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9. ABSTRACT

Malnutrition problems in LDCs can be reduced through better-organized applications of local food technology resources. The objectives of this study were to survey food technology resources in Lation America, to identify problems contributing to malnutrition among preschool children and pregnant and lactating women, to identify reasons why food technologists have not been solving those problems effectively, and to recommend actions LDC governments. A.I.D., and other donors can take to focus food technology interests and resources on the malnutrition problems. The researchers toured twelve Latin American countries in early 1976, selected member of three regional research committees, and provided them guidelines and a work plan. In December of 1976 an evaluative meeting was held to assess and correlate the three committee reports, exchange views among all concerned, and arrive at the study conclusions. Among the findings: Food technology resources vary in quality, but they are adequate for helping to solve malnutrition problems. The most common malnutrition problem is calorie and protein deficiency, followed by vitamin A, iron, iodine, and calcium deficiencies. The most serious malnutrition conditions apparently occur in the fringe areas of large cities, and the contributing factors include nutrition illiteracy, low income, inadequate food storage and processing, serious post-harvest losses, and inadequate government policies. Seventeen constraints were identified; twenty-five ways of using resources more effectively were suggested; and fourteen action programs suggested. Four pilot projects were recommended.

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FINAL REPORT

GRANT No. AID/ta-G-1238

LIFE/IFT Nutrition-Food Technology Latin American Study

(Abridged version)

Ben F. Buchanan, Coordinator

George F. Stewart, Assistant Coordinator

May 1977

ACKNOWLEDGEMENTS

We wish to express sincere thanks for their assistance, advise, and counsel in the conduct of this Study to the Technical Advisory Committee consisting of Dr. E. J. Briskey, IFT President at the time of initiation of this Study, Dr. C. O. Chichester, Chairman, IFT World Food Program Committee, Dr. Irwin Hornstein, AID Office of Nutrition, and Dr. H. J. Roberts, Executive Director of LIFE; to the IFT Governing Board - Special Grants and Contracts consisting of, in addition to Dr. Briskey, Dr. John Ayres, IFT President-Elect, Dr. C. F. Niven, Jr., IFT Past President, Mr. R. A. Greenberg, IFT Treasurer, and Mr. C. L. Willey, IFT Executive Director; and to many other IFT members and Latin American Committee members who assisted us in the conduct of the Study.

We are especially indebted to U.S. AID for its interest and financial support of the Study. Also we wish to acknowledge AID's help in making certain contacts and arrangements on our behalf in Latin America and in providing meeting facilities for some of our meetings there.

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SUMMARY, CONCLUSIONS & RECOMMENDATIONS

Purpose of Grant: The ultimate purpose of this grant was to identify actions (policy changes, resource inputs, or pilot projects) which might be taken by Lesser Developed Countries (LDC) governments, U.S. Agency for International Development (AID), or other donors to stimulate the application of local food technology resources to the solution of malnutrition problems in Latin America.

Specific Objectives:

(1) Survey present food technology resources in Latin America,

(2) Identify problems which contribute to malnutrition among the target group (preschool children and pregnant and lactating women) and which are amenable to technological solutions,

(3) Identify reasons why food technologists (or food technology institutions) have not responded more effectively and fully to solving these problems,

(4) Identify and recommend actions required by LDC governments, AID, or other donors to focus food technology interests and resources on malnutrition problems of the target group, and

(5) If appropriate on the basis of findings in (4), design one or more pilot projects in specific geographic areas to test the effectiveness of action programs identified.

Initial Steps: As a first step in the accomplishment of the objectives of this study the Coordinator and Assistant Coordinator gathered information from a variety of sources about key people and organizations in Latin America interested in, and concerned with, malnutrition there. With this material in hand and digested we made a tour of twelve countries in Latin America in early 1976 to organize the activities envisioned for the project and to set up arrangements for carrying them out. During this trip we met with a large number of people and from the group selected 16 to serve as members of three regional committees to generate the information needed to meet the objectives of the study. North American counterparts were also selected to act as consultants to these committees.

The coordinator returned to Latin America a little later to supply the three committees with guidelines and a work plan based on the five project objectives, and to help them get started on their assignments.

Committee Activities: The three committees met twice more to assess progress and make plans for completing their assignments. In October 1976 the three committees submitted their final reports.

After collation of the information from the three reports a meeting was held in December 1976 in Miami Beach attended by representatives from the three committees, all North American Advisors, representatives from the Project Technical Advisory Committee and the IFT Governing Board, and the Coordinator and Assistant Coordinator to discuss the information, exchange views and arrive at conclusions.

Committee Findings: The reports and deliberations of the committees revealed:

1. There is a wide range of food technological resources in Latin America, from very good and modern to very poor and primitive. In general, the resources are felt to be adequate for the purpose of helping to solve malnutrition problems in the areas using these resources.
2. Malnutrition conditions among the target group are relatively similar throughout Latin America. The most common condition is calorie/protein malnutrition, followed by vitamin A, iron, iodine and calcium deficiencies. Fluoride deficiency is a problem in certain areas. Other vitamin and trace mineral deficiencies were rarely identified as problems.
3. Most of the serious malnutrition conditions appear to occur in the fringe areas of large cities caused by the influx of poor people from rural areas in search of jobs. There is, however, evidence of malnutrition also in the urban and rural areas.
4. Many factors contribute to malnutrition conditions, the most prevalent being nutrition illiteracy, poor food habits, low income, poor communications (especially between food technologists and other concerned with the malnutrition problems), inadequate processing, handling, storage and distribution technologies, contaminated water supplies, and inadequate and/or ineffective government nutrition policies.
5. Serious post-harvest losses occur in all the countries; however, data are sparce and difficult to obtain. Nevertheless, losses range up to an estimated 30% due to poor storage conditions, inadequate processing and preservation technology, poor transportation, and rodents and other pests.
6. Seventeen constraints were identified which have hindered food technology resources in Latin America from being more effectively used in helping solve malnutrition problems in the target group.
7. Twenty-five ways were suggested in which food technological resources can be used more effectively to help alleviate the malnutrition conditions.
8. Fourteen action programs were suggested which would better utilize food technological resources to overcome malnutrition conditions in the target group.

Recommendations:

1. Four pilot projects:
   - A Model Integrated Nutrition and Food Technology Program for Priority Groups in a Brazilian Community.
   - Teaching Food Science and Technology as a Component of Education for Rural Development.
   - An Agro-industrial System Integrated with Public Health Nutrition, for the Improvement of the Socio-Economic and Nutritional Status of Rural Communities.
   - Utilization of Marine Resources to Combat Malnutrition in Chile.
2. An in-depth study should be made of post-harvest losses in Latin America.
3. There should be an increase in intra-Latin American training programs in Food Science and Technology, and in Nutrition.
4. Basic Food Science and Technology courses should be included in all Nutrition curricula, and basic Nutrition courses should be included in all Food Science and Technology curricula.

Some Final Observations and Impressions.

Economic and Social Development in Latin American Countries. Basic to the long term success of any action program aimed at solving the malnutrition problems of developing countries is an adequate economic development of their natural resources and a satisfactory development of their human resources. The following commentary on these developments were derived, not only from what we have seen and heard, but also were based on a fairly extensive reading of the current literature pertaining to this subject and conditions in Latin America.

There is a wide variation in the rates at which Latin American countries are developing. Among the more rapidly developing countries are Mexico, Venezuela, Brazil and Colombia; among those developing much more slowly are Honduras, Uruguay, Chile and Paraguay. The reasons for these differences are many but foremost among them in our opinion are: 1) the quality and quantity of the natural resources present; 2) the responsiveness and stability of government; 3) the availability of investment capital; 4) the availability of educational and training opportunities; 5) the availability of the infrastructures necessary for a modern industrial society, and 6) an energetic national science and technology capability.

The outlook for adequate developing in some of these countries looks bright indeed but for others we doubt that they can make it. Recognizing this prospect is important to the success of our study for if a country cannot achieve a reasonable degree of development the majority of its people will not have the financial resources to purchase the food they need. And no government can afford to give away needed food to any substantial proportion of its people on a permanent basis.

Malnutrition in Latin America. The nature and extent of malnutrition in Latin America were probably first brought to light most forcibly by the extensive nutritional surveys sponsored by the United States Inter-agency Committee on Nutrition for National Defense and carried out by the U.S. and local scientists in the late 1950's and throughout the 1960's. Subsequent studies by local nutritionists as well as by those from the U.S. and other countries have pinpointed these problems and have identified the most vulnerable groups, i.e., preschool children and pregnant and lactating women with which our study is most concerned.

Malnutrition has continued to grow in much of Latin America despite these findings and also in the face of many attempts at special intervention programs. The problem appears to be worsening in many of these countries because of a general migration of people from rural areas to the cities. These are mainly poor people in search of a better livelihood. Even though there is a fairly rapid industrialization in some of these countries, insufficient job opportunities have been created to employ these migrants and so, as things stand now, they are worse off in their new location than they were before.

A number of intervention programs for feeding the malnourished have been initiated over the past ten or so years. Surplus foods from the United States have provided large quantities of dried milk, wheat flour,

corn meal and certain formulated products to the Latin American countries under terms of Public Law 480 (Food for Peace). Just how successful these programs have been is the subject for much debate, especially when it is realized that one day they must be phased out (as indeed they now are) and also when it is realized that the commodities provided cannot generally be replaced from local sources.

It was comforting to observe during the tour that many leaders in Latin America recognize the nature and severity of the malnutrition problems in their countries and the need to develop national policies and programs of food and nutrition to cope with them. Further, they have come to realize that a major part of the food raw materials will probably have to be produced locally. They also recognize that locally adapted technologies are needed to process and preserve these foods and not just the adoption of technologies from developed countries. Above all, they realize that these foods must be products that fit in with traditional food habit patterns of the area.

Status of Food Technology in Latin America. Food Technology as a profession has obviously been developing fairly rapidly in many of these countries. Hundreds of students have been trained in the U.S. and in other industrialized countries and have returned to their native countries to practice their profession. Unhappily, too few of them seem to have found employment in the food industry and so most of them are at present working for universities or government agencies.

Regional training centers for food technologists have sprung up recently in Brazil, Mexico and Columbia. This is a hopeful sign in that such centers can probably better train food technologists for service in Latin America than can be done in the United States or in other developed countries. And, of course, there are a number of other universities there that now offer degrees in Food Science/Technology/Engineering.

The food industry of Latin America appears not to have advanced technically as fast as the profession itself. Further, the advancements that have taken place seem largely to have been imported by the multi-national companies. And much of this advancement has been in limited commodity areas such as grain milling, meat processing, sugar manufacture, fats and oils refining and dairy products manufacture. It may be that we are on the verge of much more rapid technical developments in the food industry in these countries as witnessed by what we found happening in Brazil and Columbia.

Foreign Assistance for Food and Nutrition Programs. We have already mentioned the efforts of U.S. governmental agencies in helping with malnutrition problems. We could cite many other examples. In addition to these, The United Nations is providing technical and financial help in most of Latin America, especially through such agencies as FAO, UNICEF, UNDP and World Bank. We noted that other governments offering assistance include Great Britain, Canada, Switzerland, and the German Federal Republic. Other organizations offering help include the Inter-American Development Bank, the Organization of American States, Pan American Health Organization, International Development Research Center (Canada), Ford Foundation, Rockefeller Foundation, Care and Meals-for-Millions.

IMPLEMENTATION OF PROGRAM

Rationale and Philosophy.

The basic rationale and philosophy for this study was to encourage the Latin Americans to identify their own malnutrition problems and to suggest ways by which local food technological resources could be used to help alleviate them. It was necessary, therefore, to identify and involve interested Latin American representatives in the conduct of the study. To do so it was, early-on, decided to appoint committees made up of local nationals in three geographic areas of Latin America and to put them to work with a minimum of guidance and direction. Guidance was to be supplied not only by us*, but also by a team of North American Advisors which we named to work with each committee. Advisors were selected from a list of candidates who had previously worked and traveled widely in Latin America. Since the list included the names of persons from Mexico, Puerto Rico, and Canada it was agreed to designate them as North American Advisors.

The three geographic areas of this study, represented by separate local committees, were: 1) Brazil, 2) the Northern Countries of South America, Central America, Panama and the Caribbean, and 3) the Southern Countries of South America comprising Argentina, Chile, Paraguay and Uruguay.

First Steps - Planning the Tour.

A tour of Latin America was planned during which we would talk with as many potentially interested persons as would be possible in an eight week period envisioned for the tour. Out of this would come a list of the Latin Americans who would and could help us reach the objectives of the project. The composition of the committees was to cover a wide spectrum of relevant disciplines concerned with food and nutrition action programs. Preparation for the Latin American tour took the form of reviewing pertinent literature and discussions with knowledgeable individuals and groups who were familiar with and interested in malnutrition problems in Latin America.

An itinerary was planned for the tour which would make the most efficient use of the limited time available to visit with those people and institutions thought to be most important. Contacts were made with about 120 Latin Americans, informing them of our study and our desire to discuss the project with them and their professional collegues.

The tour began on 12 January 1976 with a first stop in Brazilia and ended 5 March with the last stop in Guatemala City. Meetings were held at twenty different locations in twelve of the Latin American countries, during which we met and talked with more than 300 individuals representing 146 institutions. Of the latter (Universities, Government Agencies, and food and related industries), 67 were visited. A detailed report of the tour together with our general comments on developments, including agriculture and food supply in each country, is included. (See APPENDIX IV).

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* This report has been prepared by the Coordinator and Assistant Coordinator. Therefore, to simplify terminology, the words "we" or "us" are used to designate our combined efforts.

In our meetings with the various groups we discussed how we envisioned the study to be conducted, the need to appoint committees of local nationals in each of the three regional areas, and the value of cooperation from all interested and concerned to supply information to the committee representative in their particular area in response to the five objectives of the study. We mentioned also that each committee would have the support and counsel not only of the Coordinator and Assistant Coordinator, but also of a team of North American Advisors whose names were supplied to the participants at each meeting.

Before leaving an area we selected a candidate(s) for appointment to the regional committee of local nations, and while still there we obtained his or her (their) consent to serve on the committee. Following is a listing of the regional committees and their respective teams of North American Advisors.

LATIN AMERICAN COMMITTEES AND NORTH AMERICAN ADVISORY TEAMS

BRAZILIAN COMMITTEE:

Chm. - Dr. J. E. Dutra de Oliveira, M.D., U. Sao Paulo, Ribeirao Preto

Dr. Luiz Eduardo Carvalho, INAN, Brazilia

Dr. Ottilio Guernelli, U. Campinas, Campinas

Dr. Roberto F. Kohlmann, SANBRA/ABIA, Sao Paulo

Dr. Cyro G. Teixeira, ITAL, Campinas

North American Advisors for Brazilian Committee:

Dr. Harold E. Calbert, Univ. Wisconsin

Dr. William H. Stahl, McCormick & Co. (Recently Retired)

Dr. Herbert Weinstein, (Mexico), Currently with Kibon, Sao Paulo

NORTHERN COUNTRIES REGION COMMITTEE:

Chwm. - Dra. Teresa Salazar de Buckle, Inst.Inves.Tec., Bogota, Colombia
Dr. Ricardo Bressani, INCAP, Guatemala City, Guatemala
Ing. Francisco Aguirre, ICAITI, Guatemala City, Guatemala
Dr. Mario Solorzano M., Banco Cen. Nic., Managua, Nicaragua
Dr. Jose M. Portilla, M.D., Coruna 1082, Quito, Ecuador
Dr. Guillermo Lopez de Romana, M.D., Inst.Inv.Nac., Lima Peru
Lic. Maria Inez de Castanos, Min.Econ. y Plan., La Paz, Bolivia

North American Advisors for Northern Countries Region Committee:

Dr. Horace D. Graham, Univ. of Puerto Rico
Dr. Miguel A. Jimenez, Reynolds Metals Co.
Ing. Eduardo R. Mendez, Jr., Fries & Fries Int'l., Mexico

SOUTHERN COUNTRIES REGION COMMITTEE:

Chm. - Dr. Jorge A. Miller, The Coca-Cola Co., Buenos Aires, Argentina
Dr. Fernando Monckeberg, M.D., Univ. Chile, Santiago, Chile
Dr. Cayetano Cano-Marotta, Univ. Montevideo, Montevideo, Uruguay
Dr. Nelson de Barros B., Min.Agr. y Ganaderia, Asuncion, Paraguay

North American Advisors for Southern Countries Region Committee:

Dr. Robert H. Cotton, ITT & Fundacion Chile, Santiago & New York
Dr. John Liston, Univ. of Washington
Dr. Anthony Lopez, Va. Poly. Inst. & State Univ.
Dr. Max Milner, Retired, Scarsdale, New York

REPORT OF ACTIVITIES OF THE THREE COMMITTEES

Organization and Planning. In April 1976 the Coordinator met with each of the three Latin American Committees to present to, and discuss with them a set of Guidelines and a Work Plan for accomplishing the objectives of the Project. The Work Plan outlined an approach for the collection of information to meet the five objectives, as well as a suggested timetable.

It was suggested that committee members collect information in their respective geographic area or in their area of expertise. They were asked to seek assistance from all who might be able to help them, including the North American Advisors assigned to the committees. Specific assignments were left to the chairperson for each committee.

Committee Information and Reports. During the period of April through August 1976, each committee met at least twice to report and discuss their findings and to review progress. Members of the committees continued to assemble information in order to satisfy as completely as possible the requirements of the project objectives. A final meeting of each committee was held in September 1976 to prepare the report for submission to the Coordinator. The three committees' reports were received by us during October and November 1976; they are included herewith. (See APPENDIX I - Brazil Report; APPENDIX II - Northern Countries Region Report; and APPENDIX III - Southern Countries Region Report.)

Analysis of Data in Committee Reports. The data contained in the reports were collated and summarized by us and are presented in Tables 1 through 10 (See APPENDIX V).

Food Technology Resources. An examination of the information in Tables 1, 2, and 3 reveals a wide spectrum of food technological resources in Latin America, ranging from some being quite modern and sophisticated to others being almost non-existent. As a matter of fact, the greater the resources the more incomplete is the information. For example, in Brazil, Argentina and Colombia there are known to be food industry technical capabilities not listed in the tabulations. Also it was difficult to get a complete description of all the facilities and personnel capabilities in the various institutions. Nevertheless, the data are significant and provide an estimate of what is available in each area to help solve malnutrition problems.

A study of the individual committee reports (See APPENDICES I, II, III) reveals an abundance of physical resources, personnel, and availability of these capabilities in Brazil, Chile, Colombia and Guatemala. Other countries show strength in one or two of these attributes but not in all three. Teaching centers for classroom instruction and pilot plant training are very good in Brazil, Colombia and Guatemala; good in Peru, Ecuador, Costa Rica and the Dominican Republic; fair in Chile, Uruguay and Argentina; and poor in the other countries. In most countries there still is the urgent need to provide trained personnel for the food industry. Library facilities are excellent in Brazil, very good in Colombia, Guatemala, Argentina and Chile, but rather poor in the other countries. There appeared to be a sincere endeavor and interest in interchange of information among scientists in the Latin American countries, including provisions for training in many institutions for students and technicians from other areas of Latin America.

There have been many visiting professors and technicians from North American and European Universities, Governments, Foundations, Church groups, United Nations agencies, and others, all assisting in instruction in food science and technology in Latin America.

Malnutrition in Latin America. Malnutrition appears to be relatively uniform throughout Latin America (See Table 4, APPENDIX V). The target group in urban, suburban, small city and rural areas all suffer in varying degrees from malnutrition. The most severe and greatest number occur in the shanty town fringes of the large cities where migrants from rural areas settle in search of jobs in the cities. Rural and especially the isolated areas of most of the Latin American countries also experience serious malnutrition problems.

The most prevalent nalnutrition condition is calorie/protein deficiency. In certain areas there is a deficiency of protein or high quality protein, but in most cases this deficiency is also associated with a shortage of calories. Vitamin A and iron deficiency are also problems throughout Latin America. Iodine deficiency appears to be prevalent, primarily in the rural areas. The calcium content of the diet appears to be somewhat low in most countries except in Central America where an adequate intake results from the regular consumption of lime-treated corn products. Dental caries and loss of teeth at an early age in many areas is indicative of fluoride deficiency and other dietary problems. Lesser problems are apparent with other vitamins and trace minerals.

Reasons Why Malnutrition Occurs. In most areas of Latin America reasons for malnutrition are strikingly similar (See Table 5, APPENDIX V). As expected, economic factors, including high cost of processing and the resultant relatively high price of processed foods, coupled with low income of many consumers were mentioned most frequently as significant causes of malnutrition. Nutrition illiteracy or lack of knowledge of what foods supply needed nutrients and poor food habits also were stated frequently as reasons. Poor communication among scientists and between scientists and others concerned with solving malnutrition problems was suggested as an important indirect reason for malnutrition. Members of the three committees were particularly cognizant of this problem and were anxious to try to remedy this situation.

The problem of a non-potable water supply was listed in every country but one as an aggravation to malnutrition.

Lack of use of appropriate technologies was cited generally as an important reason for an inadequate food supply. Other factors contributing to food shortages are insufficient food production, poor transportation, poor agricultural planning and excessive post-harvest losses.

Post Harvest Losses. Table 6 (APPENDIX V) shows a picture, although incomplete, of the post-harvest loss situation in Latin America. Losses are known to range up to 30%. Data are difficult to find, but it is known that many causes contribute to these losses. Since much of Latin America is in the tropics there is considerable loss due to molds, other microbiological causes, insect infestation, and rodent damage right on the farm. Inadequate transportation from the growing areas to the consumer results in very large

losses of food products in transit. Inadequate storage facilities and poor storage conditions contribute to these losses. Inadequate processing and preservation technology are significant causes of losses and the food technologists can do something about these losses. Of particular significance is the inability to use marine resources because of losses after harvesting and the lack of application of preservation technologies.

Governments are beginning to recognize that substantial quantities of food resources are lost after harvest, a situation which contributes to the malnutrition situation, and many are taking steps to try to identify more clearly the extent of such losses and to devise means for preventing them.

Constraints to the Food Technologists. Table 7 (APPENDIX V) lists seventeen constraints, identified by the three committees, that prevent food technologists from being more responsive in helping to alleviate malnutrition conditions. Most frequently mentioned were: 1) lack of adequate communication between food technologists and others concerned with malnutrition problems, 2) lack of nutrition education among the malnourished as well as among the food technologists, 3) deficiency of practical extension work following research findings, and 4) the fact that generally the food technologist has an inadequate understanding of marketing, distribution and consumer acceptance. These and other constraints were taken into consideration by the committees in making suggestions of action programs.

Constraints Can Be Overcome. The committees suggested twenty-five ways in which they feel these constraints could be overcome (See Table 8, APPENDIX V). The three most significant are: 1) promote closer relations among regional food technology institutions, 2) encourage increased application of appropriate regional Latin American technology with eight specifically identified constraints, and 3) improve communication with nutritionists, policy makers, agriculturists, public health personnel, economists, marketing specialists, and warehousing and distribution personnel. Recognition of the ways in which the food technologist can overcome restraints and incorporation of them into the proposed action programs are significant accomplishments of objectives (3) and (4) of this study.

Suggested Action Programs. In their final reports the three committees suggested fourteen action programs (See Table 9, APPENDIX V) to be considered in the development of possible pilot projects which would utilize local food technology resources to help overcome malnutrition conditions. It is significant that each suggested action program was developed by the committees after much deliberation and analysis of the information that had been collected. Details of these deliberations and rationale for the selection of the specific suggested action programs are elaborated in the committee reports (See APPENDICES I, II, and III).

Wrap-Up Meeting. A wrap-up meeting, concluding these committee activities, was held in early December 1976 in Miami Beach, Florida, attended by representatives from all three Latin American Committees; all of the North American Advisors; Dr. Chichester, Chairman of the IFT World Food Program Committee (and representing the Technical Advisory Committee); Mr. C. L. Willey, IFT Executive Director and Dr. John Ayres, IFT President, representing the IFT Governing Board - Special Grants and Contracts; and the Coordinator and Assistant Coordinator.

The wrap-up meeting was held for the purpose of studying and discussing the information contained in the committee reports, adding new information, determining whether or not any of the suggested action programs merited development into pilot projects, and finally, drawing conclusions and making recommendations for further action.

At the Miami Beach meeting we again witnessed the enthusiasm of the Latin Americans which had increased since we first met with them. This same enthusiasm had been evident in other contacts, both by correspondence and personal, as the project progressed through its various phases - an enthusiasm that seemed to stem from the feeling that this project differed greatly in its approach from others often tried because it was their project; it would be their ideas and their technologies which would be used in helping to alleviate malnutrition problems. The energetic efforts and the time-consuming search they have made in an attempt to find solutions to problems, stimulated by our project's approach, has generated a very real interest and we have become deeply affected by their genuine belief that this project would culminate in proposed action programs that surely will succeed, and be viable contributions to solving malnutrition problems in their countries.

In the course of these discussions the Latin American representatives made quite clear the fact that they wanted very much to see some kind of follow-up programs based on the information collected and conclusions reached. They felt very strongly that the fourteen suggested action programs (See Table 10, APPENDIX V) represented ideas and concepts which could be developed into good pilot projects, utilizing local food technological resources to combat local malnutrition problems. Therefore, a careful review was made of the suggested action programs at that juncture of the meeting. These action programs were subjected to a priority analysis by the group present, using the following criteria:

Criteria	Rating
1. Severity of nutrition condition to be corrected	A+
2. Constraints which have deterred or prevented Food Technologists or Food Technology Institutions from being more effective in helping to alleviate malnutrition conditions	A
3. Ways in which Food Technological Resources can be utilized to help solve malnutrition problems	A
4. Long-term viability and potential commercialibility	A-
5. Amenability of pilot project to evaluation	A-
6. Anticipated feasibility and effectiveness of action program . .	B
7. Socio-Economic impact of action program	B
8. Transferability of proposed program to other geographical areas.	C
9. Environmental impact of action program	C

On the basis of rating the various action programs and the ensuing discussion it was agreed that the Brazilian action program entitled, "A Model Integrated Nutrition and Food Technology Program for Priority Groups in a Brazilian Community" merited developing into a pilot project proposal.

In considering the ten suggestions from the Northern Countries Committee Report it was agreed that since a large number of the suggestions pertain to agri-industrial development, these suggestions were to be combined into a single pilot project proposal, "Agri-Industrial Development Program in a Rural Community," with the probability of best being carried out in Guatemala. Also, since many of the other suggestions pertained to education, we agreed that these should be combined into a second project proposal, "Food Technology-Nutrition Education in a Selected Rural Area of Colombia."

From the various Southern Countries Committee suggestions the "Utilization of Marine Resources to Combat Malnutrition in Chile" was rated with a top priority. Another suggestion for the development of specialized foods for school and preschool children rated high but since it was established that the Fortesan intervention program in Chile encompassed the same concept this suggestion was dropped.

While still at the meeting in Miami Beach representatives of the three committees prepared handwritten outlines of the action programs for the four projects. Following the meeting these outlines were typed and sent to the various committee members for editing, corrections and additions. Upon close scrutiny and further contact with the committee representatives it became clear to all of us that much more detail and refinement were necessary to project the significant values intended in these four identified action programs. Furthermore, only the chairman of the Southern Countries Committee was present at the Miami Beach meeting and since the action program concerned itself with marine resource utilization suggested by the Chilean representative at the time of the final meeting of their committee in September 1976, the chairman asked the North American Advisors to help draw up the outline proposal. Much more detail was needed from the Chilean representative.

Therefore, in order to solidify our conclusions and recommendations on this project, and to fully satisfy objective (5) to our satisfaction and that of the Latin American Committee representatives, it was deemed necessary to meet individually with the key representatives of each committee to adequately finalize project proposals on these selected action programs.

Two-day meetings were scheduled in 1) Brazil to meet with Dutra, Chairman, Guernelli and Teixeira, 2) Guatemala to meet with Buckle of Colombia, Chairwoman, Aguirre and Bressani, and 3) Chile to meet with Monckeberg and the marine resources people who would be involved in the execution of the suggested action program. At these meetings, detailed input was supplied by the local nationals and the four pilot project proposals were finalized. The titles for these four project proposals are included in our recommendations on the next page and immediately following that are the detailed proposals themselves.

RECOMMENDATIONS

1. Four pilot projects designed specifically to overcome constraints identified previously as having hindered food technology resources from effectively helping to alleviate malnutrition conditions:

   - A Model Integrated Nutrition and Food Technology Program for Priority Groups in a Brazilian Community *
   - Teaching Food Science and Technology as a Component of Education for Rural Development *
   - An Agro-Industrial System Integrated with Public Health Nutrition, for the Improvement of the Socio-Economic and Nutritional Status of Rural Communities *
   - Utilization of Marine Resources to Combat Malnutrition in Chile *

2. An in-depth study should be made of post-harvest losses in Latin America.

3. There should be an increase in intra-Latin American training programs in Food Science and Technology, and in Nutrition.

4. Basic Food Science and Technology courses should be included in all Nutrition curricula, and basic Nutrition courses should be included in all Food Science and Technology curricula.

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* Detailed project proposals covering the four action programs of recommendation "1." follow:

PROJECT PROPOSAL

for

ACTION PROGRAM

in

BRAZIL

A Model Integrated Nutrition and Food Technology Program for Priority Groups in a Brazilian Community

BRAZIL ACTION PROGRAM PROJECT PROPOSAL

I. TITLE OF PROJECT:

A model integrated Nutrition and Food Technology program for priority groups in a Brazilian Community.

II. PHILOSOPHY AND RATIONALE:

This unique project will generate a model community program based upon local resources to help solve nutritional problems and be self sustaining on a long range basis. The project will reverse the usual development experience by making better use of the local community to develop an integrated program for a priority feeding program. It will utilize as resources the combined talents of Nutritionists and Food Technologists. Local resources and locally acceptable appropriate Technology will be utilized in developing a model program, the results of which can be applied in other areas of the country and the world.

The project has been developed in response to a study funded by U.S. AID through L.I.F.E. by three groups of Latin American Scientists and Technologists (with IFT assistance) of the constraints on the "Use of Local Food Technology in combating infant and maternal malnutrition." Some major impediments to the better use of Food Technology in local nutritional programs were identified as follows:

- Lack of nutrition education among food technologists and vice versa.
- Inadequate understanding by the Food Technologists of nutritional problems, distribution, consumer acceptance and pricing in rural communities.
- Lack of integrated plans for priority feeding programs utilizing local food resources and local expertise.

The model project will overcome these constraints by:

- Using a multidisciplinary team of Nutritionists and Food Technologists to carry out the project and to act as co-leaders.
- Cooperative planning by Food Technologists, Nutritionists and Community Leaders. A major responsibility will rest with local community for the generation of food programs and the adaptation of appropriate technologies.
- Concentrating the project in a rural area and with the rural poor. Local resources as well as local technology will be used as far as possible.

III. PRINCIPAL INVESTIGATORS: (1)

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(1) Curriculum Vitae and Relevant references in Annex A.

IV. DURATION OF GRANT PERIOD: 3 years initial with additional 2 years contingent on results of initial program.

V. BUDGET: For initial 3 year period $547,300 (details and justification in Annex B.)

VI. PROJECT PLAN:

A. Objectives:

General:

- To demonstrate in a model situation that the multidisciplinary approach of Food Technology and Nutrition can improve the nutritional status of the priority groups within a rural community using appropriate technology.
- To demonstrate that technological innovation at the appropriate level can be effectively applied in a rural community.
- To show that, with proper motivation, a rural community can effectively use food technological and nutritional information to improve its nutritional status.

Specific:

- Study of the industrialization of local cows milk so that the conditions of conservation and distribution can maintain an adequate sanitary and nutritional level.
- Study of the industrial utilization of the whey which is, until now, only used as animal feed.
- Local industrialization of corn products, so that it can be utilized by the population and that its nutritional value can be improved.
- To industrialize mixtures of rice and beans in proportion that have the maximum nutritional value so that they can be consumed daily by the population.

General Goals:

- To demonstrate possible utilization of an appropriate technology in a small community, favoring the utilization of primary products produced locally, and facilitating its commercialism and consumption by the population.
- To demonstrate that this utilization can benefit the nutritional state of priority groups.
- To demonstrate the economical importance that the application of this technology can represent.

Nutritional Goals:

- About 200 pregnant and lactating women will be assisted with supplemental food products containing iron sulfate and vitamin A. Periodic checks will be made on:
  Hemoglobin levels
  Weight changes
  Maternal lactation.
- About 1200 nursing infants and preschool children in urban and rural areas will be assisted with supplemental food products. The following data will be collected periodically:
  Growth development (weight and height)
  Hemoglobin levels
  Prevalence of malnutrition by second and third degree.
- About 1000 school children in urban and rural areas will be assisted with supplemental food products. Periodic collection of data on:
  Growth development (weight and height)
  Hemoglobin levels

B. Background Information:

1) Location and Characteristics of Test Area

São Tomas de Aquino, situated in the southern part of the State of Minas Gerais in the micro-region called Mogiana Nineira, elevation 1200 meters, will be the site of test area.

Basic activities are agriculture, cattle ranching, light commerce and a small percentage of professionals necessary to sustain the society. Industry consists of cheese and butter factories.

The surrounding farms are inclined toward cattle ranching, especially for milk production, still with a rudimentary technology, the product of which is sold to a local factory and to a cooperative in Sao Sebastiao do Paraiso. It produces about 8,000 liters of milk daily.

The municipal government maintains a slaughter house to supply local butcher shops where 32 cows and 20 pigs are slaughtered monthly and distributed to the six butcher shops in the city. These shops are managed by owners and their relatives. The sanitary conditions of the slaughtered animals are supervised by lay officials of the municipal government.

In the city there are 7 retail shops (clothing, shoes, yardage, etc.), 10 bars (small markets), 10 food stores (staple goods), 1 supermarket, 1 bakery, 1 store specializing in goods for agricultural use (manure, machines, pesticides), and 2 garages.

There are 325 vehicles in the city, including 40 trucks, 16 station wagons, and 10 taxi cabs.

The city is served by 4 bus lines that connect it to Patrocinio Paulista and São Sebastiao do Paraiso.

The majority of the population is Roman Catholic and the families are, in general, stable within the Brazilian patterns. There is 1 main church and 3 chapels in the city and 11 in the rural area.

There are 2 primary schools in the city (supported by the State), and 1 secondary school (supported by the municipal government). These are attended by 343 and 95 students, respectively. There are 12 rural primary schools with 388 students and 18 teachers (supported by the municipal government).

There are 313 TV sets capable of receiving programs from Sao Paulo. There is 1 recreation club and 1 soccer stadium.

There is 1 rest home for the elderly poor but which also shelters the chronically ill, invalids and destitutes.

Thus, Sao Tomas de Aquino is a small city with a stable population whose agricultural activities approximate the great majority of the Brazilian communities dedicated to agriculture.

This city has been well studied from the nutritional point of view. Since 1968 its population has been the object of anthropometric studies and nutritional inquiry. Since there has been only one doctor there for more than 13 years, with a hospital file well organized, the data on mortality, morbidity and social-economical conditions can be easily evaluated.

The composition of the child population is shown in the chart on the following page.

CHILD POPULATION - Sao Tomas de Aquino - (1970 Census)

Age (years)	-1	1	2	3	4	5	6	7	8	9	10	11	Total
Urban Area	53	47	51	50	55	73	68	65	59	67	69	62	719
Urban Students						7	28	45	51	64	63	47	305
Rural Area	142	117	154	126	136	122	131	130	121	93	160	124	1,556
Rural Students						2	24	67	96	80	125	101	495
Students - Total						9	52	112	147	144	188	148	800
Total	195	164	205	176	191	195	199	195	180	160	229	186	2,275

São Tomas de Aquino has a population of 6,879 inhabitants, of which 2,563 live in the urban area and 4,316 live in the rural area.

Its economy is based exclusively on the cultivation of the land and raising of cattle, in which both the rural and urban population are involved

Here small farms predominate; in an area of 179 sq. km. there are about 500 properties.

Its major cash income derives from: coffee, corn, milk, rice, and beans, as follows (1975 data):

Milk	2,943,491 liters
Corn	92,000 sacks (60 kilos each)
Rice	27,000 " " " "
Beans	1,500 " " " "
Coffee	N.A.

The city has only one industry - "Fabrica de Laticinios Santa Rita Ltda." It receives 4,000 liters of milk daily. It produces: "prato," parmesan, sardo, mussarela cheeses and butter. 2,500 liters daily of whey is the by-product which is used for animal feed.

The municipality of São Tomas de Aquino has 527 rural properties of the following sizes:

More than 200 hectares	42 properties
From 100 to 200 hectares	38 "
From 50 to 100 hectares	55 "
From 10 to 50 hectares	262 "
Less than 10 hectares	128 "

The cultivation of the land, i.e. ploughing and grading, as well as sowing of cereals, is done mostly by machine. But since the municipality is a great producer of coffee (about 4 million plants), and because this tillage is still done manually, the agricultural work like weeding, fertilizing, planting, and especially harvesting is accomplished manually.

The great portion of manual labor is obtained in the city, from which the laborers leave in the morning in trucks, with the noon meal already prepared and in containers, and which is eaten at the place of work, without heating and with only passable organoleptic and nutritional properties. About 500 laborers in the city work under these conditions.

The great majority of the agricultural products is sold in the neighboring cities, with the exception of milk which is partially sold to the cheese and butter factory and partially delivered to a cooperative located in the city of São Sebastião do Paraiso, 24 kilometers away.

There are few warehouses in the city that belong to private firms and they are insufficient to store all the corn and rice production of the area. However, for coffee there are two private firms which have facilities for processing and storing the coffee.

We have been gathering data about the nutritional state of the community since 1968. Several studies were done in Sao Tomas de Aquino on children from 0 to 12 years old which show weight, height, hemoglobin levels, etc. Some of these data are as follows:

- Aspects of the nutritional state of the child population of Sao Tomas de Aquino from 1968 onwards and its relation to the social-economic level of the family.
- Acceptance of opaque corn by children and its possible nutritional benefits.
- Anthropometric data on students of the age group of 7 and 8 years.
- Growth, development and food habits of children from 0 to 12 months of age.
- In 1975 the children whose weight and height were recorded in 1968 were weighed and measured again, showing that their weight and height development were below standards.

These surveys have shown that the priority groups in this community suffer from the following conditions: protein-calorie malnutrition, nutritional anemia (iron deficiency) and vitamin A deficiency.

The community has one hospital, one health clinic and one pharmacy.

Our Lady of the Sacred Heart Hospital is maintained by the community with state, federal and municipal funds and by formal agreement with FUNRURAL. It is a charitable institution with 80% of its 36 beds reserved for the needy and the rural laborers.

The hospital receives out-patients with an average of 700 monthly consultations where child care, prenatal care, accidents, and follow-ups on chronic cases are provided. The greatest contingent of hospitalization is pediatric and obstetric with an average of 40 hospitalizations and about 20 to 26 deliveries monthly.

It has 1 X-ray machine of 100 mA; 2 rooms for consultations; 1 room for minor surgeries; 1 surgery room; 1 laboratory, and complete files.

Para-medics personnel include 4 nursing helpers and a licensed vocational nurse.

The health clinic is maintained by the State of Minas Gerais with one doctor and one attendant. This clinic distributes medicines such as vermifuges, etc. Prevention of infectious sickness is provided through vaccinations such as: tetanus, smallpox, diphtheria, whooping cough, poliomyelitis, measles, and tuberculosis.

2) Rationale for Selection of Test Area

This community was selected for the project for several very important reasons. First of all, as already indicated, it is known that serious malnutrition exists in the priority groups. Secondly, as indicated above, the area has a relatively stable population about which a great deal is known regarding its nutritional and health status. Thirdly, the area has an excellent potential of producing almost all of the food it needs to provide excellent nutritional health. As a matter of fact, there are enough resources here to develop a substantial food processing industry which could provide for a considerable economic development of the area.

Finally, there are sufficiently qualified personnel in Sao Tomas de Aquino who are willing and anxious to help us carry out the project (the details regarding this will be identified later on in this proposal). Their assistance will be invaluable, not only in helping us reach our objectives but in helping to put the program on a continuing basis.

C. Operational Program:

1) The following information will be updated in the test area:
   a) Nutritional status of the priority groups
   b) present food production
   c) post harvest losses of food crops
   d) storage facilities for food
   e) food marketing, channels and practices
   f) human resources - MD's, teachers, extension workers, agronomists, etc.

2) Through an integrated analysis of the updated information obtained as outlined in Item C. 1) above, practical approaches will be set up to achieve the ultimate goal of nutritional improvement among the priority groups of preschool children and pregnant and lactating women as follows:

   a) Simple methods will be devised for increasing food crop production including increased yields of crops now grown; diversification of crops such as greater production of soybeans; introduction of other crops such as new corn varieties; etc.

   b) Appropriate processing technology adapted to local conditions will be applied for the preservation and nutritional improvement of available raw materials such as pasteurization of milk or possibly the sterilization of bottled cows milk, or a mixed cow and soy milk, which would result in greater stability and a longer shelf life; application of simple mixology to produce composite flours, mineral and vitamin enrichment of flour, and sugar with added vitamin A; etc. The initial phase of adapting processing technology will be carried out cooperatively in the pilot plants at ITAL and UNICAMP. The second phase then would consist of moving that appropriate processing technology directly into the community where local personnel would be trained to operate the facility. When necessary, modest and appropriate processing equipment would be acquired and installed.

   c) New food formulations will be developed that can be produced basically by the use of simple technology applied at the community level utilizing available local raw materials (except for needed vitamin and mineral supplements) to accomplish the desired nutritional levels such as composite flours for weaning preparations, breads, cookies and pastas; flour enrichment with iron and vitamins; caramelized milk products like "dolce de Leite"; sugar with added vitamin A and iron; mixtures of soy and regular beans; dry soup mixes utilizing corn, beans, soy and rice as raw materials; etc. The initial phase of product formulation would be done cooperatively in the laboratories and pilot plants of ITAL and UNICAMP and as soon as practicable moved to appropriate facilities in the community where local personnel would be trained to carry forward the production.

   d) Local distribution and marketing conditions will be improved, not only to insure that products reach the priority groups but also to develop markets outside the community for excess production of both raw materials and formulated foods not required to satisfy the needs of the community, thus initiating additional cash flow into the community.

e) The local population will be integrated into the program from its initiation, even during the survey stage, in order to acquaint them with the plans and involve them in carrying out the program. The local doctor, Jose Renato Russo, M.D.*, and local public health officials will be used to assist in establishing the nutritional base status of the priority groups and in the periodic and annual clinical biomedical checks on nutritional progress. Local politicians will be advised and their assistance requested when and where needed. Local school teachers and children will be supplied educational kits on nutrition education. Local extension personnel will be trained and utilized for agricultural production and nutrition education activities. Capable and reliable personnel will be trained and utilized in the food processing operations as they are set up in the community.

f) Crop harvesting procedures, transportation, and local food storage facilities will be improved in order to minimize post-harvest losses and to provide proper and adequate storage and handling of the processed foods.

3) Evaluation of progress will be accomplished by annual surveys in cooperation with personnel in the community by checking and recording improvement in:

a) Agricultural production both in yield and diversification through introduction of new, higher nutritional varieties and expansion of soybean production,

b) availability of raw materials for direct consumption and for production of food product formulations for the consumer,

c) effectiveness of applied appropriate food technology and quality control at the community level,

d) dietary patterns of the priority groups as well as the entire community population,

e) nutritional status of the priority groups:
clinical - height, weight, general health
biomedical - hemoglobin, serum vitamin A (1)

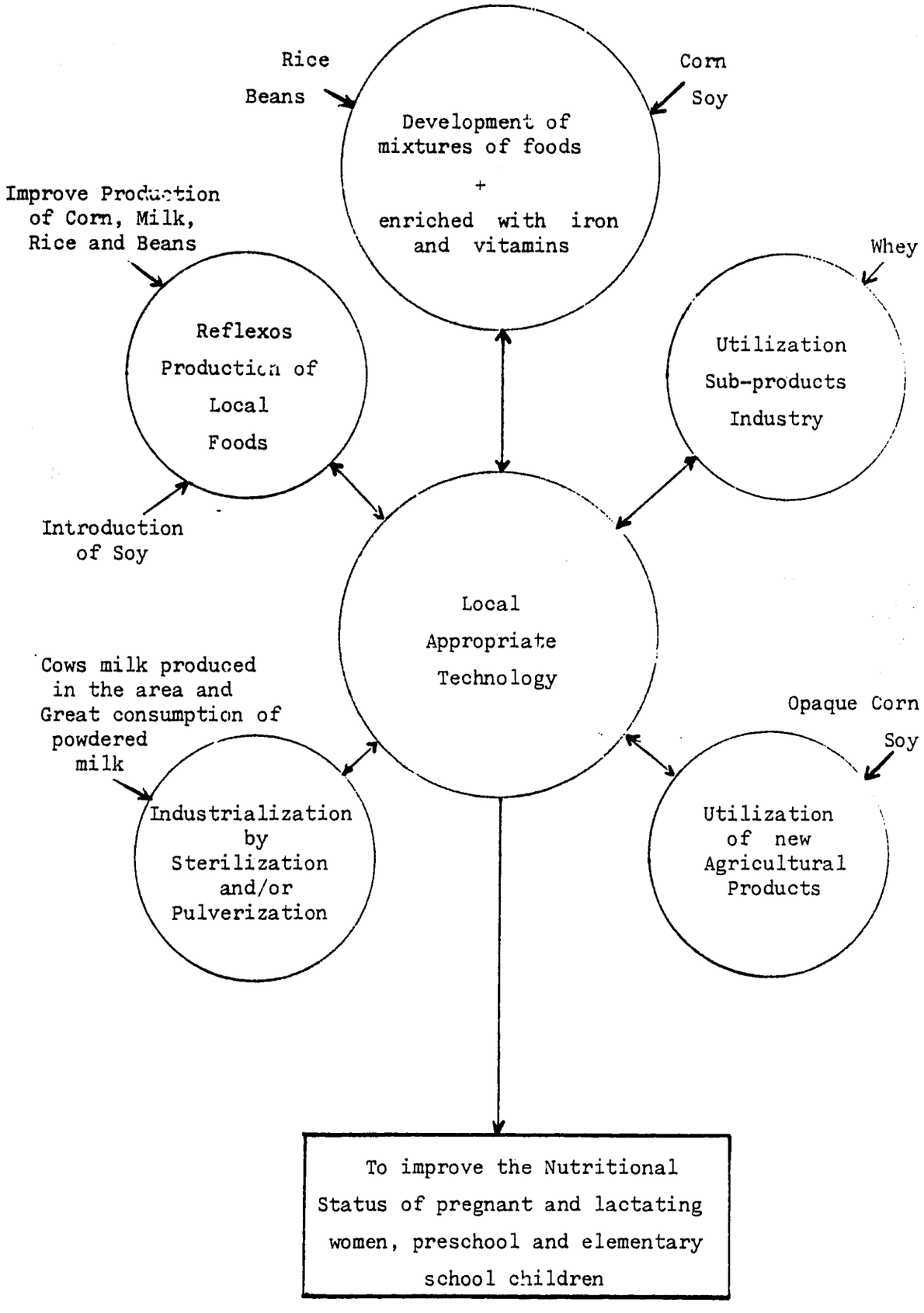
f) participation and responsibilities of the community personnel in the follow-up program.

(1) Guidelines for the Eradication of Vitamin A Deficiency and Xerophthalmia - a report of the International Vitamin A Consultative Group (IVACG).

* Leventamento Antropometrico em Escolares do Grupo Estario de 7 a 8 Anos em Sao Tomas de Aquino - MG - Jose Renato Russo. Anais do 3º Simposio Bras. de Alim. e Nutr. (SIBAN), pp 173-178 (1971).

Crescimento, Desenvolvimento, Habitos Alimentares, Morbidade e Mortalidade de Criancas de 0 a 12 Meses de Idade no Municipio de Sao Tomas de Aquino - MG - Anais do 4º Simposio Bras. de Alim. e Nutr. (SIBAN), pp 326-343 (1975).

SCHEMATIC APPROACH



PROJECT SUMMARY

Objectives	Justifiable Necessities	Strategy
1) To improve the nutritional state of pregnant and lactating women, pre-school children, and laborers. 2) To apply appropriate technology to small urban areas.	Presence of Malnutrition Presence of Anemia Absence of Technology	Enrichment or mixtures of foods produced locally. Utilization of technology already developed and utilized in other areas which can be used at the community level.

Action	Evaluation	Responsible
To distribute and control the ingestion of foods by target groups through schools, clinics, markets. To place small industries in the city through the Municipal Government, for the production of these foods.	Weight-height curves Determine level of hemoglobin Clinical Nutritional exams. Quality and functional control Economic study.	Medical School Ribeirao Preto (Dutra) Dr. Renato Russo (Local) UNICAMP (Guernelli) ITAL (Teixeira) ABIA (Consultants) IFT (Consultants)

UNICAMP = University of Campinas, Faculty of Food Engineering
ITAL = Institute of Food Technology, Campinas
ABIA = Associacao Brasileira das Industrias da Alimentacao, S.P.
IFT = Institute of Food Technologists, Chicago, Illinois, U.S.A.

PROJECT PROPOSAL

for

ACTION PROGRAM

in

COLOMBIA

TEACHING FOOD SCIENCE AND TECHNOLOGY AS A COMPONENT OF EDUCATION FOR RURAL DEVELOPMENT

Proposal Presented by:

Instituto de Investigaciones
Tecnologicas (I.I.T.)
Apartado Aereo 7031
Bogota, Colombia

Fundacion para la
Educacion Superior (FES)
Apartado Aereo 8022
Cali, Colombia

April 15, 1977

This project has been developed in response to a study, by three groups of Latin American Scientists and Technologists (with the assistance of the Institute of Food Technologists), of the constraints on the "Use of the Local Food Technology in combating Infant and Maternal Malnutrition," funded by U.S. AID through the League for International Food Education.

TABLE OF CONTENTS

I - Title of Project

Teaching Food Science & Technology as a component of Education for Rural Development.

II - Abstract

This is a project to test the effect of teaching, using a problem solving approach, with principles of food science and technology in a given area where nutritional problems are present. The teaching will be incorporated in the regular education program given to rural students at a peasant youth home. Rural students in the peasant youth home are provided with room and board facilities to continue their education beyond what is available in their "veredas". At present they are receiving only training in agriculture, nutrition, health, sanitation and rural construction, all directed towards improving their rural living conditions.

The teaching of food science and technology will be done using lectures and demonstrations that will attempt to solve problems previously identified by the students in a diagnosis stage. The scientific approach will be applied coupled with a "Systems view of the world". After completing their training many of the students will go back to their rural environment and having learned a certain methodology for identifying problems related to foods, will then bring them back to the peasant youth home problems to be solved through the use of food science and technology knowledge and will find within the program technical and financial support to carry them out.

The effect of the program will be assessed using such indicators as dietary habits, morbidity and mortality data, growth parameters in infants, expenditures for food, food losses, improvement in the living conditions, changes in food marketing practices, improvement in food handling, etc.

The grant is requested for a minimum period of three years. The institutions involved will be IIT (Instituto de Investigaciones Tecnologicas de Bogota, Colombia) and FES (Fundacion para la Educacion Superior, Cali, Colombia). The site of the program will be in the municipio of Buenos Aires in the departamento of Cauca, Colombia, with an area of 1125 Km^2 and a population of 35,000 people. The teaching will be done at the Buenos Aires' peasant youth home. Staff from IIT will be used for the teaching and demonstrations on food science and technology and for consultation by the trained students during their participation in the project. Staff from FES will be responsible for the general coordination of the special program within the regular teaching and training program of students, and will be responsible, together with IIT personnel, for the assessment of the effect of the program.

The philosophy of this program is in accordance with the National Food and Nutrition Plan (PAN) and the Rural Development Program (DRI).

The possibility of extending this type of training to other rural regions of the country would be available through the more than 100 other peasant youth homes in the country. Other possibilities would be through the vegetable school orchards program and the nutrition education program of the National Food and Nutrition Program (PAN). Extension to other countries of Latin America could easily be done by sending trainees, teachers and instructors to study the Buenos Aires program during the initial three year periof of the grant and then return home to apply it there.

III.- Principal Investigators

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National Chief of Hogares Juveniles Campesinos
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Teresa S. de Buckle
Chief, Projects Division
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Apartado Aereo 7031, Bogota, Colombia.

For curriculum vitae of the principal investigators and pertinent reference material see Annex I.

IV - Duration of Grant Period

A minimum duration of three years is envisaged with a possible extension to five.

V - Budget

A period of three years is anticipated in order to realize the proposed project. The estimated budget would be: U.S. $436,000. See Annex II for details.

VI - PROJECT PLAN

A. Background Information

Protein-calorie malnutrition is prevalent in the target group of the Buenos Aires area of Colombia. Iron and calcium deficiencies have also been found, conditions that are common to many rural areas of Colombia and of other countries in the northern Latin American region (1). Inadequate food consumption was identified as one of the reasons for malnutrition for the region in the IFT Nutrition/Food Technology Study (1).

An analysis made of the factors that hinder adequate food consumption in the region showed that the factors with the greatest importance were related to insufficient education, inadequate transportation and handling of foods, and poor marketing practices; in addition to the chronical problem of low income (which can only be solved through an improvement in the development status of the country). In a second order of importance were those related to inadequate processing and preservation facilities. The potential contribution of food science and technology to overcome these factors is without question. On the other hand, the information obtained during the same study showed that the existing processing facilities and research institutions in Food Technology in this region are generally adequate and that there is an awareness of the need to apply solutions to solve the nutritional problems common to the lower income group of the population. In analyzing the constraints that have prevented a more effective application of food technology to solving malnutrition problems, the following were noted:

- The teaching in food technology in the region may not have been focussed correctly; and teaching at intermediate level and home extension services could be extended more broadly.

- Food processing within the present day concept of the industrialized countries is probably not appropriate. Teaching simple methods for handling, storing and preserving foods may be the correct approach to provide a more adequate food supply and consumption, especially in remote rural areas.

- Extension work after completion of research studies has been deficient. It was considered necessary to study and test non-professional extension mechanisms and materials and to explore the food technology most needed in the region. (1)

It is believed that the proposed program of teaching food science and technology within a program of education for rural development may help to overcome the above mentioned constraints and may demonstrate a different approach to solve malnutrition problems in rural areas of the region. If the teaching is done to potential rural leaders, who will be in charge of carrying out specific projects in their own areas, a non-professional extension mechanism may be made available to the region.

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(1) IFT Nutrition - Food Technology Study
Northern Latin American Countries Region, Final Report, Oct. 1976
(Appendix II of the IFT Final Report, May — 1977)

B. Specific Project Plan - Methods and Procedure

1. THE GEOGRAPHICAL SETTING

The Municipio of Buenos Aires, Cauca covers an area of approximately 1124 km^2. It includes the rolling hills on either side of the Cauca River plus the high mountainous region of the western Cordillera. The altitude ranges from 1000 meters to over 3500 meters. The climate is tropical (average temperature range 18-22°C) (64-71°F) and the land is generally marginal for agriculture.

The municipio has a population of 35,000 persons of which 1000 live in the town of Buenos Aires, the administrative center. Two other towns, Timba and Suarez, have similar sized populations. The remainder of the population (32,000) live in its veredas. The word "vereda" in Spanish means narrow path, but in Colombia the term is taken to mean a rural community. Descriptively, it is a dispersed grouping of houses which are scattered along a network of paths winding through the mountains and countryside. In the municipio of Buenos Aires there are approximately 100 of these veredas.

Santander de Quilichao is not in the municipio of Buenos Aires. It is on the paved highway 45 minutes south of Cali on the way to Popayan. It is the principle "jumping off point" for those traveling to Buenos Aires. The town of Buenos Aires is one hour from Santander via a rugged gravel road. Timba and Suarez are on a branch of this gravel road, the former being a half an hour from Santander and the latter being an hour and a half from Santander.

A few of the veredas are located along the gravel road but by far the majority of them can only be reached by foot or horseback. Many of the veredas are six to eight hours by horseback from one of the towns and a few are even further still.

Each of the three towns, plus a couple of the larger veredas, has a weekly market day plus several stores which carry the more common items. Nevertheless the commercial sector of the municipio is quite limited both for selling its agricultural production and buying its consumption items. Many people find it necessary to make occasional trips to one of the regional centers such as Santander or even Cali, where the selection is much greater and the price structure is more favorable.

In the towns of Buenos Aires, Suarez and Timba education is available through the fourth year of secondary*. Nowhere else in the municipio is education available beyond primary school. Many of the veredas do not have available all five years of primary but rather provide only the first three or four years. If a child wishes to continue his education beyond what is available in his community he must obtain lodging in a community where the additional schooling is available.

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* The last two years (fifth and sixth) of secondary are generally for those who wish to continue their education at the university level.

There is one health center for the municipio and it is located in the town of Buenos Aires. It is usually staffed by a recently graduated doctor serving his obligatory year in a rural area. There are occasional periods when no doctor is available to cover the health center. A large majority of the municipio's population go from birth to death not having had access to any medical services. No other government service agencies are physically located in the municipio although there are extension activities which operate out of Santander or Popayan.

The above description of Municipio of Buenos Aires might lead one to believe that it is unusually remote and isolated. Most of the municipios population is in fact removed and isolated from whatever advances Colombi: is making on the road to development. This situation, however, cannot be considered unusual. A large part of Colombia's population live in areas which are quite similar to Buenos Aires.

2. THE PROBLEM

Colombia, like most other Latin American countries, is heavily involved in trying to plan programs and/or services which will improve the well-being and standard of living of its people. It is important that the planning activities concentrate on services which can most increase the well-being of those most in need.

The other factor is that many of the people with the least access to services, and in the greatest need, live in remote areas where the population is highly dispersed. This creates communication barriers both in the physical sense and also in the social-cultural sense.

Colombia is in the process of evolving new programs which attempt to overcome these barriers. The National Education System (Decree 088 of January 22, 1976) affirms that education is a right of all Colombians and specifically supports non-formal education. It calls for an "application of basic knowledge to local realities" in an attempt to make education more relevant for persons on the fringe of society.

The newly formed D.R.I. (Integral Rural Development) program provides technical assistance for increasing food production, construction of food storage facilities at the vereda level, improvements in environmental sanitation, and construction of penetration roads. A D.R.I. center is scheduled for the town of Buenos Aires. However, the dissemination of the D.R.I. information throughout the municipio will be a very slow process for lack of personnel and channels of communication.

Another example of Colombia's attempt to reach that population which is geographically, culturally and economically inaccessible, is the National Health System. (Decree 056 of January 15, 1975). This sets up the three level M.A.C. (Anular Coverage Model) system in which MAC-1 provides for health coverage at the local level. The MAC-1 level consists of E-1 (health center with an attending physician), E-2 (health post with auxiliar nurse) and E-3 (health promoters working at the vereda level). At the present, Buenos Aires is one of four municipios in the State of Cauca in which the MAC system is in operation. There is an E-1 in Buenos Aires and an E-2 and E-3 in Suarez. Current plans provide for creating

two additional E-2's and four or five E-3's. It will be a long time before the MAC system of health coverage will be able to reach a majority of the inhabitants in Buenos Aires' 100 veredas.

The National Food and Nutrition Plan (PAN) was set up to improve the nutritional condition of the most needy both in urban and rural areas through multiple actions that include nutrition education, the National Health system just described, the provision of potable water in rural areas and other means to improve the living conditions using the locally available resources. School vegetable orchards is one component of PAN that soon will start with an initial coverage of 100 rural schools. It is thought of as a possible means for diffusion of knowledge of agriculture and food technology.

3. THE APPROACH

The traditional approach for providing services to increase well-being will be effective when the service is specific and well defined, and when there are no logistic problems nor cultural barriers to reaching the target population. An example would be the provision of electricity to an urban area.

The above approach contains some serious drawbacks when it is applied to increasing the well-being of an area such as Buenos Aires. First, it is not always clear which service or intervention will most improve well-being. Second, the community may not effectively use the service or accept it as being beneficial. This could be the result of not fully understanding the intervention. Third, it may not be efficient for an outside agency to provide the service when there are logistical problems.

There is an alternative to the traditional approach which has been employed successfully in a variety of situations. Here the agency analyzes the problem and designs the intervention program, but solicits community members to execute all or part of it. By soliciting community participation the second and third drawbacks mentioned above can be, at least, partially alleviated.

The promotora program in Candelaria is a good example of an intervention program which made effective use of community participation. In this case community members, the promotoras, were trained to carry out specific diagnostic surveillance measurements in health and nutrition. When the measurements reached certain levels, or when specific symptoms were observed, predetermined actions were prescribed for the promotora to administer. If the prescribed actions were beyond the technical competence of the community then there was a referral to an outside agent such as the doctor working in the local health center. The Candelaria program successfully demonstrated that reliance on community participation could result in significant improvement in health and nutrition. The malnourishment rate dropped from 30% to 21% between 1968 and 1974. The success of the Candelaria experience was a factor in adopting this approach for the MAC system of health coverage.

It seems reasonable that reliance on community participation might be carried much further. In Candelaria the program was designed by professionals and executed, in part, by the community. Alternatively it may

be possible, and much more effective and efficient, to have the community carry out its own diagnosis and analysis of its problems. With this approach community members play the principal role and the outside agent provides technical assistance and physical resources only as they are needed. In spite of its tremendous potential for improving the planning process, this approach has not yet been tried for Colombia's rural population.

The success of such an innovative approach hinges on whether or not community members can learn to define and analyze their problems in a form that will yield realistic solutions. If such an approach is in fact possible, what is the best technology for teaching a problem solving methodology?

4. THE EDUCATIONAL TECHNOLOGY

There are two basic issues involved in selecting the best technology to be used in a problem-solving methodology to teach rural peasants such as those in Buenos Aires. The first is the content, that is, what is the best problem-solving methodology for their needs? The second issue considers which method of teaching would work best for the rural peasants.

A problem solving methodology which consistently produces positive results in a variety of areas is one that incorporates the scientific method. This method can be outlined into the following steps: 1) Formulate a theory based on current knowledge or observations; 2) Design an experiment (intervention program) to test the theory; 3) Based on this theory, predict the results of the experiment; 4) Perform the experiment and measure the results; and 5) Compare the predicted results with the measured results and modify the theory accordingly. This simplified procedure can be expanded and modified to apply to practically any situation that might be encountered. The scientific method has the specific advantage of being an excellent model for learning. It does not assume that a solution is known and this is important since many Buenos Aires problems do not have clear-cut solutions.

To complete the problem-solving approach the scientific method can be coupled with the "Systems view of the world." This systems view is based on the existence of relationships; it is of particular importance in defining and setting up problems. A problem is defined in terms of its relationships (both known and hypothesized) to various other factors or components. These relationships may be set in the form of a model which can then be tested, using the scientific method.

Another related criterion is the variety of applications possible. In order to grasp the universality of the methodology it is necessary to use it repeatedly with different types of problems. If the concepts are only used to analyze and solve a specific health problem they will naturally be seen only as a technique for solving that specific type of problem. However, if the concepts are also applied to problems of agricultural production, education, recreation, etc., then the methodology will be perceived as a general problem-solving technique which can be used for improving well-being in all areas.

A slightly different criterion has to do with the norms of inquiry. Most traditional education concentrates heavily for success on brute memorization of "facts." This is particularly true in the veredas of Buenos Aires where teachers are poorly trained and lack motivation. If the problem-solving methodology is to be effectively used by community members, it is of primary importance that they learn that not all knowledge and solutions originate from a higher authority such as the teacher. Confidence must be instilled in community members, showing that they are capable of working out the solutions to many of their own problems. Norms of inquiry must be stressed such that this quest for solutions becomes a quality which is valued among community members and that this works in the solution of their problems.

5. THE MECHANISM FOR ACTION

There is in Buenos Aires a mechanism in use by which community members from remote veredas are brought together in a situation which could facilitate testing the approach presented above. This is the "Hogar Juvenil Campesino" - literally translated, a peasant youth home. There are approximately 120 H.J.C.'s in Colombia, and new ones are opening each year. While each H.J.C. is run independently by the community, they are all affiliated with a national organization. The principal purpose of the H.J.C.'s is to provide room and board facilities to rural students so that they can continue their education beyond what is available in their own veredas. A second objective is to train the students in certain subjects which will improve their rural living conditions. This training is in addition to the formal education and usually takes the form of lectures and demonstrations in subjects such as nutrition, health, sanitation, rural construction and agriculture.

The Buenos Aires Hogar began operation in the fall of 1974. It is located on the edge of town about a five minute walk from the primary and secondary schools. The facility consists of dormitory space for up to 120 students, a kitchen and dining room/meeting area, and 17 plazas (approximately 27 acres) of land for agricultural instruction and experimentation. The building facilities are expected to be expanded to the point where it can accommodate 240 students with additional structures for shops, meeting rooms and library.

At present there are 120 students enrolled in the H.J.C. program in Buenos Aires. This includes both boys and girls who range in age from 11 to 20 years old. A few are finishing their primary schooling but most are enrolled in the secondary school. They represent 40 veredas of which the closest is 45 minutes and the farthest is 10 hours.

During the time when the students are not attending school they work on agricultural production and receive training from a variety of sources. The regular staff at the Hogar is relatively small and most of the instruction is carried out by extension agents from different government agencies. These include the Ministry of Agriculture, SENA (National apprenticeship service) and ICBF (the Colombian Institute for Family Welfare), among others.

It can be expected that a few of the Hogar students will leave Buenos Aires to continue their education either at the university or at vocational schools. They may or may not return to the area. There will be others who

will migrate to the cities in search of better opportunities. Nevertheless it is expected that the large majority of students will return to live in their veredas when they leave the program. The philosophy of the H.J.C.'s emphasize returning to their rural veredas and tries to minimize out-migration. They will become the new leaders of these communities by virtue of this education and training. In many cases they represent the more qualified sons and daughters of the more innovative families.

In summary the Hogar Juvenil Campesino in Buenos Aires provides an excellent opportunity to develop and test the methodology discussed earlier. It brings together young, potential leaders of the remote, dispersed population which comprises the municipio of Buenos Aires.

A project has been carried out on a small scale by workers of the Universidad del Valle through FES, by which a methodology for testing the community level nutrition diagnostic model has been developed. The project is being carried out at several sites, one of which is the municipio of Buenos Aires. This project has been in operation in Buenos Aires since January 1975. The decision was made to use the students of the Hogar to extend the project to remote communities. The project in Buenos Aires was set up to determine if the diagnostic methodology could be performed by non-professional personnel, i.e. the H.J.C. students. As the work began it was decided that, rather than teaching the students how to make measurements only, they would also be taught the theory behind the measurements and how to use the scientific method approach in solving the problem. The way this program has developed and some of the very interesting results obtained are described in Annex III.

Due to the commitment which the Hogar students have made to their formal education, the time available for working on nutrition has been limited to one afternoon during the week plus weekends. In spite of the limited time which the nutrition project has had to work, the results have been very encouraging. The positive responses from the students to the methodology used has led to the decision that the subject should be continued and expanded beyond the work presently being carried out in nutrition. It is proposed to expand it to Food Science and Technology as a means of improving the foods consumed in the area. The aspects considered would be those that could improve food quality, provide better handling methods and make more efficient use of the foods to obtain a proper diet.

6. THE SPECIFIC PLAN

a. Basic rationale and selection of students. The Fundacion para la Educacion Superior (F.E.S.) and I.I.T. propose to carry out a three year project which would develop, test, and refine the concepts which have been discussed above. The project will be carried out in the municipio of Buenos Aires and will include extension of results to other interested Colombian or Latin American groups. The proposed project will involve directly the staff and students of the Hogar Juvenil Campesino of Buenos Aires. At the beginning approximately 30 students will participate in the H.J.C. program on a full-time basis. These will be rural students who have completed the four years of secondary education and who wish to continue their non-formal education. This means that the

project will be directed at a core group of 30 full time students plus a secondary group of 90 students who are still enrolled in the traditional education system. IIT will take an active part in the project by providing the technical support for the food handling and processing aspects of the program to be carried out during the project.

b. The objectives. The project has four general objectives:

(1) To test a general problem-solving methodology with rural community members (i.e. the H.J.C. students),
(2) To teach the students specific skills and techniques in Nutrition, Food Science, and Technology associated or identified with the diagnostic procedure,
(3) To promote the execution of practical projects in the area to solve specific food and nutrition problems, and
(4) To evaluate the impact of the project on the nutritional status of the target group in the area.

c. Methodology and activities. Activities will be carried out at two levels. At the macro level, and to fulfill objectives one and four, there will be large scale, comprehensive, long term diagnoses. The current nutrition evaluation would be continued and extended to other veredas. A nutrition surveillance system will also be designed and executed. A survey related to health and sanitation conditions also would be designed and undertaken in various veredas. There would be another survey of the food handling and processing methods and facilities, together with another related to food production and the family-level economic situation and of the food industry sector and communications infrastructure.

Since the importance of quantification is to be emphasized, it will be necessary that the students learn to make many kinds of measurements, including body weight and height for classifying malnutrition, determinations of water quality and other environmental factors and the detection of various types of diseases present. Sampling and surveying techniques will also be needed as well as means of evaluating post-harvest losses, quality of fresh and processed foods, etc.

In meeting the second and third objectives, the activities will include designing and testing possible solutions on a pilot plant basis. All stages of food handling and processing from the moment of harvest until actual consumption will be considered: food handling, transportation and storage from the field to the marketing center to the home and within the home; packaging and preservation techniques for different kinds of foods (grains, tubers, vegetables, fruits and animal products); food processing at communal and home level (preservation by heat and cold, dehydration, bottling, etc. should be included as necessary); adequate food preparation at home, diet balancing and combination of varied foods available in order to improve pallatability and nutrition. The techniques and technological solutions to be explored and eventually put into practice during the development of the program would be of the following type:*

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* IIT has worked in these areas, but could also supply assistance in others that may arise during the diagnoses.

- Energy saving techniques for cooking foods at home or at the village level (e.g. corn, soybeans and beans).

- Cooking and preserving rice and corn for a week.

- Simple grain storage for the home, village or vereda (within the structure of a cooperative).

- Fabrication of appropriate packages for the collection and transportation of fresh foods.

- Addition of soybeans to traditional cereal or farinaceous foods (e.g. arepas, corn coups, etc.).

- Simple potato and cassava preservation methods.

- Improving "panela" (brown sugar) production and storage.

- Improving cassava starch (or flour) extraction and drying techniques.

- Infant food formulations and preparation.

- Production of fruit pulps, their preservation and bottling.

- Techniques for grading foods for market and the establishment of simple "vereda" collection centers.

- Animal feeding units.

Another type of skill which will be taught is how to identify and use outside resources. In performing these diagnoses it may be necessary that some of the measurements be made by "experts" from outside of the community. Solutions may be identified which are beyond the resources of the community, for example: how could a vereda obtain an aqueduct from the state environmental sanitation office? how could they improve the request with the data they have gathered? how can one obtain the help of a government extension agent to identify and eliminate a food sanitation problem? how could they request the installation of a food collection center? All of these resources are available but they do not reach the remote peasant, hence he must learn to seek out and use these services.

To carry out all these activities it will be necessary to select and modify existing technologies or to develop new solutions to the problems identified by the students in the diagnosis stage. It will also be necessary to carefully prepare teaching materials to be used in the training courses, e.g. texts. These materials would be very useful for the extension of this program to other regions in Colombia or Latin America.

C. Facilities Required.

Besides the H.J.C. facilities already in the field it will be necessary to have available laboratories and processing facilities where the experiments can be carried out to solve specific problems. These will be provided by IIT.

Some additional equipment for demonstration and research purposes will have to be purchased, to be located either in the field or at IIT, depending on its nature and use.

D. Collaborative Arrangements.

Both FES and IIT will be the responsible institutions to carry out this project. In order to achieve the proper coordination and working relationships an agreement will be drafted and signed. The respective responsibilities of each will be clearly defined. One item that will be included is regular meetings at the site of the project with the participation of at least one representative of each of the two institutions. Quarterly reports will be submitted jointly to the sponsoring organization. The project would be open for evaluation by an external agency if the sponsor feels that it is necessary. The evaluation criteria and procedure should be set up in advance.

E. International Support.

This project has been developed as a result of a study by three committees of Latin American scientists and technologists (with the guidance of the Institute of Food Technologists). The study, among other findings, identified constraints on the "Use of Local Food Technology in combating infant and maternal malnutrition." The study was funded by U.S. AID through the League for International Food Education. The IFT should be involved in the execution and evaluation of this project because it has qualified technical people with the expertise necessary to provide the technological backup needed during the life of the project. It is requested that at least one IFT consultant per year be made available to serve as an expert for this project.

F. Colombian Government Support for Project.

The proposed project represents an innovative approach in non-formal education - especially to the extent that it attempts to directly involve community members in the planning process. The project has been discussed with various government officials who are responsible for planning services for Colombia's rural population. Their response has been an enthusiastic approval. It is intended to use government support and take advantage of available services. The Ministry of Agriculture through I.C.A. (Colombia Agriculture Institute), SENA (National Apprenticeship Service), and the I.C.B.F. are already collaborating with the Hogar in Buenos Aires. When the DRI office opens the Hogar will coordinate closely with its activities. In the proposed project the students would function as auxiliary agents for the various government service agencies. The data collected and analyzed by the students will be presented to the appropriate agencies in order to work out joint intervention programs.

G. Extension of Project Findings.

The project which is being proposed here is not an abstract piece of research. If the ideas used prove to be workable and beneficial there is a structure for extending them throughout the remote areas of Colombia. Of the 120 H.J.C.'s in Colombia, many are located in the most isolated areas of the country.

While each H.J.C. is locally controlled there is a national organization which helps arrange financing and programing. The Buenos Aires Hogar distinguished itself nationally when in December 1975 it received an award for innovative programing from the national organization. One of the project directors, Dr. Bolanos, has been named as president of Directive Council of the National Federation of Hogares Juveniles Campesinos. This is the group which selects programs for recommendation to the local Hogares. It is also responsible for initiation of these programs after approval by the individual Hogares. All of this is to say that, to the extent that the proposed project is successful, there exists the possibility, indeed the probability, that it will be extended to other remote areas in Colombia.

During the third year of the project the tested methodology will be consolidated into a program which can be carried out within the normal resources of a Hogar Juvenil Compesino. At the end of the project the methodology will be continued in Buenos Aires without additional outside support. Furthermore a packaged program will be produced which can be extended to other Hogares with the assistance of the national organization. Extension of this program could also be done to other Colombian Organizations such as the School Orchard Program and Nutrition Education Workshops.

The acceptance of trainees from neighboring countries into the program as it is proposed will provide a way for initiating the extension of the philosophy and methods of the program to other countries.

PROJECT PROPOSAL

for

ACTION PROGRAM

in

GUATEMALA

An Agro-Industrial System integrated with Public Health Nutrition, for the Improvement of the Socio-Economic and Nutritional Status of Rural Communities.

This project has been developed in response to a study, by three groups of Latin American Scientists and Technologists (with the assistance of the Institute of Food Technologists), of the constraints on the "Use of the Local Food Technology in combating Infant and Maternal Malnutrition," funded by U.S. AID through the League for International Food Education.

I. TITLE OF PROJECT:

An Agro-Industrial System integrated with Public Health Nutrition, for the Improvement of the Socio-Economic and Nutritional Status of Rural Communities.

II. ABSTRACT, INCLUDING RATIONALE:

It is now well recognized that the nutrition problem of large groups of the world population is caused by a number of factors. Furthermore, the effect of individual interventions, whether of a nutritional, economical, educational, agricultural or industrial nature, have not given the results expected. Therefore, if the cause of malnutrition is of a multiphacetic nature, the solution to such a problem should follow a multisectorial approach. Even though each component has its own specific function, it is the interaction between the different components which should provide underdeveloped-malnourished population with the possibility of fully developing. Strangely enough, the Green Revolution was caused by what is called a complete technological package, since it was known that only one of the many factors involved in increasing productivity would be ineffective in itself. The rationale of the present proposal is, therefore, to apply in a community a multisectorial approach based on an agro-industrial system to induce an improvement of the socio-economic and nutritional status of the rural population.

Based on the above, the specific objectives of the project are:

1. To develop appropriate systems of agricultural production of foods for human consumption and feeds for animal production.

2. To develop and implement food conservation and transformation techniques, both at the home and at the adequate technological level.

3. To utilize the products and by-products of plant and animal production systems of the area to complement each other.

4. To implement much needed agricultural and home economic extension activities.

5. To introduce with the above, public health measures and nutrition education.

The activities of the project will be centered in a cooperative located in the highland areas of Guatemala where there is malnutrition. Application of education activities will be performed at the cooperative and member farms. Two experimental centers will be set up within the cooperative. These will carry out specific problem oriented research; one having to do with production activities while the other will be used for processing foods. Once the information is analyzed and found feasible it will be transferred to the cooperative. The two centers will also channel their activities on problems arising at the cooperative. Systems will be set up to process grains after harvest, store them and eventually transform them into other foods. Likewise, animal production systems will be introduced and developed. Together with production, and processing, marketing systems will be implemented.

At the cooperative, its membership will receive basic medical care and extension services in agricultural production; home food preparation and pre-preservation instructions will be provided. The main intervention will have food technological characteristics while the others will be of a supporting nature.

The project calls for yearly evaluations of socio-economic and nutrition changes, as well as in food intake, adaptation of new technologies, and development of agro-industries.

Cooperation will be obtained from the cooperative itself and its members, as well as from National Agricultural Institutions and other Divisions of INCAP and ICAITI.

The project has been planned for a 5-year period, divided into three phases. During the first the cooperative will be selected and the logistics of the program will be set up taking from 6 to 12 months. The second phase will be the implementation phase of 4 years duration, and the last will be the final evaluation phase.

III. PRINCIPAL INVESTIGATORS:

1. Lic. Francisco Aguirre
   Sub-Director
   Central American Research
   Institute of Industry
   ICAITI
   Guatemala City, Guatemala
   Central America

1. Dr. Ricardo Bressani
   Head, Division of Food
   and Agricultural Sciences
   Institute of Nutrition of
   Central America and Panama,
   INCAP, Guatemala City,
   Guatemala, Central America

For curriculum vitae and relevant references see ANNEX 1.

2. Additional Professional Staff of ICAITI

2. Additional Professional Staff of INCAP

For names and curriculum vitae of additional staff see ANNEX 2.

IV. DURATION OF GRANT - 5 YEARS:

Due to the type of study to be carried out, it is felt that the present grant should have a minimum duration of 5 years. These 5 years are to be divided into three main phases. Phase 1, of 8 months duration, is to be considered as the planning phase. Its purpose is: a) to select the test area and obtain basic information on the socio-economic and nutritional conditions of its population; b) to plan the type of food technology interventions and supporting activities; c) to schedule the time of implementation; d) to work out the logistics of the supporting activities and enroll the appropriate assistant personnel and, e) to establish the management of the project between the two responsible institutions. Upon completion of this first phase, a complete report will be prepared including a revised specific project plan of main interventions, and of other supporting activities and collaborative institutions and personnel. At this time also the budget will be revised.

Phase II will then be initiated after approval by the supporting institutions. This phase, or the implementation phase will be of a 3-year duration. This means that the food technologies decided upon in phase 1 as well as the supporting activities should be well established in order to implement them in the shortest possible time. Evaluation of the development of the project and of changes taking place will be obtained yearly. Site visits and workshops will be held to evaluate the advances made and modify, if necessary, the main and other supporting interventions. Reports will be prepared on a yearly basis.

Finally, Phase III of one year duration will consist of a complete evaluation and final workshop on the project's accomplishments. A programmed withdrawal will take place hoping that the interventions made will have accumulated enough energy to support a self sustained system.

V. TENTATIVE 5 YEAR BUDGET - U.S.$1,435,050

ITEM	YEAR 1	2	3	4	5	TOTAL
PERSONNEL(1)						
INCAP	$ 52500	$ 60000	$ 65000	$ 70000	$ 60000	$ 307500
IFT Consultants	2000	2000	2000	2000	2000	10000
ICAITI	52500	60000	65000	70000	60000	307500
EQUIPMENT(2)	-	25000	50000	50000	-	125000
SUPPLIES(3)	1500	15000	15000	15000	10000	56500
SERVICES(4)	11500	13000	13000	16000	10000	63500
TRAVEL(5)						
Nationals	2000	10000	10000	10000	6000	38000
IFT Consultants	2000	2000	2000	2000	2000	10000
REPORTS	1500	1500	1500	2000	2500	9000
Totals	$125500	$188500	$223500	$237000	$152500	$ 927000
CONTINGENCIES	18825	28275	33525	35550	22875	139050
INDIRECT COSTS	63000	72000	78000	84000	72000	369000
Totals	$207325	$288775	$335025	$356550	$147375	$1435050

(1) 1 Project Manager plus 3 Professional/Institution to be allocated among staff depending on needs.

(2) Tractors, Silos, Pumps, Electrical Motor, Animals, etc. Other.

(3) Fertilizers, Herbicides, Transportation Facilities, Water, Electrical Power, Gas, Fuels.

(4) Chemical Analyses, Statistical Analyses, Contractual Services, Transfer of Technology.

(5) Local: 96 trips/year. Foreign: 4 total/Institution/year.

VI. PROJECT PLAN:

A. INTRODUCTION

A.1. Objectives and rationale for their accomplishment

Ever since the world recognized that a significant number of people, particularly those living in developing countries, suffered from malnutrition, millions of dollars have been invested by a number of organizations to learn of the reasons, causes and effects of malnutrition among the human population.

This first stage led to the development of strategies designed to have a major impact on malnutrition. Among the first was the development of high protein foods, since at the beginning an overwhelming emphasis was placed on overcoming protein deficiencies. Although these high protein foods proved to be quite effective at the metabolic unit as well as in institutional feeding, their impact on the problem as a whole is very limited. They gave rise, however, to a more efficient use of natural resources and have promoted a certain amount of economic activity and technological advances not available before. Activities in this field still continue and their real value will become more evident in the future.

The next approach tried was to improve the nutritional quality of cereal grains, because of their high intake. A breakthrough of this approach came with the finding that the Opaque-2 gene in corn improved the protein quality of this cereal grain. Much interest was developed and activities now have been increased to include the genetic improvement of the protein quality of other cereal grains and of legume foods. These programs have, up to the present time, contributed little to the solution of the malnutrition problem, however it is expected that they will be quite useful once they become part of the crop production system particular to areas within a country.

Almost at the time the above possibility became known, great efforts were being made on increasing production of the cereal grains and legume foods, activities supported with relatively substantial endowments by the International Agricultural Research Centers and at a lower level by national institutions. The first effect of this activity became known as the Green Revolution, since significant increases in cereal grain yield were obtained.

Other interventions, different from those indicated above, such as nutrition education, industrial development and increase in income, have also been tested as solutions to the nutrition problem. As with the other, their effects have been only partially successful.

The conclusion which must be reached from the lack of complete success from the individual solutions tested is that they by themselves can not solve the problems, since the problem is one arising from a number of situations which prevail in the developing countries. Therefore, it is felt that a multisectorial approach or systems approached could be much more successful. This approach, however, must be carried out following techniques similar to those utilized by United States State Universities, serving as the source of technological and educational know-how and information, to be extended to the target population of the selected region. The approach should then be one involving activities of soil and plant

science (Agronomy), conservation and processing of foods (Food Science and Technology), Animal production (Animal Husbandry), marketing (Economics) and education (Home economics and Nutrition education). The above activities should be focused on the achievement of an improved socioeconomic situation of the population of the area chosen, which will translate itself in better living conditions, improved nutritional status, and overall quality of life.

Based on the above, the objectives of the project are:

- To develop appropriate systems of agricultural production of foods for human consumption and feeds for animal production.
- To develop and implement food conservation and transformation techniques, at the home and appropriate technology levels.
- To utilize the products and by-products of the plant and animal production systems of the area to complement each other.
- To implement appropriate agricultural and home economic extension activities.
- To introduce with the above public health measures as well as nutrition education.

A.2. Background information

A.2.1. Malnutrition conditions in target group of the area

(a) The most important nutritional problems

The Guatemalan population is subjected to a series of severe nutritional problems, among which the most important are the following:

(1) Protein-Calorie malnutrition. Anthropometric and biochemical results of nutritional surveys carried out in the area have shown that the majority of the population suffer from chronic protein-calorie malnutrition. This is especially true for children. Almost a fourth of the population does not satisfy its caloric requirements and severe protein-calorie malnutrition incidence is as high as 2%. This has a negative effect on growth and development, resistance to adverse conditions, and work efficiency.

(2) Vitamin A deficiency. Dietetic and biochemical studies have shown also that the prevalence of vitamin A deficiency is very high, especially in small children. This, associated to the protein-calorie malnutrition, results in retarded physical development and a lowering of resistance against infections. If glaring symptoms of vitamin A deficiency do not, as a rule, appear in the population it is due to the fact that the deficiency of protein and calories reduces growth and, consequently, vitamin A requirements.

(3) Riboflavin deficiency. The studies referred to above have shown that there is a riboflavin deficiency related to protein deficiency, since the source of this vitamin is usually the source of the other nutrient.

(4) Nutritional anemia. Iron deficiency affects a great sector of the population, especially pregnant and lactating women, women of reproductive

age, adolescent boys, and children below 3 years of age. In the urban sector iron deficiency anemia is common in women from adolescence to menopause, and in children below 3 years. Folic acid deficiency is as prevalent as iron deficiency mainly in lactating and pregnant women and in men between the ages of 12 and 44. Vitamin B-12 deficiency, on the other hand, is not a public health problem.

(b) Other nutrients

No deficiency has been found in respect to calcium, iodine, ascorbic acid, niacin and thiamine.

(c) Other health problems related to nutrition

(1) Retarded growth and development. It has been found that during the first three months of life, height and weight of Guatemalan children are normal compared to appropriate standards. Thereafter, however, the rhythm of growth slows down: at 6 months they are already below the standard, at 2 years they are retarded one year, and at 5 years they are retarded almost two years. No recuperation from this retardation during the growth period was found. The final result is then a smaller adult than that whose genetic potential has not been adversely affected by environmental factors, among which the nutritional factor is one of the most important. The retardation in the growth of the head is also significant since it may affect mental development.

(2) Physical condition. According to weight and skin fold, obesity is practically non-existant. Adult young men are lean and the results of Harvard step tests were excellent, showing a cardiovascular adaptation to strong physical exercise of short duration. The effect on long-term physical exercise is still not known.

(3) Dental caries and periodontal disease. Dental cavity and periodontal disease incidence is very high showing a deficiency in oral hygiene on both rural and urban populations. Bad teeth or absence of teeth can result in well known nutritional problems due to the inability to consume solid foods.

(4) Mortality. Malnutrition is a very important causative factor in child mortality, which is high for children below 5 years of age. The most important immediate causes of death are infectious diseases such as diarrhea, respiratory infections, measles, and whooping cough. Malnutrition is not, in most cases, an immediate cause of death but it does contribute to the high mortality due to infectious diseases.

(d) Responsible factors

The deficient nutritional conditions of the Guatemalan population are due to several factors, most of them interrelated. These factors can be classified as follows: 1) availability of foods at the national level; 2) distribution and consumption of basic staples; and 3) utilization of the foods eaten by the population.

(1) Availability of nutrients at the national level. The total amount of foods available for human consumption in Guatemala is insufficient to satisfy the minimum requirements of the population. The protein and Calorie

requirements for the whole population are satisfied 88% and 80%, respectively. This apparent availability of protein, is, however, misleading, since the distribution of the different kinds of protein among the different sectors of population is so uneven that some sectors consume almost exclusively low quality protein which are not well utilized by the organism, while other sectors consume adequate quantities of high quality protein.

A qualitative analysis of the data on food availability shows that the deficit was greater for highly nutritive foods such as beans and animal products, both of which are good sources of protein. Most of the low production of basic staples can be blamed on poor agricultural practices. These in turn are partially the result of social, economic and educational limitations. There is little incentive for social or economic organizing and so families live isolated one from the other. The low economic status results in a diminished purchase capacity and this leads to the exportation of products, in search of better markets and demand. Fast population growth contributes to the ever-increasing problem of food availability.

(2) Food distribution and consumption. The insufficient availability of foods is aggravated by uneven distribution, since highly nutritious foods are expensive and consumed almost exclusively by the middle and high economic strata of the population. Furthermore, uneven distribution of certain foods within the family contribute to lower the nutritional status of some members. For example, children after weaning are fed very small amounts of foods such as meat and beans, in relation to the rest of the family. This is due to poor nutrition education in the population, the great majority of which is not aware of the nutritional origin of kwashiorkor and marasmus.

(3) Environmental factors which interfere with food utilization. The nutritional status of a population is not only the result of what it eats, but of how it utilizes the ingested nutrients. It is well known that infections affect the nutritional status, especially when the intake is already deficient. The results of surveys indicate that the population is exposed to a high risk of infestations by intestinal parasites. The high prevalence of Entamoeba histolytica and other intestinal protozoa contributes also to the deficient nutritional status. Certain helminths such as hookworm are important factors in determining the prevalence of iron deficiency anemia, even in the presence of adequate dietetic iron.

A.2.2. Technology resources available that can be applied in solving the malnutrition conditions

The two institutions responsible for the development and management of the present project, ICAITI and INCAP, have, throughout the years, developed a variety of technologies which can be applied to the target area. These resources are detailed in ANNEX 3.

A.2.3. Past and Present Constraints to the use of Food Technology Resources

No information can be provided to indicate the past constraints to the use of food technology, resources, since no experience is available with respect to the particular population living in the target area. In other words, no attempts have been made in the past to approach the introduction of the available technologies as is proposed in the present project. However, it may be possible that an important constraint may be the lack of appropriate communication between the food technologists and processor and

consumer. It may also be possible that the technology offered is not necessarily the one sought by the target population or that its cost is beyond the purchasing capacity of the target population.

Additional constraints are the difficulties in introducing new types of farm crops and the deficiency in practical extension work as applied to the production of the new crops, and of the ways in which it can be used as a food or as an industrial crop.

A.2.4. How these constraints can be overcome so that available Food Technology Resources can be effectively used

The introduction of the available Food Technologies will be planned between the collaborating target population groups and the institutions responsible for these introductions. There must exist good communications between the two sectors, and the activities to be performed must fit the needs and wishes of the target population or their representatives.

Once a decision has been reached the implementation phase should be carried out to insure success. It should be well planned from the point of production of the raw materials to the process itself and up to the necessary equipment to perform the processing. There must be constant communication, supervision and extension, implying that personnel from the institutions managing the project must be present and available all the time.

To insure success, model units for both production of the raw materials and processing, must be set up, which will be used to test the interventions and modify them if needed.

B. SPECIFIC PROJECT PLAN. METHODS OF PROCEDURE

B.1. Management Considerations

The project is organized into three closely interlocked phases. The first is the location and selection of the cooperative having the appropriate characteristics needed for participation in this study. The area expected to meet all the criteria is the highland region of Guatemala where one cooperative will be selected from the many such units accessible at altitudes between 5000-8000 feet above sea level.

The logistics of setting up and managing a complex multivillage field study are not easy; however, the principal investigators and others in their respective institutions have had successful experiences over the last eight years in doing just this in Guatemala. In the first phase, intervention-decision research will be carried out and baseline data on the selected cooperative will be collected.

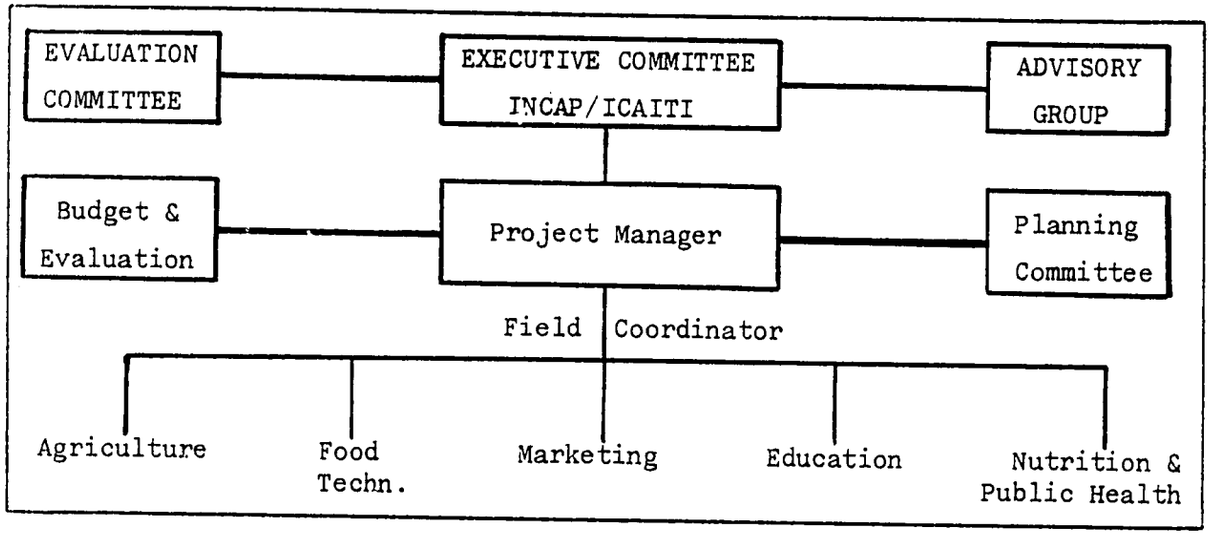
There will be a planning review of findings at the end of the first year, prior to beginning the second phase of the study; that is, the interventions in the cooperative and villages. The purpose of this review will be to report on the results of the intervention-decision research, the state of the baseline data collection in selected villages, the progress on logistics, and the updating of budgets and other input needs, based on the experience of the first year. If unsurmountable problems have been encountered in critical areas affecting the power to interpret clearly the interventions, certain portions of the study may have to be redesigned.

The entire study will be terminated at that time if no clear interpretation is forthcoming.

The management plan includes, in addition to annual written reports, annual oral reporting to the sponsoring organization by the investigators, and annual visits by consultants in the fields of epidemiology, statistics, nutrition, agriculture and food technology to the project sites.

The third phase, at the end of the period of data collection, includes final analyses and publication of results.

From the point of view of the management arrangements between the two institutions, the following strategy is presented.

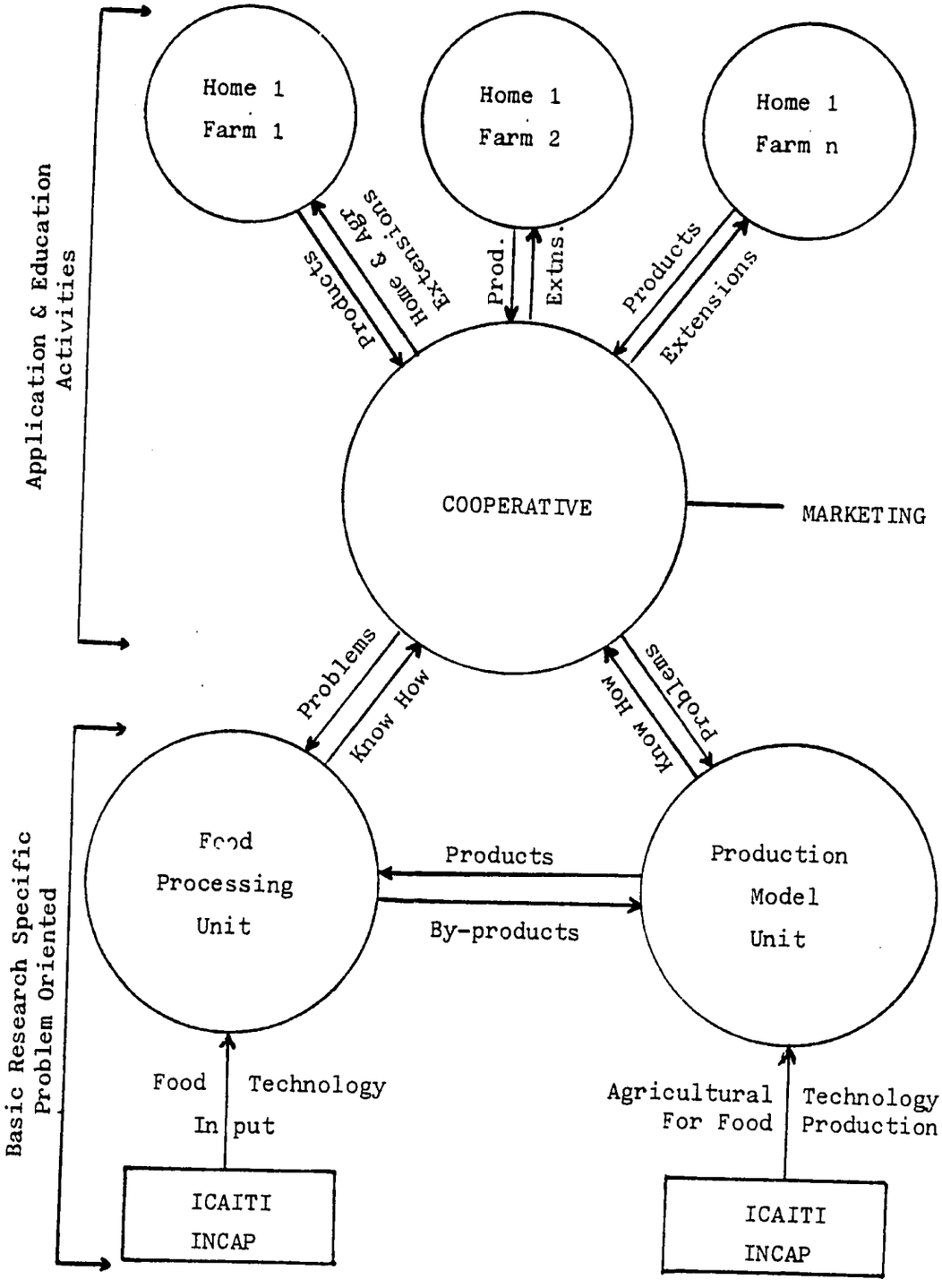


B.2. Specific Plan for the Project

The method of approach will be to intervene with the plan of activities into cooperatives already in existence in the country, and which have the necessary infrastructures, without which it would be more difficult to initiate the project. At the present time, many of the cooperatives in Guatemala, are grouped under the Federation of Cooperatives. The project is to be implemented into one of the cooperatives whether associated or not, so as to be more specific and efficient in the transfer and application of the technology to be offered. At the beginning, the technology to be transferred will have to be of the particular interest of the cooperative, that is, around the activity which the members now perform and which made them become associated. At later stages, the agro-industries will be diversified. Special efforts will be made to adapt appropriate technologies pertinent to the activities of the cooperative. For purposes of being more specific in the project plan, this was based on the possibility that the cooperative chosen is the one named "El Novillero, Santa Lucia Utatlan, Solola, Guatemala".

The general method of procedure to be followed is based on the diagram illustrated in FIGURE 1. The components of the system are the following:

FIGURE 1. Diagram Showing Interrelationship Between Institutions and Activities



(a) The Cooperative

This will constitute the center where most of the activities will be carried out; various kinds will be performed. One is related to the cooperative's own activities, which at present is the production of rabbits and their processing. Supporting activities are a feed mill, grains storage, and the processing of rabbit skins. The second activity will be related to the technology to be introduced by both ICAITI and INCAP. A third will be related to education, both of the farmer, the members of the cooperative, and to housewives.

(b) The Agricultural Production Unit.

This represents the equivalent of an experimental farm, which will serve as a place for introducing new varieties, and developing production systems for crops and animals. Its output will be for the cooperative and for the farm units. FIGURE 2. shows the land distribution approach for an integration of agricultural activities. The model is applicable to farms with a minimum land area of 3 hectares, however, it can be scaled upwards for larger farms.

(c) The food processing unit.

This represents the equivalent of a pilot plant. As with the agricultural production unit, it will serve as a development and testing facility for technologies to be implemented at the cooperative. It is intended also as a workshop for assembling and repairing equipment, preliminary testing of mechanical interventions and the like. It will be supported by the pilot plants of both ICAITI and INCAP.

(d) The Farms.

The fourth component of the system is made of the farms owned by the members of the cooperative. These will be the recipients of the agricultural technology as well as of the extension work to be done in home food preparation and preservation.

Based on the above, the following activities will be performed:

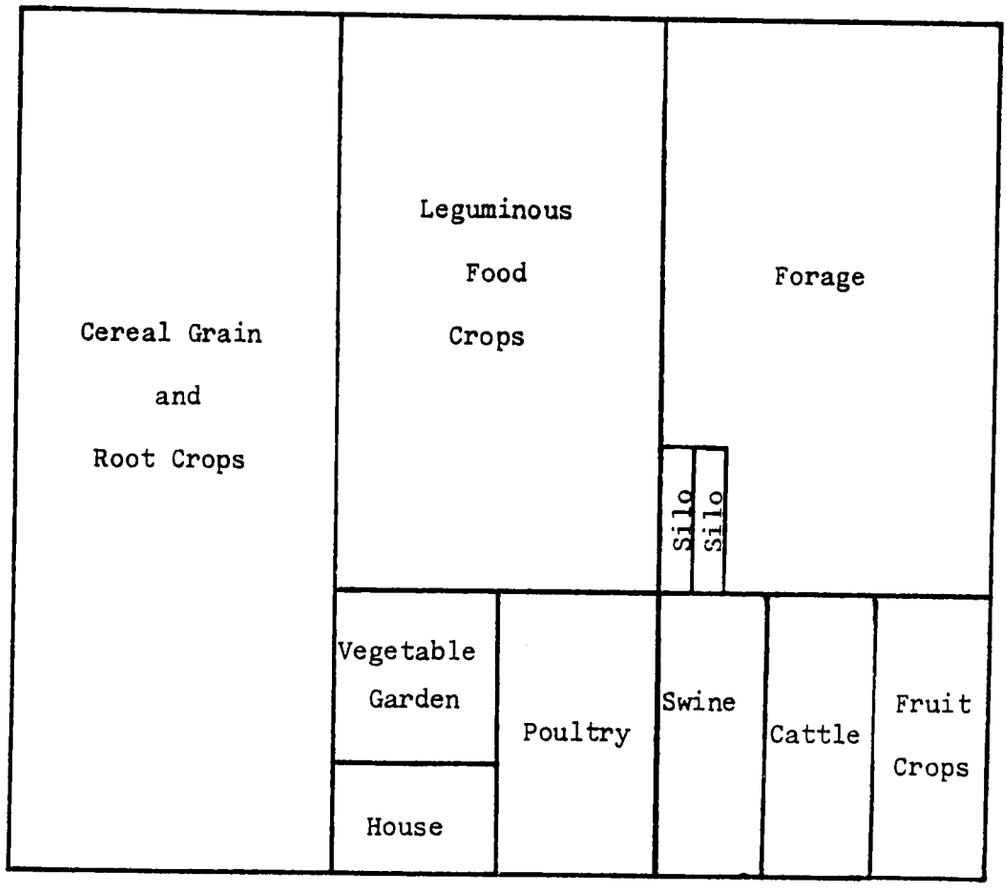
- At present the cooperative has been developing a commercial rabbit production unit. Therefore, the initial activities will be focussed on solving the problems encountered in that field. These include: the development of economic rations, search for local feed raw materials and their processing, feed pelleting, and waste disposal systems and waste utilization.

- Processing of rabbits, conservation, packaging and transportation of carcasses and their marketing. Special attention will be given to the utilization of the skins.

- Once the above is solved other activities will be introduced, for which subprojects will be prepared. Probably one of the first will be food preservation and utilization at the home level, as well as nutrition education.

- At the same time, the production unit will be started by screening new crops to be planted, chosen on the basis of needs, commercial value, or as raw material for the processing unit.

FIGURE 2. Multi-Crop and Production Model Unit



Primary Products

Cereal Grain
Food Legumes
Vegetables
Fruits
Eggs
Milk
Meat
Silage

By-products

Corn Stalks and Stubs
Agricultural By-products
Manure

- At the processing unit, systems for food drying and preservation will be first initiated, to be followed by diversification of use.

- Commercial production of fresh foods and of processed foods will follow. This will be chosen on the basis of criteria developed between the cooperative and the cooperating institutions.

- Where pertinent, the use of simple water pumps and simple methods of purifying the warer will be introduced for easy access to potable water.

B.3. Description of Test Area and Target Group Involved

Possibly one of the most significant movements taking place in recent years in various Latin American countries has been bringing together rural population groups into cooperative associations, as a means of making them participants in the socio-economic system within the country. Without any doubt, the concept is effective if it is considered as a movement involving concomitant interventions, besides the agro-industrial concept, into other needed interventions such as increased and diversified agricultural production, conservation and transportation, as well as measures in public health and nutrition education. Most approaches to the nutrition problem are unilateral, and the nutrition problem, being a biological system, requires a balance between the various components which follow the law of diminishing returns, or of limiting factors. The cooperative movement, therefore, could proceed faster if other activities are carried out to support the main activity of the cooperative. Furthermore, it is essential for them to be diversified so as to be more competitive.

The cooperative has been chosen as the site where the present proposal is to be carried out because they meet the needed characteristics in terms of area and of population, and where, it is presumed, the need of technological assistance is more acute.

As already indicated, the cooperative chosen goes by the name of "El Novillero", in Santa Lucia Utatlan, Solola, Guatemala. It is located at 8000 ft. above sea level at 145 km from Guatemala City. The total number of families in the organization is 1800 for a total population of 12,600 persons. It was organized in 1963 and it has been in operation ever since. The cooperative area includes around 20-30 housing groupings (caserios) with some small communities and villages. Most of the land is hilly; however, some flat land is also available. The cooperative proper owns around 150 hectares and other available land runs around 2 hectares per member of the cooperative. Because of the activities going on at the cooperative, migration of the population has been minimal.

Agricultural products of the area include potatoes (seed as well as commercial), wheat (representing the main income of the population), corn, faba beans, apples and honey. The cooperative has also, among its equipment and facilities, a feed mill, agricultural implements, grain silos and irrigation equipment.

B.4. Foods to be used

The objective of the present proposal is not to test or evaluate the nutritional effectiveness of a food intervention. Rather it pursues to evaluate the effectiveness of various types of interventions, not including

specific food preparations or other food combinations. However, very much considered with the terms of reference of the agro-industries complex will be the production of nutritional improved foods and processed at the cooperative's physical facilities. Furthermore, through the home economics and food preparation and preservation educational activities, and based on the agricultural program of the project, emphasis will be given to consumption by all age groups of a better balanced diet between corn and beans as the foundation for improved nutrition which hopefully will be achieved through the consumption of certain supplementary foods.

Mention was already made of the possibility of producing locally a tortilla supplemented with soybeans, and other high protein-energy foods based on corn and soybeans. Other possibilities based on the foods produced in the area of the cooperative will also be studied. For example, rather than using corn, dehydrated potato flour has been used to develop foods of better quality, potatoes being an agricultural food product of the cooperative. Likewise, we have been able to produce highly nutritious foods using faba beans as the main component and, as previously indicated, this is also a product produced in the area.

These foods could be produced eventually on a large scale for which the appropriate technology will be developed by the two sponsoring institutions, including the design of marketing and distribution systems as well as methods of preparation and utilization of products by the consumer.

B.5. Means for Agricultural Production, Post-Harvest Handling, Storage, Processing and Preservation of Foods

Emphasis on agricultural production and post-harvest technology will first be given to those agricultural crops already being produced by the cooperative and member farms. These are: corn, wheat, potatoes, faba beans, common beans, and possible a few others. In the area of food animal production, attention will be given to rabbit production, processing and marketing because it is an ongoing activity of the cooperative. However, attention will be given also to improving sheep production as a source of animal protein and wool. Sheep production is incipient in the area and its low productivity is due to diseases and lack of adequate food. Both the meat and wool represent additional sources of income and suggest the possibility of the initiation of other agro-industries.

The post-harvest handling, storage, processing and preservation will be performed at the center of the cooperative where equipment for such a purpose is available or will be obtained. It is here also where industrial processing equipment will be installed for the diversification of use of raw materials, or the production of foods to be used by the population, or distribution and marketing to other areas.

New crops or other food animal species will be tested for adaptability and economic potential, as well as to cover nutritional needs by the population.

This is the rationale for the small experimental farm. Certain fruits adapted to highland conditions, as well as forage legumes and beans, root crops, and cereal grains other than corn and wheat, will be tested. Being small farms, economic advantages can only be obtained through a diversified agriculture, which could be advantageous from the nutritional point of view.

Marketing and distribution systems, a special activity of ICAITI, will be primarily within the country but, if possible, also to foreign markets. As a matter of fact, rabbit carcasses are already being exported to the U.S. from the area.

Finally, through the extension and home economic activities, different ways of using various foods to maintain a nutritional balance will be promoted.

B.6. Evaluation Procedure

The data to be collected in the proposed investigation may be classified into five areas. These are:

- The nutritional status of target group,
- The socio-economic status of the members of the cooperative,
- The increment in efficiency of present cooperative activities as a result of the transfer of technology,
- The extent of adaptation or implementation of new technologies, either of an agricultural nature or of food processing, and
- The impact made by the home economics and nutrition education interventions of the project.

Specifically, the data collection in each area will consist of the following:

(a) Nutritional status of target groups

To achieve one of the objectives of this study, food intake, physical growth, morbidity and mortality data are necessary for all members of the population but particularly for mothers and children. Other data include home diet surveys and socio-economic characteristics of the family. After an initial census of the population, data collection activities will be programmed for all individuals in the study sample. This evaluation will be performed before the other interventions are initiated and yearly after that.

(b) Evaluation of Agricultural Intervention Technology

This will consist in measuring increased productivity and economic value of the crops produced. Likewise, the evaluation will comprise also the quantifying of the diversification achieved, for food crops as well as for animal-derived foods. The nutritional and economic significance of this intervention will also be measured from data gathered under (a). Evaluation of these activities will be based also on the increased efficiency of the main activity of the cooperative. In the particular example under consideration, this will consist of the total rabbit population, carcasses reaching the market, economic growth, feed efficiency and the like. This will be done also on a per year basis.

(c) Evaluation of Technological Inputs (Agro-industries)

It will be based on the success achieved in starting new agro-industries, of a food nature as well as of other goods. Also evaluated will be the achievements made in food preservation at home, which will be evident from data collected under (a).

(d) Evaluation of socio-economic status

Parameters such as income per capita, energy consumption, educational and health facilities, agricultural production and the like will be monitored on a per year basis as indicators of an overall improvement of the well-being of the population.

C. PRESENT FACILITIES

C.1. The Division of Food Science and Agriculture of INCAP

The Division of Food Science and Agriculture, one of the 8 divisions of INCAP, is dedicated to research, teaching and advisory activities in the member countries, in the fields of food science, food technology and animal nutrition. For administrative purposes, the activities have been divided into four different programs, whose objectives are the following:

(a) Program on Basic Foods.

It has the general objective of studying the different factors affecting availability, intake, and biological utilization of basic foods, with the purpose of providing the population of the area with a nutritionally improved diet. The program has many projects dealing mainly with the two staple foods in the area, legumes and cereals.

(b) Program on Food Technology.

This program aims at increasing the availability of foods through the development of technologies that will result in the utilization and conservation of the raw materials in the area, and of agricultural and industrial by-products for the production of foods. Among the different programs being carried out, the development of intermediary technologies is of the utmost importance for the development of the area.

(c) Program of Sources of Nutrients.

Its overall objective is to study the fundamental aspects of foods and of new sources of nutrients in order to offer the Central American population better foods and alternative sources of nutrients which can be used in both human and animal nutrition. This program is also interested in developing analytical methodology which, because of its simplicity and rapidity, can be used in studies on the genetic improvement of food crops.

(d) Program of Animal Nutrition.

The goal of this program is to generate knowledge and develop technologies which can be applied under the ecological conditions of the Central American area to increase production of foods of animal origin, without affecting the availability of basic foods for humans. One of the agricultural by-products of the area which is being thoroughly studied by this program is coffee pulp which offers possibilities as a feed component in rations for ruminants and monogastric animals.

All programs are interested in intensifying relations with public national or international institutions in the area concerned with the interest of the different INCAP programs. Likewise, about 36% of the time of the professional staff of each program is dedicated to teaching and training in the graduate programs of the Division.

The facilities of the Division include laboratories in biochemistry, nutrition, food science and microbiology, as well as an experimental animal laboratory, a food technology pilot plant, and a small experimental farm located 41 km from the central laboratories. All physical facilities have the necessary modern equipment and the professional staff includes 5 Ph.D., 4 M.Sc., and 4 B.Sc. The subprofessional group includes 6 laboratory assistants, laboratory helpers, animal caretakers and farm laborers.

INCAP has other facilities and personnel in Education, Public Health, Evaluation, Biomedical Research, Applied Nutrition, Quality Control as well as an Statistical Center.

C.2. Division of Applied Research - ICAITI

The facilities available include laboratory equipment and pilot plants for most of the unit operations related to food technology. A special unit of bioengineering is available for industrial microbiological processes where a great deal of experience has been accumulated in the biotransformation of agro-industrial wastes. The methane generators as well as the pyrolitic conversion of agricultural by-products, through appropriate technologies, can be evaluated for specific applications in concrete geographical areas.

Facilities are also available at ICAITI for economic evaluation, market assessment and financial projections of new developments. Experience has been accumulated on the main aspects of handling, transporting, processing and preservation of basic foods in Central America, and their economic implications.

An information network is also available to retrieve pertinent technological information from data banks from different parts of the world. Analytical services, such as those related to pesticide residues, or soil and leaf analysis available at ICAITI may prove pertinent for the purposes of this project.

D. COLLABORATIVE ARRANGEMENTS

Even though the many activities of the project will be carried out by specific groups of ICAITI and INCAP, mainly those related to the introduction of food technologies, cooperative arrangements will be made with other groups within each institution, particularly those with special expertise. Likewise, collaborative arrangements will be made with other institutions, mainly those related to agriculture such as the National Institute for Agricultural Science and Technology, National School of Agronomy and the School of Veterinary Science and Medicine, and of Agronomy.

Within INCAP, various groups have much experience on evaluation procedures as well as in the management of Public Health measures. Advantage will also be taken of INCAP's School of Nutrition for those activities related to Nutrition Education and Home Economics. ICAITI's Division of Marketing and of Feasibility Studies should be also very useful in the successful development of the project, once decisions have been made on the technologies to be implemented. In some cases provisions will have to be made for financial support for some of the collaborative arrangements to be made. Most of these will be determined after completion of Phase 1 and plans are made for Phase 2 of the project.

E. POTENTIAL FOR EXPANSION OF THE PROJECT CONCEPT TO A WIDER GEOGRAPHICAL AREA

It is now well recognized in Latin America that health programs based on health centers located in relatively large communities have not been effective, mainly because the number of people covered has been relatively small. Recently, the trend in extending health programs is to take the activities of such programs closer to people living in rural areas by means of smaller health centers and trained personnel, some of which are members of the community.

Obviously, food technology resources cannot be taken to individual homes, or even small communities, because the operation of even the smallest of the appropriate technologies requires a minimum economic input without which the investment is not worth the effort. This, however, does not apply to food processing and nutrition education.

In the past, most - if not all - food technology institutions dealt with research activities which were applicable to large or relatively large industries. These were not very much interested in such activities, and even if they were, in order to show an adequate margin of profit, either production and sales had to be large to pay for the investment or they had to seek government subsidy. This approach, however, must change for food technology programs to be useful, and the approach is to introduce the technology among groups representing the productive force of a country, particularly if they are associated into some sort of groupings, such as agro-industrial cooperatives. Limited experience shows that such an approach has a good potential for expansion to a wider geographical area or to other countries. It must be remembered, however, that the approach is one of multisectorial interventions, not only of food technology alone, or of any other individual activity.

The systems approach envisaged in this project could be easily transferred to many other areas or regions of Latin America that face the same circumstances of the site selected in Guatemala. Other parts of the world with similar characteristics could also profit from the results obtained as well as from the management experience gained on this multidisciplinary effort to the malnutrition problem.

As the project advances (2nd or 3rd year) some fellowships could be made available for Latin Americans in other countries interested in witnessing or experiencing themselves with the effects of this type of programs. Other countries of the world could also send trainees provided that they have good command of the Spanish language, since most of the activities will take place in rural areas where other languages than Spanish would be difficult to understand.

ANNEX 3.

FACILITIES AND CAPABILITIES

of

Division of Agricultural and Food Science
Institute of Nutrition of Central America and Panama
(INCAP)

and

Central American Research Institution for Industry
(ICAITI)

FACILITIES AND CAPABILITIES OF DIVISION OF AGRICULTURAL AND FOOD SCIENCE (INCAP)

Food crops and animal production system of experimental farm.

As part of the physical facilities of the Division of Food and Agricultural Sciences of INCAP, the institution acquired about 16 years ago, a farm located in the highlands of Guatemala, for the purpose of producing raw materials for research activities in the laboratories, and for purposes of testing the quality of foods with higher animals. With time, these activities gave rise to agricultural production systems for food crops and animal feeds, which can be transferred to other localities. A relatively high number of technologies are available going from production and conservation of forage crops as silage, to utilization of by-products of food crops and recycling of wastes which could be applied, with the necessary modifications, to the area chosen for the development of the project.

Food Technology.

Also available from the Division is a series of foods with corn as the main ingredient, having a high nutritional value and based on the food patterns of preparation and consumption of the target population. The technologies to prepare such foods are also available. One of them is a fortified tortilla, made from 85% corn and 15% soybeans, which are processed together. An atole can also be made from this food. Both of them have a high nutritional value. By increasing the concentration of soybeans to 30% with 70% of corn a weaning food of high protein content and quality can be made. Also available is a procedure to can immature corn, which, when cooked and ground, makes a very popular drink in the target area.

A very simple process can also be implemented to stop the hardening of beans after harvest, which will also decrease losses due to insect and fungi damage. This will permit the cooking of beans in less time under stmospheric conditions, and store it when raw without losing marketing value due to seed hardening.

If needed, a grain dehydration system can also be set up which uses corncobs and other agricultural wastes as sources of energy. Since the area chosen is a wheat-producing area, this technology may be useful as a source of energy to dry the grains when harvested to avoid post-harvest spoilage. There are other possibilities, wuch as the production of enriched bread made in local clay ovens, and the utilization of faba beans also grown in the area. How many of these possibilities will be applied depends on how the projects develop and on the particular interest of the cooperative. The idea, however, is to be able to produce enough to be used by the local population as well as for marketing.

Animal Production.

The animal production program of the Division of Food and Agricultural Sciences of INCAP has developed technologies for the production of small animal species as well as swine and ruminants. These technologies have been developed on the basis of the availability of local feed resources,

grown as direct crops or consisting of the agricultural by-products of the area. The technology to be effective requires small amounts of concentrates which are carriers of additional nutrients and supplements. Some experience has been accumulated on the transfer of such information to the field with success.

Basic Food Crops and Sources of Nutrients.

In addition to the other two programs of the Division, that is Animal Production and Food Technology, the Division also has developed transferable technologies derived from the Basic Food and Sources of Nutrients programs.

FACILITIES AND CAPABILITIES OF CENTRAL AMERICAN RESEARCH INSTITUTION FOR INDUSTRY (ICAITI)

As part of its general program to further Central America's industrial development through applied research, ICAITI has developed Food Technology resources which fall under the following activities:

Industrial Economics.

This Division handles the economic aspects of projects. There is within the institution, experience and know-how to carry out economic feasibility studies, evaluation of projects, industrial accounting and cost studies, market studies and studies on rationalization, methods and procedures. These aspects will be very useful in the development of the project being proposed.

Technological Resources.

These have been developed by the Technological Research Division of the Institute. Among its numerous contributions, the following should be of particular interest to the present proposal:

- Development and patenting of a new process for the manufacture of corn flour.
- Processing and conservation of agricultural local raw materials, such as fats and oils, foodstuffs and cereals.
- Studies on the installation of fertilizer and insecticide plants.
- Industrialization of bagasse, a by-product of sugarcane manufacture.
- Advice on the installation and operation of food canning plants.
- Studies on the manufacture of manioc (cassava) and corn starch, including the utilization of starch for manufacture of syrups, dextrins and other commercial products.
- Research on the dehydration of fruits and vegetables.
- Assistance in the planning, modernization and expansion of local textile mills.
- Vegetable protein extraction.
- Biotransformation of agricultural wastes to produce methane for energy.
- Studies on the establishment of modern slaughterhouses.

Other activities and services.

The Institute can provide other activities and services to the present proposal derived from the Standards Division and the Division of Engineering and Industrial Services, where programs on quality control and feasibility studies constitute the backbone of their work.

PROJECT PROPOSAL

for

ACTION PROGRAM

in

CHILE

Utilization of Marine Resources to Combat Malnutrition in Chile

ACTION PROGRAM PROPOSAL - CHILE

I. TITLE:

Utilization of Marine Resources to Combat Malnutrition in Chile.

II. ABSTRACT (including philosophy and rationale for project).

It is proposed to use a multi-disciplinary approach in the development and utilization of foods based on marine resources to overcome certain malnutrition of the poor in selected areas of Chile.

This approach will overcome several constraints that have heretofore crippled nutritional food product development in Chile and fractionalized efforts to solve its malnutrition problems:

- policy makers have not recognized the importance of food technology's role in making more and better foods available to target groups
- nutritionists and food technologists have not worked together to develop products that provide the undernourished with the nutrients they need and are acceptable to them as every-day dietary items
- the resources of the sea have been greatly underutilized as raw materials for high quality protein food for the undernourished
- lack of communication between food technologists and the food industry, especially concerning the opportunities that exist to develop and market low-cost, nutritious foods for the malnourished.

To accomplish this end we propose to do the following:

- Food Technology research groups at three universities will cooperate in the development of marine product-based foods for the target group (pregnant and lactating women, infants and pre-school children)
- a medical nutrition team from one of the universities will carry out pre- and post-feeding period surveys in selected, low-income communities to establish the benefits from intervention feeding programs based on the above mentioned foods.
- market development programs will be initiated with interested food companies to encourage commercialization by them of the developed products.
- cooperation will be sought with public and private agencies sponsoring food intervention programs for the poor whereby the developed products will be utilized by these agencies in their programs.

By these means we hope to show that marine product-based foods can be used on a continuing basis to solve some of the serious malnutrition problems now prevalent in Chile.

III. INVESTIGATORS: (1)

A. Fundacion Chile
David F. Owen, Ph.D. - Coordinator of Project
Manager of Nutrition Research
Fundacion Chile, Santiago

(1) See Annex A for Curriculum Vitae.

B. University of Chile

Fernando Monckeberg, M.D. - Co-principal Investigator
Director-General, Institute of Nutrition and Food Technology
University of Chile, Santiago

Claudio R. Romo, Ph.D. - Co-principal Investigator
Professor, Head Technological Division-Foods
Institute of Nutrition and Food Technology
University of Chile, Santiago

C. Catholic University of Valparaiso, Chile

Pablo M. Herrera Larrain, M.D., - Co-principal Investigator
Professor and Head, Department of Food Engineering
Catholic University of Valparaiso, Chile

D. Catholic University of Chile, Talcahuano

Mario Arancibia Valenzuela, B.S. - Co-principal Investigator
Professor of Marine Products Technology and Microbiologist
Catholic University of Chile, Talcahuano, Chile

IV. DURATION OF PROJECT - 3 years initially, with additional 2 years contingent on results of initial phase of program.

V. BUDGET - For 3 year period - U.S.$289,500 plus donation of small drum dryer (For details see Annex B.)

VI. PROJECT PLAN

A. Objectives

1. Develop or perfect marine-based food product
   a. dehydrated fish fillets - C.U. of Chile, Talcahuano
   b. cured or smoked fillets - C.U. of Chile, Talcahuano
   c. Cochayuyo (sea weed product) - C.U. of Chile, Talcahuano
   d. salted fish patties - C.U. Valparaiso
   e. formed, boneless products - C.U. of Valparaiso
   f. fish-cereal combinations - C.U. of Valparaiso
   g. extruded, precooked fish-cereal combinations - U. of Chile
2. Screen candidate products for acceptability, safety and nutritive value.
3. Production and distribution of chosen products for feeding tests using target groups in selected areas.
4. Carry out bio-medical tests (pre- and post-feeding periods) to evaluate effectiveness of intervention program to overcome malnutrition problems.
5. Conduct industry orientation and promotion programs for developed products to encourage commercial exploitation.
6. Encourage public and private agencies sponsoring food intervention programs to use developed products.

B. Background Information

During the year 1976, an IFT fact-finding team toured Latin America with the aim of determining the role of the food technologist in combatting malnutrition. Their findings were to point up which foodstuffs, now neglected

or misused, could be improved or preserved through application of technology so as to be more easily distributed to and used by the segments of the populations most in need.

Their findings indicated that in the several countries visited, a variety of reasons or constraints have tended to stifle the food technologist and his talents. This in turn has led to a reduction in the quality and quantity of foods available to the general public which in turn tended to limit the purchasing power of the poorer class thus leading to an intake of foods of lesser nutritional value by those who most need the nutrients of inexpensive wholesome foods. Latin American countries have had many nutrition intervention programs which have promptly ceased once active supervision is stopped. Again the food technologist has not been involved and the foods being used bear little resemblance to natural dietary items.

In assessing the availability of material sources of protein the team was impressed with the quantity of fish available in the Southern Cone (especially Chile) which, while eaten on the coast, is little utilized in the interior of the countries of this region. The main reason for this lack of application appears to be the development of products which are stable under non-refrigerated conditions and, also which appeal to the target groups. Again, the talents of food technologists have not been employed and only the traditional, artisanal preparations dominate. This historical type of fish and mollusk preservation has led to sanitation and acceptance problems that effectively block new applications through the actions of health authorities. This must be changed before the real value of marine products in country-wide nutrition improvement can be realized.

This negative attitude we intend to change through use of product development and improvement techniques employed by capable food technologists, evaluation of results of dietary programs by medical personnel, and through convincing marketing demonstrations and institutional feeding programs for the poor.

Chile is a country with some 3000 miles of coast line and a rich marine life close inshore. At this time her fisheries, while capable of sustaining a high per capita seafood usage, are not being adequately utilized and thus protein malnutrition exists in the midst of plenty.

Chile has several fine universities with the capability of providing research and development. Pilot plant and laboratory facilities are more than adequate for product development work. Generally, in each institution there is a nucleus of U.S. or Canadian trained professionals.

Malnutrition is a definite problem in Chile, being either protein or calorie deficiencies or a combination of both. In 1970 about 20% of the population of 10 million was classified as living in extreme poverty. In this condition, preschool children (without lunch distribution), pregnant and lactating women are the hardest hit and generally protein is the nutrient most needed. In one hospital of Santiago it was determined that 83.2% of all infants who died over a 4 year period did so as a result of malnourishment. According to the Chilean National Health Service 1975 figures from a 60% sample of the total population, 18% of the children suffered from malnutrition - 4.2% being of the second and third degrees. Unfortunately, with the current economic pinch this figure is on the rise.

No data exist of actual malnutrition among mothers but, from birth weight figures 15% of all children born weigh less than 2500 grams, it must be very significant. Also indicative are the data that 27% of all newborn infants that die do so within 28 days after birth. These are but a few of the details pointing up the conditions existing in the food and nutrition area.

C. Operational Program

The program against malnutrition will originate in three universities cooperating in the project. Each has outstanding features which will contribute to the overall success of the program. Each is expected to act as a unit yet each will function in a team effort to achieve the objectives of the project.

The Catholic University at Talcahuano has been engaged in training artisan fishermen both in the catching and preservation of fish by drying and smoking. Their pilot plant facilities are limited but with the types of products with which they will be working - dried, salted fish, smoked fish and cochayuyo (seaweed) - they are adequate. Their knowledge of artisanal practices, species and quantities of fish available will be especially useful to the project. Too, the types of products produced are well accepted by the population, not only in the local area but also in other parts of Chile, as well as in Brazil and Venezuela.

The geographical area of the test feeding program associated with this sub-project will be the nearby city of Curico. Curico has been well documented, nutritionally speaking, in the past and the bio-medical records are available to us. This area is one of poverty with a critical need for animal protein since, while the surrounding area is basically agricultural, not much in the way of animal products is produced. Thus, fish is an excellent potential supplement for their usual diet.

The Catholic University at Valparaiso has well established pilot plant facilities for product development work. Adequate facilities are available also for the necessary chemical, biochemical and microbiological backup work.

Valparaiso has a Food Technology Department organized in conjunction with the Department of Marine Resources. In combination, its capacity to develop new or improved products from the sea is good to excellent.

Potential products include salted fish patties, formed, deboned fish tissue, fish protein on cereal bases and dried variations of these products. This group will produce a more sophisticated class of products than those of Talcahuano and aimed more at supplying the rural-urban population of their immediate area. With the deboning equipment, they are able to utilize raw material of what might be termed "trash" in the sense that it is not well utilized for human food. The tissue or pulp will be used in the development of two main classes of foods: 1) One stable at ambient temperatures. This property will be possible through the washing of the deboned tissue pulp to remove the oxidation-sensitive fat; and 2) The other prepared from pulp will be a sausage or cured type of product. Tissue used in this manner may be mixed with tissue from red meat animals, thus extending, economically, scarce but much desired red meat products.

The test feeding area will be in the outlying areas of Valparaiso where large concentrations of relocated people from the country have settled and exist in extreme poverty, and thus are severely malnourished.

The third member of the project team is the most complex and is capable of developing not only new food products, but also of evaluating the nutritive value of all products developed by the entire project team. This is the Institute of Nutrition and Food Technology (INTA) of the University of Chile. INTA will develop the most sophisticated of the fish-based products. Products in mind at the moment include those in which fish is combined with cereals in an expended, precooked "snack" type item or in which fish is mixed with pre-gelatinized potato granules and drum dried.

INTA will also organize the nutritional evaluation teams which will do the initial bio-medical surveys of the malnourished in the test areas and also the final evaluations. Computerized programs will be utilized in the final assessment of product performance in the feeding trials.

In the utilization of the developed products we would have the cooperation of government child-care centers in gathering bio-medical information as to the pregnant and lactating women and infants. In addition test groups of pre-school children would be drawn from the Jardines Infantiles or kindergarten organization. These are only two examples from a half dozen or more official feeding programs in Chile aimed at alleviating malnutrition. They are most anxious to cooperate with us where possible.

D. Specific Project Plan

All products developed will be kept minimal in raw material and processing costs, will be easily prepared by consumers, will be very acceptable to consumers, free from health hazards and shall furnish a very significant level of high quality protein. The products will also possess good shelf life, without needing refrigeration or special packaging. Furthermore, the technology of processing and preservation will be as simple as possible and relatively inexpensive. All the latter considerations should insure commercial interest in the products and their use by food intervention agencies.

Market potential and feasibility studies will be carried out in cooperation with food manufacturers and distributors. Towards the end of the project a workshop will be held to aquaint the industry with the program and to stimulate their interest in commercializing the developed products.

It is anticipated that the developed product will also be introduced into the food intervention programs being sponsored by the Chilean Government. Those in charge of such programs will be encouraged to consider using those developed products which have been shown to overcome malnutrition among the target group.