) seed production."

Here again, CIAT was influential in ICTA activities. Certified bean seed is expensive because of the quantity needed per hectare. In addition, because the majority of bean diseases are seed-born, CIAT began promoting local "clean seed" production for low resource farmers. This practice encouraged the transfer of improved bean varieties among small farmers, and the impact of farmer representatives in seed production in Guatemala is illustrated in the number of "artisan seed plots" that have been established e.g., 11 in 1987, 407 in 1988).

The other important new stimulus for ICTA is coming from the USAID "Small Farmer Diversification Project" (SFDP) for the western highlands. The

project focusses on promoting nontraditional crop and livestock enterprises with the goal of improving small farmer income. In addition to technology transfer for mini-irrigation and soil conservation, the project consists heavily of applied research, extension, and credit for vegetable, fruit, and livestock production. This project is likely to be combined with an extension of the "Highlands Agricultural Development Project" and continue for several more years.

Several quotes (USAID 1983) from the project paper and final evaluation report of the SFDP reveal the technical biases and methodological short-comings. These pertain directly to ICTA's role in the project:

"The project goal was to expand productive capacity by enabling the populous subsistence group to produce efficiently and competitively through improved knowledge, skills, and infrastructure, permitting a transition to commercial agriculture."

"In short, adherence to the strict requirement of rigorous scientific research (i.e., testing and validation of new plant and animal technologies) is not always fully compatible with the imperative to get new technologies to the farmer quickly (i.e., transfer and extension) in order to exploit commercial opportunities in a world of great economic flux and inexorable population growth."

"The immediate focus of this project should be quick, pragmatic trials in the project sites of known varieties (i.e., already validated elsewhere in Guatemala). In essence, this is the meaning of "fine tuning" available technologies."

ICTA and USAID came into conflict because of basic differences in the perception of how to go about doing research. During the 1970s, USAID had been instrumental in helping ICTA to develop the procedures of rapid rural appraisals to determine farmer problems, development of technologies thought to be appropriate to solve these problems, on-farm trials to validate these technologies and to solicit farmer feedback, and eventual diffusion of results. As is indicated by the quotes above and our interviews, a decade later the USAID managers of the SFDP were no longer versed in and supportive of this slow, methodical approach to agricultural research and extension. They wanted ICTA to "fine tune existing varieties" for almost immediate diffusion. Personnel from ICTA, well acquainted with the horror stories of extension of inappropriate technology that led to the development of on-farm client-oriented research, rebelled against the pressure to do what they perceived as quick and dirty research. Substantial friction thus surrounded the project. USAID felt that ICTA wanted to "study everything to death" before recommending new fruit, vegetable and livestock technologies. DIGESA was charged with extension and felt that ICTA was not providing them with recommendations that they could use. ICTA felt that USAID was subjecting farmers to unneeded risk by recommending "half-baked" technologies.

While the timing of this project was excellent in terms of strengthening ICTA at a point where it had been severely weakened and forcing it to broaden its efforts outside of basic grains, ICTA resources were inadequate for meeting the responsibilities assigned to it. ICTA did not

have sufficient personnel to cover all areas especially after the project was extended from fourteen to sixty-four municipios. In addition, ICTA did not have much capability in the fruit, livestock, and vegetable area. Only in the last few years, largely as a result of training provided under these USAID projects, has ICTA developed much capability in these commodity areas.

During the worst period of friction between ICTA and USAID, the latter began to utilize more private sector research and has considered using the private sector more in the extension of the Highlands Agricultural Development Project (HADP). Our perception is that there is nothing wrong with building up some alternative research capabilities in the country; the more agricultural research, the better. It would be a mistake, however, to ignore the existing research capabilities and professionalism of ICTA. Current USAID personnel need to be aware of the conditions under which ICTA was founded and how its evolution has been affected by conditions largely external to it. The ideology, philosophy, and methodology of ICTA were created and institutionalized in part with the assistance of USAID. Current USAID personnel, who do not share the perspectives of their predecessors, cannot expect ICTA to immediately change its *modus operandi*.

We believe that the overall effect of the SFDP and HADP will eventually be positive for ICTA because they are forcing the institution to examine its methodologies to determine whether research can be done in a more time-effective manner. ICTA will also have to devote more emphasis to cash crops and livestock rather than subsistence crops. This will force ICTA to really begin paying attention to the "whole farm" rather than being an institution that is primarily oriented to studying cropping systems. Table 2-10 illustrates how attention to different production enterprises, as reflected in national budgetary allocations, has shifted over the years to emphasize commercial horticultural production. These are a direct result of the USAID projects along with changing governmental priorities.

On the negative side, these projects have moved ICTA from its emerging "component technology" focus and returned it to the Green Revolution "technological packages" concept, which is likely to favor high-resource farmers with a greater potential for obtaining credit. Using the USAID mandated "model farms," set up to use unproven production package technologies also deviates from the ICTA "community base" approach to farmer participation. Finally, the project continues to be extremely weak in social science technical assistance, implying a return to technology generation dominated by biological scientists. How can a project that seeks to increase farmer income and standard of living measure its progress or anticipate unintended negative social consequences without the involvement of social scientists?

Table 2-10. ICTA Budget for commodity programs, 1980-87

Crop	Quetzales budgeted		% Change 1980-87	% of 1987 allocation
	1980	1987		
Maize	203,675	420,126	106	19.6
Beans	116,011	188,828	63	8.8
Rice	81,701	201,850	147	9.4
Wheat	109,607	181,681	66	8.5
Sorghum	81,484	142,922	75	6.7
Vegetables	210,555	924,816	339	43.2
Sesame	30,768	79,747	159	3.7

Source: Calculated from the "Presupuesto programado y solicitado por programas y disciplinas a nivel nacional." ICTA, Sector Publico Agropecuario y de Alimentacion. Guatemala. 1988.

In summary, the conceptual, methodological, and technical innovations, for which ICTA became well known a decade ago, show signs of decay. The negative factors that affected ICTA in the late 1970s and early 1980s put an end to much of the evolution of methodologies. A shift from the determination of research priorities based on on-farm analyses to a more traditional commodity-driven research emphasis is detectable. Many of the socioeconomic data collection activities, such as the farm registers, have become mechanical and routine without adequate attention being given to their analysis, interpretation, and utility.

A good example of this is that, despite the enormous resources devoted over the years to collecting farm register and socioeconomic data, there has been only one recent attempt to analyze this information. The publication on Sistemas de Produccion Practicados en el Altiplano de Chimaltenango, Guatemala [Production Systems Practiced in the Highlands of Chimaltenango] (Reyes-Hernandez, Garci'a, and Campos 1985) was only made possible because the analysis and writing of it were supported by the Bean/Cowpea CRSP. ICTA justifiably argues that it does not have the staff and/or resources to be able to analyze the mountains of information that are produced by the socioeconomic and technology validation teams, but the question arises as to why substantial resources continue to be spent on collecting data that cannot be analyzed.

The socioeconomic program, which accounted for a substantial part of ICTA's worldwide reputation with the international development community, is in desperate need of revitalization. Following the departure of the international and highly trained national scientists in the "dark period," ICTA has been unable to locate and attract well-qualified social scientists. The division of responsibilities for the on-farm testing by the Technology Validation Teams and evaluation of new technologies by the Socioeconomics Unit continues to be a weak link in the chain of events in the ICTA methodology for technology generation and transfer.

## Internal Linkages

Much of what we have said already refers to the linkages that ICTA has with other institutions in the country. In this section, however, it is useful to provide a brief summary of other programs in the Ministry of Agriculture and Food and ICTA's relationships with them.

The Public Agricultural Sector (Sector Publico Agri'cola -- SPA) is made up of the following institutions that are all decentralized and have a certain degree of autonomy from the Ministry of Agriculture and Food:

Banco Nacional de Desarrollo Agri'cola (BANDESA) -- Agricultural Development Bank

Instituto Nacional de Transformacio'n Agraria (INTA) -- Agrarian Transformation Institute

Instituto Nacional de Comercializacio'n Agri'cola (INDECA) -- Agricultural Marketing Institute

Instituto Nacional Forestal (INAFOR) -- Forestry Institute (Because of corruption this institute was being reorganized in mid-1988. Its duties and responsibilities will soon be taken over by a new organization to be called the Dirreccio'n General de Bosques y Vida Silvestre [General Direction of Forests and Wildlife] that is likely to be under the direct administrative control of the Ministry of Agriculture and Food.)

Planta Procesadora de Productos La'cteos (PROLAC) -- Milk Products Processing Organization

Instituto de Ciencia y Tecnologi'a Agri'colas (ICTA) -- Agricultural Science and Technology Institute

Under the direct administrative control of the Ministry of Agriculture and Food are the following:

Unidad Sectorial de Planificacio'n (USPADA) -- Sectorial Planning Unit

Dirreccio'n de Servicios Agri'colas (DIGESA) -- Agricultural Services (extension and technical assistance)

Dirreccio'n de Servicios Pecuarios (DIGESEPE) -- Livestock Services (extension and technical assistance)

When ICTA was created, it was supposed to coordinate its activities with all of these other organizations, especially DIGESA, which was responsible for agricultural extension and BANDESA, which was responsible for providing agricultural credit. DIGESEPE was created in 1979 and was also charged with the responsibility to work with ICTA. In actuality, there was little coordination among these institutions until the establishment of PROGETTAPS. PROGETTAPS established Regional Committees (COREDAS -- Comites Regionales de Desarrollo Agri'cola) and Subregional Committees (COSUREDAS -- Comites Subregionales de Desarrollo Agri'cola), staffed by the regional and subregional directors of the six principal organizations in the Public

Agricultural Sector, to do joint planning and monitoring of on-going activities.

In fact, communication with DIGESA and DIGESEPE has improved substantially. There is still little communication with the other organizations, though there is increasing recognition of the need to work with INDECA to insure that there will be a market for the agricultural products produced as a result of ICTA, DIGESEPE, and DIGESA work. Directors within ICTA also recognize that adopting a true systems perspective for their work will make it necessary to work also with the public sector agency responsible for forestry activities.

Internally, ICTA has a director general's office that is responsible for coordinating all of the activities of the agency. Public relations, computing, legal affairs and auditing offices report directly to the director general. There are four units under the director general -- the Administrative and Financial Services Unit, the Vegetable Production Unit, the Livestock Production Unit, and the Planning and Programming Unit. Vegetable Production and Livestock Production are the research units and are the largest in terms of personnel. The Vegetable Production Unit contains the commodity (e.g., maize, wheat, beans) and disciplinary support (e.g., socioeconomics, technology validation, soils) programs. The eight regional programs are part of the Vegetable Production and Livestock Production units. These regional programs carry out the on-farm research components of ICTA's activities. Within the eight regional programs there are fourteen Technology Validation teams that operate in regions or subregions. PROGETTAPS is supposed to help ICTA expand the number of teams to nineteen.

We found that there were not serious problems of communication within the institute. The technology validation teams sometimes express the belief that their work is deemed less important than that of the commodity programs. And as we have already noted, the socioeconomics program has fallen on hard times as a result of neglect and the inability to recruit new, qualified personnel. What is impressive, however, is that ICTA is aware of the problems and is attempting to address them. The current administrators see the important role for each of the components of the program and seem to be working to address the areas of concern and weakness. ICTA has been very responsive to the evaluations of it that have occurred at its behest (Facultad de Agronomia, Universidad de san Carlos de Guatemala, INAP, and IICA) 1986), with support from ISNAR (Ruano and Fumagalli 1988) and our effort. We believe that the recommendations within these three reports will result in a significant attempt by ICTA to improve linkages within the institute, as well as between the institute and other agencies.

### III. LESSONS DERIVED FROM THE ICTA CASE STUDY AND CONSTRAINTS TO THE IMPLEMENTATION OF FSR/E IN ICTA

This section of the report will attempt to draw general lessons from our study of ICTA. In this section, we will follow the structure established by Byrnes (n.d.) in his review of farming systems projects. We first consider those elements in which ICTA has been successful, then consider the constraints to better implementation of the FSR/E methodology.

The importance of ICTA in Guatemala in terms of a global assessment of FSR/E is that FSR/E was not added on to an existing research and extension system, nor is it confined to one or several projects in ICTA's general operations. On the contrary, ICTA bases all of its operations on a systems research philosophy and methodology and has done so since the beginning of the institute in 1972. Thus, it provides an example of FSR/E with substantial time depth and with a scope that encompasses all of the public sector agricultural research for a country.

#### Reasons for the Successes of ICTA

Although still weakened by low salaries, obvious personnel training needs in the social sciences, old vehicles, and a limited research budget, the ICTA experiment in participatory, on-farm research has survived serious economic and political upheaval. This in itself is a testimony to success. The following are some of the many factors contributing to this success:

- o A very well prepared plan of action, all aspects of which underwent a comprehensive review by a national and international team of experts. The final product of the long planning process is encapsulated in a simple flow chart (technology development scheme) showing methodological stages for on-station and on-farm research, complete with feedback channels. In essence, this flow chart represents nothing more than the application of scientific reasoning to problem identification and problem solving. However, by specifying disciplinary responsibilities over a sequence of interrelated activities, it illustrates the team work of social scientists, commodity and on-farm researchers, and extension personnel in the process of technology development for a specific target group. At the same time, the simplicity of the model can be easily understood by newcomers, while the actual techniques of on-farm research are refined as experience dictates. Throughout difficult periods of turmoil within the institute and external to it, the core of personnel in ICTA have remained loyal to this perspective.
- o When it was founded, ICTA was blessed with high-quality technical assistance and external funding from USAID and the Rockefeller Foundation. The IARCs provided strong support in the areas of short-term training and maize and bean germ plasm, which provided "on shelf" technology for immediate agroecological adaptation. Although other Latin American countries also received similar support, the organization of ICTA in the direction of on-farm research on basic grains and the heady enthusiasm of the "research

revolution" were fertile ground for this international support. ICTA was receptive and the chemistry for success was right. ICTA-improved varieties have been widely accepted and form the basis for a substantial domestic seed industry that insures the delivery of this important input to farmers throughout the country.

- o ICTA has continued to place importance on human capital development. The "boot camp" (CAPA) program has replenished the thinned ranks of technicians with equally dedicated workers, who believe in the organization to the point of accepting poorer salaries and working conditions than they could obtain in the private sector. Although personnel turnover has been high, ICTA has retained more people in times of trouble than sister organizations in neighboring countries.
- o The semi-autonomous nature of ICTA has insulated the organization somewhat from changes of governments and political priorities. With the exception of the period from 1980 to 1985, leadership has been experienced, competent, and dedicated to the revolutionary vision from which ICTA was conceived. As was the case with the quality of the international technical assistance received during its infancy, much of ICTA's success can be attributed to the personalities, dedication, and charisma of its leadership.
- o Farmer involvement in on-farm research was at the core of the ICTA philosophy. Whereas many other countries gave lip service to farmer participation in research- managed on-farm experiments and extension-managed demonstrations, ICTA emphasized farmer-managed technology validation. The result was almost a textbook example of the enhanced adoption potential of the technologies under study and farmer-researcher-farmer information feedback.
- o The fact that on-farm research teams were part of the original design for the institute's methodology eliminated many of the internal conflicts with commodity and disciplinary specialists that plague many FSR/E programs that have been superimposed over existing research structures. Those involved in on-farm work were not constantly challenged as to their professionalism or quality of research results, nor have they had to compete for research funds, equipment, and respect within the institute. Without the dissension from within, ICTA has been able to maintain its concentration on improving the efficiency of on-farm research.
- o Decision making in agricultural research was decentralized. Regional directors were responsible for developing research programs with the aid and counsel of regional technology testing teams. At the same time, support discipline teams in socioeconomics, soils, seed production, communications, and training provided a fabric of national coordination, and the commodity programs have generated technology and provided backstopping for the technology validation teams. Budgetary expenditures in agricultural research have been skewed in favor of regional efforts. However, the limited research resources of ICTA were not diluted to cover the entire country uniformly. Instead,

regional efforts were given priority according to the relative importance of specific areas of the country. In this way, ICTA was able to concentrate on improving staple food production on small and medium-sized farms in the most densely populated and resource-poor regions of the country.

- o ICTA has continued to maintain sufficient capital for operating expenses. Many research organizations in other countries are often caught in the trap of having over 90 percent of their funds committed to paying salaries and other personnel costs. ICTA has resisted overexpanding its operations and its payroll so that, in most years, it has been able to allocate at least 25 percent of its funds for operating expenses. Researchers are able to get access to most supplies that they need, vehicles are available to the technology validation teams to organize and visit the on-farm experiments, and equipment is generally able to be maintained.
- o ICTA focused its limited resources on only the crop subsystem of the farm and on a relatively few enterprises within the crop subsystem. Research institutions in other countries attempted a more balanced approach toward all of the principal crop and livestock enterprises found in the agricultural sector, including the supporting academic disciplines (e.g., soil science, pathology). This placed a tremendous strain on limited financial and human capital resources of those institutions, especially when on-farm research activities were superimposed on a weak assortment of commodity research programs. The end result is a diluted and ineffective national research effort. This is not the case at ICTA. In fact, the organization has recently been criticized for focussing on too narrow a range of commodities and problems.
- o ICTA has shown a sensitivity to system interactions. This began simply, such as the need for better ear cover on the high-yielding maize variety ICTA B1 to prevent insect damage or the need to develop rice varieties that meet consumer expectations and do not shatter during hulling. Maize varieties are also routinely selected for having wide leaves in addition to high yields, because the leaves are used for wrapping tamales. More recent attention is being given to the interaction between wheat straw used for animal bedding, which is then incorporated in potato fields as organic fertilizer (compost). This holistic system awareness will be advantageous as ICTA moves into research on livestock and cash crop subsystems.

In the following sections we will discuss some of the most important constraints that have been identified by Byrnes (n.d.) as affecting FSR/E programs. Not all of these constraints have limited ICTA in Guatemala, and in some cases the institute has overcome them in important and innovative ways. Thus, in the "constraints" that follow, both positive and negative aspects of FSR/E in ICTA will be discussed.

## Internal Constraints to Doing FSR/E

### 1. Farmer orientation and participation

ICTA has always been quite clear that its mandate is to help the farmers with small and medium-size holdings in the country. Its on-farm research activities are designed with this in mind and the vast majority of the on-farm trials and validation parcels are on the fields of small farmers.

Nevertheless, ICTA is well aware that its research has probably been of greater benefit to farmers with larger holdings. This is because most of the beneficial technology that has been developed in the research institute consists of new seed varieties. These are now being produced by private seed companies and are mainly purchased by wealthier farmers with large extensions of land.

For this reason, ICTA, with the assistance of BID and FIDA through PROGETTAPS, has begun several new initiatives to reach farmers with smaller landholdings. The first of these is the farmer representative program. The idea of this is that ICTA technicians train and work with promoters from DIGESA and DIGESEPE. These individuals conduct sondeos, plan research, and establish on-farm trials and demonstration plots. They work with ten farmer representatives elected from communities. Each of the farmer representatives is paid a half time regular wage and is responsible for organizing groups of at least twenty farmers from their communities. In this way, each ICTA technician can work indirectly with two-hundred farmers. If there are DIGESA and DIGESEPE promoters as well, the number of farmers can triple to six-hundred. This program is designed so that the technicians can have a multiplier effect with a large number of farmers at a relatively low cost.

The second new initiative is the artisan seed production program. Here the farmer representatives are taught techniques for producing, storing, and multiplying clean, improved seed. This program is currently working with rustic storage facilities developed by CIP for potatoes, with technology for beans developed by CIAT, and with seedbeds for vegetables that will be transplanted. In 1987 11 demonstration plots for seed were planted in 1987 and by 1988 this had been expanded to 407.

We were quite impressed with the level of participation of farmer representatives and farmers in the communities we visited. ICTA personnel seemed to have developed good relationships with these individuals. This was especially impressive in Indian communities in which the farmer representatives not only tested and demonstrated new technology but also served as the only means by which ICTA personnel could communicate with monolingual speakers of Indian languages. Thus, the farmer participation model that is essential to FSR/E is being strengthened in innovative ways at ICTA. This effective participation seems to be operating best in the Quetzaltenango region of the country, but ICTA has plans to extend it to the other regions.

## 2. Locational specificity of technical and human factors

Technology validation teams presently work in fourteen areas of the eight regions into which the country has been divided by the Public Agricultural Sector. There are plans to expand the number of teams to nineteen, but even then, the coverage of the country will be quite limited. ICTA has concentrated its efforts on the most populous regions of the country and on regions where the majority of farmers are resource poor.

The problems that have affected the socioeconomics unit mean that characterizations of agroecological zones have been done for only a few areas of the country. At this point, it is difficult to estimate how many of the resource-poor farmers would potentially benefit from the research being done by ICTA. "Homogeneous areas" (in ICTA's terminology) remain to be identified for most regions of the country.

## 3. Systems orientation

The systems orientation pervades the rhetoric of ICTA. It is apparent, however, that the commodity programs determine a substantial amount of what goes into the on-farm trials. In addition, ICTA research in the past was focussed heavily on a few grain crops. Thus, the systems orientation often consisted of trying to determine how a specific commodity like sorghum, maize, or wheat fit into a larger context rather than focussing on how the whole system operated. This orientation became especially apparent when USAID tried to use ICTA to spread vegetables and fruits as cash crops in highland agricultural systems.

One problem that is mentioned frequently by ICTA personnel is that it has been difficult for them to find appropriate places for their technicians to study farming systems research and extension. CATIE was the obvious choice, but ICTA personnel have criticized CATIE for really only focussing on cropping systems. People sent to U.S. institutions learned disciplines or commodities. Chapingo in Mexico seems to be the current institution of choice.

The "dark period" of ICTA must also be blamed for decreasing the ability to really do systems research. The socioeconomics program, for example, was moved from the Vegetable Production Technical Unit to the Programming Unit. This reflected the lack of understanding of one of the outside directors of the role of socioeconomics in ICTA. The technology validation teams received little support, and networking possibilities were diminished because of lack of travel funds and money to send technicians for training. Thus, during the period in which FSR/E was evolving on the global scene, ICTA was cut off from developments and new ideas.

There also seems to be a lingering dogmatism within ICTA concerning its approach. A reflection of this is the continuing attachment to gathering time-consuming farm registers without an understanding of how they are to be analyzed or used. ICTA has not done much in attempting to innovate new, time-effective techniques for tasks like farm registers. Some justifiable criticism (especially from USAID) has been made regarding the inflexibility of the institute on this and other issues.

In recent years, ICTA has expanded its systems focus by establishing a unit to focus on livestock production and has improved its capacity in fruits and vegetables. More emphasis is being placed on the discipline of soil management. So current trends are toward a greater systems perspective within the institution. When added to the new ideas concerning techniques of technology transfer using the farmer representatives, there is reason for optimism concerning systems research in ICTA.

#### 4. Problem-solving approach

This is related to the points made above. ICTA has been slow to move away from its focus on basic grains. While it was and is important to focus on improvements in grain production for farmers with small plots of land, there is little likelihood that this will result in improving their levels of income. ICTA now seems to recognize the need for developing more effective research programs in combining fruit, vegetable, and livestock with improved grain production to address ways to improve incomes more realistically.

Here again the lack of an effective socioeconomics program causes substantial problems. The socioeconomics program as currently constituted can only apply techniques of the 1970s for doing sondeos, characterizations, and evaluations. If resource-poor farmers are to move into cash cropping, changes should be made in the socioeconomics program to focus more on the marketing alternatives and the policy environment. These are critical areas that are not now part of ICTA's thinking or planning.

#### 5. Technology testing in on-farm trials

ICTA has come to use a system in which farmers provide the inputs for the validation trials. This insures that the farmers maintain an interest in the economic results of these trials and insures better feedback concerning the results of the trials. The validation trials and demonstration plots are increasingly being turned over to the farmer representatives, a method that should allow for greater spread and coverage.

PROGETTAPS has adopted the on-farm research methodology of ICTA and, because of the cooperation of DIGESEPE and DIGESA personnel, these techniques are being spread to other organizations in Guatemala. The resulting stronger links between research and extension can only improve the FSR/E functioning in the country.

#### 6. Interdisciplinarity

Socioeconomics was one of the more innovative aspects of ICTA's program in the 1970s. With the loss of the highly respected Rockefeller advisor and those individuals trained during his tenure, the socioeconomics program has never regained its previous stature. Only eleven individuals remain in this unit; most of these individuals are technical school graduates in agronomy (peritos agronomos) with no training in socioeconomics, the acting director has B.A. level training in anthropology, and the permanent head of the unit is presently out of the country studying for a Master's degree.

The respect that the program once had has been lost. In part this is because of the "dark period" years in which the program was not understood, and in part it is because of the relatively low level of training of the individuals who fill the positions. Salaries are low compared to other areas; supposedly an agronomist who has been in socioeconomics for thirteen years is only making as much as a newly recruited individual in the CAPA program. The acting director told us that one indication of the lack of respect for the program came when new vehicles were to be purchased for the various teams. While all the Technology Validation teams were getting new trucks, the socioeconomics teams were asked to make do with three trucks and two motorcycles.

In the 1970s the socioeconomics unit was able to involve scientists from other disciplines and the commodity groups in carrying out sondeos and evaluations. This no longer seems to be the case and is an indicator that the interdisciplinarity in the institute is suffering because of the poor status of socioeconomics.

Although this area badly needs strengthening, the various USAID projects that have been operating and that are planned for Guatemala totally ignore this need. The extension of the Highlands Agricultural Development Program provides substantial money for training of biological agricultural scientists. Yet, despite mentioning the importance of characterizations of areas, of anticipating sociocultural problems, and of the need for baseline studies to use eventually as comparisons for evaluations, only six months of consulting for a Guatemalan social scientist is contemplated. No money is provided for training.

7. Feedback to shape agricultural research priorities and agricultural policies

The debilitation of the socioeconomics unit and the collection, but not analysis, of farm register data by technology validation teams indicate that there is no longer an effective means of identifying research priorities. We have the impression that increasingly the people in the commodity programs are identifying research priorities. Farmers are less important in the process than they were in the 1970s. To be sure, feedback still occurs because of the experimental trials, validation trials, and demonstration plots, but this is after substantial research has already been done.

### External Constraints on Doing FSR/E

1. Stakeholder understanding of FSR/E

One of the unique aspects of ICTA is that much of the development of the institution was planned by Guatemalans collaborating with USAID, the Rockefeller Foundation, and individuals from some of the international agricultural research centers.

In addition to the involvement of Guatemalans in the planning process, another important step was taken when the technical assistance team of foreigners was incorporated into the structure of the new organization. That is to say, these individuals were not treated as technical assistants but as regular members of the organization, part of the hierarchy of the institution, and subject to the same rules and norms as other personnel.

The close working relationships that were established between Guatemalans and the foreigners seemed to arise out of this relationship. Guatemalans and foreigners had an equal stake in whether or not the institution succeeded; the loyalty to the organization and philosophy of ICTA that evolved from this is one of the strengths that began from this move.

At present, it is clear that ICTA personnel have more of a stake in the success of FSR/E than do any of the donor agencies. ICTA has been committed to the approach since 1973. While USAID supported the initial efforts, their commitment to research projects using an FSR/E approach is relatively minimal.

## 2. Agricultural policy or strategy defining the role of FSR/E in research and extension

The systems approach of ICTA was heavily influenced by the national goals for Guatemala in the early 1970s. One question is whether these goals still apply today.

The present civilian government in Guatemala probably is more sympathetic to doing research for resource-poor farmers than any of the military governments that preceded it. The current vice minister of agriculture and food was formerly with ICTA and he is firmly behind the PROGETTAPS work with farmer representatives. He has also established some programs to help small producers more directly market their products.

Nevertheless, with the debt crisis and economic problems that are affecting Guatemala, there is also a national policy of attempting to increase exports. Thus, the USAID programs for small farmer diversification by getting them to move into cash cropping are reflective of a changed national agricultural strategy. ICTA is coming around to working within the context of this new policy environment, though it is being more responsive in terms of improving its technical expertise than improving its capacity in the socioeconomic area.

## 3. Long-term commitment of resources

ICTA has been in existence with a relatively unchanged philosophy since that time. The national government has not wavered in its support of ICTA's programs. In fact, because of its respected reputation within the country and internationally, ICTA has fared somewhat better in terms of budget than other parts of the Public Agricultural Sector.

PROGETTAPS has been working with ICTA and other agencies using an FSR/E framework. Recent USAID projects in the agricultural sector are compatible with an FSR/E perspective but there is clearly a much less positive commitment to this approach than there was when USAID supported the creation of ICTA.

## 4. Existing research capability and shelf technology

The original goals of ICTA were to work with the basic grains that comprised the majority of the diet of the nation and that were largely grown by small, resource-poor farmers. The financial support of the Rockefeller

Foundation and of USAID was obtained because those Guatemalans who were attempting to establish ICTA argued convincingly that the work of the International Agricultural Research centers then established would have little effect if there were not strong national programs to adapt and transfer the new genetic materials and other technology being created. Rockefeller support was channeled through two of these international agricultural research centers. The USAID Food Productivity and Nutrition Improvement Project (FPNI) focussed on providing ICTA with continued technical assistance for research on conventional maize, other basic grains, and vegetables.

The composition and contracting of personnel illustrates one of the original operating principles of ICTA. As McDermott (1977a:13) noted, ICTA relied 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 maize) from these sources to highly controlled experiments at the centros de producción; to on-farm, researcher-managed experiments; to on-farm, farmer-managed tests; and, for a successful technology, to dissemination by DIGESA and others.

ICTA has been quite successful in adapting on-shelf technologies in basic grains, validating them, and releasing them for use by agriculturalists. ICTA estimated that in 1985-86, maize producers in the country sowed 112,000 hectares (23 percent) using ICTA varieties, bean producers sowed 15,000 hectares (8.6 percent of the total) using ICTA varieties, and 80 percent of the land in rice was planted with materials developed by the institute. Most of this seed is now provided by the private seed industry, the development of which was stimulated by ICTA. Most of the seed distributed by the private sector in Guatemala is based on ICTA-developed varieties. This increase in domestic production has essentially obviated the need for imports, thus providing a substantial savings of foreign exchange for the country.

##### 5. Consensus on criteria for evaluating FSR/E

Evaluation of the research carried out by ICTA is still in a primitive stage. During the 1970s the institute developed what was called indices of acceptability. The index measured the percentage of farmers participating in farmer-managed validation trials who continued to use the technology in the following year. An index of over 50 percent adopting is grounds for disseminating the technology to other farmers. This index is still used in the institute though there continues to be substantial disagreement over its use.

Personnel in the socioeconomics program, which is responsible for gathering the data for the index of acceptability, report that many people in the commodity programs become angry when indices of acceptability do not meet the minimum standard. These individuals say that the relatively few farmers participating in farmer-managed trials are not a large enough sample to prove that a technology is acceptable or not. They say that if a larger sample had been used, many technologies would be accepted. The socioeconomics program also sees a problem with the index of acceptability. The problem is that the index does not give any idea of how widely the technology spreads and whether other farmers who do not have farmer-managed

trials adopt the technique.

This again is a case of a technique developed in the 1970s not being improved upon or modified in the light of experience. The problem is that the personnel in the socioeconomics program just do not have the training to be able to make the appropriate changes.

#### 6. Capability to process farming systems data

This has been addressed earlier. ICTA does not have sufficient personnel or equipment to process farm register and other data collected as part of FSR/E activities. Many people who now work in the socioeconomics and technology validation programs told us of heaps of data sheets stacked in offices. Many of these stacks are several years old and are unlikely to ever be processed.

It is unlikely that the situation will improve in the near future. ICTA has recently ordered programmable calculators to distribute to the technology validation teams and the socioeconomics teams. It seems obvious that personal computers would be much more practical if the data were collected in a manner that would allow them to be input and analyzed rapidly. The problem is that the current staff, although they are doing the best job they can with current resources, does not have the training to be aware of what the possibilities are.

#### 7. Links with extension, agri-support services, and farmer organizations

For most of ICTA's history, links with extension have been minimal. This was a problem for ICTA because it could not diffuse technology by itself. It is for this reason that its major success was with improved seed, a situation in which private companies did the actual dissemination of the product. ICTA provides the improved germ plasm to produce the improved seed.

The advent of PROGETTAPS, however, has led to a significant improvement in communication. DIGESA and ICTA personnel now collaborate closely in several regions of the country. Attempts are being made to develop stronger links with DIGESEPE. The modular program using teams from ICTA, DIGESA, and DIGESEPE, which work with farmer representatives, seems to hold great hope for improving the technology transfer process.

ICTA has collaborated well with other private companies for specific commodities. We have mentioned the linkages with a beer company to work with barley producers, the agreement with Quaker to work with oat producers, and the agreement with the wheat producers. These organizations channel financial resources to ICTA to work on specific problems.

### Generic Constraints to Implementing FSR/E Projects

#### 1. Management structure of the institute

ICTA management is relatively decentralized, with a substantial percentage of the researchers assigned to the regional offices. Sixty-five

percent of the budget is in the regional programs. The administrative structure of the institute is relatively lean. So long as the directors are in accord with the philosophies and goals of the institute, the management structure has worked well.

ICTA's semiautonomous status means that it can contract new personnel, purchase equipment, and allocate its budget without the approval of a central government agency. The only position within the institute that has been subject to the winds of political change has been that of the director general. This contrasts with many other countries in which a change of government often means a replacement of a substantial proportion of the institution.

## 2. Government funding to meet recurrent costs

The funding situation of ICTA was discussed extensively in the second section of this report. The main conclusions that we reached there were the following:

- a) Until PROGETTAPS loans were made, over 75 percent of all annual budgets of ICTA were provided from government resources;
- b) The country does not allocate a large percentage of its budget to agricultural research, but what it does allocate seems to be well spent;
- c) ICTA maintains a relatively low level of personnel so that it can devote about a quarter of its annual budget to operating expenses; and
- d) ICTA provides about a fifth of its budget to the two main programs concerned with FSR/E -- the socioeconomics and technology validation support disciplines.

## 3. Staffing with trained manpower

ICTA has devoted substantial resources to improving the capabilities of its staff. In the first thirteen years of its existence, fifty-four individuals received postgraduate training outside the country, despite several years in which the policy was not to send anyone abroad. Although there has been a loss of trained individuals from the program, most commodity programs and disciplines have maintained a core of adequately trained individuals. The level of training of personnel has improved substantially since the institute was founded.

The CAPA program has been an important factor in ICTA being able to maintain an esprit de corps and a shared philosophy within the organization. This ten-month training program for new personnel is costly but probably has contributed to the maintenance of the ICTA program through its toughest times.

Trained individuals are most sparse in the two areas most concerned with FSR/E -- socioeconomics and technology validation. Socioeconomics lost its most capable individuals during the "dark period" when it was

transferred into the programming unit. It has not been able to recruit new staff partially because of the repression suffered by the university social science programs during the political violence of a few years ago.

Technology validation loses about 15 percent of its team members each year. The major reason is that there are few opportunities for training or advancement open to individuals on these teams. Most members believe that they have to transfer to one of the commodity programs or to one of the disciplines to have a chance of getting training outside the country or of moving into positions of greater responsibility in the institute.

Recent USAID programs continue to provide funds to strengthen ICTA personnel. Unfortunately, these training funds do not include opportunities for individuals in either socioeconomics or technology validation.

#### 4. Management of training

There is a commission on grants within the institute that has the responsibility of planning what training needs to be done and for selecting the individuals to be sent abroad. This commission takes into account the needs expressed by program and discipline coordinators, the experience and abilities of the individuals who apply for training, and the goals and needs of ICTA.

ICTA successfully underwent the transition from having line positions filled by foreigners to an institute staffed by Guatemalans. Though this transition was more abrupt than it could have been, the level of trained personnel carried the institute through the "dark period." ICTA is in a new stage of development with individuals who rose through the ranks now occupying administrative positions in the organization.

ICTA has a training center in Jutiapa where it conducts its own in-service training program (CAPA). This location is also often used for workshops and other training activities. ICTA personnel have participated actively in short courses, workshops, and other such training in Guatemala and abroad.

#### 5. Management of technical assistance

ICTA made excellent use of the high-quality technical assistance and external funding from USAID, the Rockefeller Foundation, CIAT, and CIMMYT. Much of this was probably due to incorporating these individuals directly into the hierarchy and norms of the organization. Although other Latin American countries also received similar outside technical support, they were unable to develop such an effective working relationship between national and foreign staff.

The wisdom of putting foreigners into line positions is illuminated by contrast to the recently concluded USAID Small Farmer Diversification Program. A technical assistance team was established as a parallel group outside of ICTA. Most of the individuals who were part of this team never established good working relationships with their ICTA counterparts. The result was hard feelings on both sides and a less successful project than could otherwise have occurred.

## 6. Factors beyond the institute's control

The political violence in Guatemala in the late 1970s and early 1980s made it impossible for ICTA personnel to work in many areas of the country. The highlands were especially dangerous during this period and it was in these areas that ICTA had concentrated most of its efforts. During the last several years the violence has subsided and ICTA has re-established many of its programs.

The changes in military governments have also exacted a toll on ICTA. Political appointees from 1978 to 1983 were not sympathetic to ICTA's philosophy or goals. Three successive director generals of the institute created morale problems that led to the departure of the foreign technical assistance team and many of the most capable Guatemalan staff. This "dark period" is something from which ICTA has only recently begun recovering.

The result is that the conceptual, methodological, and technical innovations for which ICTA became known a decade ago have not continued. The negative factors that affected ICTA in the late 1970s and early 1980s put an end to much evolution in the procedures of ICTA. Currently it seems that many of the techniques developed during its early years are applied without considering their original purpose or their utility. Some, like the time-consuming farm register, are rarely analyzed. The Technology Validation teams and the Socioeconomics discipline need revitalization with people who have sufficient training so that they can further the conceptual, methodological, and technical level of the institute.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

1. The systems perspective has been fully institutionalized at the Instituto de Ciencias y Tecnologia Agricolas. This is indicated by the level of financial support being provided by the national government, the importance of the on-farm client-oriented research that is central to the philosophy and methodology of ICTA, and the high emphasis placed on the systems perspective in the training programs sought for ICTA personnel.
2. We were extremely impressed with the level of professionalism and commitment of the scientists associated with the Instituto de Ciencias y Tecnologia Agricolas. There is a very positive mystique that pervades the institution. Even those individuals who have left ICTA comment on this mystique. Efforts should be made to build upon the solid foundation of professionalism, commitment, and mystique that exists. ICTA can do this by continuing to place importance on human capital development.
3. The institutionalization of the systems perspective and the high degree of self-assurance and confidence engendered by the professionalism of ICTA personnel have led to a situation in which the institution is able to articulate its own demands and to set its own research agenda. This independence has caused the institution some problems, particularly with USAID/Guatemala, but it also indicates a degree of institutional maturity that should be encouraged in developing country institutions. We believe that it is important for agricultural research organizations like ICTA to be able to effectively channel external assistance in productive directions rather than simply responding to each new initiative established by aid agencies.
4. For the above reasons, we believe that it is essential for USAID/Guatemala to continue collaborating with and supporting the programs of ICTA. Although there have been and will continue to be disagreements concerning research priorities, methodologies, and goals, both organizations should be able to learn from and take advantage of one another's perspectives and capabilities.
5. External technical assistants, when needed for agricultural research, should be directly incorporated into the structure of ICTA. This model worked well when ICTA was established in the 1970s and recent projects that have not done so have encountered problems as a result. Incorporating technical assistants into the organization would show respect to ICTA for its management and research abilities.
6. ICTA should continue to build its external linkages with foreign universities and organizations that have capabilities in farming systems research and extension. Because it suffered from such outside stimulation during its dark age, the methodology used by ICTA is in need of being revitalized. In terms of its internal linkages within Guatemala, ICTA should work with universities to try to incorporate more of the systems perspective in the agricultural teaching programs. Some of this is already occurring as ICTA personnel teach part time in several universities, but these efforts can be better coordinated and

made more effective.

7. The initiatives that have begun as a result of the PROGETTAPS effort, especially the coordination and collaboration with DIGESEPE and DIGESA, must be continued and broadened. ICTA depends on these organizations for the diffusion of its research results. Unless these organizations work together, none of them can do an effective job.
8. ICTA should continue its efforts to broaden its systems efforts to include livestock and cash crops like fruits and vegetables. The resource poor farmers who are viewed as principal clients for ICTA research can only substantially better their situation by improving the productivity of their whole system, including cash crops, livestock, basic grains, and off-farm opportunities.
9. ICTA must continue its efforts to upgrade the capabilities of the technology validation teams and the socioeconomics unit. These units were sources of considerable dynamism when the institute was first established, but unless these areas are strengthened again ICTA will continue to evolve toward an institution that is organized around commodity research programs.

## PEOPLE INTERVIEWED

### USAID -- Guatemala

Ing. Agrónomo Edgar Pineda, Office of Rural Development  
Audon Trujillo, Jr., Office of Rural Development  
Dr. Thomas Ivers, Office of Rural Development  
Brian Rudert, Office of Rural Development  
Harry Wing, Agricultural Development Officer, Office of Rural Development  
Gary Smith, ROCAP  
Ronald Curtis, ROCAP  
Elena Brinerman, ROCAP

### ICTA

#### Central Office

Ing. Agr. M.S. Horacio Juárez Arellano, Gerente General  
Ing. Agr. Alejandro Fuentes Orozco, Training and Technical Exchange  
Coordinator  
Ing. Agrónomo Wotzbell Méndez Estrada, National Coordinator of Technology  
Validation  
Lic. Hugo Zelaya, National Coordinator of Socioeconomics

#### Jutiapa

Ing. Rogelio Juarez Salinas, CAPA Training Coordinator  
Mario Melgar Arias, student in CAPA program

#### Quetzaltenango

Ing. Marco A. Maldonado, Director of ICTA, Region I  
Ing. Esau Guerra, Coordinator for ICTA participation in PROGETTAPS  
Ing. Edin Orozco Miranda, Prueba de Tecnología, ICTA  
Perito Agronomo Josue Solanich, District Supervisor, DIGESA  
Ing. José Robles, Prueba de Tecnología, ICTA  
Ing. Eduardo Lopez, Artisanal Seed Production, DIGESA  
Ing. Carlos de Leon Navarro, Regional Coordinator of PROGETTAPS, DIGESA  
Francisco Juarez Cabrera, Agricultural Representative, Tuipox, Concepción  
Chiquirichapa

Also visited village of San Miguel Sigüila

#### DIGESA

Ramiro Ortiz, Consultant to DIGESA

#### Instituto de Nutrición de Centro América y Panama

Dr. Hernan L. Delgado  
Dr. Mario Molina

Also visited the Cuatro Pinos cooperative

Ministry of Agriculture and Food

Ing. Agrónomo Carlos de León Prera, Vice Minister of Agriculture and Food

Universidad Rafael Landívar

Mario A. Martínez, Dean of Agriculture

## **APPENDICES**

## APPENDIX I

### A Synthesis of the Evolution of Agricultural Research in Guatemala

<u>Year</u>	<u>Events</u>
1920	Creation of the National School of Agriculture
1930	Creation of the Instituto Quimico Agricola Nacional (National Institute of Agricultural Chemistry); carried out agricultural research on fertility of soils
1944-45	Founding of the Instituto Agropecuario Nacional (National Agricultural and Livestock Institute); this initially began as a cooperative venture between the Association of Cinchona [Quinine] Cultivators of Guatemala and the U.S. Department of Agriculture; later expanded to establish three experiment stations and research on maize, beans, rice, wheat, coffee and rubber
1950	Founding of the Faculty of Agronomy in the University of San Carlos, the national university of Guatemala
1954	A government commission recommends the creation of an autonomous institute of agricultural research; the IAN is replaced by el Servicio Cooperativo Interamericano de Agricultura (Interamerican Cooperative Service of Agriculture), an entity not dependent on the central government; three new experiment stations open and one of the existing stations is moved
1956	Founding of the Facultad de Veterinaria y Zootecnia at the University of San Carlos
1959	SCIDA disappears and is replaced again by the IAN which functions as a part of the Ministry of Agriculture (i.e., not autonomous)
1960-70	Wheat and potato programs of the agricultural experiment station at Labor Ovalle, Quetzaltenango begin on farm research activities, a pre-cursor of the on-farm trials carried out by agriculturalists
1964	The Economic Commission for Latin America (ECLA) and the Interamerican Institute for Cooperation in Agriculture (IICA) deliver a report to the governments of Central America on the state of agricultural research in the region; the First Reunion of the Central American Committee on Agricultural and Livestock Development is held in Costa Rica; it recommends that coordinated research begin on production of maize, rice, beans, sorghum, meat, milk, coffee, cotton, and sugar cane; and

it recommends that IICA coordinate the work of national agricultural research programs

1959-70 Work at Labor Ovalle using work done at the Office of Special Studies in Mexico as a model results in new varieties of wheat that raise production during the period from sixteen to forty-five thousand tons; in 1964 initial informal talks begin between Ing. Astolfo Fumigalli and Ing. Mario Martínez G. (and later other persons) about the idea of organizing an autonomous insitute of agricultural research; USAID provides project support through a series of projects including Agricultural Development (No. 520-11-190-197.1) to help improve agricultural extension activities and to establish an agricultural research institute responsive to small farmer technology problems

1970 Reform of the agricultural public sector which creates the National Bank for Development (BANDESA), the Institute of Agricultural Marketing (INDECA), and the General Direction of Agricultural Services (DIGESA) as part of the first national development plan; Ing. Mario Martínez G. is named vice-minister of agriculture; initial discussions begin between the vice-minister of agriculture, the director general of agricultural research, the director of USAID/Guatemala, and the Rockefeller Foundation about support for a research institute in Guatemala

1971-72 A work group of national and international experts is formed (with the support of the Rockefeller Foundation and USAID/Guatemala) to plan the philosophy, structure, general strategy, needs, functions, and other aspects of a potential agricultural research institute; the third of these work groups produces what has become known as the Green Book -- an analysis of the agricultural sector and a justification for the creation of ICTA; a draft of the law to create ICTA is prepared; Ing. Mario Martínez becomes minister of agriculture; discussions with the Rockefeller Foundation, CIMMYT, CIAT, USAID/Guatemala, and the Ministry of Agriculture continue; in May 1972 a document is signed by the Ministry of Agriculture and the director general of CIAT to provide two scientists to work in ICTA who would be supported by funds from the Rockefeller Foundation; USAID/Guatemala in coordination with CIMMYT agrees to support two expatriate scientists in the maize program in October; Decree No. 68-72 is issued by the Congress creating the Instituto de Ciencias y Tecnología Agrícolas as an autonomous institution

1973 ICTA is formally inaugurated on May 10 with Ing. Astolfo Fumagalli as director general, Dr. Robert Waugh as adjunct director, and Dr. Eugenio Martínez as technical

director

- 1974 Teams for on-farm trials are established for three regions of the country; Ing. Mario Martínez is named director general and Ing. Astolfo Fumagalli as sub-director general; the support discipline of Socioeconomics is formally created with the support of the social science department of the Rockefeller Foundation and Dr. Peter Hildebrand is named as coordinator of the discipline
- 1975 Guatemala Food Productivity and Nutrition Improvement Project (FPNI) is funded by USAID for five years for \$1.83 million; Prueba de Tecnología (on-farm trials) teams begin work; commodity research programs are established as support for the on-farm work
- 1976 The course for in-service training (Curso de Capacitación en Servicio -- CAPA) of technical scientists is established along with the seed production discipline support unit
- 1978 Change of government and change of ICTA director and sub-director
- 1979 The Animal Production Program is reorganized and strengthened; the General Direction of Livestock Services (DIGESEPE) is created for livestock extension activities
- 1982 USAID Small Farmer Diversification Project begins
- 1983 Devaluation of Quetzal from its previous level of parity to the dollar
- 1985 The Project for the Generation and Transfer of Agricultural and Livestock Technology and Seed Production (PROGETTAPS) is approved; Ing. Astolfo Fumagalli resigns to become a private consultant; Ing. Agronomo M.C. Horacio Juárez Arellano is named Director General
- 1986 National coordinator named for Prueba de Tecnología program

## APPENDIX II

### Foreign Scientists Who Worked with ICTA

<u>Scientist</u>	<u>Program</u>	<u>Financing</u>
Ing. Hugo Córdova (El Salvador)	Maize Program	CIMMYT/AID
Ing. Carlos Crisóstomo (Chile)	Technology Testing	AID
Ing. Roland Hardwood (USA)	Finance	Rockefeller
Dr. Peter Hildebrand (USA)	Socioeconomics	Rockefeller
Ing. Douglas Kuehn (USA)	Vegetable Program	AID
Ing. Marceliano López (Colombia)	Training	CIAT/BID
Dr. Eugenio Martínez (Mexico)	Technical Director	CIAT/Rockefeller
Ing. Silvio Hugo Orozco (Colombia)	Bean Program	CIAT
Dr. Albert Plant (USA)	Sorghum Program	AID
Dr. Federico Poey (USA)	Maize Program	CIMMYT/AID
Dr. Wayne Porter (USA)	Bean Program	CIAT/AID
Ing. Federico Scheuch (Peru)	Seeds	CIAT/BID
Dr. Robert Waugh (USA)	Adjunct Director	CIAT/Rockefeller
Dr. Kasuhiro Yoshii (Japan)	Bean Program	CIAT/AID

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