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(279-0052)

YEMEN ARAB REPUBLIC

FACULTY OF AGRICULTURE

SUBPROJECT PAPER

AGENCY FOR INTERNATIONAL DEVELOPMENT

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PREPARED FOR AID BY
CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
Tucson, Arizona
Corvallis, Oregon
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ACRONYMS

ACB	Agricultural Credit Bank
ADO	Agricultural Development Office
ADSP	Agricultural Development Support Program
A/E	Architectural and Engineering
ARDA	Agricultural Research and Development Authority
ASA	Agricultural Sector Assessment
CARS	Central Agricultural Research Service
CBD	Congress Business Daily
CID	Consortium for International Development
CID/Yemen	Consortium for International Development/Yemen Office
COP	Chief of Party
CPO	Central Planning Organization
DLRC	Documentation and Learning Resource Center
EOPS	End-of-Project Status
ESL	English as Second Language
FAPU	Faculty of Agriculture Planning Unit
FAO	Food and Agriculture Organization of the United Nations
FOA	Faculty of Agriculture
FOS	Faculty of Science
FFYP	First Five Year Plan (1976-1981)
HITS	Horticulture Improvement and Training Subproject
IBRD	International Bank for Reconstruction and Development

ISAI	Ibb Secondary Agricultural Institute
LDA	Local Development Authority
LGU	Land Grant University
MAF	Ministry of Agriculture and Fisheries
MOE	Ministry of Education
NES	National Extension Service
NE/TECH/AG	Near East Bureau, Office of Technical Support, Agricultural Development Division
OSU	Oregon State University
PETS	Poultry Extension and Training Subproject
PV	Present Value
RRC	Regional Research Center
SFYP	Second Five Year Plan (1981-1985)
SOW	Scope of Work
SPD/FOA	Subproject Director/Faculty of Agriculture
SPID	Subproject Identification Document
SPP	Subproject Paper
SURDP	Southern Uplands Rural Development Project
TDA	Tihama Development Authority
TDY	Temporary Duty
TL	Team Leader
UNDP	United Nations Development Program
UOS	University of Sanaa
USAID	United States Agency for International Development
USAID/W	United States Agency for International Development/Washington D.C.

USAID/Y	United States Agency for International Development/Yemen Arab Republic
YAR	Yemen Arab Republic
YARG	Yemen Arab Republic Government
YR	Yemeni Rial(s): YR 1.00 = $0.22 YR 4.68 = $1.00

I. SUMMARY

A. Overview

1. Recommendation

Authorization of a grant of $26.6 million to the Yemen Arab Republic Government (YARG) for implementation of the Faculty of Agriculture (FOA) Subproject under the Title XII Agricultural Development Support Program (ADSP). The project will provide technical assistance, training, instructional farm development, and limited commodity support for a new faculty and architectural and engineering (A/E) services for the design and construction supervision of the faculty building.

2. Duration

Eleven (11) years (FY 84 through FY 94).

3. Purpose

To support the establishment within the University of Sanaa (UOS) of Yemen's first FOA which will be responsive to the Yemen Arab Republic's (YAR) agricultural development needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure.

4. Justification

a. Agriculture is the largest sector of the YAR's economy. Traditional agricultural practices prevail and agricultural productivity in real terms is very low. Lack of a trained Yemeni labor force in agriculture and the resulting low labor productivity are major constraints for the agricultural sector.

b. The Agricultural Sector Assessment (ASA) concluded that the highest United States Agency for International Development (USAID) priority in agriculture should be assistance to education, emphasizing (in order of priority) B.S. level and secondary school level agricultural education.

c. The estimated demand for an agriculture labor force in the public and mixed sector and trained to the bachelor degree level is 1,540 persons through 1991 according to the YARG manpower study used in preparing the Second Five Year Plan (SFYP). The most efficient manner of meeting this long-range demand for B.S.-trained agriculturalists is to develop an indigenous FOA at the UOS with Yemeni professors.

d. The United States Government, through USAID, is a world leader in establishing agricultural colleges and universities in developing countries. The Consortium for International Development (CID), the contractor for the Agricultural Development Support Program in Yemen, is composed of 11 U.S. agricultural universities, and has a comparative advantage in the development of an FOA at the UOS.

e. Agricultural production in the YAR is expected to increase when there are strong agricultural research, extension, and education/training institutions which are linked in a supportive triangular arrangement. Such coordination and mutual support depends on the existence of these three institutions in Yemen. One side of this supporting arrangement is missing as long as education at the post-secondary level is being done outside Yemen in numerous countries and institutions. Establishing an FOA in Yemen will provide the higher education side of the triangualar arrangement and will also assist in the coordination with the other two sides through short-term and in-service training and through research by faculty members.

5. Method of Implementation

The proposed FOA Subproject will be implemented as an activity under the ADSP and will be accomplished via three overall contracts. First, a contract amendment will be negotiated to the ADSP contract between USAID and CID for CID to provide technical assistance, commodity procurement, participant training, funds with which to develop the instructional farm, and overall subproject administration (including adequate campus backstopping). Second, USAID will negotiate a contract to provide A/E design and construction supervision services for the faculty buildings and the buildings. Finally, the YARG will negotiate an agreement with another donor (most likely the Saudi Fund) to provide the financial resources with which to construct the faculty buildings. Implementation details are further elaborated in Annexes M and O.

CID will work closely with the U.S. A/E firm in an advisory role as design specifications for buildings are developed. For the instructional farm, CID will develop the layout and design specifications and supervise the construction activities. For the faculty buildings, CID will provide on-campus consultation to the architects and engineers as design specifications are developed.

United States Agency for International Development/Yemen Arab Republic (USAID/Y) will provide general monitoring of the subproject through its Agricultural Development Office, which has broad responsibility for ADSP activities, and its Mission Engineer. In-country CID activities will be coordinated through the CID/Sanaa Office and the Core Subproject. CID has identified Oregon State University (OSU) as the lead university for the design and implementation of this proposed subproject.

6. Life-of-Project Costs

Table 1 summarizes the life-of-project obligations for the FOA Subproject. USAID funding for an 11-year period will be used to train 29 prospective Yemeni faculty members to the Ph.D. level in the United States; establish an instructional farm on the FOA campus as an integral part of the curriculum; provide four professors to fill positions until Yemeni staff complete their training; provide training and advisory assistance for the Yemeni dean, librarian, English as a Second Language (ESL)/technical agricultural specialist, and instructional farm manager; purchase limited laboratory equipment; design the classroom/office building; and supervise construction of the same.

YARG is providing the land, Yemeni staff and salaries, and operating costs. YARG is seeking loan financing from another Arab country for construction of the classroom/office buildings.

7. Exchange Rate (10/83)

$1.00 = Yemeni Rials (YR) 4.687 YR 1.00 = $0.213

8. Environmental Recommendation

A negative determination was approved on July 8, 1983 (see Annex C).

B. Subproject Identification Document (SPID) and Other Design Issues

The major issue in the design and development of the subproject has been the YARG's ability to locate financial resources with which to construct a faculty building and to assume the increasing recurrent costs inherent in an institution-building process such as this subproject represents. Both of these questions were discussed at length in a recent meeting by representatives of the Central Planning Organization (CPO), UOS officials, representatives of the Ministry of Agriculture and Fisheries (MAF) and Ministry of Education (MOE), USAID/Y administrators, CID/Yemen, and members of the Subproject Paper (SPP) Team. At the November 1983 meeting, CPO administrators announced that funds for construction of the faculty building ($23.1 million) now appear to be assured by the Saudi Fund, thus removing the major barrier to implementation of this subproject. (See letter from Anwar Rizq Al-Harazi and Fathi Salem Ali dated January 7, 1984, Annex D).

TABLE 1

ILLUSTRATIVE LIFE OF SUBPROJECT OBLIGATIONS (FY 84-94)

COMPONENT	USAID GRANT	YARG	OTHER DONOR PARALLEL FUNDING	ESTIMATED TOTAL
Land	-	12,400	-	12,400
Technical Assistance (Personnel)	8,063	7,964	-	16,027
Training	5,914	-	-	5,914
Instructional Farm	1,947	-	-	1,947
Classroom/Office Buildings				
Design & Construction Supervision	1,703	-	-	1,703
Construction	-	-	22,000	22,000
Commodity Support	1,467	-	-	1,467
Other Direct Costs	1,800	2,708	-	4,508
Contingency and Inflation	5,754	8,500	1,100	15,354
TOTALS	26,648	31,571	23,100	81,318

The question of the assumption of recurrent costs of the FOA is more difficult to assess at this point, but is brought to realistic conclusions in Annex H. For instance, given the UOS' record during a decade of rapid institutional growth, it is realistic to assume it will sustain the FOA's budgetary needs through the subproject implementation phase and beyond.

The United States Agency for International Development/Washington D.C. (USAID/W) review of the SPID was summarized in the U.S. State Department cable #22024, July 20, 1983, (see Annex A). A number of issues were raised in the telex that required additional analysis in the SPP. The SPP design team has addressed each of the issues by stating the issue verbatum from the cable, and indicating how the team responsded in developing the SPP:

1. Past Experiences and Lessons Learned

A summary of key lessons learned from past experiences and the sections of the SPP in which past experiences were considered are shown in Table 2.

2. Role of Women

Issue: Serious thought must be given to attracting and hiring women into the project at an early date. This is especially true since a large number of Yemeni men have left agriculture to seek higher incomes in Saudi Arabia and the Gulf States and women have taken their places on the farm. The curriculum that is to be designed for the faculty should encourage women to enroll from the onset, in courses that will accelerate their study of the agricultural sciences. This is particularly relevant since women, at this time, comprise almost a majority of the students at the UOS. In addition, there does not appear to be any reason why specific courses designed for women in home economics and nutrition could not also be included. These issues should be considered in the social analysis section of the SPP.

Response: The social soundness analysis in the SPP (Annex F) answers the issues on roles of women in the FOA, both as students and as faculty. The proposed general agriculture curriculum has been developed in harmony with the social soundness analysis and found to be appropriate for both women and men. Strategies for attracting women into the FOA are integrated into the social soundness analysis. Annex E (Table E-11) shows the enrollment level of women at the UOS to be 12 percent.

A detailed analysis of women's roles in the proposed FOA is found in Annex F of the SPP.

3. Backward and Forward Linkages

Issue: The role of the FOA in the whole agricultural sector must be delineated in more detail. Following are typical questions which the SPP should address. What is the relationship of the FOA with the MAF? What is the relationship with the private sector? What linkages exist at this time

TABLE 2
Applications of Lessons Learned to SPP Development

Lesson Learned in Past Projectst	Application in SPP
Establish strong institutional linkages.	Institutional Analysis (Annex E).
Identify government commitment to project.	Institutional Analysis (Annex E).
Design project to further development plan of government.	Section II-C, Relationship to YARG Development Strategy.
Establish clear lines of authority and relationships between project participants and sponsors.	Summary I A-5 and Section III, Implementation Arrangements.
Select a politically strong and technically competent counterpart agency.	Institutional Analysis (Annex E).
Determine availability and experience of local personnel.	Technical Analysis (Section IV-A).
Compensate for potential problems that result from bureaucratic process of host government.	Social Soundness Analysis (Annex F), Technical Analysis (Annex E), Economic Analysis (Annex G), and Detailed Financial Plan (Annex I).
Determine financial viability of target institution.	Institutional Analysis (Annex E).
Design project for the adverse impacts of inflation.	Detailed Financial Plan (Annex I).
Specify compatible project staffing levels.	Annex E and Budget Analysis (Annex I).
Specify realistic project staffing levels.	Technical Analysis (Annex E).
Provide for indigenization of the institution.	Technical Analysis (Annex E).
Anticipate potential management of the institution.	Institutional Analysis (Annex E).
Avoid over-identification of the institution with the U.S.	Social Soundness Analysis (Annex F), Implementation Arrangements, Section V.

between other faculties at the university? What administrative regulations permit coordination among these various faculties? What are the linkages that exist between the faculty and the secondary schools?

Response: Linkages have been explored extensively by the SPP team because of their importance in accomplishing the objective of the FOA. The team met on numerous occasions with policy setting personnel of the MOE, MAF, and UOS, USAID/Yemen, CID/Yemen, agricultural secondary schools, regular secondary schools, Sanaa Livestock School, regional development associations, international donor funded research and demonstration projects, and existing extension organizations. The most significant observation from these meetings was that linkages have already been established and are evolving in an orderly fashion. These linkages are presented diagramatically and discussed in Annex E (Figures E-4, E-5, E-6, and E-7).

4. Adequate Supply of Agricultural Students

Issue: This area must be looked at closely, since there are only three secondary agricultural schools which will serve as the principal source of supply of students. Other established and proposed faculties within the university system will compete for the limited number of students graduating from these, as well as from the other secondary schools. The SPP might consider a summer school program and/or the provision of a fifth year as methods to bring in secondary students who might not otherwise qualify for admission to the faculty.

Response: The SPP team visited the three agricultural schools and six science option secondary schools. An interest survey was conducted on a sample of boys' and girls' classes. This survey is summarized in the social soundness analysis (Section IV-B). The majority of potential FOA students will come from the secondary schools. University administrators estimate that 80 percent of FOA students will come from the science option secondary schools and 20 percent will come from the three agricultural secondary schools. Based on school visitations, oral interviews and sampling of career interests by the SPP team, we believe that an adequate supply of students will be available to the FOA. The general consensus of secondary administrators is that there will be far more students than available training slots in the new FOA. A detailed analysis of the sources of students is in Annex F.

5. Participant Training

Issue: The SPID provides for long-term training for 15 faculty members. This number appears to be insufficient when viewed from actual situations such as drop-outs, non-returnees, and those who will take other jobs when they do return. This number also appears to be rather thin when considering the teaching, research, and extension roles which the faculty will be called upon to perform. The SPP design team should reexamine the actual number of participants which the project should train.

Response: The SPP team has conducted lengthy discussions with UOS officials and prepared a detailed analysis of the staffing needs of the FOA. The number of Yemeni to be involved in long-term training has been increased from 15 to 29. This number is based on the requirements of the curriculum, current retention rates for participants and on the extension and research responsibilities of the faculty members. The specific staffing and training plans for the FOA are included in Annex E. Recommendations for the involvement of women as participant trainees are found in Annex F.

6. Curriculum Development

Issue: The Near East Advisory Council (NEAC) was concerned that many of the proposed courses for the FOA in the natural and biological sciences are also taught in other faculties of the UOS. Is there a need for duplication? Concurrently, if it is determined that these other faculties are willing to provide instruction in these courses, then the SPP must address the issues of whether they can support the FOA curriculum at the level being proposed. In view of the issues outlined in #4 above concerning an adequate supply of students, it is of utmost importance that the design of the SPP provides for elimination of as much duplication as possible. Concern was also indicated at the NEAC as to the type of training that the faculty would offer. For example, is provision being contemplated for other than traditional B.A./B.S. degree training in agriculture, such as non-formal short courses, in-service training, extension/demonstration activities, etc.?

Response: The SPP team members have worked closely with the Faculty of Science (FOS) in the development of the core science block for first-year students. The Faculty of Science teaches science classes for other faculties in the UOS. The Dean of the Faculty of Science is committed to providing staff to teach science courses in the FOA. Once the FOA building is completed, university professors will come to the science labs in the FOA to teach the FOA students. This issue is clarified and strengthened in Annex E of the SPP. The FOS will continue to provide instruction for FOA first-year students throughout this subproject.

The FOA will place a strong emphasis on research and extension. As part of the extension activities, a wide range of short courses, demonstrations, in-service activities, and adult education classes will be centered in the classroom, laboratories, and instructional farm of the FOA. Further explanation of short-term non-degree instruction is found in Appendix E.

7. Evaluation

Issue: The framework for data collection, as well as a more detailed evaluation budget, must be developed in the SPP. The data collection strategy should not, however, as is stipulated in the SPID, be defined by the technicians provided under the project. Data collection and evaluation should stand alone as distinct components of the project and be closely integrated into the implementation plan.

Response: The evaluation plan has been expanded in Section V of the SPP. An attempt has been made to define more clearly the frameworks for evaluation, data collection methods, and analysis of collected data.

8. Administrative Operations

Issue: Questions were raised during the NEAC review as to who would carry out administrative functions related to the FOA. Will these functions be the responsibility of the FOA, or will they be conducted by the central university administration? How will they be financed? Issues in the administrative area should be adequately covered in the SPP by a public administrative specialist. Public administration skills should be included on the design team, even if it requires an additional team member.

Response: A public administration specialist has examined the administrative structure and linkages in depth. Annex E has sections devoted to the clarification of this issue. The organization of the evolving UOS and the proposed FOA are similar to those which have proven effective in the U.S. Land Grant Universities (LGU). The division of administrative responsibilities between the two entities seems logical and consistent with the capabilities of each.

9. YARG's Contribution to Project Activities

Issue: The NEAC realized that YARG is now facing budgetary constraints of some magnitude. Nevertheless, the USAID/Y should be sure that YARG understands fully what costs it will have to provide on a continuing basis when this project becomes operational.

Response: The SPP team members have discussed this issue with a wide range of YARG officials, USAID/Y, staff and UOS administrators. This issue has been addressed in many sections of the SPP. Special emphasis has been given to recurrent costs in Section IV.C. of the SPP.

In summary, all respondents believe that strengthing the capability of the secondary and higher education systems in the YAR (an objective of the SFYP) will be honored in substance as well as in principle. Budgetary allocations for the MOE and the UOS generally kept pace with planned expenditures implied by the First Five Year Plan (FFYP) (1976-1981) and in the first year (1982) of the SFYP. This generally optimistic picture is drawn from experience only through 1982 and information provided by YARG officials in mid-level positions in the MOE, MAF, and UOS.

Recent analysis by the World Bank concerning the public finance and public expenditure situation in the YAR indicates a potential for significant budgetary deficits. Stabilized remittance incomes, inability to collect all of the import duties now authorized, emergency expenditures (military, earthquake relief, etc.), the inability to replace expatriate

professionals in the educational system who remit salaries abroad, etc., all threaten the ability of YARG to fulfill the objectives of the SFYP.

The UOS has an advantage in the allocation issue in that it receives significant capital and operating funds from other donors (principally the Kuwait Fund) which must be matched (in principle, not contractually) by YARG. Rather than risk this stipend, the SPP team believes YARG will effectively allocate funds necessary for the continued comprehensive development of its national university, including the new FOA.

II. BACKGROUND AND SETTING

A. Background

The YAR has attempted to meet some of its needs for trained agricultural personnel through foreign technicians either employed directly by YARG or provided through donor assistance. The next step in the development of Yemen's agricultural institutions is the training of Yemeni technicians who can replace the foreign personnel and fill the even greater number of vital positions that have never been staffed. Ever larger numbers of Yemeni go abroad each year for bachelor degree training in agriculture. There are disadvantages in the present system in terms of overall costs, loss of foreign exchange, relevance of training, and return and retention of personnel. It is a natural and appropriate evolution to move towards development of an in-country agricultural training facility at the B.S. degree level.

The YARG believes that an FOA at the UOS should be developed to fill the gap of trained personnel in agriculture. During the past 2 years, the YAR has initiated comprehensive studies which would provide guidance concerning the appropriate type of facility and how the faculty should be organized. The YARG has requested USAID assistance in the process of planning and implementing an FOA, and USAID has indicated a willingness to participate.

YARG issued Republican Decree No. 51 establishing the FOA on July 26, 1982 (see Annex D). It is important for the development of Yemen's agricultural potential that the FOA begin operation as soon as possible. Delays will increase the cost of construction, increase the cost of training Yemeni abroad, and decrease the rate of development in the agricultural sector.

B. Trained Manpower as a Constraint to Development

The need for appropriately trained indigenous manpower is apparent, as documented by YARG and donor studies. The draft SFYP of the YARG states:

> "Among the most crucial problems which hindered the implementation of the nation's Three Year Plan, then its First Five Year Plan, was the critical scarcity of technical and specialized skills, and the acute shortage of administrative and professional capabilities. This has caused dependencies on foreign skills. . . for the implementation of development projects and has resulted in (cost overruns) and in underutilization of capacities. . . . A priority is reducing the country's reliance on non-Yemeni personnel." 1/

A recent World Bank report echoes this concern:

> "Inadequate supply of technical level cadre has actually been the most serious bottleneck to the implementation of the (development program) and stands to be even more serious in the SFYP." 2/

The recent USAID ASA verifies the impact of the shortage of university-trained administrators and professionals, and proposes that top priority be assigned to B.S. level education.

The problem is illustrated by the demand in donor projects for educated Yemeni counterparts to serve in line positions and as candidates for graduate education. Competition among donors for scarce Yemeni talent is high. For example, the recently proposed World Bank Agricultural Research and Development Authority Project (ARDA) has a requirement for 44 senior scientists at technical and administrative levels, 49 junior scientists, and 12[illegible] technical and administrative staff. While the World Bank is to provide graduate education for senior scientists, no baccalaureate or technical school education is planned. 3/ This situation is representative of the real dimensions of a very difficult problem.

The YARG believes that external training of Yemeni students and importation of expatriate technicians is but a temporary solution, and, as such, is insufficient and undesirable to continue. In the long-term, the YARG believes that establishment of an FOA at the UOS is the appropriate solution to one aspect of its manpower dilemma. YARG has, therefore, requested USAID and other donor support in this endeavor. The USAID ASA strongly encouraged this decision by the YARG, and proposed that:

> "While some of the necessary B.S. level education can be provided by training abroad, there is clearly a priority need for continuing agricultural education at the university level in Yemen that merits USAID attention." 4/

C. Relationship to Development Strategy

1. Conformance to YARG Development Strategy

During the implementation of the YARG's FFYP from 1976/1977 through 1980/1981, the agricultural sector's average annual growth rate was less than 2 percent. The stagnation was due to several factors: lack of trained manpower, lack of irrigation, emigration of farm labor, product marketing, storage and distribution problems, and insufficient public support to the sector. During this period, due largely to absorptive capacity constraints caused by the lack of trained human resources, only 38 percent of the investment projects planned for the agricultural sector were carried out. In the education sector, significant expansion of education opportunity occurred with a total of all pre-university enrollments rising from 276,000 in 1976 to 453,000 in 1981; university enrollment increased from 2,300 to 4,200 during the same period.

Given the regional comparative advantages Yemen has for rain-fed and irrigated agriculture and the diversified employment opportunities available in Yemen in the last 8 years, it is clear to YARG planners that increased productivity of labor in agriculture is requisite for economic growth. Transfer of technology, an improved human resource base and

responsible public institutions of research, extension, and credit receive high priority in the YARG's SFYP (SFYP, 1982/1986) for agricultural development. The CPO, UOS, MAF, and MOE have agreed that creation of a university FOA, using a generalized U.S. land-grant model, is the best means to transfer technology, train technicians, and strengthen research and extension. Establishment of the FOA during the SFYP is one of the YARG's highest priorities. The Minister of Development, Minister of Agriculture and Fisheries, and the Prime Minister have strongly emphasized this priority in their discussions with USAID and other potential donors.

2. Relationship to USAID/CID Development Strategy

USAID strategy in the YAR since 1978 has concentrated primarily on expanding the YAR's human capital, institution-building and technology transfer. The primary sectoral emphasis for these themes is agriculture and education. An extreme shortage of mid-upper level Yemeni technicians, managers, and researchers has retarded project/program implementation, hampered achievement of project goals, and, consequently, led to extension of project time frames and cost overruns. The YARG and other donors are equally aware of this manpower shortage. Institution building in Yemen requires both in-country primary and secondary education as well as technical and scientific education to produce the men and women who will be the catalysts, planners, and managers for the development process.

USAID assistance to establish an FOA at the UOS is a major element in both human resources and institutional development in Yemen. It complements other USAID projects which assist primary and secondary education, institution building in the MAF, horticultural and poultry development activities, and rural development projects. It also complements other donor projects which seek to expand the UOS during the SFYP through creation of Faculties of Engineering and Medicine and improving existing Faculties of Education and Science.

3. Relationship to the Agricultural Sector Assessment

The ASA recommended four strategy components for the USAID agricultural assistance program in the YAR. Listed in order of priority, they are:

a. Assistance to education emphasizing first B.S. level and then secondary school level agricultural education;

b. Assistance to expanding the institutional capability of the MAF to provide services to private farmers;

c. Assistance to increase the capability of the MAF to undertake improvements which would increase the effective utilization of water supplies for irrigation; and

d. Assistance to promote private sector development.

Education is the highest priority because the major impediment to successful development activities is the lack of an effectively functioning work force in the public and private sectors. The top priority must be assigned to B.S.-level education for those who will provide education and training services to others in the agricultural sector. Agricultural education at the B.S.-level has the potential of producing graduates who cannot only educate and train others, but also provide the necessary administrative and management skills needed for the successful operation of schools or training institutions such as an extension service. It is these graduates who are needed to staff the scientific, technical, and administrative upper levels in public and private institutions and organizations, including the MAF. B.S. level personnel are also desperately needed to direct and implement development projects and provide suitable candidates for advanced degrees.

4. Relationship to the ADSP (279-0052).

A key objective of USAID/Yemen's development assistance program in the YAR is institutional development through human resource education and training. In the agricultural sector, this objective is being achieved by implementation of the ADSP under a long-term Title XII arrangement with the Consortium for International Development (CID). ADSP is a sector-wide program conducted in a collaborative mode which identifies, designs, and implements several subprojects in priority areas. The goal of the ADSP is to increase income and improve the quality of life of rural inhabitants. The purpose is to improve the capacity of the YARG and Yemen's agricultural producers to develop and sustain an agricultural sector which effectively and efficiently uses Yemeni natural resources, is integrated into the economy, and is supportive of broad based and equitable social and economic development. The thrust of the program and all of its subprojects is to support the establishment in the YARG of a strong institutional base that will facilitate accelerated agricultural development.

There are currently four ADSP subprojects in progress.

*Core
*Horticulture Improvement and Training (HITS)
*Poultry Extension and Training (PETS)
*Ibb Secondary Agricultural Institute (ISAI)

The Core Subproject is responsible for providing technical assistance and training to the central administration of the MAF in planning, policy analysis, design, implementation and evaluation of national agricultural development efforts. Core is also responsible for coordinating with the YARG in the development of additional subprojects and providing broad administrative and logistical support for their implementation.

The HITS and the Poultry Extension and Training Subprojects are expected to provide the MAF with an institutional capacity to support

increasing fruit and poultry production and protection services for rural producers through education, extension, and training.

The ISAI Subproject supports the education and training of mid-level agricultural technicians who will enter into public or private sector services, or who are eligible for university training in the agricultural sciences. This cadre will form an essential element that will contribute to agricultural development efforts in the YAR.

The proposed FOA Subproject will contribute directly to a major, end-of-project status (EOPS) of elements of the ADSP, namely "an agricultural education system identifying small farmer and rural population needs and capabilities, and providing responsive education and training. . .in technology, economics, and administrative skills."

The FOA Subproject will support and complement the MAF's program and other subprojects in the ADSP by:

a. Producing graduates who will serve as managers and counterparts in the MAF and donor-sponsored projects and as candidates for participant training programs for graduate level study;

b. Producing candidates for M.S. level training who will serve in a teacher or training capacity (multiplier effect) in agricultural, technical, and vocational schools and in MAF/donor-sponsored development projects;

c. Strengthening research on priority agricultural and rural development issues, including those being addressed by ADSP subprojects;

d. Supporting those agencies that are active in developing and extending technology to private producers and cooperatives, including technology being developed in ADSP subprojects;

e. Supporting growing needs for well-trained technical manpower in the private sector; and,

f. Facilitating improved extension and demonstration linkages to local farmers and improved cultural practices on the instructional farm which will support activities of other USAID, MAF, and other donor projects.

5. The Agricultural Education Subsector

Another donor will provide funds for FOA building construction. USAID is the only donor considering providing technical assistance/training for the FOA.

As noted in a recent study:

"There are few opportunities to receive any education in agricultural subjects in the YAR. No agriculture is taught in the primary or regular secondary schools; nor is there an agricultural college at the university. There are only three technical agricultural schools within the YAR school system: The ISAI, the Surdud Secondary Agricultural School, and the Sanaa Veterinary Secondary School." 5/

The ISAI is a 3-year school (grades 10, 11, 12) with a functional capacity of 60 students per year and an actual enrollment of 52 students in its first (1982) graduating class. It is in its fourth year of technical training for agricultural extension agents and technicians. More academically oriented graduates can also pursue university level agricultural studies.

The Surdud Secondary Agricultural School, modeled after the Ibb School, enrolled its first students in 1982 with financing from the International Bank for Reconstruction and Development (IBRD). Like Ibb, Surdud trains agricultural extension agents and technicians. It has a functional capacity of about 50 students per year.

The Sanaa Veterinary Secondary School, also financed by IBRD, initiated operations in 1982. It too has a functional capacity of about 50 students per year for a total of 150 students. The program emphasizes animal production and health courses. Graduates are projected to serve as animal husbandry/veterinary technicians.

In addition to long-term formal education, short-term training of 1 year or less is provided under various donor projects in extension, plant and animal production and protection, animal health, and agricultural modernization. They include the USAID-funded subprojects in the ADSP, the Southern Uplands Rural Development Project (SURDP), and the Tihama Development Authority (TDA) Project. These last two projects have trained between 250 and 280 agricultural extension agents since 1974. British sponsored projects have provided extension training in animal health and mechanics, producing about 180 trained Yemenis in the past 7 years. The British Agricultural Mechanics Training Project provided 2-week to 4-week courses for extension agents and rural mechanics. Generally, these donor projects provide training courses, but do not leave in place a permanent Yemeni capacity for skilled or semi-professional training.

III. DETAILED PROJECT DESCRIPTION

A. Purpose and Summary Components

The FOA is being proposed as a subproject of the ADSP (279-0052). The broad goal of the ADSP is "to increase rural incomes in the YAR through agricultural development." Each subproject contributes to the realization of this goal by supporting a more specific subgoal. The subgoal of the FOA Subproject is:

> "To increase the supply of appropriately trained manpower to plan, manage, implement and evaluate development activities in the private and public agricultural sector of the YAR."

Achieving the purpose of the FOA subproject is expected to have a significant impact on the above mentioned subgoal. The purpose of the FOA Subproject is:

> "To support the establishment within the UOS of Yemen's first FOA which will be responsive to the YAR's agricultural development needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure."

This purpose statement reflects the objectives of the FOA as jointly defined by the UOS, the MAF, and the MOE, and recommended by three donor agency studies.

The proposed subproject is expected to continue for 11 years, beginning in FY 1984. There are five major EOPS elements which should exist by FY 1994, the end of USAID's proposed contribution to the FOA. These are:

1. A functional, indigenous FOA, within the UOS, engaged in teaching and applied research and assisting MAF extension activities;

2. Approximately 200 students educated and graduated at the baccalaureate level and assuming responsible technical and management positions in the public and private agricultural sector; and an established capability to produce 80 to 120 graduates per year;

3. Continuing collaboration between the FOA, the MAF, the MOE, private agencies, and agricultural producers on:

   a. Research and research priorities;

   b. Extension;

   c. Curriculum development for 2-year and baccalaureate level programs;

d. Agricultural and technical secondary school training;

e. Other formal agricultural training programs (workshops, seminars, etc.); and

f. In-service training;

4. An operational instructional farm that is integrated into the curriculum, extension, and research functions of the FOA; and

5. A productive and ongoing relationship between the FOA and one or more U.S. agricultural university faculties of agriculture.

This subproject is clearly institution building by design, and has as a by-product of this focus the graduation of students educated in agricultural sciences. The primary concern is to institutionalize within the YAR a capacity to produce trained agricultural manpower at the B.S. level. Graduates constitute the major, but not the sole, raison d'etre for the FOA.

B. Broad Elements of the Development of the FOA

Table 3 summarizes the broad elements of the overall development of the FOA. It is proposed that USAID support to the FOA be provided in two major activities: (1) technical assistance, participant training, instructional farm development and building construction, limited classroom and laboratory materials and equipment, and library reference materials, and (2) architectural design services for the FOA, classrooms, library, laboratories, and office buildings, as well as engineering supervision of the construction process.

The faculty building construction, as outlined in Annex K, will be funded by other donors. The cost estimates reported in Annex I (Table I-1) include construction costs and room furnishings.

The YARG will provide land for the faculty building and the instructional farm, and will finance the local faculty and staff. Through the duration of the subproject, the YARG will gradually assume an increasing share of the recurring costs for the operation of the instructional farm as shown in Annex I (Table I-6).

TABLE 3

BROAD ELEMENTS OF THE DEVELOPMENT OF

THE FACULTY OF AGRICULTURE [1/]

AID SUBPROJECT		PARALLEL FINANCING OF OTHER DONORS	YARG
Institutional Development (Technical Assistance/Training)	Architectural and Engineering Services for the FOA Building		
1. Pre-Authorization Mobilization Activities in Training and Farm Development	1. Preliminary FOA Building Design (including classroom, library, labs, offices) a. Prefeasibility Study b. Program of Requirements c. Site Inventory d. Schematic Design		1. Pre-Subproject Planning Activities 2. Land for FOA and Farm
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2. U.S. Technical Assistance 3. Participant Training 4. Instructional Farm Development and Building Construction 5. Instructional Greenhouse and Laboratory Development 6. Library Reference Materials	2. Final Design of FOA Buildings 3. Engineering Supervision of Construction Phase	1. Construction of all FOA Buildings, except the Instructional Farm Buildings 2. Furnishings for Above	3. Local Faculty and Staff 4. Operating Expenses (including utilities, local transportation, maintenance, repair, etc. 5. Equipment Replacement

[1/] Dashed line separates mobilization and implementation phases.

IV. PROJECT ANALYSIS

A. Technical Analysis

1. Manpower Assessment

Annex H contains a detailed discussion of the issues concerning professional and paraprofessional personnel in YAR generally and in the agricultural sector specifically. The discussion here focuses largely on professional personnel issues. In the sense that trained (e.g., secondary school level) agriculturalists are candidates for university training at the FOA, these issues are discussed in the social soundness analysis. There is an important "requirements and training" issue regarding skilled or trained (sub-B.S. level) agriculturalists, but that is believed to be outside the scope of this SPP.

a. Requirements for B.S. level Agriculturalists and Economic Demand: The agricultural sector of the YAR needs the services and capability of a fully functional MAF staffed with university-trained personnel, preferably Yemeni nationals. Without a professional staff trained to (at least) the B.S. degree level in general agriculture or a specialized agricultural discipline, combined with managerial training as appropriate, the fully effective functioning of this agency may not be achievable. Projections of professional level manpower needs in MAF have been prepared as a consequence of the FFYP and SFYP. These needs are more related to filling technical requirements of donor-assisted projects (which call for Yemeni counterparts) than to strengthening the current on-line functioning capability of MAF. In this context, the requirement estimates are justified. MAF probably needs 300 B.S. level graduates just to fulfill the needs of the FFYP which ended in December 1981. By 1986 (end of SFYP), there is a stated need for 600 more graduates. To place these projections in perspective, there are (in November 1983) about 200 B.S. level (or higher) professionals in MAF (or affiliated with MAF) of whom no more than 50 are Yemeni nationals.

Although there is no questioning of need in general, it is necessary to examine the economic and other forces which have operated on the "needs fulfillment" process at the MAF. This is necessary because MAF has been coordinating a training program (with donor assistance) since 1974 aimed at supplying a stream of B.S. level cadre to its ranks. For the number of graduates presumed to emerge from these programs in the first 3 "end of pipeline" years, the apparent retention rate (15 percent) has been disappointing. In Annex H, reasons for this low retention rate are explored. There is reason to believe that economic incentives are only partially

involved. Other reasons, such as the lack of a defined career structure at MAF, for example, could be very important. The SPP team was unable to gain much comprehensive, quantitative information about response of B.S. level graduates to general economic incentives (and in agriculture, specifically). Private sector opportunities are abundant in commerce and (to a lesser extent) industry. Monthly salary differentials are striking, perhaps 50 to 100 percent greater in commercial firms than in MAF positions. These differentials must be balanced against employment perquisites, not the least of which is greater job security in the YAR Civil Service. Although the redirection of B.S. level agriculturalists into the private sector is to some extent unavoidable, the redirection of specialists to other ministries should be the cause of some concern since some professionals in this category are willingly accepting salary decreases in order to so do.

The potential for new B.S. level agriculturalists to join private sector agribusiness appears to be limited at least in the near term. The (very) small scale of farming operations now in existence and the improbability for the establishment of large farms lies at the heart of this observation. Exceptions exist in some poultry enterprises, the few horticultural operations and perhaps food processing/food marketing firms. Firms which supply inputs to agriculture are reported to have not gained enough size or experience to warrant the hiring of technical staff as is common in the United States.

b. Supply or Professional and Paraprofessional Workers for the Agricultural Sector: Economic and Other Determinants of Career Choice: One objective of the (professional) manpower assessment was to determine the responsiveness of educated Yemeni to economic incentives and other non-pecuniary rewards (or disincentives) in the matter of career choice. Although the SPP lacked the time and resources to conduct any thorough investigation, the observations of several interviewees in MAF, UOS, and the mixed public sector and private sector in agriculture led to some initial conclusions about the supply of professional and paraprofessional workers in agriculture. Individuals at these training/ability levels appear to be significantly responsive to economic incentives. This is especially true in commerce where it is observed, for example, that many students at UOS secure part-time employment in business firms for the sake of gaining experience and immediate income. As a result, B.S. level programs in the Faculty of Commerce have sometimes been stretched out to seven or more years. In the MAF, for instance, it is not uncommon to encounter career

professionals who have opted for training in agriculture simply due to scholarship availability.

This is not to suggest, however, that non-pecuniary factors are unimportant in career choice. Agriculture is perceived by most respondents as being important to Yemen. Agriculture is also perceived as an area where foreign donors are involved, an incentive for those making a career choice since opportunities for advanced level training abroad are likely to exist in such situations. Perceptions about disincentives involved in a professional career in agriculture, especially in MAF, do exist among professional staff in YARG ministries. As mentioned above (career structure, job satisfaction, etc.), these factors do affect professional recruitment, especially in MAF. How much these factors affect the supply of graduates for MAF can only be guessed at. Indications are that there is a considerable exchange of such information among agriculture students (even those studying abroad) about the advantages of certain kinds of jobs in YAR, and especially MAF. In spite of faint signs of dissatisfaction with careers at MAF, no respondent would agree with the statement that MAF was viewed as the last resort for employment. Perceptions of agriculture as a professional career by secondary school graduates are probably not well formulated by students at that stage. However, observations by instructors at ISAI were that it is difficult fo dislodge a negative stigma concerning work in practical aspects of agriculture. Early indications are that most of these students who are on an "agriculture track" at the secondary school level will opt for B.S. level training.

c. Conclusions: There is a justifiable need for training B.S. level agriculturalists for service in YAR generally and MAF in particular. The number of Yemeni in professional level positions at MAF, related ministries, and the mixed public sector and private enterprise firms is markedly low. There appear to be no serious obstacles to supplying B.S. level agriculturalists to YAR and to MAF in particular. The economic incentives are no less attractive in MAF than in other ministries. The need for graduates in purely agricultural jobs in the mixed public sector and private enterprise firms is observed to be limited at the present time. There appears to be a good match between needs and potential supply from the point of view of the viability of the FOA. However, there is a need to continue to to monitor the process of "needs fulfillment" in relevant agencies and firms concerning professional and paraprofessional agriculturalists in YAR. The FOA Subproject should include ongoing evaluation of how well the MAF, related agencies, and mixed public sector and private enterprise recruit, develop

career structures for, manage, and most important, retain their incoming professional and paraprofessional personnel.

2. The Project

The YAR opened its doors to the outside world in the early 1970's. Increasingly, the villages are looking to the government for access to public goods in return for taxes. 6/ The YAR has undergone profound and fundamental political, economic, and social changes which established the foundations of a modern state during the 1970's. Key economic factors have been the massive outflow of labor to neighboring oil producing countries, remittances which have triggered significant private investment back into the predominantly agrarian economy, increased demand for food and consumer goods, massive inflows of donor aid, weak absorptive capacity, and limited central government planning activities. 7/, 8/

Ninety percent of the YAR's population lives in rural areas and has traditionally been involved in some aspect of agricultural production. Labor outmigration has placed severe stress upon maintaining agricultural production. Shortage of skilled manpower is an overriding constraint to development as skilled manpower is drawn from a labor pool with very limited education and no modern agricultural training. 9/

The foundations of the country's physical and social infrastructure were laid by the YARG's First Three Year Development Program in 1973-76 and the First Five Year Plan (FFYP) in 1976-81. Both plans placed primary emphasis upon (1) building institutions for agricultural and rural development and (2) building a public school system which provides free country-wide primary and secondary education.

No agricultural institutions existed prior to 1970. The MAF was organized in 1970. Agricultural research independent of MAF was initiated in 1973 with the establishment of a Central Agricultural Research Service (CARS) in Taiz in the Southern Uplands region with support from the United Nations Development Program (UNDP)/Food and Agriculture Organization of the United Nations (FAO). Research continued to expand with an increasing number of commodity-oriented bilateral assistance projects. All research projects to date have been conducted independently with little regard to overall coordination. The National Extension Service (NES) was added to MAF during the FFYP. It has operated almost entirely on a regional basis. The extension agents in regional and central MAF offices are funded by the MAF. Agents working out of regional development offices care funded by outside donors.

Plans have been developed, but not yet approved, to reorganize the MAF research activities as outlined by a World Bank loan proposal. The plan calls for all agricultural research in YARG to be supervised and coordinated by an ARDA, with establishment of ARDA Headquarters and the Central Highland Regional Research Center (RRC) in the Dhamar area, the Tropical Lowland RRC in Surdud, and the Southern Uplands RRC at the CARS site in Taiz. The ARDA plan, if implemented, is expected to provide national

coordination for all agricultural research and research sites for each of YAR's three major ecological zones.

There are limited opportunities to receive training in agricultural subjects in the YAR. No agriculture is taught in the primary schools nor the regular secondary schools. There are only three secondary agricultural technical schools in the YAR. Each provides 3 years formal technical training beyond the ninth grade, culminating in a technical school diploma (see Section IV.B. and Annex F). All secondary schools are administered by the MOE. The agricultural secondary schools are to supply the technical level manpower needs of the country, including NES (see Annex F for details). The agricultural secondary schools are also a potential source of students for the FOA (see Section IV.B.3 and Annex F). Short-term in-service agricultural technical training is being provided by various donor sponsored projects, including CARS, the British Veterinary Services Project, the British Agricultural Engineering Project, and USAID's horticulture and poultry projects.

There is one university in the YAR, the UOS, and it contains seven faculties: Arts, Law, Education, Science, Commerce and Economics, Medicine, and Engineering. Veterinary Medicine, Agriculture, Dentistry, and Pharmacy are planned. A priority goal for the FOA is to train agricultural B.S. graduates to:

*Staff the MOE and MAF in technical, professional, and administrative roles;

*Staff some 56 on-going donor supported agricultural and rural development projects;

*Provide personnel for the emerging agri-business sector;

*Collaborate in the development and staffing of a national agricultural extension service; and

*Provide technical expertise for numerous local development authorities (LDA).

In addition to the training of B.S. graduates, the FOA will be an integral component of the YAR agricultural research capability and will be involved in the training and upgrading of agricultural personnel in the NES and regional and LDA. These relationships (linkages) are outlined and defined in Annex E.

a. Faculty Development

(1) Technical Support: An integrated system of initial and ongoing technical support is proposed to the FOA as part of this 11 year development process. This support has four major components:

(a) Provision of an FOA Advisor, a TL/Subproject Manager, a co-manager of the instructional farm, and a co-librarian during the initial 5 years of the institution's development and expatriate faculty members during the time Yemeni faculty are receiving international training to prepare them for specific faculty assignments. The scheduling of this support is detailed in Annex E and reflected in the annual budget presentation, Annex I;

(b) Training of Yemeni faculty members (see paragraph which follows);

(c) Establishment of long-term collegial relationships between individual faculty members of the FOA and specific U.S. agricultural university faculty members. This relationship is funded through temporary duty (TDY) support through project year 7 and is described in detail in Annex E;

(d) Provision of an on-going program of faculty development in the form of TDY personnel who will bring particular expertise as needed to enhance the teaching, research, and/or extension capabilities of the faculty. A total of 4.7 person years of TDY support is provided in the subproject budget (Annex I).

(2) Training Requirement: The sub-project provides for the training of 22 Yemeni faculty members during the development phase of the FOA. In addition to these, seven participants were identified as of November 1983 and have been approved for U.S. graduate training. The 22 persons identified for doctoral level training will be distributed in academic fields as follows:

ACADEMIC FIELD	Number
Agricultural Economics	2
Agricultural Engineering	4
Extension Methods	2
Agricultural Education	1
Animal Science	2
Crop Science	2
Foods and Nutrition	1
Food Science and Technology	2
Horticulture	1
Poultry Science	2

Rangeland Resources	1
Soil Science	2
Subtotal	22
Participants already in training	7
Total	29

In addition to the 29 persons to receive doctoral level training, shorter-term training is specified for the FOA Dean, Instructional Farm Manager, ESL/Technical Specialist, and Librarian. For the latter two, post-baccalaureate or master's-degrees are anticipated. Every effort is planned to recruit one or more women to be included among the trainees for faculty positions. The schedule for these training activities is detailed in Annex E and reflected in the detailed budget (Annex I).

(3) Laboratory Development: Access to laboratory facilities has been identified as a major need of secondary school graduates in the YAR. Included in the preliminary facility design are 4,810 sq m of laboratory space, distributed as follows:

Use	Space, sq m
Plant science laboratories	400
Soil science laboratories	290
Animal and poultry science laboratories	385
Food science laboratories	270
Basic science laboratories	720
Animal and poultry nutrition laboratories	250
General teaching laboratories	240
Computer instruction	100
Agricultural mechanics space	1,200
Greenhouses	500
Support space	455
TOTAL	4,810

The building budget further includes provision for furnishings. The details of laboratory space are included in Annex K.

This laboratory space represents 49 percent of the total space planned for the FOA. This is considered to be an adequate allocation of laboratory space to provide a quality educational experience for B.S. students in agriculture.

(4) Technical Reference Materials: Plans for the FOA facility include 200 sq m of space allocated to a library (Annex K). A separate library was selected for the FOA rather than (a) integrate agricultural reference materials into the university library system or (b) develop a system whereby the FOA and MAF share reference materials and facilities that would be provided in the USAID-funded DLRC for the MAF. This proposal for a separate FOA library is consistent with the experience of other UOS faculties, and has resulted from the limited facilities of the central university library.

The FOA library is designed similar to those on most university campuses in the U.S. Its major clientele will be the students and the Faculties of Agriculture, Science, and Commerce. The students and faculty will use the library for the preparation of term papers, research papers, extension information, and general classroom and laboratory use. The FOA library will be a teaching/academic research facility containing reference materials, journals, books, and relevent periodicals for students.

The DLRC at the MAF will be used primarily by MAF and other YARG ministry personnel, foreign technicians, and project design teams. The documents that are to be housed in the DLRC will be government documents, records, project feasibility studies, research reports, general agriculture texts, and reference books. The DLRC will have the capacity to generate large amounts of government statistics that will be used by YARG to develop policies in agricultural planning, marketing, crop development, census, etc. Additionally, the DLRC will have the capacity to duplicate large volumes of material that will be used by constituents of the agricultural sector.

Clearly, the FOA library differs from the DLRC in location, clientel and purpose. The FOA library will operate as a lending library mainly for student use. The DLRC will be a repository for single copies of reports and reference documents (not books) which can be read and desired portions copied. The DLRC will not loan materials. Combining the two facilities, either physical or administrative, would weaken both entities. Since they are key units whose functions are critical to the development of their respective institutions and economics of scale are limited at

best, the USAID/Y does not recommend attempting to service both functions with one facility.

It is planned that one co-librarian will assist in the establishment of the FOA library. This FOA library advisor will coordinate efforts with the DLRC to share information and materials that will enhance the quality of both facilities.

Until appropriate Yemeni staff are trained and in place, the DLRC proposes to have two technical assistance positions for long-term personnel and the FOA library will have one position. The DLRC advisor will supervise establishment of the DLRC building and its information retrieval systems and search the country for reports to put into the DLRC. The DLRC reference specialist will perform the tasks of a librarian in the DLRC facility and train a Yemeni counterpart to do the same. The FOA library advisor will establish with a Yemeni counterpart the FOA library and its systems for purchasing, cataloging, storing, and lending books to students.

(5) Commodity Support: Commodity support is essential to the successful operation of the FOA. Within the budget (Annex I) are the following commodities schedules at the appropriate times in the life of the subproject.

Non-Expendable Equipment and Materials

Teaching materials	$ 57,000
Library resources	305,000
Teaching equipment	304,000
Office equipment	220,000
Misc. equipment	60,000
Vehicles	75,000
TOTAL	$1,021,000

Expendable Equipment and Materials

Office supplies	$127,000
Teaching materials	11,000
Vehicle & equipment parts	32,000
Miscellaneous	33,000
TOTAL	$203,000

The above listed commodities are considered supplemental to those included in the faculty building construction budget. The equipment included in the building budget will include such items as desks, chairs, limited filing cabinets, tables and certain laboratory and shop equipment. The commodities included in the USAID budget are considered to be of the following types:

Non-Expendable Equipment and Materials

Teaching materials: slide sets, movie films, overhead transparencies, cassette tapes, and computer software.

Library resources: reference volumes, handbooks supplemental texts, journal subscriptions, and equipment catalogs.

Teaching equipment: slide projectors, movie projectors, overhead projectors, projection screens, demonstration units, and small equipment such as wires, pumps, monometers, plows, and example irrigation sprinkler nozzles.

Office equipment: word processing equipment, typewriters, calculators, dictating equipment, copying machines, and desk lamps.

Vehicles: automobiles, pick-ups, and student transport vans

Misc. equipment: supplemental items such as cut-away engines, hand tools, and microscopes.

Expendable Equipment and Materials

Office Supplies: papers, pens, chalk, copying supplies, typewriter ribbons, stationery, and file folders.

Teaching materials: computer paper, overhead transparencies, charts, copy paper, handouts, video tape blanks, steel, lumber, cement, and other laboratory supplies.

Vehicle equipment parts: tires, fan belts, saw blades, pump seals, and other commonly consumed and repair items.

Misc.: service agreements, repair bills, paint, and essential maintenance items.

b. Instructional Farm

The FOA Project Planning Design Team and the UOS administration have determined that an instructional farm should be designed to serve the FOA. A CID team planned the instructional farm. The farm should be used mainly for instruction and demonstration of existing technology. It will also serve research needs of the FOA and allow on-campus extension-type training.

The instructional farm will be located on the new campus of the UOS at the intersection of Ring Road and Wadi Dhar Road. Up to 22 hectares are available for the farm. The farm should serve the needs of the disciplines planned for the FOA: agronomy, horticulture, irrigation and mechanization, and animal and poultry science. Details of the instructional farm are shown in Annex J.

In general, the instructional activities should represent as much diversity as possible. The climatic conditions of YAR are diverse; thus, local conditions pose some limitations since Sanaa is on a high mountain plain. Most of the demonstrations should have widespread, immediate application. The physical and economic resources available to the farmers should be considered in designing demonstrations.

An instructional farm cannot totally represent the diversified agriculture of the entire country. A network of demonstration and research farms throughout the YAR is planned for the future. The planned demonstrations on the Sanaa campus should show optimum and sub-optimum irrigation and rainfed agriculture.

The students of the FOA need "hands-on" exposure to the technology of modern agriculture. The background of most students will not be in modern agriculture. Eventually, as many as 300-400 students will need access to the farm each year. They will complete many of the practicums themselves, providing much of the labor. Most of the demonstrations should have immediate practical significance so that the students can carry the knowledge to the farmer for direct application. Some of the demonstrations, however, will introduce new concepts not immediately acceptable to the producer. Some demonstrations will show problem situations. As far as possible, all crop and horticultural commodities produced in the YAR should be demonstrated.

(1) Early Development Activities: The FOA tentatively plans to enroll its first class of students in September 1986. The current plan is for the first year of the curriculum to be in the existing FOS (see Annex M). The remaining years (Years 2-4) of study will be in the FOA. The first year of actual instruction on the new FOA campus, therefore, will begin in September 1987. In order to meet this projected schedule, the UOS is negotiating now to have the FOA buildings and instructional farm completed and operational by September 1987.

Concerning the instructional farm, it is critical to have it operational at least 1 year prior to its opening for student training. This will provide farm management personnel the necessary time to establish systems of operation and coordination with the Yemeni and expatriate teaching faculty. It will also provide the faculty members the necessary time to plan the on-farm elements of their courses and to initiate limited research activities. All of the above should be star ' no later than Septmeber 1986 and be well under-way prior to the arrival of students during the summer practicum of 1987.

The Technical Analysis (Annex E of the SPP) concludes that, starting from ground zero, approximately 2 years will be required for the development of the farm. Considering CID's experience in Yemen with HITS and PETS, this is a very realistic estimate.

Should this schedule not be followed, the instructional farm would not be completed by September 1986, and, most likely, will not have had sufficient time to become operational by September 1987 when the second year students arrive on the FOA campus. Moreover, the faculty members will not have the necessary time to become familiar with the farm before starting classes in September 1987. This would lead to an untenable situation in which a significant portion of the training for the first group of students is void of practical experiences on campus. The vacation practicums could possibly off-set this undesirable situation to some extent. However, even student performance in these field practicums would most likely be marginal without the critical on-campus experience that an instructional farm could provide. A further important consideration in this regard is the

possibility of establishing a precedent of having a first class which, in effect, misses a large and necessary part of the curriculum.

The budget for the first project year of the instructional farm has been based on the study by Vomocil, et. al. (Annex J). A number of the estimates were spot-checked by referring to the worksheets which are available at CID/Sanaa and by using other available information. The study cost estimates have been escalated to the time of anticipated construction by using an inflation factor of 10 percent.

The technical information in the draft study is sufficient to proceed with the design of the eight farm buildings, the layout and design of the farm plots, the fencing, the gravel roads, and the on-farm water distribution system.

The Core Subproject's engineering technician at the CID/Sanaa will prepare a topographical survey of the area for the proposed instructional farm, with the help of a local survey crew. The survey data will be submitted to CID offices at OSU where CID agronomists, animal and poultry scientists, and engineers will lay out the farm plots and prepare specifications for leveling, grading, and roads and for the purchase of fencing and other equipment. They will also prepare scopes of work and contract documents for the construction contract and requests for proposals for the A/E contract for the design of the buildings.

(2) Technical Support: The technical support provided to the instructional farm is similar in character to that provided the overall FOA. Initial expatriate input to the farm will include provision of a farm co-manager for a period of 5 years while operating procedures are being formulated. In addition, FOA expatriate faculty will be closely involved with planning the day-to-day operation of the instructional farm, conducting classroom practicums and workshops, and training MAF personnel and other agricultural development leaders. Additional support is also included in the development of the instructional farm in terms of engineering design and construction supervision. Further details on the technical support related to this facility are included in Annexes E, I, and J.

(3) Training Requirements: Training requirements for the instructional farm are closely related to those of the FOA since the faculty members are directly involved in operations and utilization of the farm. In additional, a farm manager is scheduled for training in the U.S. to become familiar with effective experimental/instructional farm operation.

(4) Facility Construction: Constuction of the instructional farm is scheduled to commence in Year 1 of the project with detailed engineering design, site development (surveying, leveling, grading, and road construction), installation of the perimeter fencing, installation of the on-farm water distribution system, and provision of water to the site (drilling of the well and installation of the supply line from the well to the farm site).

Construction of the instructional farm is scheduled for completion during the second year of the project. This will include constructing and equiping the crop science field laboratory, livestock field laboratory, poultry field laboratory, and the farm shop. Once these construction projects have been completed, the facility will be available for agricultural development (see Implementation Schedule, Annex M, and Figure 2, Section III).

(5) Water Delivery: Preliminary engineering evaluation has been completed and a general scheme selected for providing water to the instructional farm. The system includes drilling two wells, the first to be funded by USAID, the second by the UOS, approximately 3 kilometers west of the farm site, installation of submersible turbine pumps and a 30 cm pipeline from the well site to the farm, and an on-farm plastic lined water storage reservoir with a capacity of 1,500 cubic meters.

Within the boundary of the instructional farm, the water delivery system will consist of an integrated network of main lines, sub-mains, concrete lined channels, an elevated water storage tank, and the associated drop structures, standpipes, and pipeline fittings. This system is scheduled for installation during the first year of the project. Complete details are provided in Annex J.

The water delivery system is specifically planned to provide a full range of irrigation possibilities

within the farm. Full development is dependent upon having a sufficiently productive well system to provide a firm water supply of 15 to 20 liters/second at maximum capacity.

(6) Integration into Curriculum: The instructional farm is planned as an integral and essential aspect of the FOA teaching program. It will be the site of numerous demonstrations as the faculty strive to relate their theoretical teachings to the physical realities of agriculture in the YAR. Annex E includes a presentation of competencies to be mastered by the students. This skill development will occur on the instructional farm.

Many of the students will arrive at the FOA with limited agricultural experience. For this reason, the students will be directed to the instructional farm on a regular basis for equipment, plant, animal, and practice identification. As part of their educational program, the students will be responsible for performing a significant portion of the agricultural operations to develop their skills and to provide them an opportunity to use the extensive variety of agricultural implements provided on this farm.

(7) Demonstration and Community Outreach Programs: The instructional farm will be used extensively for demonstrations, workshops, and short-term training courses. Although most of these educational efforts will be provided by the agricultural faculty, the facility may also be used by MAF personnel, under FOA supervision, and other agricultural experts including TDY expatriate faculty members with particular areas of expertise. The instructional farm setting will be an appropriate learning site for extension, local development association, and regional development authority personnel. Further insights into the use of this facility to promote technology application to individual farming operations can be seen by reference to the linkage discussions in Annex E.

(8) Faculty Research Activities: The instructional farm has been designed to facilitate initiation of faculty research in addition to item (7) above. Although the priority use of the farm is for student training and competency development, the other uses are not conflicting.

Although a variety of research activities are possible, the following potential list are indicative of the types of research possible.

(a) Evaluation of alternate feed materials
(b) Plant variety evaluations
(c) Pesticide evaluations
(d) Water use efficiency testing
(e) Seeding density evaluations
(f) Effect of alternate tillage practices
(g) Fertilization trials
(h) Alternate crop testing
(i) Product storage trials
(j) Solar energy demonstrations
(k) Evaluation of multiple cropping techniques
(l) Use of artificial light for egg production

The budgeting process for the instructional farm makes faculty research particularly attractive. There are already sufficient personnel included in the farm budget to conduct the appropriate trials. In addition, there are sufficient operating funds provided in the budget to allow these activities to proceed. Students may also be productively involved in these activities to enhance their educational programs.

c. Curriculum and Practicum Experiences Curriculum

(1) Curriculum: A proposed curriculum in general agriculture is shown in detail in Annex E. This curriculum is based on the UOS requirements of 144 semester credit hours for a B.S. degree. To meet the UOS requirements, a student must complete 36 credit hours for each school year. The UOS requirement of 15 credit hours in Arabic, English, and Islamic Civilization are included in the proposed curriculum.

The general agriculture curriculum is designed with a first year program in the basic sciences such as chemistry, botany, zoology, mathematics, and physics. The basic science courses will be taught in the FOS. All basic science courses are currently being taught at the UOS. The proposed curriculum follows the existing credit patterns of the FOS.

The SPP team is cognizant of the need for strengthening the basic science component of the curriculum. For example, a course in organic chemistry is needed at the second year level. In achieving a balance of basic sciences and technical agriculture

classes, it was necessary to eliminate several needed courses from the curriculum to maintain student classloads at 18 credits per semester. The Dean and the FOA Advisor must have some latitude in modifiying the curriculum to achieve the appropriate balance of staff expertise, subject matter, and learning activities.

Technical agriculture classes were designed for the following emphasis areas:

--Agricultural Economics
--Animal and Poultry Science
--Plant and Soil Science
--Agricultural Engineering
--Horticulture
--Pasture and Rangeland Management
--Food Technology
--Plant Pathology and Entomology
--Extension Methods

Each of the areas of emphasis is significant to the development of agriculture in the YAR. The general agriculture curriculum includes a series of courses that will prepare students in each of the emphasis areas to a degree that will allow them to enter specialization programs in the emphasis area of their choice. The program emphasis areas and related courses are shown in Annex E.

The proposed curriculum is a model curriculum for general agriculture. It does not allow for electives or program options. As the FOA evolves and matures, elective courses can be added to the program emphasis areas. The curriculum can be moved toward specialization and program options as staff expertise becomes available to the FOA. A tight curriculum, without electives and program options, will help to assure that a solid program in general agriculture is established. The evolution of electives, program options, and advanced degree programs will be a natural extension of the basic curriculum.

The proposed curriculum is targeted toward the needs of the rural farmer in the YAR. Although public and private agencies will employ FOA graudates, the curriculum must be directed at the needs of the rural society that is being served by those agencies rather than agency needs. The proposed courses are purposely skewed toward applications and practicums that are needed by working agriculturalists.

This curriculum provides a theoretical base that will allow FOA graduates to pursue graduate programs in any of the major otions in agriculture. At the same, time the graduate is prepared as a well-rounded agriculturalist who can work in a variety of job settings. Specialization of curriculum should be deliberately avoided during the early phases of FOA implementation. Program options should be an outgrowth of a maturing program as departments become organized and Yemeni staff are available.

The curriculum is dynamic in nature. It must be continually updated to keep abreast of technology. The proposed curriculum should be fully reviewed prior to its implementation in the FOA. Minor adjustments and modifications in course requirements, course content, and scheduling of classes will be a responsibility of the FOA Dean. The general pattern of the curriculum must be maintained to mesh with the training and staffing schedules of this subproject.

(2) Practicums: In addition to the basic coursework, three vacation practicums have been proposed to assure that students get "hands on" training in agriculture. A description of the vacation practicums are found in Annex E. The practicums are designed to give students involvement in agriculture in the different regions of Yemen, in practical skills on the instructional farm, and in a practical work experience in a productive agricultural setting.

(3) Competencies: A list of skills or competencies has been suggested for each of the program emphasis areas. The competency lists are performance indicators to measure a student's ability to do the basic skills of agriculture. The instructional farm is designed to help students achieve competence through "hands on" instruction. The competency lists will be further refined by faculty members to reflect better the needs of Yemeni agriculture. A competency checklist will be used to enhance classroom instruction in technical agriculture. Examples of competency checklists are included in Annex E.

(4) Secondary Teacher Preparation: An advanced degree (M.S.) is currently being required for teaching in an agricultural technical school. With such requirements in place, it does not seem reasonable to include a teacher preparation component in the B.S. program in

general agriculture. Teacher preparation training is proposed as an additional 18 week program beyond the completion of a B.S. degree. This important component will evolve as agriculture programs are implemented in the secondary schools of Yemen. A proposed curriculum for agricultural teacher preparation is included in Annex E.

(5) Student Workload: The proposed curriculum of 144 semester credit hours will require the student to complete 18 hours during each of eight semesters. Additional credits will be obtained through vacation practicums. The student workload is a full one, as necessitated by the 144 credit requirements of the UOS. Some students may require an additional semester or year to complete the degree requirements.

(6) Faculty Workload: The faculty work loads were computed to allow time for extension and research development. Also, the current workload requirements of the UOS were observed in calculating the staff required to teach the proposed curriculum. Annex E contains the faculty workloads in relationship to the curriculum and staff responsibilities for research and extension.

(7) English Language Proficiency: The students in the FOA should obtain a level of English proficiency that will allow them to pursue advanced degree programs in English speaking universities. The first 2 years of the FOA curriculum requires students to take formal English classes. A continuum of English instruction is proposed for the third and fourth year through further elective classes and through infusion into the technical classes. A conceptual model of ESL training is shown in Annex E.

d. Evolution of Organizational & Administrative Structure: The evolution of organizational and administrative structure is described in detail in Annex E, Section C. In accordance with the recommendation of the Faculty of Agriculture Planning Unit (FAPU), the land-grant model will serve as a guide to shaping the structure of the FOA. Initially, resident instruction will be the primary function of the FOA. There will be a nondepartmentalized structure with the only administrator being the dean who will be responsible through the vice rector to the rector of UOS.

As the FOA grows, departmental units will eventually emerge. These departments would be agricultural economics, agricultural and extension education, agricultural engineering, crop production and protection, food science and technology, and livestock and poultry production and protection. Managed by department heads, these departments would operate expanded and more sophisticated programs of teaching where students could option for greater specialization at the baccalaureate level.

The long-range organizational structure envisions the dean, assisted by three associate deans, responsible for leadership in teaching, research, and extension. Faculty members in each department would participate in all three activities, some holding joint appointments in at least two areas. In addition, it is anticipated that FOA members will hold joint appointments with the MAF while courtesy appointments to the FOA may be extended to appropriate staff of the MAF and MOE. In essence, this is the generalized land-grant model and it may take 15 to 20 years to achieve this goal in YAR.

In order for the FOA to perform well the activities of teaching, research, and extension, institutional linkages must be established and nurtured. These linkages, administrative and operative, are illustrated and described in detail in Annex E, Section E. The UOS, MOE, and MAF have been highly supportive of and involved in the proposal to establish the FOA. Therefore, willingness on the part of those institutions to develop and strengthen linkages can be expected.

3. A/E Services for the FOA and Instructional Farm Buildings.

The subproject includes USAID-funded provisions for the professional services of a selected A/E firm to design and supervise the construction of the FOA and instructional farm building. Preliminary A/E activities contracted by USAID in January 1983 resulted in a Prefeasibility Study for the faculty buildings (see Annex K). This document was approved by USAID/Washington in August 1983 and is now being used as a document to help attract other donors to finance the construction of the FOA building. Cost estimates from that study are included in Annex I, Table I-1, as "other donor parallel financing." The Prefeasibility Report details a building of approximately 14,000 square meters at a cost of roughly $22 million, including furnishings, basic equipment, and contingencies.

Annex L documents the A/E Scope of Work (SOW) for A/E Services as prepared by Gauthier, Alvarado and Associates, the U.S. A/E firm that was contracted by USAID to complete the Prefeasibility Study. It details a phasing plan for the A/E services and cost estimates totalling $1.7 million, which has also been built into the budget estimates in Annex I.

4. YARG Contribution to Project Development

Table 2 itemizes YARG inputs prior to the initiation and through the duration of this subproject. Pre-subproject activities beginning in 1980 and continuing since that time have included a number of outside donor studies. Some of these were sponsored by USAID. YARG issued the official Republican Decree No. 51 (see Annex D) on July 26, 1981, officially establishing an FOA.

Land for construction of the FOA building and development of the instructional farm was designated on the new UOS campus in late 1982. This land, estimated at 25 hectares, has been valued at $12.4 million, as indicated in the YARG cost estimates (see Annex I), and the Summary Financial Plan (see Table 6, Section IV.D).

In addition, YARG and UOS officials have acknowledged their obligation to assume the gradually increasing recurring costs (local faculty and staff operating expenses and equipment replacement) that are inherent in this institution building subproject. Through the life of project, these obligations total $31.6 million, including contingencies and inflation (see Table 6, Section IV.D.). Given the outstanding growth and achievement record of the UOS and its progressive plans to expand in other vital areas, there is every reason to have confidence in the institution's commitment to the FOA. Section IV.E. summarizes a detailed institutional analysis of the UOS and its capability for continued program development.

5. Construction of Instructional Facilities:

A prefeasibility report on facilities, other than those on the instructional farm, is included as Annex K. A brief summary of that report follows. The facilities proposed were based upon an anticipated enrollment of 600 students--20 percent females, 80 percent males--in a 4 year academic program which may eventually include six agricultural disciplines. The amount and type of space provides for research and extension activities as well as teaching.

The facilities comprise 14,000 square meters of classrooms, teaching and research laboratories, offices, auditorium, prayer rooms, library, and snack bar. The library space was included because UOS policy is to have one main library and a satellite library in each of the faculties. Approximate cost of the construction was projected at $19 million and furniture and equipment costs were projected at $3 million. Total time for planning, design, bid letting, contract awarding, and construction will be 4 years.

Details of construction supervision services for the facilities are presented in Annex K (p. 16). USAID/Yemen proposes that USAID fund the construction supervision services. The cost for these services is expected to be about $550,000.

6. Institutional Development

a. Technical Assistance: Table 4 summarizes the person-year inputs throughout the subproject. Technical assistance will be provided in two categories: on-campus (U.S. lead university) subproject management and in-country subproject management.

(1) On-Campus Subproject Management. Figure 1 provides an organizational scheme for the FOA Subproject administration and technical assistance, and indicates how subproject personnel will link with appropriate counterparts within the UOS. Figure 2 details a phasing plan for the overall subproject.

Overall subproject management will lie with the Subproject Director, located on the lead university campus. The Director will have responsibility for overall subproject activities, including such things as managing fiscal and personnel concerns, maintaining proposed implementation schedules and work plans, preparing subproject reports, responding to internal and external evaluations, and providing liaison with the CID Deputy Executive Director for the Yemen ADSP and CID lead university officials. The position ranges from a full-time position during the early years of the project to 0.50 FTE during the final subproject year.

The subproject also calls for full-time on-campus secretarial/accounting support to the Subproject Director (see Table 3).

(2) In-Country Subproject Management. As shown in Figure 1, the in-country management team will consist of the following personnel:

(a) a Team Leader (TL)/Subproject Manager,
(b) an FOA Advisor,
(c) a Farm Co-Manager;
(d) a Co-Librarian;
(e) several expatriate faculty hired while Yemeni counterparts complete graduate training programs; and periodic subproject consultants to provide leadership for program modifications, in-service training seminars and workshops, internal and external subproject evaluations, and in-country graduate student supervision.

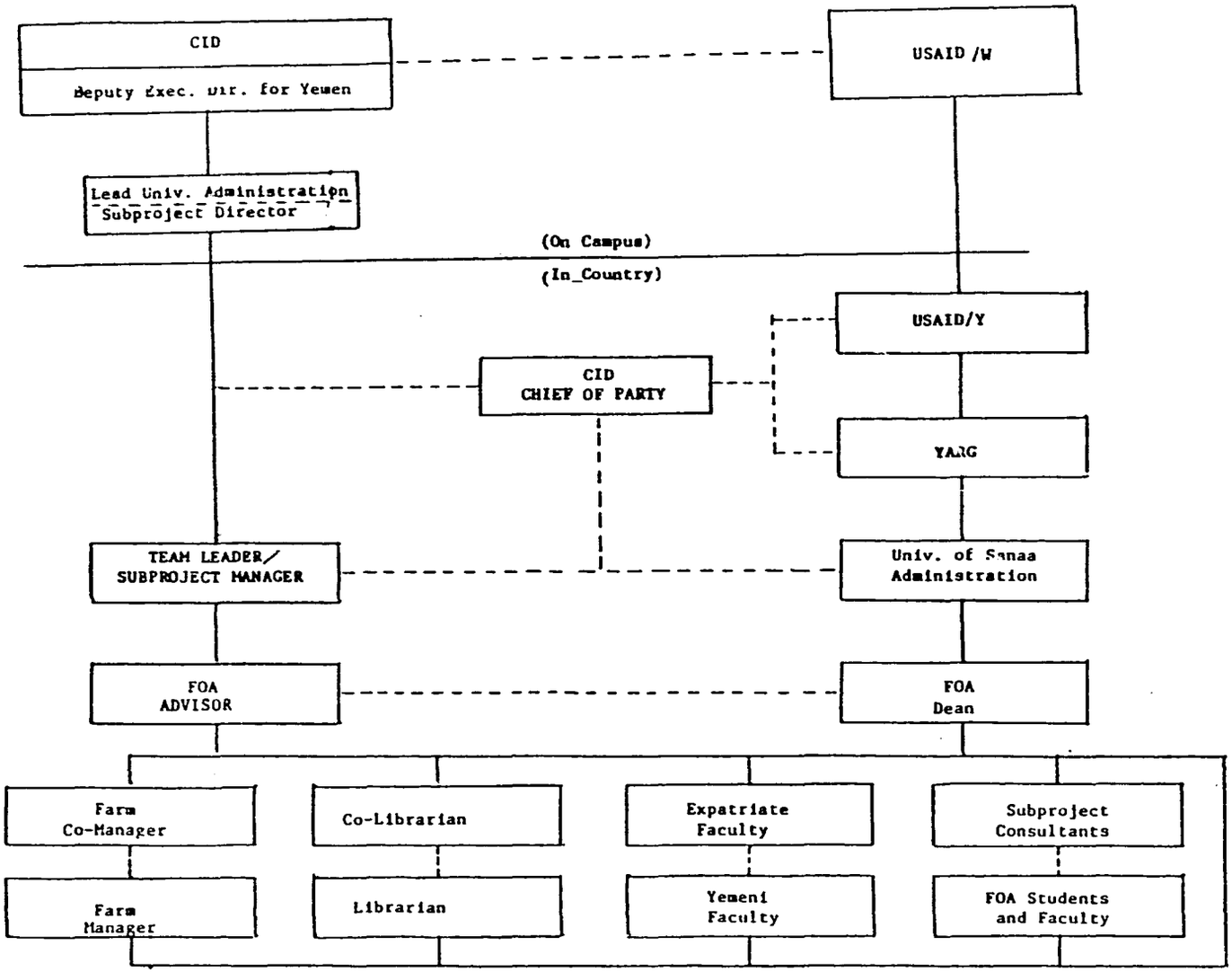
The TL/Subproject Manager will be responsible for in-country management of the subproject. S/he will

TABLE 4

Person-Year Analysis of On-Campus Subproject Management and Support, In-Country Technical Assistance and Participant Training.

Category	Subproject Year											Total
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	
I. On-campus subproject Management and Support												
A. Subproject Director	0.75	1.0	1.0	1.0	1.00	0.75	0.75	0.50	0.50	0.50	0.50	8.25
B. Secretary/Accountant	0.75	1.0	1.0	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	10.75
Subtotal	1.50	2.00	2.00	2.00	2.00	1.75	1.75	1.50	1.50	1.50	1.50	19.00
II. In-Country Subproject Management and Technical Assistance												
A. Team Leader/Proj. Manager	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.00
B. Faculty Advisor	-0-	0.50	1.00	1.00	1.00	1.00	0.50	-0-	-0-	-0-	-0-	5.00
C. Farm Co-Manager	1.00	1.00	1.00	1.00	1.00	1.00	0.50	-0-	-0-	-0-	-0-	6.50
D. Co-Librarian	-0-	-0-	-0-	1.00	1.00	-0-	-0-	-0-	-0-	-0-	-0-	2.00
E. Expatriate Faculty	-0-	-0-	2.00	4.00	4.00	3.00	2.00	1.50	0.50	-0-	-0-	17.00
F. Subproject Consultants	0.33	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	1.13
G. Graduate Student Supervision	0.40	-0-	0.63	0.29	0.58	0.17	0.63	0.29	0.17	0.17	-0-	3.33
H. Project Evaluation	-0-	-0-	-0-	0.08	-0-	-0-	0.08	-0-	-0-	0.08	-0-	0.24
Subtotal	2.73	2.58	5.71	8.45	8.66	6.25	4.79	2.87	1.75	1.33	1.08	46.20
III. Participant Training	7.0	20.00	25.00	28.00	25.50	22.00	16.50	8.50	4.50	1.50	-0-	158.50
TOTAL	11.23	24.58	32.71	38.45	36.16	30.00	23.04	12.87	7.75	4.33	2.58	223.70

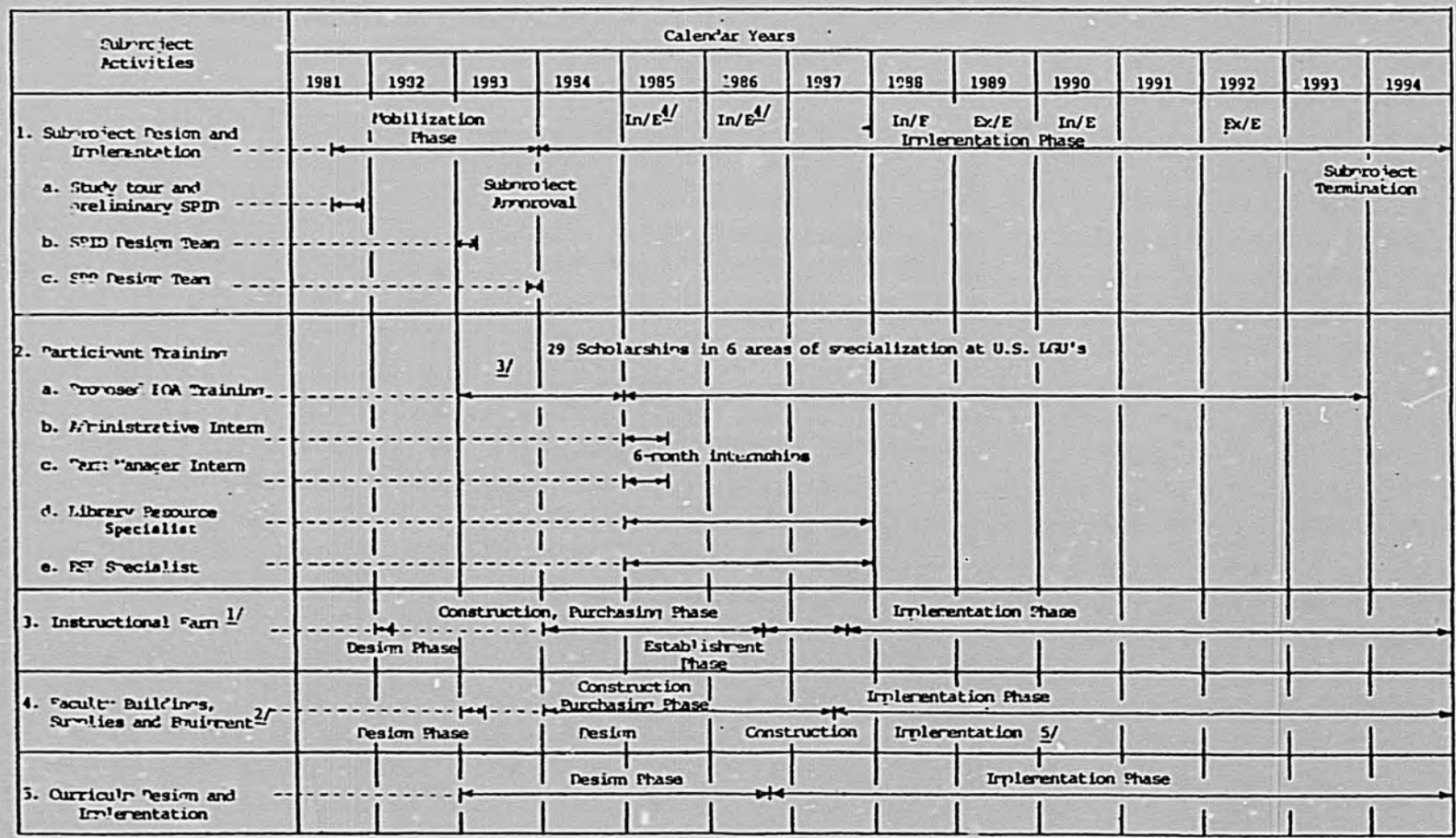
FIGURE 1
ORGANIZATIONAL CHART FOR FOA SUBPROJECT ADMINISTRATION AND TECHNICAL ASSISTANCE 1/



1/ Solid lines represent administrative and/or operational linkages.
Dashed lines represent contractual and/or functional linkages.

FIGURE 2

PROPOSED PHASING PLAN FOR FOA SUBPROJECT



1/ USAID will finance site preparation, well drilling, pump delivery pipe, building design and construction, equipment and supplies will provide well, site, obtain right-of-way access for water delivery, and well hookup.

2/ USAID will finance limited equipment, materials supplies, architectural design, and construction observation services. YARG and other donors will finance construction of sma buildings and commodities (desks, chairs, lab and greenhouse benches, shelves, etc.)

3/ Seven scholarships previously authorized for project mobilization for 1983 calendar year under Core Subproject.

4/ In/E: Internal Evaluation; EX/E: External Evaluation

maintain in-country subproject fiscal records, handle subproject commodity flow from stateside couriers, and other logistical and management support as deemed appropriate. S/he will work closely with the in-country CID/USAID fiscal and administrative personnel and with FOA fiscal and personnel staff in a counterpart training capacity through the duration of the subproject. The Subproject Manager will be hired immediately upon approval of the subproject.

The FOA Advisor will assume his/her responsibilities midway through the second subproject year as his/her Yemeni counterpart returns to the YAR following a 6-month administrative internship at a U.S. agricultural institution. The FOA Advisor will work closely in a counterpart training mode with the Dean of the Faculty of Agriculture to assist in its management and development. The person selected for this position should have had experience as a senior-level administrator for a U.S. agricultural university instructional program. S/he will maintain office hours in the FOA building and generally keep abreast of the daily concerns that will arise as the faculty begins to adjust to its new surroundings and expanding student population. S/he will report directly to the TL/Subproject Manager and in-country Chief of Party (COP) for administrative guidance and logistical support. As indicated in Table 3, this position will be phased out midway through the seventh subproject year.

The subproject calls for a person to serve as co-manager of the FOA instructional farm. This person will be hired immediately to provide in-country leadership for the development and implementation of this important facility. The candidate selection criteria should focus on construction and design capability of farm facilities (buildings, roads, fences, water delivery systems, etc.), knowledge of practical livestock, poultry, and crop production and management, and a practical understanding of how such a facility can enhance and complement a developing instructional program at the baccalaureate level. The instructional farm is described in detail in Annex J. The Farm Co-Manager will work closely with his/her Yemeni counterpart, as indicated in Figure 1, to provide leadership for the daily operations and management of the farm. S/he will seek ways to encourage expatriate and Yemeni faculty to use the farm regularly as an avenue to the hands-on, practical

application of appropriate agricultural production technology for the YAR. The Farm Co-Manager will report directly to the in-country Faculty Advisor for administrative leadership. This position will be phased out midway through the seventh subproject year, at which time his/her Yemeni counterpart will assume full management of the instructional farm.

The Co-Librarian will join the in-country subproject staff at the beginning of the fourth subproject year as the faculty building nears completion. This person, trained in library science, will be responsible for assembling and referencing the library resources that will constitute the FOA library. His/her primary goal will be to train a Yemeni counterpart who will have been trained in library science at a U.S. agricultural university. The Co-Librarian will also look to the FOA Adviser for administrative leadership. The position will be a 2-year assignment.

Expatriate faculty will be hired early in the implementation phase of the subproject to teach the courses in the curriculum while Yemeni counterparts complete their graduate programs abroad. Annex E (Table E-2) indicates the areas of specialization where expatriate input is needed. The subproject calls for 17 person years of expatriate faculty input, beginning midway through the third subproject year and phasing out during year 9. It is likely that third country nationals will be sought in this capacity as they must be fluent in both Arabic and English. The expatriate faculty will look to the FOA Advisor and FOA Dean for administrative leadership.

Consultants are projected as regular inputs in this subproject. A total of 4.7 person years are budgeted to provide leadership for program modifications, in-service training and workshops (see Annex I for details), subproject evaluations (see Section V.C. for details), and in-country graduate student supervision (see Annex E, Section G). These experts will be selected for specific planned inputs as the project progresses. They will be contracted by the on-campus Subproject Director in direct response to perceived needs in-country.

b. Participant Training: A detailed schedule of participant training is presented in Annex E (Table E-1). This activity, already authorized and initiated under the

Core Subproject, has placed three participants in graduate programs at U.S. agricultural universities, with four more in language preparation prior to entrance into graduate programs. The FOA Subproject would eventually train 22 additional participants through the Ph.D. in appropriate disciplines for the FOA. The subproject will also provide post-baccalaureate and/or M.S./M.A. training for one person in library science and another with specialization in ESL/technical agriculture. A total of 173 person years of graduate training is projected through the life of the project, sufficient to allow for adequate faculty given normal retention rates.

Selection of graduate candidates will be jointly administered by the collaborative efforts of officials from the UOS, MAF, USAID, and CID. Every effort will be made to select and encourage women to seek graduate training and eventually become faculty members. The social implications of women as direct beneficiaries of this subproject are described in Section IV.B. and Annex F of this paper. The participant training scheme is also an integral part of an attempt to assure long-standing relationships with U.S. agricultural universities, as spelled out in detail in Section IV.A and Annex E. Coordination of participant selection and placement will be jointly administered by the Subproject Director and the in-country CID Core Training Advisor. The final three participants are scheduled to complete training and join the FOA at the end of the tenth year, as shown in Table 3.

c. Instructional Farm Development: One of the first activities to be initiated upon the approval of this subproject will be the development of an instructional farm adjacent to the FOA with facilities, buildings, and equipment to offer a wide range of practical learning experiences for FOA students and others that might come to the FOA for short courses, workshops, and in-service training. This projected 22-hectare resource is described in detail in Annex J, and its integration into the curriculum and impact on project beneficiaries is detailed in Annexes E and F.

It is proposed that USAID contribute $1.94 million to this facility, excluding contingencies and inflation. It is extremely critical that this farm be ready for use as the first class of students enter the FOA in September 1987. Mobilization activities initially approved in the SPID were postponed pending the discussions with the YARG relative to other donor funding of the FOA building. The instructional farm will benefit agricultural development efforts in Yemen through its demonstrations, farmer visits, etc.

d. Classroom and Laboratory Materials and Equipment: The subproject proposes that USAID provide limited classroom and laboratory materials and equipment that would complement teaching, research, and extension programs of the FOA. Table 6 in Section IV.D. indicates that approximately $1.467 million in obligations has been targeted for expendable and non-expendable equipment for the FOA building and instructional farm. These commodities, coupled with the building furnishings and equipment itemized in Annex K and provided by an outside donor, should provide the FOA with the basic items necessary to launch the programs and outreach of the FOA.

e. Library Reference Material Development: The subproject calls for the establishment of a separate FOA library to be designed into the proposed faculty building. While USAID will not fund the building and library construction, the subproject recommends that USAID provide approximately $0.3 million to provide the rudimentary reference materials necessary to initiate a separate lending library for students and faculty of the FOA.

The proposal for a separate FOA library is consistent with the experience of other UOS faculties, and has resulted from the limited facilities of the central university library. It will be designed similar to those on most university campuses in the U.S. Its major clientele will be the students and Faculties of Agriculture, Science, and Commerce. The students and faculty will use the library for the preparation of research and term papers, extension information, and general classroom/laboratory use. The FOA library will be a teaching/academic research facility containing reference materials, journals, books, and relevant periodicals for students.

The subproject will provide second baccalaureate or M.S. degree training in library science for a Yemeni to eventually be designated as the FOA Librarian. S/he will be assisted in the development of the library by a U.S. librarian counterpart, as indicated earlier in this section.

The SPID discussed the unique role the FOA library will play apart from the Documentation and Learning Resource Center (DLRC) to be funded by USAID for the MAF. While these two units will differ in location, clientele, and purpose, every effort will be made to coordinate the sharing of materials and published information.

7. Conclusion

The SPP team considered similar projects in other developing countries and incorporated the lessons learned into the design of this FOA. U.S. LGUs serve as the predominate model for development of the teaching, research, and extension components of the FOA. The curriculum is based on the studied agricultural needs of the YAR. This led to the design of a highly practical, competency-oriented curriculum. The organizational structure, physical facility, and appropriate linkages are all outgrowths of this basic strategy.

The manpower analysis (Annex H) documents the existing and projected requirement for trained agricultural expertise.

The SPP team believes the proposed subproject is technically sound and appropriate to the needs of the YAR.

B. Social Soundness Analysis

The social soundness issues relevant to the proposed FOA at the UOS are discussed at length in Annex F. Specific considerations are highlighted in the following section. These issues include: the status of agricultural education in the YAR, the purpose of the FOA, the source of students, the beneficiaries of the FOA, education of women in the YAR, the impact of the FOA on women, employment opportunities for FOA graduates, and the institutional linkages of the FOA to Yemeni society.

1. Agricultural Education in YAR

Agricultural education in YAR is limited. No agriculture is taught in the primary, preparatory, or secondary schools. However, students can take a science option in the secondary school system which includes 3 years of training in mathematics, biology, chemistry, physics, mechanics, and statistics. This training provides sufficient academic background for pursuing further education in agricultural subjects. Specialized long-term training in agriculture in YAR is available through technical agricultural secondary schools. Short-term training programs are offered by various donor projects.

2. FOA Subproject Purpose

The primary purpose of the FOA Subproject is to develop the institutional capacity within YAR to train Yemeni men and women as agriculturalists at the baccalaureate level. This is to be accomplished through the establishment of an FOA within the UOS.

3. Source of Students

The major source of students for the FOA will be from the secondary schools (science option) (see Annex F). In addition, graduates from

the agricultural secondary schools who have demonstrated academic excellence will be potential candidates for admission to the FOA. University administrators estimate that 80 percent of FOA students will come from the secondary schools and 20 percent from the three agricultural schools. Directors of the agricultural and secondary schools concur with these estimates.

4. Student Educational Preference Study 10/

One important factor in evaluating the likely success of an FOA in the YAR is the interest by secondary students in enrolling in an agricultural curriculum. In order to assess this factor, a questionnaire (Annex F, Figure 4) was designed and administered to students in the scientific stream of the secondary school system, to students in the two agricultural secondary schools and to students in the Veterinary Secondary School (Sanaa). Results of the survey are summarized in Annex F (Table F-4).

Based on the student educational preference study, school visitations, oral interviews, and the assessed potential sources of students, there should be an adequate supply of students available to the FOA. In fact, the general consensus of secondary school administrators is that there will be far more students than available training slots in the new FOA. A detailed analysis of the sources of students is in Annex F.

5. Beneficiaries

a. Primary and Secondary: The primary beneficiaries of the FOA Subproject are expected to be the agricultural students trained at the B.S. level who enter the private and public sectors directly or who go on for advanced degrees. Salaries, prestige, personal satisfaction, and upward economic mobility are viewed as the principal economic and personal benefits.

The secondary beneficiaries of the FOA Subproject are expected to be the people served by agricultural institutions. The FOA will provide trained Yemeni men and women to fill technical and administrative positions for both public and private institutions, with the greatest intended emphasis upon public institutions. The public institutions include the research and extension components of MAF, the semi-autonomous regional development authorities, and other public institutions, such as MOE, which require agricultural graduates to serve their programs. People served by the small but expanding agri-business sector of Yemen, including credit banks, agricultural input supply firms, and agricultural product processing and marketing firms, also will be secondary beneficiaries. The extent to which the public versus private sectors will benefit from the FOA is not known at this time.

b. Tertiary: The tertiary beneficiaries of the FOA Subproject are expected to be local villagers through the improved tecnnical training at the agricultural institutes, FOA research studies and developments, the hiring of graduates of such institutions by the NES, and proposed placement at the provincial and local levels. The local extension centers are expected to test, evaluate, and modify for local conditions the research work conducted at the regional experiment stations.

c. Education of Women in the YAR: Traditionally, women have not been educated in Yemen. The major constraints to educating females in Yemen have been social attitudes and family obligations that keep girls at home and the pattern of early marriages.

Families objected to educating daughters on moral grounds. Girls were not allowed to study publicly in the presence of boys and male teachers. Furthermore, it was felt that women did not need to be educated because their families or husbands were responsible for taking care of them.

Today, many of these attitudes toward educating females are beginning to change. As more and more women become educated, social barriers will disappear gradually. Progress is being made slowly, and it will continue.

There are men and woman pioneers who have taken the initiative to promote changes. They will be the ones who provide the momentum for continuing change and progress in the educational system in Yemen. Their spirit is strong. Their own words best reflect their commitment towards accomplishing these goals. On educating women, a UOS male faculty member said:

> "The best way to protect the Yemeni woman is by educating her. She is a person, after all. By educating her, she will be protected from ignorance, disease and poverty, and, in turn, she can protect all of us. . .her family, her husband and the society. She is our sister. . .we are all human."

How fast will this change occur? It will be gradual, but it will happen. A Yemeni extension woman stated firmly:

> "Don't limit your thinking in the development of the FOA to what is possible

today. The situation in Yemen| will change over time. Every day and every month there are changes. Things are beginning to happen that were impossible before. In 5 years, there will be many more opportunities for men and women than what are available today. We must look to the future with an open mind."

There are Yemeni who are commited to improving their society. It will take a unified effort on their part. They are willing, and they will succeed.

d. The Impact of FOA on Women: The official policy of YARG encourages women to attend school. Opportunities for educating Yemeni women are increasing slowly. It is important that serious thought be given to encouraging and supporting this trend at all levels of training. This is especially critical since male emigration has placed many women in key production roles. Hence, women must have access to appropriate training in agriculture in order to improve their individual productivity, which, in turn, will contribute to the growth of the Yemeni economy.

It is essential that the FOA encourage women to study the agricultural sciences. They should actively recruit women making them aware of the opportunities in agriculture. They need to have a support structure once they enroll; the curriculum needs to include courses that will attract women; university research and extension activities must be responsive to the needs of rural women and men throughout Yemen; and job opportunities for B.S. graduates must be assessible to women.

Following are several suggestions for encouraging women to enroll in the FOA. First of all, FOA faculty could visit the secondary girls' schools to meet with the third-year science students to provide them with information and written literature about the faculty. It would be advantageous if this faculty member were a woman. Meeting with the parents also could be arranged.

Housing is another issue that is of particular concern for women. Some women will be able to stay in the women's dorms with family approval. For others, this may be more difficult. Assistance with arranging alternative housing with relatives or families would help to encourage the enrollment of women from more traditional families. As more women enroll and as society begins to accept some of these changes, it will become increasingly easier for other women to enroll. Already, there are approximately 300 UOS women students who are in residency homes under the supervision of a house mother.

Another incentive for women to enroll would be the availability of financial assistance and scholarship support. This is particularly important for families with several children. Usually, the family resources are invested in the education of boys first, then the girls. If alternative assistance was available, it would encourage families to educate the girls also.

Orientation and a support structure for women, once they have enrolled, is extremely important. This can be accomplished through formal orientation sessions and informal group meetings of women students and women faculty members. A woman faculty student advisor could direct and advise women in their scholastic programs, give them moral support, and provide them with a positive role model to observe. It would be impossible for a male faculty member to provide this type of support, since he does not face the same constraints as women.

The existence of women faculty members would help attract women students. Therefore, it is recommended that qualified women be identified in all fields of agriculture. Based on the established selection process for selecting participant trainees of the future FOA faculty, qualified women and men could be selected for advanced graduate training. A number of eligible women for participant training have come to the attention of the SPP team. (See Footnote 16 for a list of these women. Also see Table E-1, Annex E, for a list of the participant trainee positions. Additional discussion on the selection process is discussed in the text of Annex E.)

The curriculum of the FOA was designed to include courses that will attract women. Based on the assessed interests of women in secondary schools, and the needs of rural women, the recommended curriculum for general agriculture is relevant to both women and men. (see Annex E, Table E-3). Because rural women are engaged in all aspects of agricultural and livestock production, food processing, management of farm and family resources, marketing, family nutrition, and extension, there is no need to have a dual track curriculum.

University curricula, research, and extension activities must be responsive to the needs of rural women and men. In order to accomplish this, it is recommended that women faculty members be represented and/or consulted on the following university advisory boards: The Curricula Review Committee, the Research Advisory Committee, and the Extension Coordinating Committee, (see Annex E for further discussion of these committees).

e. Extending Benefits to Farmers and Farmer Groups: There are several types of media that are being employed for disseminating agricultural information to rural communities: Television, video films, slide shows, printed materials, demonstrations, and group meetings. Such media have proven to be an effective means for communicating information in the YAR. Therefore, what is needed are additional materials and more qualified extension personnel rather than new approaches.

The FOA could provide leadership in producing films and other media that are aimed at the agricultural sector through cooperation of their extension faculty. Men and women students could help in developing such materials through class projects.

Specific attention should be devoted to the preparation of information for rural women by women students. Because of the social constraints that make it difficult for rural men and women to participate together in group meetings, much of the extension material will need to be prepared with a specific target group in mind.

7. Employment Opportunities for FOA Graduates

In order to attract students to the FOA, there must be employment opportunities for them after they graduate. It is anticipated that there will be many opportunities for FOA graduates to staff the MOE and MAF in technical, professional, and administrative roles; to staff the on-going donor supported agricultural and rural development projects; to provide personnel for the emerging agri-business sector; to collaborate in the development and staffing of a National Agricultural Extension Service; and to provide technical expertise for numerous LDA and a growing credit bank system. (see Annex G for a comparison of salary levels for various occupations in the YAR, 1983).

All of these jobs would be available to both men and women if they are motivated and interested. Already women are employed in the governmental ministries, private agri-business companies, academic institutions and donor projects. Among the women and men interviewed, there was a general consensus that professional women could work in these jobs without a problem.

8. Institutional Linkages

The FOA as planned will have a significant impact on the social structure of the YAR. Annex E outlines the four major areas in which these linkages will operate. However, particular attention is appropriate to the significance of these linkages to particular components of Yemeni society.

The young people, both men and women, will have an additional opportunity for university level education, hence, employment opportunities. These linkages are outlined in Annex E (Figure E-6). Of particular significance in these linkages are the opportunities for women to access professional careers in both the public and private sectors. Examples include employment as extension personnel, food processing industry employees, managers of agricultural statistical reporting agencies, and writers of technical agricultural literature. Another source of professional employment for women will be within the agricultural education enterprise itself.

Men and women associated with agricultural operations in the rural areas of the YAR will be linked to the FOA as outlined in Annex E (Figure E-4). This diagram highlights the variety of pathways by which knowledge will flow into this particular sector of society. As these people experiment with and adopt more effective agricultural, village sanitation and resource management techniques, the bondages of low income, drudgery labor and poor health will give way to improved lifestyles.

9. Conclusions

The FOA Subproject has been proposed to develop the institutional capacity within YAR to train Yemeni men and women as agriculturalists at the baccalaureate level.

The SPP team has conducted a detailed evaluation of the agricultural education needs in the YAR, the available institutional capabilities for training in agricultural disciplines, the potential sources of students, the interest of students in enrolling in an agricultural curriculm, the curriculum needs for men and women students and the potential impact of the FOA on secondary and tertiary beneficiaries.

Based on interpretation and analysis of secondary and primary data (see Annex F) the SPP team has established the following:

a. There is a need for trained agriculturalists in Yemen at the national, provincial and local levels;

b. Agricultural education in YAR is limited;

c. The FOA would provide a needed institutional capacity to train Yemeni men and women as agriculturalists at the baccalaureate level;

d. There is a sufficient supply of students available to the FOA;

e. There is more than sufficient interest by students in enrolling in agricultural curriculum;

f. The proposed curriculum for general agriculture is pertinent to and appropriate for both men and women;

g. Women students need to be encouraged to join the FOA;

h. Participant trainees for the FOA faculty need to include both men and women;

i. FOA research and extension activities must respond to development needs of the rural population; and

j. Sufficient employment opportunities exist for FOA men and women graduates.

Hence, from a social soundness perspective, the SPP team believes the proposed subproject is sound and appropriate to the needs of the YAR.

C. Economic and Budgetary Analysis

1. Least Cost Analysis

a. Internal Versus External Training: Although this SPP identifies many ways in which anticipated benefits of the proposed SPP will emerge, it is not possible to quantify the private and social costs and benefits to make a determination of economic feasibility. An alternate approach consists of two steps. The first step is to note the primary and most tangible output of the FOA: The training of a target number of B.S. level general agriculturalists by the end of the project life and the capacity to train graduates at a specified rate thereafter. The second step is to analyze the costs of establishing and operating the FOA compared to the costs of achieving this output by training in established institutions. Experience has shown that training that is most similar to that to be offered in the proposed FOA can now be provided in a select number of Arab universities or in the United States. Training in Western European or Eastern Bloc countries is not an admissable alternative. Furthermore, USAID has had prior experience with the two alternatives, leading to adequate information on the annual per student costs.

This comparison, a least cost analysis of the three alternatives (called FOA, Arab, and U.S. for short), was performed. Although the details of the analysis are thoroughly discussed in Annex G, it is important to note some important features of the analysis. First, a total "present value (PV) of costs" taken over a given planning horizon (21 years) was considered as the principle indicator of cost effectiveness. However, there is deemed to be special merit in using indicators which reflect the

availability of graduates to offer their services in the YAR after receipt of degree and, in particular, the availability of graduates to serve in MAF. Hence, two indicators were calculated which show PV costs per graduate retained in MAF and PV costs per graduate retained in YAR. Each of these indicators can be reduced, furthermore, to show the "per graduate" cost accruing solely to USAID in addition to the "per graduate" cost accuring to the "combined sponsors." Using a base level set of cost figures and other assumptions, the least cost indicators shown in Table 5 were derived.

This base level analysis indicates clearly that training B.S. level graduates in the U.S. is not an economically viable option. Because the comparison of the costs of the FOA and the Arab options yield mixed conclusions, they must be considered more carefully, however.

From USAID's point of view, it is clear that the FOA is the least cost alternative. From the combined sponsors' point of view, the analysis shows the FOA alternative as having the least cost but by a narrower margin.

A major part of Annex G is devoted to an elaboration of this analysis and the various assumptions. A major concern is whether the Arab university costs are understated in the base level figures because of subsidies. A sensitivity analysis conducted on the model with respect to this factor reveals that the FOA would be competitive if the subsidy in effect amounts to at least $1,150 (up 14 percent from the base level estimated cost). In annex G, other assumptions in the analysis are altered in order to test the effects on the least cost indicators.

The analyis should not be concluded without due consideration of factors that transcend the kind of financial analysis approach used here. Important quality considerations are at issue. A top rate Yemeni faculty is involved in the FOA option, whereas there is believed to be some unevenness in the quality of the Faculties of Agriculture in Egypt, Jordan, and Syria. Furthermore, the way the FOA is envisioned to interface with the agricultural sector of Yemen (as specified in other parts of this SPP) cannot be paralleled in the Arab options. Training programs "customized" for Yemen could be established at Arab institutions but only at much higher costs.

b. Other Internal Alternatives: The FOA SPID listed "within the YAR" alternatives to the project design detailed in this SPP. The SPID suggested that four of these

TABLE 5

Present Value Costs per Retained Graduate:
Base Level Run

Least Cost Indicator	Costs ($)		
	FOA	Arab	U.S.
1. Retained in YAR -- Cost to AID	$10,375	$34,614	$ 97,373
2. Retained in YAR -- Cost to Combined Sponsors	$39,562	$34,614	$ 97,373
3. Retained in MAF -- Cost to AID	$12,965	$51,921	$259,603
4. Retained in MAF -- Cost to Combined Sponsors	$49,440	$51,921	$259,603

alternatives would involve lower costs than the current design. One alternative did not list a specific comparative cost. Two alternatives were listed as more expensive. Two of the suggested lower cost options involve modification/ expansion of the ISAI. One significant social cost of this alternative would be subordination of the goals of the agricultural secondary school. As discussed in the SPID, there are significant quality considerations involved with these alternatives, which clearly favor the FOA.

c. Conclusions: The FOA has a least cost advantage in four (out of four) categories compared with a U.S. training alternative and in three (out of four) categories when compared with an Arab training alternative. The least cost advantage apparently experienced by Arab universities in the one other category could be more than offset by the sum of:

(1) Subsidies to Arab universities that lead to the understating of the true cost of those programs;

(2) Significant quality advantages incorporated into the proposed FOA;

(3) Intangible, but significant linkages that an FOA will have with the rest of the YAR economy; and

(4) Direct contribution of the FOA to the mission of the MAF.

2. Budgetary Analysis

a. YARG Development and Recurring Budget: The economy of the YAR is characterized by very significant external components; remittances of 300,000 to 400,000 Yemeni men working abroad, high levels of expenditures on imported commodities, and payments to expatriate professionals working in Yemen which are remitted out of the country. Recent trends in these indicators of the external economy indicate cause for concern. Remittances have stablized or slightly declined. The once restrained spending on consumer goods has given way to more lavish spending expecially for imported goods.

The domestic private economy is relatively undeveloped, and consists of small, uniformly dispersed, regional trading centers. The domestic public sector economy is largely dependent on import duties for revenues. Vigorous expansion of the public sector economy is largely dependent on import duties for revenues. Vigorous expansion of the public sector has been facilitated by external donor-supported

projects. The monetary requirements for operating these projects (assumed by YARG) and for carrying out the normal functions of government threaten to exceed the ability to generate public sector revenues. Further discussion on this issue as well as a prognosis for remedial actions is included in Annex G, Economic and Budgetary Analysis.

b. Budgetary Allocations to Higher Education: Annex H contains information pertaining to the financial operations of UOS, the principal institution of higher eudcation in YAR. Because a detailed financial history of the university was not available, it was only possible to infer a rough estimate of the operating budget of UOS, its past history, and its likely continuity over future periods. The operating budget figure appears reasonable for an institution the size of UOS. The general education budget (stated in real terms) has been increasing at a significant rate. YARG investment in general education activities is projected to continue increasing throughout the SFYP. In spite of an awareness of general governmental budgeting constraints, YARG officials in CPO, MOE, and UOS were emphatic in their opinion that the UOS would continue to receive funding for operations of present and planned facilities.

c. Operating an FOA at the UOS--Recurring Costs: The proposed FOA budget was reviewed with officials of the UOS. It was concluded that the annual cost to YARG of the FOA would not constitute an unreasonable financial burden. Assurances were provided by UOS, MOE, and CPO officials that the YARG share of the FOA costs would be disbursed in full and on schedule.

d. Conclusion: It is believed that YARG is committed to fulfilling its objectives in the educational sector and that there is little risk that the YARG share of the FOA costs will not be forthcoming. Since recurring cost issues affect all CID/Yemen Subprojects, however, efforts should be initiated to monitor the budgeting of funds for subproject by YARG (including provision of in-kind goods and services). The monitoring of FOA costs should be part of the FOA evaluation strategy.

D. Summary Financial Plan

1. Total Project Costs

Establishing an FOA in Yemen, including facility construction, will cost approximately $81.3 million. The estimated cost of the proposed USAID subproject is approximately $26.6 million.

2. USAID Contribution

It is recommended that USAID provide a $26.6 million grant to finance the design and construction of the FOA instructional farm, technical assistance, participant training, commodity support, and other direct costs. Approximately $5.2 million (20 percent) of the USAID funds will be for direct purchase of Yemeni Rials to cover specified local cost items.

Included in the $26.6 million USAID grant is approximately $1.7 million to fund A/E services to design the faculty classroom and office buildings and supervise construction. The detailed budget and SOW for the A/E services are contained in a prefeasibility study which is in Annex L.

3. YARG Contribution

The YARG contribution will approximate $31.5 million in Yemeni Rials equivalent for land, salaries, operating costs, etc., but excluding university overhead costs of administration, faculty to teach service courses outside of agriculture, student room and board, etc. (see Annex E for a detailed discussion of the institutional analysis.)

4. Other Donor Contribution

The balance of the funding will be parallel financing in the form of a loan from another donor for construction of the FOA classroom, lab, office, and library facilities. The parallel financing could be as much as $23.1 million. The YARG is expected to provide funds for any construction not supported by a parallel financing loan.

Tables 6 and 7 summarize the proposed financial plan for the establishment of the FOA. Budget details are provided in Annex I.

5. Physical Contingency and Price Escalation

The local inflation rate has recently dropped from 30 percent to approximately 12 percent and is projected to drop to 10 percent by 1986 (the third project year and second year of inflation). It is estimated that average annual international price increases will be 7.5 percent in 1984 and will drop to 6 percent by 1986 (see State 015268, 1/18/83).

The budget includes a physical contingency of 5 percent for each year of the subproject. An inflation rate of 8 percent (compounded) was used for both the foreign exchange and local currency budgets. Inflation was factored on the physical contingency. Inflation and contingency thus applied total approximately $15.4 million for inflation and $2.3 million for contingencies.

E. Institutional Analysis

The reader is referred to Annex E, Section I, for more detailed information concerning the UOS and the FOA.

TABLE 6

SUMMARY FINANCIAL PLAN - FOA COMPONENTS 1/

($000)

CATEGORY	USAID		YARG ($ Equivalent)	OTHER DONOR Parallel Financing	ESTIMATED TOTAL
	Dollar	Local Currency			
Land	-	-	12,400	-	12,400
Personnel	4,638	-	7,466	-	12,104
Allowances	1,575	-	-	-	1,575
Travel and Transportation	1,499	351	498	-	2,348
Commodity Support	1,239	228	-	-	1,467
Participant Training	5,760	154	-	-	5,914
Development of Instructional Farm including Farm Buildings	462	1,485 2/	-	-	1,947
Facility Construction	-	-	-	22,000	22,000
Other Direct Costs	1,848 3/	1,655	2,709	-	6,212
SUBTOTAL	17,021	3,873	23,073	22,000	65,967
Contingency at 5%	474	193	534	1,100	2,301
Infaltion, compounded @ 8%	3,962	1,125	7,964	-	13,051
TOTAL (Rounded)	21,457	5,191	31,571	23,100	81,319

1/ Marginal differences due to rounding

2/ Approximately 75 percent is for local construction costs

3/ Includes $1.703 million for faculty building design and construction supervision

TABLE 7

SUMMARY FINANCIAL PLAN for FACULTY OF AGRICULTURE SUBPROJECT

($000)

CATEGORY	SUBPROJECT YEAR											TOTAL
	1	2	3	4	5	6	7	8	9	10	11	
I. USAID BUDGET												
A. USAID Dollar Budget	1310	2337	2245	2579	2331	1958	1684	1055	743	486	293	17021
1. Contingency, 5%	26	61	61	68	70	53	46	31	24	19	15	474
2. Inflation, 8% (Cmpd.)	-	102	211	372	528	519	570	463	432	409	356	3962
Subtotal	1336	2500	2517	3019	2929	2530	2300	1549	1199	914	664	21457
B. USAID Local Currency Budget	1186	487	338	391	430	286	289	156	127	92	91	3873
1. Contingency, 5%	59	24	17	20	21	14	14	8	6	5	5	193
2. Inflation, 8% (Cmpd.)	-	41	59	107	162	141	178	117	113	96	111	1125
Subtotal	1245	552	414	518	613	441	481	281	246	193	207	5191
TOTAL USAID BUDGET	2581	3052	2931	3537	3542	2971	2781	1830	1445	1107	871	26648
II. YARG BUDGET	12400	53	671	756	833	1054	1190	1345	1473	1589	1709	23073
A. Contingency, 5%	-	3	34	38	42	53	59	67	74	79	85	534
B. Inflation, 8% (Cmpd.)	-	4	117	206	315	519	733	1008	1316	1666	2080	7964
TOTAL YARG BUDGET	12400	60	822	1000	1190	1626	1982	2420	2863	3334	3874	31571
III. OTHER DONOR FINANCING	-	22000	-	-	-	-	-	-	-	-	-	22000
A. Contingency, 5%	-	1100	-	-	-	-	-	-	-	-	-	1100
TOTAL OTHER DONOR FINANCING	-	23100	-	-	-	-	-	-	-	-	-	23100
GRAND TOTAL	14981	26212	3753	4537	4732	4597	4763	4250	4308	4441	4745	81319

1. UOS

The UOS was founded in 1970. In the short span of 13 years, seven faculties have evolved. These had 231 faculty members and 6,872 students in the 1982/83 academic year. Many buildings have been constructed on two campuses within the city of Sanaa. This dramatic growth was supported by YARG and directed by capable university administration. An administrative structure, similar to that which has been effective in U.S. LGUs, has evolved to that shown in Annex E.

The UOS was initially part of the MOE. Today, however, it is independent of that ministry. It does maintain a vital linkage with the MOE through the Minister of Education chairing the Advisory Council which prescribes policy for the university.

Budget submission of the UOS to the Ministry of Finance and the CPO is independent of submission from other governmental entities.

The UOS plans to add four faculties: Agriculture, Veterinary Medicine, Pharmacy, and Dentistry. These will require new facilities and will increase administrative and operative costs of the university.

Success of the new faculties depends upon the capability of the FOS which will teach mathematics and basic science courses for their students. The FOS presently teaches, and will continue to teach, courses for students in four faculties: Education, Commerce and Economics, Engineering, and Medicine. The FOS has the administrative capability and professional staff, which can be increased to teach courses for its majors and perform the service teaching role. However, its facilites are limited. To accommodate some increase in enrollment, the facilities now used from 0730 to 1400 hours may be used from 0730 to 1800. Also, some increases can be made in class sizes.

2. Faculty of Agriculture

The FOA, as proposed, is compatible with administration of the UOS. It should benefit from the administrative structure, policy mechanisms, and services which have evolved in the university. Women faculty members and women students should be readily accepted in the FOA. They are in all the other faculties and fill leadership roles in the MAF. Just as the UOS is dependent upon hiring non-Yemeni faculty members, the FOA will utilize some non-Yemeni until Yemeni educated to the Ph.D level replace them. Initially, the FOS will teach the mathematics and the basic science courses for students in the FOA in existing facilities. However, the classrooms and laboratories for these courses must be constructed either in the facilities of the FOA or elsewhere in the UOS.

V. IMPLEMENTATION ARRANGEMENTS

A. Implementation Strategy

1. USAID/Yemen

The USAID/Yemen Agricultural Development Office (ADO) will assume full oversight and monitoring responsibility in consultation with other elements of the Mission. This will include, but not be limited to, technical assistance, approving annual workplans, expediting diplomatic relations with the YARG, approving budgets, and organizing external evaluations. A Project Officer will have ready access to the CID FOA Subproject Director and TL, and will work cooperatively with the USAID/Yemen ADO and CID/Core COP for coordination with other elements of the ADSP.

USAID/Yemen will arrange for other technical inputs from USAID that are required, such as review and periodic monitoring by an USAID/Yemen engineer of the USAID-funded construction elements of the instructional farm.

2. CID

The project was designed and will be implemented by CID as a subproject of the ADSP (279-0052). USAID will sign a subproject contract with CID. OSU has been selected as the lead university and will be responsible for providing the on-campus Subproject Director and meeting all technical aspects of the subproject. All other long-term and short-term staff recruitment shall be through all participating CID universities. OSU will be responsible for subproject administration in close cooperation with the CID Executive Office in Tucson, Arizona, and with the Core Subproject administration.

All of the CID universities have a strong tradition of teaching, research, and extension. There will be a large pool of professionals and technicians from which to draw expert technical assistance. The project does not require any full-time individuals with highly unusual, rare skills; staffing, therefore, is not expected to a problem. OSU will assign a Subproject Deputy Director on the OSU campus who will coordinate all technical and administrative backstopping though the CID network. An Acting Subproject Director has already been designated. Additionally, the CID Deputy Executive Director for Yemen will work collaboratively with the Subproject Director to insure full and appropriate backstopping of the FOA Subproject.

CID will enter into a subcontract(s) with a local contractor for construction of the instructional farm. In order to facilitate the work under the subcontract(s), facilitate UOS participation, and provide some legal protection to CID (operating in a country with relatively limited legal protection for outsiders in any disputes that may arise), the UOS will be signatory to the subcontract. Selection of the subcontractor will be in collaboration with the USAID/Yemen.

CID expects the Mission to arrange periodic oversight and monitoring by an USAID engineer to assist in insuring that USAID procedures and quality standards are met.

B. Implementation Schedule

A detailed implementation schedule is presented in Annex M. The initial work plan and scopes of work for the initial subproject personnel are presented in Annex O.

C. Project Evaluation

Given the extended life of project (11 years), USAID/Yemen recommends that the project be subjected to a series of evaluations to more clearly assist its progress and to insure that the design remains relevant to the needs of FOA. The contractor, CID, in collaboration with USAID and YARG, will undertake an internal assessment of the project in years 2, 5, and 8. USAID will schedule more comprehensive external evaluations of the project in years 3, 6 and 9. The external evaluation in year 6 will constitute the mid-term evaluation, and will be the most comprehensive. The team for the external evaluation will consist of external consultants plus USAID/W representatives. The budget includes funding for 30 work days TDY service for each external evaluation.

The evaluations will review the effectiveness of the FOA Subproject activities to date and the status of accomplishment of its inputs, outputs, and purposes. Each external evaluation will be done as part of the evaluation of the total ADSP (Project 279-0052) and all of its subprojects. The external evaluations will review the effectiveness of the FOA Subproject, as well as its relationship to the other subprojects and its contribution toward achievement of the ADSP's goal, purpose, and outputs.

Initial indicators for the first internal and external evaluation should include, but are not necessarily limited to, the following:

1. Status of construction of faculty buildings and instructional farm.

2. Analysis of FOA enrollment by sex, background, home location, high school, etc.

3. Analysis of Yemeni faculty in training and employed.

4. Relevance of curriculum instructional farm and student work experience program to the small, traditional farmer and to rural women.

5. Development of relationships between the MOE, MAF, and FOA and between teaching, research, and extension.

Table 8 shows the frameworks, methodologies, types of data analyses to be made, and data collection instruments to be used with both internal assessments and external evaluations.

TABLE 8
Evaluation Plan

SYSTEM	FRAMEWORK	METHOLOGIES	TYPE OF ANALYSIS	DATA COLLECTION INSTRUMENTS
INTERNAL ASSESSMENT PROJECT YEARS 2, 5, 8	• Assessment team is representative of project. • Assessment team includes both American and Yemeni project staff. • Assessment team utilizes a formalized assessment process for collecting data, analyzing data and reporting findings. • Assessment is based on logframe outputs.	• Establish a formal assessment team of CID, AID, Core and YARG staff. • Establish benchmarks for assessment. • Develop data collection instruments based on benchmark questions. • Collect and compile data. • Analyze and summarize data. • Write conclusions, commendations and recommendations for improvement of project. • Disseminate assessment report to AID/Yemen, CID, Core, YARG and AID/Washington.	• Descriptive analysis of project implementation. • Comparative analysis of FOA development with logframe and implementation timelines. • Statistical treatment of demographic data on enrollments, sex of students retention rates, staff/student ratios, overseas training, etc. • Discrepancy analysis between curriculum being delivered and that designed in SPP.	• Oral interview guides. • Mail questionnaires. • Observation guides. • Document search guides.
EXTERNAL EVALUATION PROJECT YEARS 3, 6, 9	• Evaluation team lacks direct involvement on project implementation. • Team will use a variety of data collection methods. - Direct oral interviews - On-site observations - Document search • Evaluation will be part of the AID project evaluation. • Evaluation team will be given assistance in finding documents and people needed to complete this evaluation.	• Evaluation team members will be recommended by the Project Director and approved by AID/Washington. • Evaluation team will meet with AID/Y and University staff to establish the parameters of the evaluation and the procedures to be used. • Collect and compile data. • Analyze and summarize data • Write evaluation report.	• Follow-up study on Yemeni training in U.S. universities. • Analysis of demographic data on faculty, students and programs at the University of Sanaa. • Analysis of documents of project such as project reports, correspondence, institutional agreements, etc. • Program quality assessment through oral interviews, document searches and on-site observations. • Comparative analysis of FOA development with log frame. • Analysis of cost effectiveness of project.	• Follow-up survey. • Oral interview guides. • Mail questionnaire • Observation guides. • Document search guides.

FOOTNOTES

1/ Draft, SFYP, Chapter 3, p. 27, YARG, March 1982.

2/ IBRD, Yemen Arab Republic Agricultural Sector Analysis, Nov. 1981; see also IBRD, "Manpower Development in the YAR," March 1981, p. 84.

3/ USAID Agricultural Sector Assessment, 1982.

4/ Ibid.

5/ Ibid.

6/ Ibid.

7/ Ibid.

8/ Ibid.

9/ Ibid.

10/ In order to determine potential interest levels in the FOA, questionnaires were administered to science students in secondary schools in Hodeidah, Taiz, and Sanaa. Second and third level students enrolled in the science option were polled. The following schools were included in this survey.

Hodeidah

1. Omar Ibn Abn Al-Aziz Secondary School (boys):

   a. Third level: Natural History Class.
   b. Second level: English Class.

2. Bilquis Secondary/Preparatory School (girls):

   a. Third level: Law Class.
   b. Second level: Math Class.

Taiz

1. Farouk Secondary School (boys):

   a. Third level: Chemistry Class.
   b. Second level: Math Class.

2. Bilquis Secondary/Preparatory School (girls):

   a. Third level: English Class.
   b. Second level: English Class.

Sanaa

1. Gamal Abdul Nassar Secondary School (boys):

   a. Third level: Physics.
   b. Second level: Math.

2. Arwa Secondary School (girls)

   a. Third level: Physics
   b. Second level: English

In addition, students in the Surdud Secondary Agriculture School, the Ibb Secondary Agricultural Institute, and the Bir El-Guhourm Veterinary Secondary School (Sanaa) were polled to determine the interest level in the FOA.

ANNEX A

SPID APPROVAL MESSAGE

Department of State

UNCLASSIFIED TELEGRAM

PAGE 01 OF 02 STATE 282204 2448 095877 AID5136
ORIGIN AID-00

ORIGIN OFFICE NETC-04
INFO NEPD-04 A-NE-01 NECP-03 NENA-03 PPCE-01 PPPB-02 GC-01
GCFL-01 GCNE-01 WID-01 STAG-02 ED-02 ENGR-01 IT-06
AGRI-01 STFA-01 RELO-01 HAST-01 STHR-01 OM-00
/036 A0

INFO OCT-00 COPY-01 INR-10 EB-08 NEA-07 AMAD-01 /047 R

DRAFTED BY AID/NE/TECH/AD:ARCHIE HOGAN:AH
APPROVED BY AID/AA/NE:WM.FORD
AID/DAA/NE:B.LANGMAID
AID/NE/PD/ENGR:J HAGRON (DRAFT)
AID/NE/TECH:K.SHERPER (DRAFT)
AID/NE/DP/PR:G.DONNELLY (DRAFT)
AID/NE/NENA:C. CROWLEY (DRAFT)
AID/GC/NE:M.KLEINJAN (DRAFT)
AID/NE/PD/MENA:J.WILLIAMS (DRAFT)
AID/NE/PD:S.LINTNER (DRAFT)
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FM SECSTATE WASHDC
TO AMEMBASSY SANAA PRIORITY

UNCLAS STATE 282204

ADMAID DIR,ADO,PRO

E.O. 12356: N/A
TAGS:
SUBJECT: YEMEN-FACULTY OF AGRICULTURE -NEAC
REVIEW.AGRICULTURE DEVELOPMENT SUPPORT PROJECT 279-0052

1. NEAC MET JUNE 30, 1983 AND REVIEWED FACULTY OF AGRICULTURE SUBPROJECT IDENTIFICATION DOCUMENT. IT WAS GENERALLY FELT THAT THE SPID WAS A WELL PREPARED MISSION DOCUMENT. THE NEAC APPROVED THE FOA SPID AND RECOMMENDS THAT CID/MISSION PROCEED WITH DEVELOPING THE SPP.

2 PRE-IMPLEMENTATION: MISSION IS AUTHORIZED TO PROCEED WITH PRE-PROJECT EXPENDITURES FOR THE A&E WORK, SURVEYING AND DELINEATING THE FARM GROUNDS, AND THE INSTALLATION OF FENCES AS REQUIRED. NOTWITHSTANDING, MISSION SHOULD NOT PROCEED WITH FUNDING OF OTHER PROPOSED PREPROJECT ACTIVITIES UNTIL IT HAS RECEIVED UNQUALIFIED ASSURANCE FROM YARG THAT FUNDS REQUIRED FOR CONSTRUCTION WILL BE AVAILABLE OR THAT THE FACULTY OF AGRICULTURE WILL BE ALLOWED TO COMMENCE INITIAL OPERATION UTILIZING THE FACILITIES OF THE FACULTY OF SCIENCE OR OTHER CURRENTLY VAILABLE FACILITIES. IN ADDITION MISSION IS ENCOURAGED TO VERIFY YARG'S STATEMENT THAT AN AMPLE SUPPLY OF WATER EXISTS, WHICH CAN BE DEVELOPED FOR SUPPLYING BOTH THE SCHOOL FARM AND THE FACULTY. THIS VERIFICATION SHOULD PROCEED ASAP

3 DEVELOPMENT OF THE SUBPROJECT PAPER WILL ENTAIL REEMPHASIZING AND STRENGTHENING THE FOLLOWING SEGMENTS OF THE SPID WHERE THE NEAC FELT CLARIFICATION IS NEEDED

A. PAST EXPERTENCE AND LESSONS LEARNED: THE SUBPROJECT DESIGN TEAM IS ENCOURAGED TO LOOK AT ABSTRACTS OF AID'S PAST EXPERIENCES IN DEVELOPING FACULTIES OF AGRICULTURE IN OTHER COUNTRIES SUCH AS AFGHANISTAN, TURKEY, MOROCCO, TUNISIA, THE WEST BANK, ETHIOPIA ETC. THE LESSONS LEARNED FROM THESE ENDEAVORS MAY ENABLE THE TEAM TO BUILD IN SAFEGUARDS THAT WILL PERMIT THE PROJECT TO AVOID SOME OF THE PITFALLS ENCOUNTERED IN THESE PAST ACTIVITIES NE/TECH/AD WITH THE ASSISTANCE OF NE/PD/PAE WILL PROVIDE

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THE DESIGN TEAM WITH DATA ON THE ABOVE.

B. ROLE OF WOMEN: SERIOUS THOUGHT MUST BE GIVEN TO ATTRACTING AND BRINGING WOMEN INTO THE PROJECT AT AN EARLY DATE. THIS IS ESPECIALLY TRUE SINCE LARGE NUMBERS OF YEMENI MEN HAVE LEFT AGRICULTURE TO SEEK THEIR FORTUNES IN SAUDI AND THE GULF STATES, AND WOMEN HAVE TAKEN THEIR PLACES ON THE FARM. THE CURRICULUM THAT IS TO BE DESIGNED FOR THE FACULTY SHOULD ENCOURAGE WOMEN TO ENROLL FROM THE ONSET, IN COURSES THAT WILL ACCELERATE THEIR STUDY OF THE AGRICULTURAL SCIENCES. THIS IS PARTICULARTLY RELEVANT SINCE WOMEN AT THIS TIME COMPRISE ALMOST A MAJORITY OF THE STUDENTS AT THE SANAA UNIVERSITY. IN ADDITION THERE DOES NOT APPEAR TO BE ANY REASON WHY SPECIFIC COURSES DESIGNED FOR WOMEN IN HOME ECONOMICS AND NUTRITION COULD NOT ALSO BE INCLUDED. THESE ISSUES SHOULD BE CONSIDERED IN THE SOCIAL ANALYSIS SECTION OF THE SPP.

C. BACKWARD AND FORWARD LINKAGES: THE ROLE OF THE FACULTY OF AGRICULTURE IN THE WHOLE AGRICULTURAL SECTOR MUST BE DELINEATED IN MORE DETAIL. FOLLOWING ARE TYPICAL QUESTIONS WHICH THE SUBPROJECT PAPER SHOULD ADDRESS. WHAT IS THE RELATIONSHIP OF THE FACULTY WITH THE MINISTRY OF AGRICULTURE? WHAT IS ITS RELATIONSHIP WITH THE PRIVATE SECTOR? WHAT LINKAGES EXIST AT THIS TIME BETWEEN OTHER FACULTIES AT THE UNIVERSITY? WHAT ADMINISTRATIVE REGULATIONS PERMIT COORDINATION AMONG THESE VARIOUS FACULTIES? WHAT ARE THE LINKAGES THAT EXIST BETWEEN THE FACULTY AND THE SECONDARY SCHOOLS?

D. ADEQUATE SUPPLY OF AGRICULTURE STUDENTS: THIS AREA MUST BE LOOKED AT CLOSELY SINCE THERE ARE ONLY THREE SECONDARY AGRICULTURAL SCHOOLS WHICH WILL SERVE AS THE PRINCIPAL SOURCE OF SUPPLY OF STUDENTS. OTHER ESTABLISHED AND PROPOSED FACULTIES WITHIN THE UNIVERSITY SYSTEM WILL COMPETE FOR THE LIMITED NUMBER OF STUDENTS GRADUATING FROM THESE AS WELL AS FROM THE OTHER SECONDARY SCHOOLS. THE SPP MIGHT CONSIDER A SUMMER SCHOOL PROGRAM AND/OR THE PROVISION OF A FIFTH YEAR AS METHODS TO BRING IN SECONDARY STUDENTS WHO MIGHT NOT OTHERWISE QUALIFY FOR ADMISSION TO THE FACULTY.

E. PARTICIPANT TRAINING. THE SPID PROVIDES FOR LONG TERM TRAINING FOR FIFTEEN FACULTY MEMBERS. THIS NUMBER APPEARS TO BE INSUFFICIENT WHEN VIEWED FROM ACTUAL SITUATIONS SUCH AS DROP OUTS, NON-RETURNEES AND THOSE WHO WILL TAKE OTHER JOBS WHEN THEY DO RETURN. THIS NUMBER ALSO APPEARS TO BE RATHER THIN WHEN CONSIDERING THE TEACHING, RESEARCH AND POSSIBLE EXTENSION ROLES WHICH THE FACULTY WILL BE CALLED UPON TO PERFORM. THE SPP DESIGN TEAM SHOULD RE-EXAMINE THE ACTUAL NUMBER OF PARTICIPANTS WHICH THE PROJECT SHOULD TRAIN.

F. CURRICULUM DEVELOPMENT: THE NEAC WAS CONCERNED THAT MANY OF THE PROPOSED CORE COURSES, FOR THE FACULTY OF AGRICULTURE, IN THE NATURAL AND BIOLOGICAL SCIENCES ARE ALSO TAUGHT IN OTHER FACULTIES OF THE UNIVERSITY. IS THERE NEED FOR DUPLICATION? CONCURRENTLY, IF IT IS DETERMINED THAT THESE OTHER FACULTIES ARE WILLING TO PROVIDE INSTRUCTION IN THESE COURSES, THEN THE SPP MUST ADDRESS THE ISSUE OF WHETHER THEY CAN SUPPORT THE FACULTY OF AGRICULTURE CURRICULUM TO THE LEVEL BEING PROPOSED. IN VIEW OF THE ISSUES OUTLINED IN ITEM D. ABOVE CONCERNING AN ADEQUATE SUPPLY OF STUDENTS, IT IS OF UTMOST IMPORTANCE THAT THE DESIGN OF THE SPP PROVIDES FOR THE ELIMINATION OF AS MUCH DUPLICATION AS POSSIBLE. CONCERN WAS ALSO NOTICED AT THE NEAC AS TO THE TYPE OF TRAINING THAT THE FACULTY WOULD OFFER. FOR EXAMPLE, IS

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PROVISION BEING CONTEMPLATED FOR OTHER THAN TRADITIONAL BA/BS DEGREE TRAINING IN AGRICULTURE SUCH AS NON-FORMAL SHORT COURSES, IN-SERVICE TRAINING, EXTENSION/DEMONSTRATION ACTIVITIES ETC?

G. EVALUATION: THE FRAMEWORK FOR DATA COLLECTION AS WELL AS A MORE DETAILED EVALUTION BUDGET MUST BE DEVELOPED IN THE SPP. THE DATA COLLECTION STRATEGY SHOULD NOT HOWEVER, AS IS STIPULATED IN THE SPID, BE LEFT TO THE DISCRETION OF TECHNICIANS PROVIDED UNDER THE PROJECT, TO DEFINE. DATA COLLECTION AND EVALUATION SHOULD STAND AS DISTINCT COMPONENTS OF THE PROJECT AND BE CLOSELY INTEGRATED INTO THE IMPLEMENTATION PLAN.

4. ADMINISTRATIVE OPERATIONS: QUESTIONS WERE RAISED DURING THE MEAC AS TO WHO WOULD CARRY OUT ADMINISTRATIVE FUNCTIONS RELATED TO THE FOA. WILL THESE FUNCTIONS BE THE RESPONSIBILITY OF THE FOA OR WILL THEY BE CONDUCTED BY THE CENTRAL UNIVERSITY ADMINISTRATIVE OFFICE? HOW WILL THEY BE FINANCED? ISSUES IN THE ADMINISTRATIVE AREA SHOULD BE ADEQUATELY COVERED IN THE SPP BY A PUBLIC ADMINISTRATION SPECIALIST. PUBLIC ADMINISTRATION SKILLS SHOULD BE INCLUDED ON THE DESIGN TEAM, EVEN IF IT REQUIRES AN ADDITIONAL TEAM MEMBER.

5. YARG'S CONTRIBUTION TO PROJECT ACTIVITIES: THE MEAC REALIZED THAT YARG IS NOW FACING BUDGETARY CONSTRAINTS OF SOME MAGNITUDE. NEVERTHELESS, THE MISSION SHOULD BE SURE THAT YARG UNDERSTANDS FULLY WHAT COSTS IT WILL HAVE TO PROVIDE ON A CONTINUING BASIS WHEN THIS PROJECT BECOMES OPERATIONAL. SHULTZ

ANNEX B

LOGICAL FRAMEWORK

ANNEX B

LOGICAL FRAMEWORK

Project Title: Faculty of Agriculture Subproject
Agricultural Development Support Program

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Measures of Achievement	Means of Verification	Assumptions
GOAL	GOAL	GOAL	GOAL
To increase rural incomes in the YAR through agricultural development.	Increased agricultural production. Improved agricultural trade balance. Increased farm income.	YARG statistics. Socio-economic analyses.	Agriculture will remain an important economic activity in rural Yemen.
SUBGOAL	SUBGOAL	SUBGOAL	SUBGOAL
To increase the supply of appropriately trained Yemeni men and women to plan, manage, implement, and evaluate development activities in the private and public agricultural sector of the YAR.	Increase in number of trained Yemeni men and women working in agriculture and rural development and a corresponding decrease in expatriates in key positions	1. YARG employment data. 2. MOE records. 3. MAF records on expatriate involvement in rural development	1. Incentive structure sufficient to attract Yemeni personnel to employment in the agricultural sector and to retain trained Yemeni personnel in the YAR. 2. There will continue to be a demand for trained Yemeni personnel in the agricultural sector.

ANNEX B (Continued

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
PURPOSE	END OF PROJECT STATUS	MEANS OF VERIFICATION	ASSUMPTIONS
To support the establishment within the University of Sana'a Yemen's first Faculty of Agriculture that is responsive to private and public sector development, and has appropriate linkage to the agriculture sector's production and institutional structure.	1. An operational indigenous Faculty of Agriculture within the University of Sana'a engaged in teaching and research, and assisting MAF extension activities. 2. Four hundred-eighty students trained and graduated, and assuming responsible positions in the private and public sector, and an established institutional capability to produce 120 graduates per year. 3. Ongoing collaboration between the Faculty of Agriculture, the MAF, the MOE, private agencies and agricultural producers on: a)research and research priorities b)extension c)curriculum development d)in-service training 4. A productive and ongoing relationship between the Faculty of Agriculture and U.S. Land-Grant University Faculties of Agriculture. 5. An operational instructional farm that is integrated into the curriculum of the Faculty of Agriculture and is providing students opportunities for relevant, practical experiences.	1. Project evaluation reports. 2. University/Faculty of Agriculture records. 3. Follow-up surveys of graduates. 4. Lists from U.S. Land-Grant Universities of seminars, special courses, and TDYs to support relationships with the Yemeni FOA. 5. Formative evaluations in the context of annual workplans and other existing project reporting fora.	1. University of Sana'a policies will continue to support the development of a Faculty of Agriculture. 2. Adequate facilities not funded by AID will be funded by 6/1/85 and available for use by 6/1/89. 3. Faculty of Agriculture will be successful in recruiting and graduating students in projected numbers. 4. Private and public agencies in the YARG, particularly MAF and MOE, will continue to be supportive of an indigenous Faculty of Agriculture. 5. Incentive structure for faculty will continue to attract and retain qualified personnel for the FOA. 6. Sana'a University will receive adequate budgets from the YARG, University tuition, and/or other donors. 7. University FOA policies, personnel, and budgets will be implemented during and after project in accordance to the schedule as outlined in the budget. 8. University/FOA facility and equipment maintenance and replacement policies will be implemented during and after the project.

ANNEX B (Continued)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUTS	MAGNITUDE OF OUTPUTS	MEANS OF VERIFICATION	ASSUMPTIONS
1. An appropriate and flexible administrative/organizational structure which can accommodate projected growth in the Faculty of Agriculture and changes in the country's agricultural sector. 2. Trained Yemeni faculty capable of instructing at the B.S. level, conducting research on priority Yemeni rural development issues, and assisting other institutions in extension. 3. A flexible co-educational curriculum that is responsive to the training needs of the YAR. 4. An agricultural sciences library. 5. Agricultural sciences laboratories. 6. An instructional farm on the university campus. 7. Graduates at the B.S. level. 8. Programs for in-service and refresher training for professional agriculturalists in the private and public sector. 9. Faculty exchanges, seminars, and other evidence of relationships developed with the U.S. Land-Grant University Faculties of Agriculture.	1. One administrative/organizational structure. 2. Yemeni faculty trained in the following fields: a)7 in livestock and poultry production and protection. b)7 in crop production and protection c)3 in agricultural economics d) 6 in hydrology and agricultural engineering e)3 in agricultural education/Extension Methods f)3 in food science and technology g)1 in library science h)1 in ESL/Technical Agriculture 3. One co-educational curriculum. 4. One library. 5. Instructional and research laboratories in the following areas: a)animal and poultry science b)plant sciences c)agricultural mechanics d)soil science e)agricultural and product processing f)food science and technology g)agricultural media preparation 6. 120 B.S. graduates per year. 7. Two in-service training courses per year.	1. Project evaluation reports. 2. Project training and other records. 3. Site inspections. 4. University records. 5. Lists from U.S. Land-Grant Universities of seminars, special courses, and TDYs to support relationshps with the Yemeni FOA.	1. Quality participants are available for training, will meet English language requirements, will complete training as scheduled, and will return to specified faculty positions. 2. Adequate facilities will be funded by 6/1/85 and available for use by 6/1/89. 3. Adequate water will continue to be available to support operation of facilities, including instructional farm. 4. Only minimal remedial education will be required of prospective Faculty of Agriculture students. 5. U.S. Land-Grant Universities will develop and nurture university relationships with the Yemeni Faculty of Agriculture.

ANNEX B (Continued)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
INPUTS	QUANTIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
1. AID grant of $22.6 million over 11 year period (FY84-94).	(See budget)	1. AID Project Agreement(s). 2. YARG budget and records of budget allocations. 3. University records. 4. CID contract	1. AID grant to support architectural and engineering services for the design and supervision of facility construction will be approved and released in a timely manner. 2. Other donor funding of facility construction will be approved and released in a timely manner. 3. AID, YARG, and other donor commitment to supporting project remains strong throughout life-of-project. 4. Land for the Faculty of Agriculture and instructional farm will remain available. 5. The campus of the Faculty of Agriculture and particularly the instructional farm will not be negatively affected by urban encroachment.
2. YARG contribution of YR 148 million over same period.	(See budget)		
3. Implementation contract with CID.			

ANNEX C

APPROVED INITIAL ENVIRONMENTAL EXAMINATION

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

C
C/D

RECEIVED
JUL 25 '83
YEMEN PROGRAM
SANA'A Y.A.R.

July 8, 1983

MEMORANDUM

TO: USAID/Yemen/AGR, Patrick Peterson

THRU: NE/TECH/AD, Archie Hogan

FROM: NE/PD/ENV, Stephen F. Lintner, Environmental Coordinator

SUBJECT: SPID - Yemen Faculty of Agriculture

I have reviewed the subject document and concur in the Mission's recommendation of a "Negative Determination." The subject subproject is exempt from further review under the provisions of FAA Section 216.2 (c)(vii). For construction and water and waste management issues the safeguards spelled out in the Initial Environmental Examination should be enforced.

cc: GC NE

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YEMEN ARAB REPUBLIC

PRIME MINISTER'S OFFICE

الجمهورية العربية اليمنية
رئاسة مجلس الوزراء

P. O. Box : 175 - SANA'A
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صندوق بريد : ١٧٥ - صنعاء
تلغرافيا : سنبلان
تلفون : ٢٩٩٢-٣
٧٣٥٣-٦-١٠

Dept : Minister's Office
Our Ref : 5429
Date : 9 December 1982
Subject

الموضوع

Dear Mr. Ward,

In a recent meeting with you, we discussed the status of project development for the Faculty of Agriculture, Sana'a University.

This letter is to confirm to the Agency for International Development that donor financing has been negotiated from other donors in an estimated amount of US$20 millions (excluding the cost of land) for the construction and basic equipping of buildings and facilities for the new Faculty of Agriculture. The Y.A.R. Government contribution for the construction and equipping of the Faculty of Agriculture will be about Yemeni Rials 45 millions (excluding the financing from other donors).

Is it possible for AID to finance the detailed engineering and architect services originally [illegible] in our January 26, 1982 letter No. 411. This is required so that donor commitment needed for financing construction and construction supervision services can be firmed up. We appreciate AID's favorable consideration of Yemen's request for assistance in the design and construction of an experimental farm for the Faculty of Agriculture, as well as training for faculty members and administrators, and technical assistance.

Sincerely yours,

Fuad Kaid Mohammed,
Minister of Development Chairman
Central Planning Organization

Mr. Ward,
Director,

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ANNEX D

YARG REQUEST FOR ASSISTANCE AND PRESIDENTIAL DECREE

الجمهورية العربية اليمنية

رئاسة الجمهورية ومجلس الوزراء

المكتب الفني

قـــرار جمهـــوري رقم(٥١) لسنة ١٩٨٢م

بانشاء كلية للزراعة بجامعـــة صنعـــاء

الجمهوريـــة

بعد الاطلاع على الدستور الدائم ،

وعلى الاعلان الدستوري الصادر بتاريخ ١٩٧٨/٢/٦م بتشكيل مجلس الشعب التأسيسي المعدل بالاعلان الدستوري الصادر بتاريخ ١٩٧٨/٤/١٧م ،

وعلى الاعلان الدستوري الصادر بتاريخ ١٩٧٨/٤/٢٢م بالعمل بقرار مجلس الشعب التأسيسي بتحديد شكل رئاسة الدولة واختصاصاتها وعدتها ،

وعلى الاعلان الدستوري الصادر بتاريخ ١٩٧٩/٥/٨م بتعديل بعض احكام الاعلانات الدستورية السابقة الخاصة بمجلس الشعب وتوسيع اختصاصاته ،

وعلى قرار مجلس القيادة بالقانون رقم(١٣٦) لسنة ١٩٧٦م باعادة تنظيم وزارة التربية والتعليم وتحديد اختصاصاته ،

وعلى قرار مجلس القيادة بالقانون رقم(٨٩) لسنة ١٩٧٧م باصدار قانون جامعة صنعاء ،

وبعد أخذ رأي مجلس الجامعة وبناء على عرض وزير التربية والتعليم ،

وبعد موافقة مجلس الـــــوزراء ،

قـــــرر

مادة(١) تنشأ كلية للزراعة وتكون ضمن كليات جامعة صنعاء وتسري عليها احكام القانون رقم ٨٩ لسنة ١٩٧٧م باصدار قانون جامعة صنعاء .

مادة(٢) يعمل بهذا القرار من تاريخ صدوره ، وينشر في الجريدة الرسمية .

صدر بالقصر الجمهوري بصنعـــــــــاء

بتاريخ ٦ / شوال / ١٤٠٢هـ

الموافق ٢٦ / يوليو / ١٩٨٢م

حمد محمد عبد الملك الاصبحي
وزير التربية والتعليـــــم

د / عبد الكريم علي الارياني
رئيس مجلس الوزراء

العقيد / علي عبد الله صالـــــح
رئيس الجمهوريـــــة

القائد العام للقوات المسلحـــة

C.P.O.
Dept. of Projects and Loans
Ref : 75
Date : 1/7/1984

R. Fendall
OSE

Re Financing the Construction of Faculty of Agriculture at Sana'a University

To :
The Director,
USAID - Sana'a.

In reference to the previous correspondence with you regarding financing the construction of Faculty of Agriculture at Sana'a University;

We wish to advise you that the Govt. of Yemen represented by the CPO, is currently in touch with the relevent authorities to join in the financing operation of building the Faculty of Agriculture. The main parties are the Saudi Development Fund, who expressed their initial approval of financing the project. In case of financial difficulties, the Yemeni government will cover the deficit of financing the project from the State's budget.

In consideration of the above, please advise us as of your opinion.

Thanking you for your continued cooperation.

Please accept our best regards.

Director-General,
Projects and Loans

Anwar Rizq Al-Harazi

Deputy of the CPO

Fathi Salem Ali

D-6

DIR/DD	
ASH	✓
[illegible]	
CONT	
EXO	
HR	
PROG	
RD	
CHRON	
AF	

CPO
Dept. of Technical Cooperation and Conference
Assistance Section

Ref: 411
Date: 1/26/1982

Subject: Contribution on Faculty of Agriculture Project

To:
The Director
USAID/Sanaa

This is to inform you that we have received Sanaa University's note No. 1531 dated 1/19/1982 regarding your contribution in the Faculty of Agriculture Project of Sanaa University and their request for a meeting to discuss the type and scope of assistance which USAID could provide in this vital project. In the previous meetings you have expressed your interest to contribute in this project specially in the following fields:

1. To provide participant training in Agriculture (Masters/ PHDs), 5 scholarships per year during the next five years.

2. Funding of technical studies related to Engineering Designs and specifications, inorder to submit these studies to the Iraqi fund for International Development.

3. To reclaim the land located inside the university campus of Wadi Dhahr Road to be a nucleus for the Faculty of Agriculture Farm.

We would also like to inform you that the government has obtained necessary funds for the Faculty Buildings. The project is given a higher priority in the plan.

Please take note and initiate necessary action and advise.

Thank you for your cooperation.

Fatehy Salem Ali
Deputy CPO

cc: Sanaa University

ANNEX D

PRESIDENTAL DECREE

ESTABLISHING THE FOA

Typed exactly as received from Abdulkader M. Uqba

Y.A.R.

President of the Republic and the Cabinet

Legal Office

REPUBLICAN DECREE NO. 51

YEAR 1982

FOR THE ESTABLISHMENT OF

AGRICULTURE FACULTY -

SANAA UNIVERSITY

AFTER THE DECREE INTRODUCTION AND CONSTITUTIONAL REFERENCES.

Item (1) - the establishment of the Agriculture Faculty and to to be included with Sanaa University faculties and valid under the rules of the law no. 89 for year 1977 "The Law of Establishing Sanaa University".

Item (2) - This decree is legal from its effective date and to be published in the Government Official Magazine.

Issued at the Republican Palace

Date of Issue 26th July 1982

Signed by

Ali Abdulla Saleh	Abdulkarem Al Irani	Ahmed Mohamed Abdul Malik Alasbahi
Y.A.R. President and Commander in Chief	Prime Minister	Minister of Education.

بسم الله الرحمن الرحيم

SANA'A UNIVERSITY

Vice Rector Office

جامعة صنعاء

جامعة صنعاء

نائب المدير

RECEIVED

DEC 3 '83

YEMEN PROGRAM
SANA'A Y.A.R.

Date: 27th/Nov/1983.

Ref :

Dear Mr. Weden,Jr.,

Thank you for your letter dated November 2nd,1983. I am glad to note that we have reached the execution phase, and in this regard I wish to confirm;

1) The water from the well drilled for the Faculty of Agriculture will be used exclusively for that purpos

2) The planned farm will be primarly teaching & demonstration farm and will not be used for activiti outside the faculty and curriculum needs.

Hoping these points will pave the way for immedia work in the farm. With my best regards,

Yours Truly,
Sana'a Universi
Vice - Rector

Dr. A. Qirbi.

جامعة صنعاء

D-5

ANNEX E

TECHNICAL ANALYSIS

ANNEX E

TECHNICAL ANALYSIS

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ANNEX E

TECHNICAL ANALYSIS

I. Objective of the FOA.

The objective of the FOA is to increase the supply of appropriately trained manpower in the YARG to plan, manage, implement, and evaluate development activities in the private and public agricultural sector of the YAR.

II. Location and Physical Facilities of the FOA.

A number of location alternatives have been carefully examined by university officials and outside consultants. The initial study prepared in 1980 by Dr. Naser A. Al-Aulaqi, then Associate Professor of Agricultural Economics in the Faculty of Business and Commerce, addressed this issue. In a strong argument for locating the proposed FOA within the UOS, Dr. Al-Aulaqi pointed out:

> "The big requirement for nonagricultural sciences, whether at the B.A. or M.A. and Ph.D. levels, indicates that agricultural colleges impose on their students an amount of nonagricultural sciences in which other college (faculties) specialize. This warrants the existence of an agricultural college within the campus of the university so that students could be able to study the other requirements." 1/

Dr. Al-Aulaqi also cited the economic advantage in avoiding the costs of duplicating staff that would be necessary to reach all the elements of a baccalaureate program in isolation from the rest of the university. He concluded that the proposed FOA must be located on the UOS campus and that a building of about 20,000 mz would adequately serve the needs of this new faculty. 2/

In April of 1981, Dr. I.A.M. Lucas, Principal of Wye College of the University of London, was invited to YAR by UOS officials and the British Council. In addition to other items, Dr. Lucas addressed the question of location and firmly supported the stance of Dr. Al-Aulaqi citing the strong need to develop close ties, especially with the FOS. He also concluded that no single site in the YAR would be representative of all the country's diverse agricultural regions. 2/

During 1981, CID and USAID developed a report on a month-long fact-finding tour by selected YARG officials of the Faculties of Agriculture in Jordan, the United Kingdom and the United States. This report also documents the need for locating the FOA within the UOS. 3/

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In early 1982, at the request of the YARG, the UNDP FAO sent a team of consultants to the YAR to prepare feasibility studies and recommendations concerning the establishment of an FOA. This team did not question alternative sites, indicating their assumption that the FOA would be an integral part of the campus. 4/

The League of Arab States sent a team to YAR to study the establishment of an FOA in Yemen. The team considered a number of possible alternative sites and concluded with more than a dozen strong arguments for locating the FOA within the existing UOS. 5/

Thus, a number of studies have focused on the issue of location and all are unanimous in recommending that the FOA be located within the UOS. In this growing community of scholars, a young, indigenous faculty would have an opportunity to develop close ties with other faculties on the campus as well as to plant the seeds for the all-important linkages with the MAF and MOE, located nearby, and the remainder of the public and private agricultural sector.

While USAID will not finance the construction of buildings to house the FOA or purchase land on which to locate an instructonal farm, both items will provide essential and needed support facilities for the FOA. YARG has agreed to finance the construction of a faculty building with funds expected to be made available through low-interest loans from sister Arab nations. The buildings will include offices, classrooms, libraries, laboratories, and greenhouse space, and, according to World Bank estimates, will cost in the vicinity of $20-22 million. A cost of $22 million, including $3 million for equipment, was projected by the firm of Gauthier, Alvarado and Associates (see p. 17, Annex K). USAID is proposing to provide A/E design consultants to work directly with construction architects and engineers to assure a functonal relationship between offices, classrooms, and research facilities. USAID, through the provisions of this proposed FOA Subproject, will provide essential classroom materials, library resources, teaching equipment, and construction observation services.

This subproject will also support the development of an instructional farm on about a 22 hectare site adjacent to the faculty building (see map, p. 30, Annex J). The farm will provide an essential practical training element for students enrolled in the FOA, utilizing demonstration plots for agronomic and horticulture crops, facilities for livestock and poultry, and examples of rain-fed and irrigated crop production. The use of this facility will be an integral part of many of the courses in the curriculum. It can also be used as a demonstration resource for local farmers or extension agents where the latest cultural practices can be shown via tours and workshops sponsored by the FOA. The details of this important instructional tool are presented in Annex J of this report. The university will provide the land for the instructional farm, and USAID will finance the site preparation, development and construction costs, as well as the procurement of necessary supplies, equipment, and participant training. Detailed analysis and justification is contained in Annex J. Based on prior

CID experience with the poultry and horticulture subprojects, it is recommended that 2 years be scheduled to bring the instructional farm to a functonal state.

III. Proposed Structure and Organization of the FOA

In accordance with the recommendation of the FAPU, the land-grant model will serve as guide to shaping the proposed FOA. 3/ Initially, resident instruction will be the primary functon of the FOA. It will take time for the FOA to establish its credibility with the MAF and with the grassroots elements of the agricultural sector in terms of the additional functions of teaching, research, and extension. While the FOA may not fully take on the two latter functions, it is critical that linkages be developed with the MAF as soon as possible. We have found in our discussions with MAF officials, a highly favorable attitude of cooperation in achieving such an end.

Figures E-1, E-2, and E-3 schematically depict the transition that would occur ideally if the land-grant model is to be eventually achieved. The EOPS will result in an indigenous faculty functioning as a single unit, under the leadership of a dean (Figure E-1). This rudimentary faculty will include some degree of specialization in agricultural economics, agricultural education and extension, agricultural engineering, crop production and protection, food science and technology, and livestock and poultry production. Prospective FOA members will specialize in field crops, horticulture, and soil science. Agricultural engineering will include specialization in terms of irrigation and water relations, agricultural mechanization, and computer applications. The fisheries science areas have been excluded from the FOA because the curriculum for fisheries science differs markedly from that of the agricultural sciences. At some point in the future the UOS may decide to include fisheries sciences within the FOS, which currently teaches courses in marine science.

As the FOA grows, departmental units could eventually emerge within the FOA as shown in Figure E-2. Managed by appointed departmental heads, these units would operate expanded and more sophisticated programs of teaching, where students could, if desired, select greater specialization at the baccalaureate level.

Figure E-3 depicts the long-range organizational structure in which the Dean is assisted administratively by Associate Deans responsible for leadership in teaching, research, and extension. Faculty members in each department would participate in all three activities, some holding joint appointments in at least two areas. In essence, this is the generalized land-grant model, and it may take 15 to 30 years to achieve its parallel in the YAR. The important point is not so much that this model be achieved; rather it is critical that the FOA eventually impact, through whatever means

FIGURE E-1

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE
UNIVERSITY OF SANAA, END-OF-PROJECT STATUS(1993)

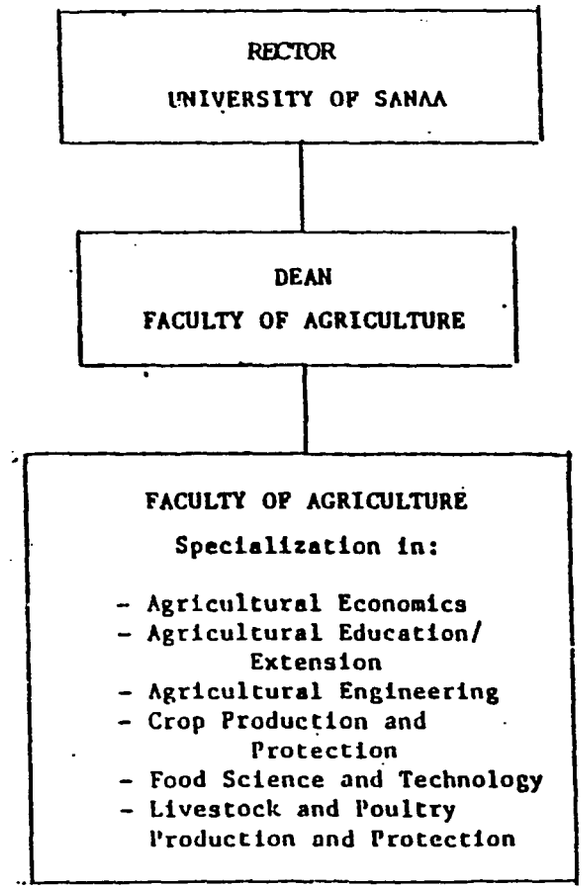

FIGURE E-2

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE,
UNIVERSITY OF SANAA, INTERMEDIATE STATUS (1999)

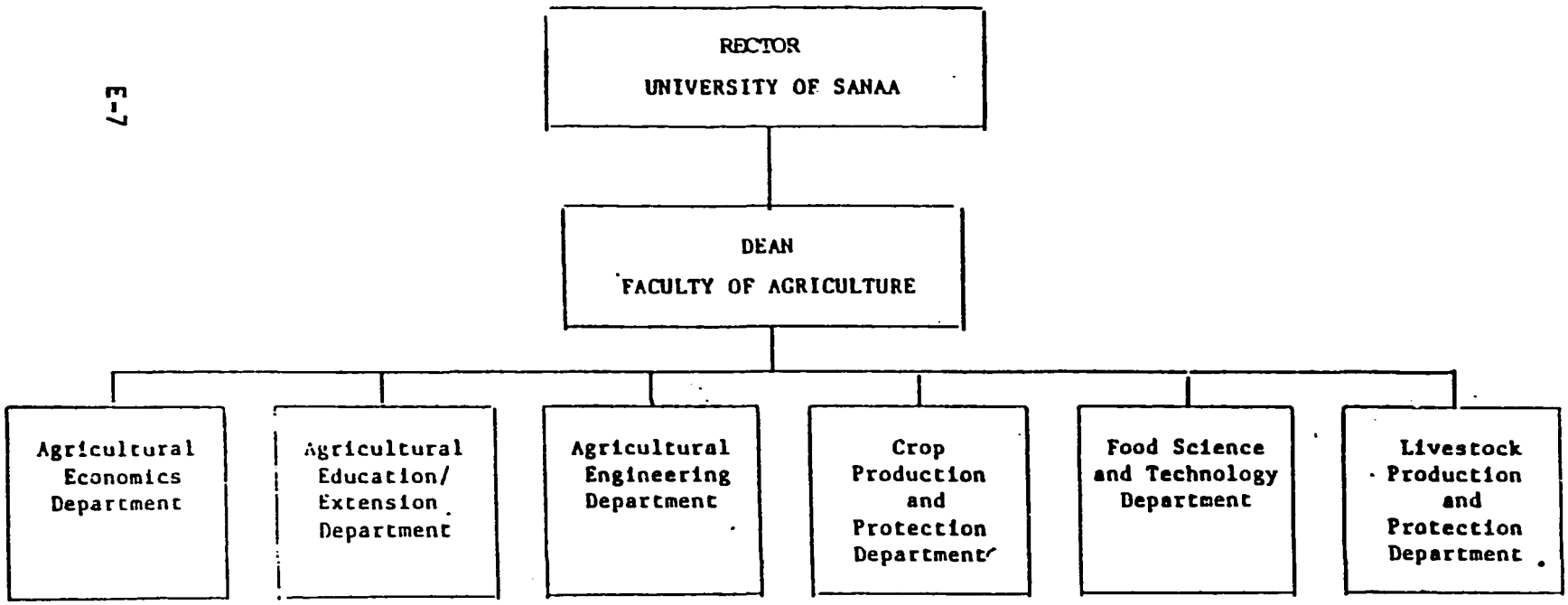

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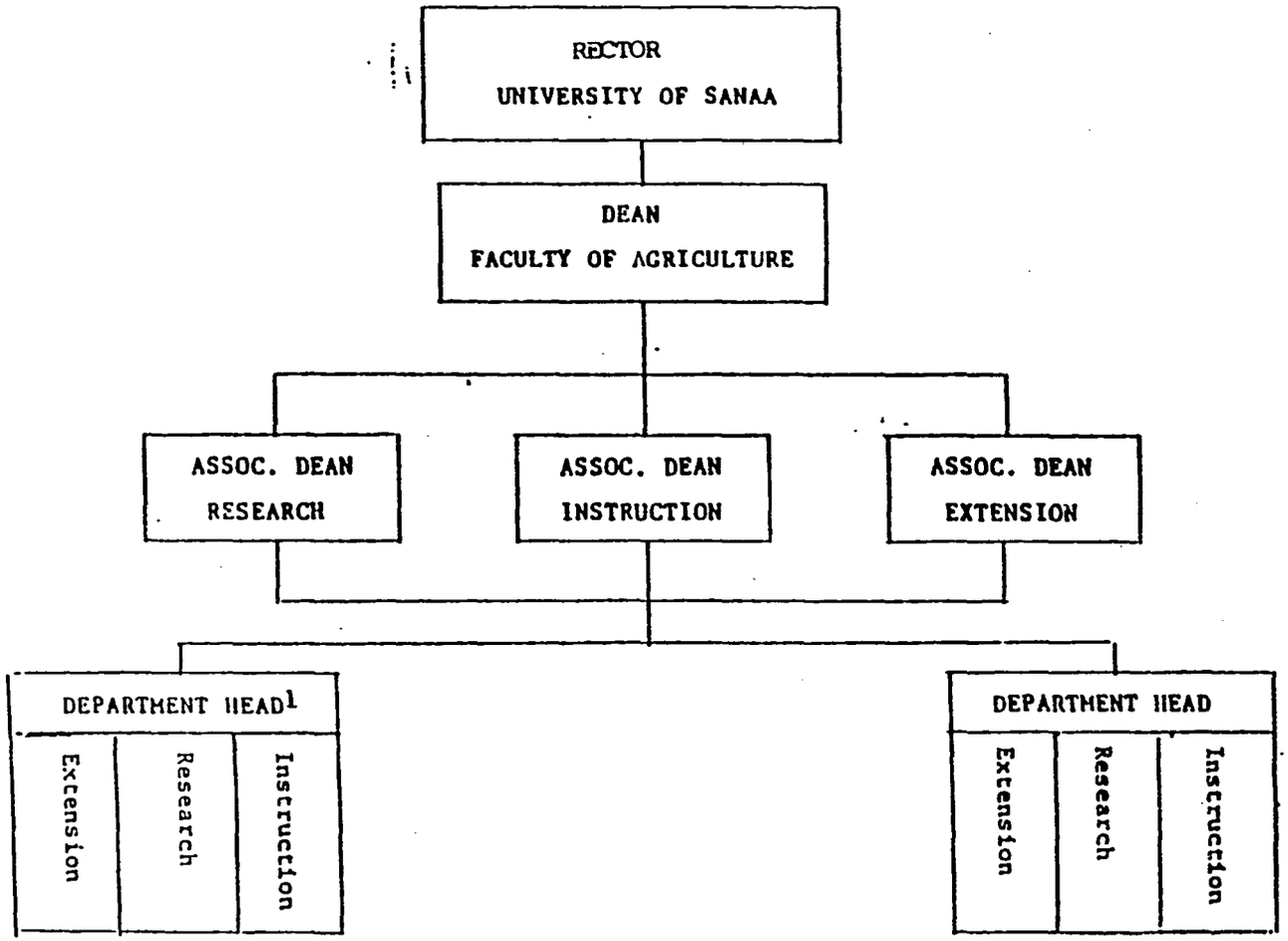
FIGURE E-3

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE, UNIVERSITY OF SANAA, ULTIMATE STATUS (2010)



[1] It is expected that multiple departments may eventually develop in response to changing needs.

and linkages necessary, the rural agricultural sector which prinicpally consists of the Yemen farmers. If this can be done effectively through MAF channels of research and extension, the goals of this subproject will very likely be realized.

IV. Training and Staffing Plan for the Proposed FOA

Key elements of this subproject are:

A. Internships of 6 months in length in the United States for the Yemeni Dean Designate and the Yemeni Farm Manager Designate, and

B. Academic preparation of prospective Yemeni faculty in the area of specialization targeted for the FOA. Table E-1 illustrates the phasing of the participant training.

Two participants are scheduled for 3 years of study in the U.S. beginning in the second year of the subproject. One of them will earn either a second baccalaureate or a M.S. degree in Library Science. The other will earn an M.A. degree in ESL with emphasis in technical agriculture.

Graduate preparation will be provided for 29 prospective FOA members. Seven scholarships have already been authorized under the Core Subproject. Eleven trainees will be selected to begin graduate study in the second subproject year and five, three, and three trainees in successive years. It is anticipated that 5.5 years will be required for each of them to earn both the M.S. and Ph.D. degrees. Only 3 percent of the trainees from Yemen sponsored by USAID have not earned degrees. Among those completing degrees about 25 percent have not returned immmediately, but 100 percent have returned within 5 years to Yemen. Providing for 29 Yemeni to begin graduate study takes into account the past experience of a possibility that up to 25 percent of those completing degrees may not return immediately to Yemen. Also, it should be noted that Yemeni completing Ph.D. degrees under sponsorhip of other donors may join the FOA.

Graduate training programs will be designed such that formal coursework will be completed abroad, and the research and thesis may be done in-country with supervisory visits by the student's major professor at an appropriate point in the progress toward completion of the research. Some research supervision will be possible by CID in-country professional personnel. Such a mechanism will enable Yemeni graduate students to focus research projects on important problems of Yemeni farmers and will initiate the important process of establishing linkages and credibility with the agricultural sector of the YAR. It will also promote the development of important long-range linkages between the FOA and the U.S. agricultural institution. Such a relationship could eventually be beneficial at both institutions in terms of developing library research, sponsoring special seminars, etc. This procedure is outlined more completely in Section G of this Annex.

TABLE E-1

PROPOSED PHASING OF FOA PARTICIPANT TRAINING AT U.S. LAND-GRANT UNIVERSITIES BY AREA OF SPECIALIZATION, SUBPROJECT YEAR, STUDY EMPHASIS, AND TARGETED FOA RESPONSIBILITY

AREA OF STUDY AT U.S. LAND-GRANT UNIVERSITY	Core Project 1983 2/	SUBPROJECT YEAR 1	2	3	4	5	6	7	8	9	10	11	TARGETED FOA RESPONSIBILITY 1/
Horticulture	◄	—	—	—	—	►|							Crop Prod. & Protection
Poultry Science	◄	—	—	—	—	►|							Livestock/Poultry
Agricultural Economics	◄	—	—	—	—	►|							Agric. Economics
Entomology	◄	—	—	—	—	►|							Plant & Animal Protect.
Soil & Water Management	◄	—	—	—	—	►|							Crop Prod. & Protect.
Animal Science	◄	—	—	—	—	►|							Livestock/Poultry
Agricultural Engineering	◄	—	—	—	—	►|							Agric. Engineering
Library Science 3/			◄	—	►								Agric. Library
ESL/Technical Agriculture 4/			◄	—	►								Faculty of Agriculture
Agricultural Marketing			◄	—	—	—	—	►|					Agric. Economics
Farm Management			◄	—	—	—	—	►|					Agric. Economics
Irrigation, Water Relations			◄	—	—	—	—	►|					Agric. Engineering
Gen. Agricultural Eng.			◄	—	—	—	—	►|					Agric. Engineering
Extension Methods			◄	—	—	—	—	►|					Agric. Educ./Ext.
Animal and Poultry Nutrition			◄	—	—	—	—	►|					Livestock/Poultry
Plant Breeding Genetics			◄	—	—	—	—	►|					Crop Prod. & Prot.
Food Science & Technology			◄	—	—	—	—	►|					Food Science & Tech.
Citrus, Vegetable Production			◄	—	—	—	—	►|					Crop Prod. & Protection
Layer, Broiler Production			◄	—	—	—	—	►|					Livestock/Poultry
General Soil Science			◄	—	—	—	—	►|					Agric. Educ./Ext.
Secondary Teacher Training				◄	—	—	—	—	►|				Agric. Educ./Ext.
Cattle, Sheep, Goat Production				◄	—	—	—	—	►|				Livestock/Poultry
Cereal, Forage Production				◄	—	—	—	—	►|				Crop Prod. & Protection
Livestock Grazing Management				◄	—	—	—	—	►|				Livestock/Poultry
Soil Morph., Fert., Physics				◄	—	—	—	—	►|				Crop Prod. & Protection
Agricultural Mechanization					◄	—	—	—	—	►|			Agric. Engineering
Extension Methods					◄	—	—	—	—	►|			Agric. Educ./Ext.
Livestock & Poultry Breeding					◄	—	—	—	—	►|			Livestock/Poultry
Computer Applications						◄	—	—	—	—	►|		Agric. Engineering
Human Nutrition						◄	—	—	—	—	►|		Food Science & Tech.
Food Chemistry Processing						◄	—	—	—	—	►|		Food Science & Tech.
TOTAL IN TRAINING	7	7	20	25	28	25.5	22	16.5	8.5	4.5	1.5	0	

1/ See proposed organizational structure, Figure E-1

2/ Limited training was authorized prior to SPID approval. Seven participants have been identified and approved for U.S. graduate training as of 10/83.

3/ Second baccalaureate of M.S. degree in Library Science.

4/ M.S. degree in ESL with emphasis in Technical Agriculture.

Table E-2 presents a staffing plan for the FOA showing the need for expatriate staff in order to meet anticipated enrollment projections during the third subproject year. Current plans are to enroll the first class of agricultural students in the fall of the second subproject year. It is proposed that first year students be enrolled in the FOS, since the majority of their courses will be in that area. Students will begin their agricultural coursework during the third subproject year (second year of enrollment), thus necessitating some expatriate staffing as indicated in certain areas. Trained Yemeni faculty are already available in agricultural economics, and crop production and protecton. Expatriates would be provided by this subproject in agricultural engineering, livestock, and poultry production and protecton, during years 3 and 5, and in the area of agricultural educaton during subproject years 5 through 9. The expatriates will acquire experience in irrigation, growing crops, and acquiring and managing livestock on the instructional farm prior to the use of the farm for teaching in year 4.

The subproject also provides for expatriates in an advisory role to the Dean of the FOA, the Instructional Farm Manager, an ESL/Technical Agriculture, and the FOA Librarian. In each case, the Yemeni professional will have returned to Yemen in time to join with their expatriate counterparts for the advisory period indicated.

The detailed SOW for the USAID-funded expatriate staff will be developed and agreed upon as an integral part of the Annual Work Plans. This Initial Work Plan, covering the period of March through September 1984, is provided in Annex O, and includes the draft SOW for the initial contingent of expatriate technical assistance.

V. Institutional Linkages

An FOA is proposed to increase the income of Yemeni living in rural areas by contributing to agricultural development. The FOA will accomplish this goal by three major functions:

*training of B.S. graduates;
*conducting meaningful agricultural research; and
*providing workshops, demonstrations, training sessions, and applied instruction materials to farmers, farm families, and agricultural interest around the YAR.

In order for these functions to be provided effectively, a series of institutional linkages will be necessary. Two types of linkages are envisioned: administrative and operational.

Administrative linkages are those where specific supervisory or financial relationships exist. Operational linkages are those relationships without

TABLE E-2

STAFFING PLAN FOR FOA SHOWING PHASING OF

EXPATRIATE STAFF BY TRAINED YEMENI FACULTY THROUGH SUBPROJECT DURATION

Area of Specialization or Responsibility	Subproject Year 1/ and Staffing Source										
	1	2	3	4	5	6	7	8	9	10	11
Agricultural Economics 2/			Trained Yemeni Staff								
Agric. Education/Extension 3/						Expatriate Staff				Trained Yemeni Staff	
Agricultural Engineering				Expatriate Staff			Trained Yemeni Staff				
Crop Production & Protection 4/						Trained Yemeni Staff					
Food Science & Technology				Expatriate Staff					Trained Yemeni Staff		
Livestock/Poultry Prod.				Expatriate Staff			Trained Yemeni Staff				
Dean of FOA		Expatriate Staff Advisor						Trained Yemeni			
Instr. Farm Manager		Expatriate Advisor						Trained Yemeni			
FOA Librarian				Expatriate Advisor			Trained Yemeni				
FOA ESL Specialist				Expatriate Advisor			Trained Yemeni				

1/ Assumes prospective students enrolled in University of Sanaa Faculty of Science during third subproject with enrollment in FOA during fourth subproject year.

2/ Assumes trained Yemeni available.

3/ Assumes first classes in agric. education/extension in fourth year of curriculum.

4/ Assumes trained Yemeni available.

specific supervisory or financial responsibilities, but which depend upon cooperation and mutual benefit in order to remain intact. Operational linkages are effective means of coordination and long-range planning, and can be an important avenue in avoiding duplication of efforts.

A. Policy Linkages

Policy linkages are essential to the successful functioning of the FOA. Among the decisions to be made are identification of short, intermediate and long-term goals. These decisions will be most effectively made when coordinated with CID/Yemen, MAF and MOE. The linkages to accomplish these goals are shown diagrammatically in Figure E-4. This set of linkages provides sufficiently broad input from agricultural development agencies to provide a coordinated program to the agricultural sector. Linkages will exist at several levels, ranging from the Rector-Minister level, to the Dean-faculty level.

B. Training Linkages

The education and utilization of trained agricultural workers is a cooperative venture involving the various secondary schools, the FOA, the graduate level education programs located outside Yemen and the employers of the graduates. These relationships are shown in Figure E-5. One portion of the linkages will be achieved by the movement of personnel, students and graduates. The other linkage will take the form of consultative feedback as outlined. A Curriculum Review Committee, consisting of five senior faculty members, is proposed to solicit feedback from the employers of students, as well as from the graduate level educational institution attendees and faculty members. By this process, an element of quality control will be established. This feedback will provide a quantitative tool for making changes to the curriculum and to the individual course outlines.

C. Research Linkages

A research program responsive to the agricultural technology needs of the YAR can best be achieved by a system of linkages as outlined in Figure E-6. This scheme will allow input from those people and agencies best prepared to guide the selection of general areas of research expertise as well as identification of specific research projects. Linkages will be established at both the administrative level (deans, department heads and directorate leaders) and the operational levels (faculty members, experimental farm directors, technical institute directors and individual faculty members from international educational and research institutions). The financial support for these linkages has been established in the subproject budget. Costs will involve deployment of TDY and expatriate faculty as well as travel and technical support for in-country researchers.

FIGURE E-4

FACULTY OF AGRICULTURE

Policy Linkages

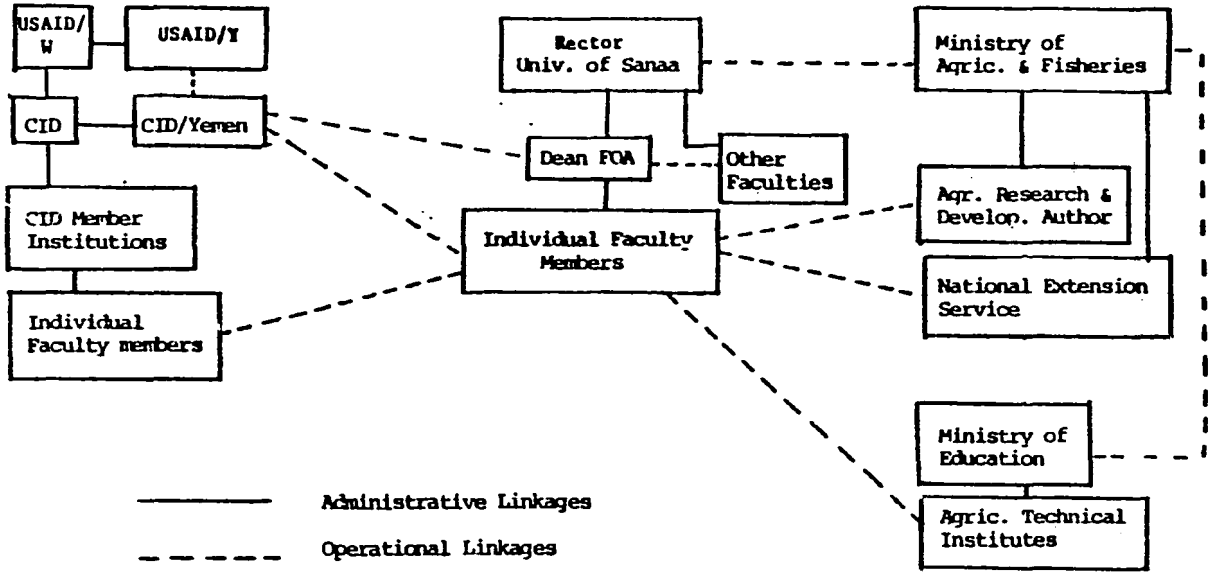


FIGURE E-5

FACULTY OF AGRICULTURE

Training Linkages

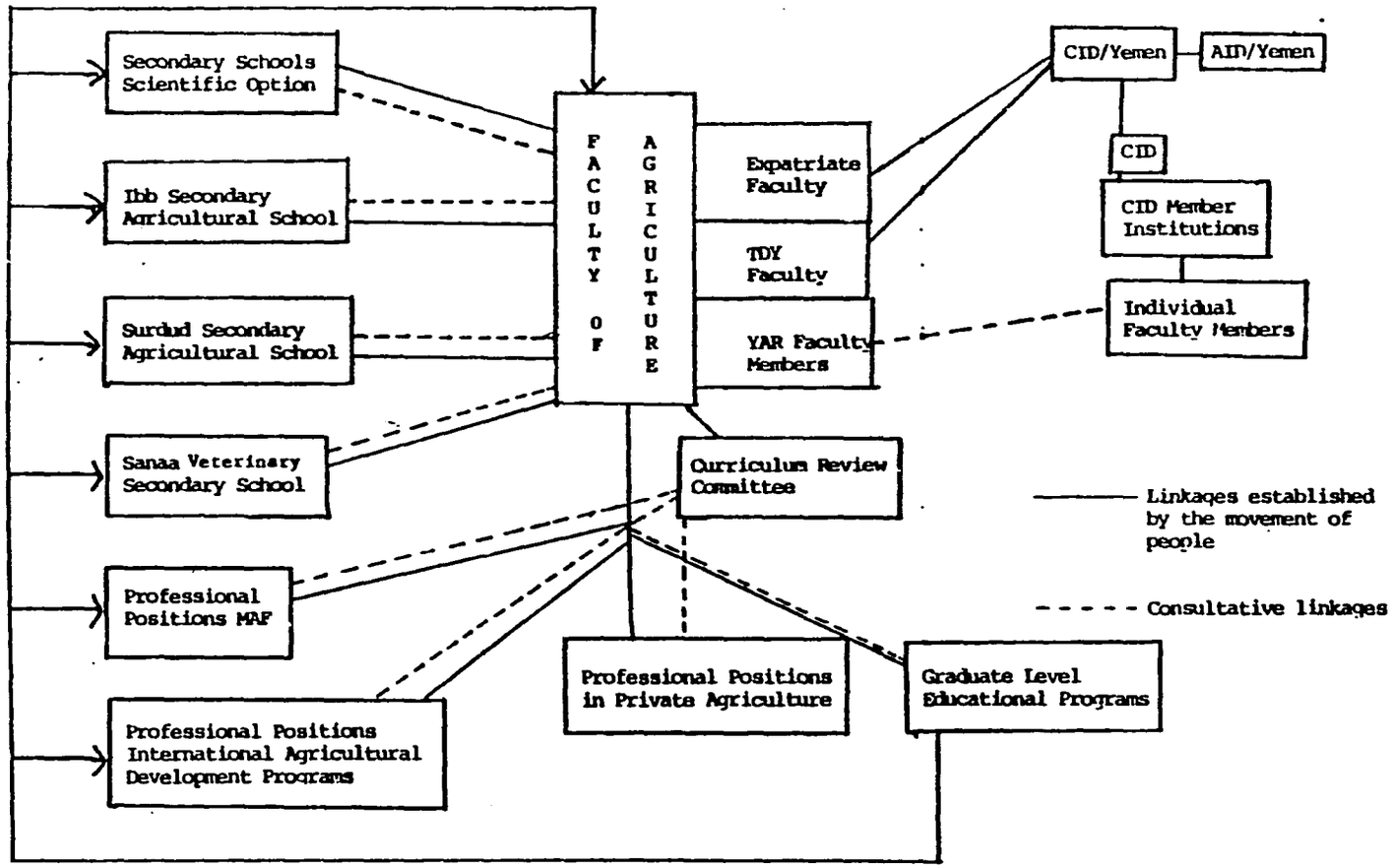
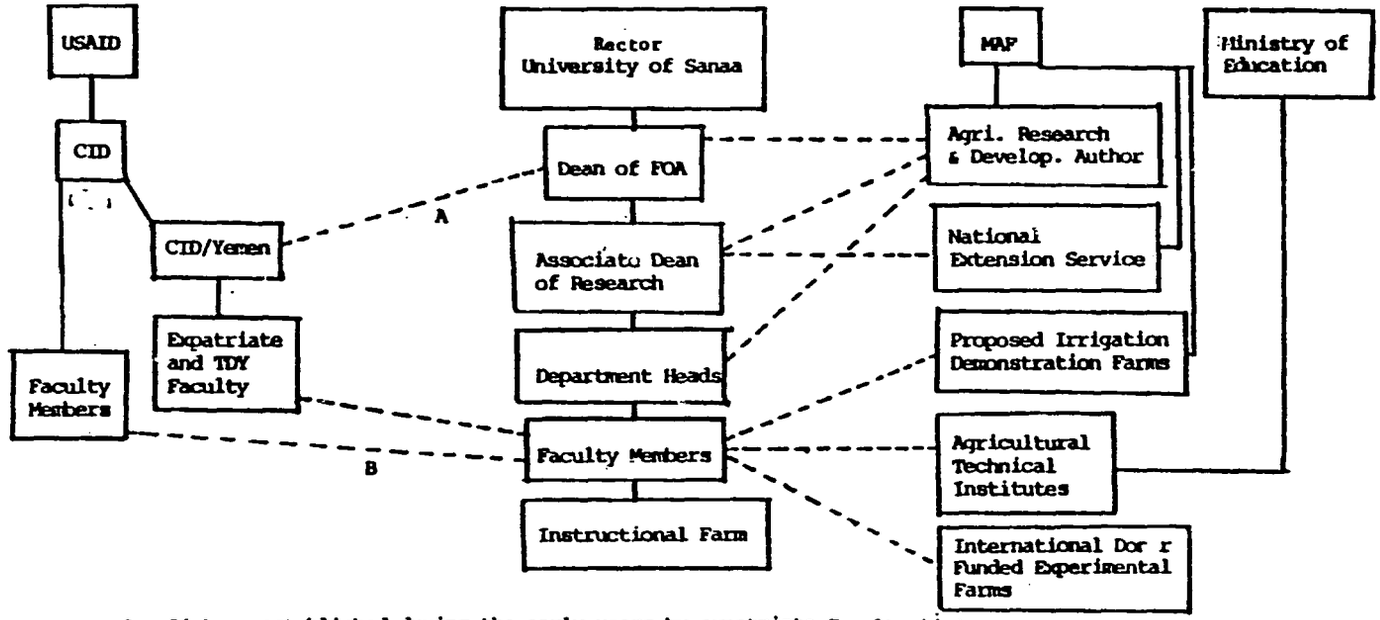


FIGURE E-6

FACULTY OF AGRICULTURE

Research Linkages



A. Linkage established during the early years by expatriate Faculty Advisor.

B. Linkage established during the participant training process and maintained by TDY assignments

——— Administrative Linkages

- - - - Operational Linkages

D. Linkages to Impact Farm Households

The most effective means of promoting agricultural development in the YAR will involve applications of the contemporary, scientific and agricultural expertise directly to the agricultural production sites, namely local farms. This process requires the extensive network of linkages shown in Figure E-7. This system involves a cooperative effort of the FOA, MAF, and MOE assisted by USAID/Yemen, CID/Yemen and the other international donor funded agricultural research and demonstration farms.

Because of the complexity of this linkage scheme, it is proposed that an Extension Coordinating Committee (ECC) be established to monitor the coordinating process. The ECC shall consist of representatives of the Dean, FOA, Minister of Education, Minister of Agriculture, major donor organizations, and three local officials to represent the farmers of the YAR. This committee is responsible for advising the Dean, FOA and the extension education members of the faculty as to how the process can best be judged to meet the needs of YAR Agriculture.

VI. Recommended Curriculum

A recommended curriculum is outlined in Table E-3, followed by course descriptions for the basic courses to be included in the first year of instruction.

The curriculum has been designed to meet the needs of several emphasis areas in agriculture. Table E-4 shows the emphasis areas and individual courses within each area. Course descriptions of the technical agricultural courses and practicums are included in this annex.

Several areas of concern that relate to curriculum are discussed below.

A. Involvement of Yemeni in Curriculum Design

The FOA curriculum has been developed by the SPP team in cooperation with officials of the UOS. The basic science block was reviewed by the Dean of the FOS and his Department Heads. Course credits and course descriptions are aligned with courses now being offered in the FOS.

The technical agricultural curriculum for the second, third, and fourth years has been reviewed by Dr. Nasser Aulaqi of the UOS. Dr. Aulaqi has involved key staff members in the review of the technical curriculum.

The proposed curriculum has been discussed with secondary school directors, agricultural technical school staff, university staff, and USAID staff. The recommendations of each group have been considered in the curriculum design.

FIGURE E-7

FACULTY OF AGRICULTURE

Linkages to Impact Farm Households

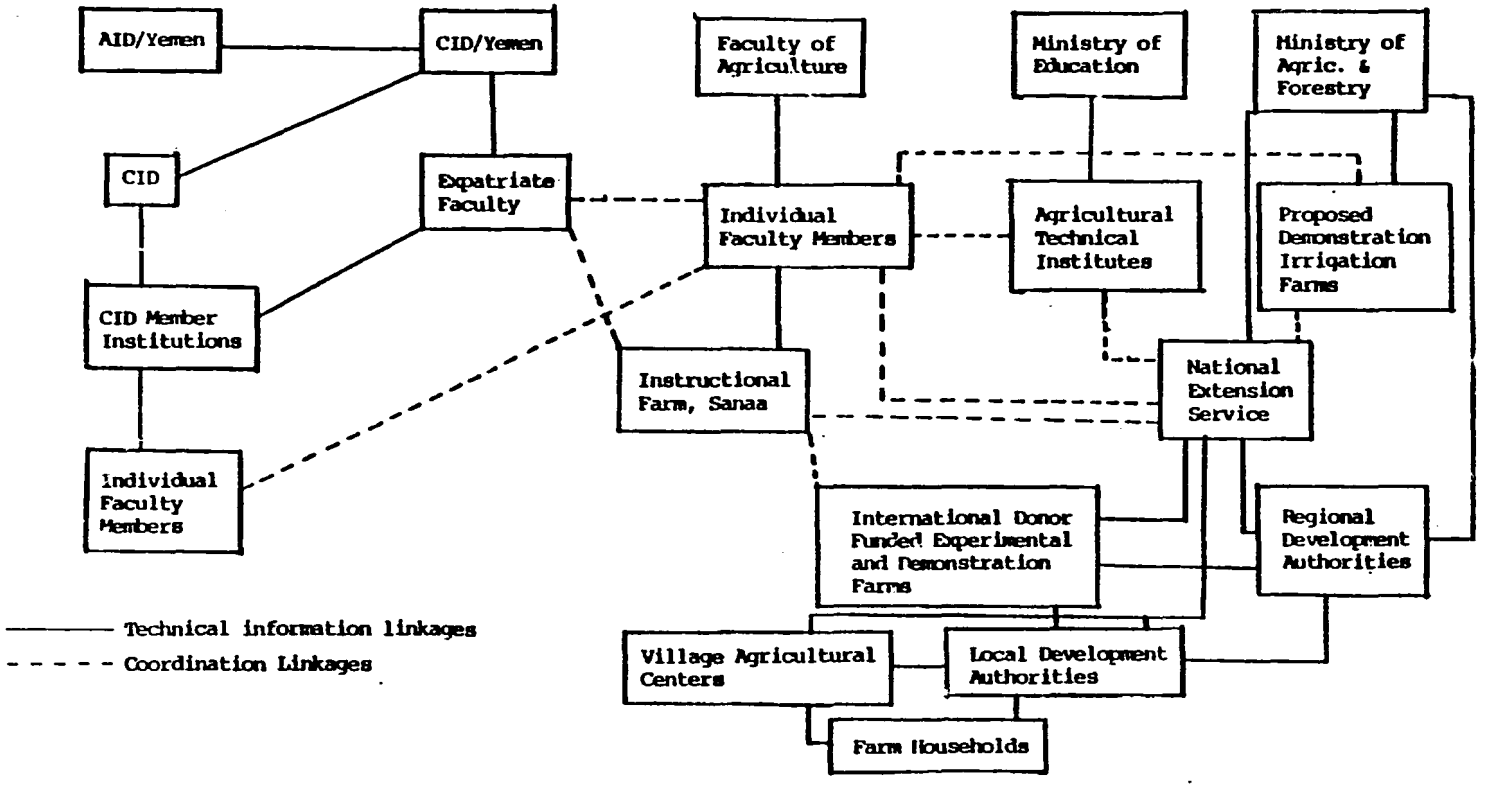


TABLE E-3

RECOMMENDED CURRICULUM FOR GENERAL AGRICULTURE
UNIV. OF SANAA-FACULTY OF AGRICULTURE

( ) Semester Credit Hours

Year 1 1/		Year 2		Year 3		Year 4	
Arabic	(3)	Arabic	(3)	Feeds and Feeding	(3)	Animal Production	(3)
English	(6)	English	(6)	Animal/Poultry Improv.	(3)	Poultry Production	(3)
General Chemistry	(8)	Animal and Poultry Science	(3)	Plant Growth/Soil Fertility	(3)	Cereal/Forage Production	(3)
General Zoology	(4)	Plant Science	(3)	Plant Breeding	(3)	Advanced Farm Mngt.	(3)
General Botany	(4)	Soil Science	(3)	Agricultural Marketing	(3)	Agricultural Policy	(3)
Physics	(4)	Farm Management	(3)	Agricultural Business Management	(3)	Fruit & Vegetable Production	(3)
Mathematics	(4)	Plane Surveying	(3)	Farm Machinery	(3)	Food Quality Evaluation/ Quality Control Systems	(3)
Islamic Civilization	(3)	Agricultural Mechanics	(3)	Plant Propagation	(3)	Pasture/Range Management	(3)
		Microbiology in Food Technology	(3)	Food Processing/Human Nutrition	(3)	Extension Methods	(3)
		Pasture/Pangeland Resources	(3)	Pasture/Pangeland Analysis	(3)	Rural Sociology	(3)
		Statistics	(3)	Entomology	(3)	Fiscal & Personnel Management	(3)
				Plant Pathology	(3)	Irrigation & Drainage	(3)
TOTAL CREDIT HOURS	36		36		36		36
Vacation Practicum I 2/		Vacation Practicum II 2/		Vacation Practicum III 2/			

1/ Students will be enrolled in the Faculty of Science for the first year of training. English classes will be taught in a newly created Language center.

2/ See description of practicums and minimum competency lists.

TABLE E-4

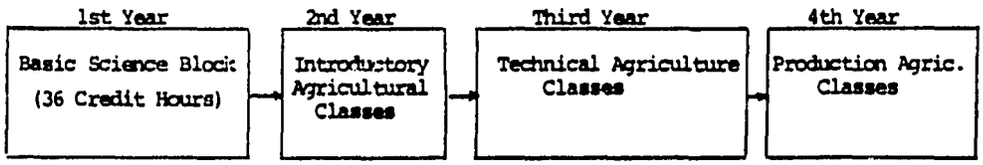
GENERAL AGRICULTURE CURRICULUM EMPHASIS AREAS

YEAR 1	EMPHASIS AREA	YEAR 2	YEAR 3	YEAR
BASIC SCIENCE BLOCK . Arabic (3) . English (6) . Chemistry (8) . Botany (4) . Zoology (4) . Physics (4) . Mathematics (4) . Islamic Civilization (3) .	ANIMAL/POULTRY SCIENCE	Animal and Poultry Science (3)	Feeds and Feeding (3) Animal/Poultry Impr. (3)	Animal Pro Poultry Pr
	PLANT/CROP/SOIL SCIENCE	Plant Science (3) Soil Science (3)	Plant Growth/ Soil Fertility (3) Plant Breeding (3)	Cenal/Fora Production
	AGRICULTURAL ECONOMICS	Farm Management (3)	Agricultural Marketing (3) Agricultural Business Management (3)	Advanced F Management Agricultur
	AGRICULTURAL ENGINEERING	Plane Surveying (3) Agricultural Mech. (3)	Farm Machinery (3)	Irrigation Drainage (
	HORTICULTURE	-	Plant Propagation (3)	Fruit and Production
	FOOD TECHNOLOGY	Microbiology in Food Technology (3)	Food Processing/ Human Nutrition (3)	Food Quali Evaluation Control Sy
	PASTURE/RANGE MANAGEMENT	Pasture/Range Resources (3)	Pasture /Range Analysis (3)	Pasture/Ra Management
	ENTOMOLOGY/PLANT PATHOLOGY	-	Entomology (3) Plant Path. (3)	-
	EXTENSION METHODS	Statistics (3)	-	Extension Rural Soci Fiscal and Management

Technical Agricu re Credits = 99.

TABLE E-4 (Cont.)

BASIS SCIENCE BLOCK COURSE DESCRIPTIONS



Arabic Language (3 credit hour - University Requirement)

Islamic Civilization (3 credit hour - University Requirement)

English (12 credit hours in 1st and 2nd years) (4,0)

English as a second language; introduction of agricultural vocabulary; Courses include vocabulary, structure, speech, reading, writing, listening comprehension and study skills.

General Chemistry (8 credit hours) (3,3)

General Chemistry I (4 credit hours) (3,3)

(a) Atomic structure - The periodic properties - Chemical bonding - Molecular geometry. Introduction to organic Chemistry. (Nomenclature, classification, structure and properties of organic compounds).

(b) Practical: Qualititative chemical Analysis I - Identification of simple and mixed anions.

General Chemistry II (4 credit hours) (3,3)

(a) Gases laws and the kinetic theory of gases. Liquid state-solid state-solutions - thermo-chemistry chemical equilibrium - applications on ionic equilibria in solutions.

(b) Practical: Qualitative chemical analysis II: Identification of simple and mixed cations.

Biology I (4 credit hours)

Cell Biology, cell activities, energetics, cell division, principles of genetics, plant morphology, tissue types, development, plant and animal biology and physiolgy of the different systems.

Biology II (4 credit hours)

Principles of classification, nomenclature, plant and animal diversity to represent the major phyla/evolutionary concept of different groups. Plants and animals and their environments.

TABLE V-4 (Cont.)
(2,2) = Theory, practicum, hours per week)

ANIMAL AND POULTRY SCIENCE EMPHASIS

1st year	2nd Year	3rd Year	4th Year
Basic Science Block	Animal Sciences Poultry Science	Feeds and Feeding for Livestock and Poultry/Animal and Poultry Improvement	Animal Production Poultry Production

Animal and Poultry Science

Principles of modern livestock production; local breeds and types of livestock; market and breeding classes of cattle, sheep and goats; live animal and carcass evaluations. Introduction to poultry production including: classes, breeds and types of poultry; the poultry industry (worldwide/Yemen); physiology; management involving incubation brooding, growing and adult care, and culling; housing; feeding and sanitation.

Feeds and Feeding for Livestock and Poultry (3 credit hours) (2,2)

Metabolism and digestive physiolcgy; nutritional deficiencies, feedstuff composition; nutrient requirements of livestock and poultry; ration formulation;feed processing; feeding recommendations.

Animal and Poultry Improvement (3 credit hours) (2,2)

Genetics, breeding systems, selection principles; anatomy and physiology of reproductive organs; artificial insemination.

Animal Production (3 credit hours) (2,2)

Nutrition, breeding, health and sanitation and management of cattle, sheep and goats.

Poultry Production (3 credit hours) (2,2)

Incubation, brooding, rearing, management, housing, health and sanitation, feeding, processing of poultry; and commercial egg production.

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TABLE E-4 (Cont.)

(2,2) = Therory, practicum hours per week

PLANT, CROP AND SOILS EMPHASIS

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Plant Science Soil Science	Plant Growth/Soil Fertility Plant Breeding	Cereal/Forage Crop Production

Principles of Plant Science (3 credit hours) (2,2)

Fundamental principles and concepts of plant science; planting, culture, rotation, production, hazards, quality and improvement of crops.

Soil Science (3 credit hours) (2,2)

Origin, formation, classification; physical, chemical and biological characteristics; effects of soil management on agricultural production

Plant Growth/Soil Fertility (3 credit hours) (2,2)

Soil water; water movement in plants; water in dryland crop production; relationships between soil properties and plant nutritient availability; use of fertilizers and manure; evaluation of fertility status of soils.

Plant Breeding (3 credit hours) (2,2)

Genetic and cytogenetic principles, methodologies and theories in improvement of cereal, forage and horticultural crops; review of current litarature in plant breeding.

Cereal and Forage Crop Production (3 credit hours) (2,2)

Production, distribution, adaptation, ecological relationships, morphological and taxonomic relationships, markets, utilization and quality aspects of cereal crops species; varieties, mixtures, establishment, production and management of forage crops.

TABLE E-4 (Cont.)
AGRICULTURAL ECONOMICS EMPHASIS

(2,2) = Theory, practicum hours per week

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Farm Management	Agricultural Marketing Agricultural Business Management	Advanced Farm Management Agricultural Policy

Farm Management (4,0)

Agriculture as a business; the decision-making process; tools of decision making; acquiring, organizing and managing land, labor and capital resources; reasons for success and failure.

Agricultural Marketing (3 credit hours) (3,1)

Marketing functions; economics of agricultural markets; marketing firms and their services; price determining forces, marketing problems; cooperatives.

Agricultural Business Management (3 credit hours) (3,1)

Introduction to management concepts and applications in agricultural business, emphasizing production, financial and marketing decisions, as well as personnel management.

Advanced Farm Management (3 credit hours) (3,1)

Applications of economic principles and concepts to issues of farm planning and organization under conditions of certainty and uncertainty

Agricultural Policy in Yemen (3 credit hours) (4,0)

The state of the Yemen economy with special attention to the agricultural sector; forces determining gross national product, GNP, balance of payments, public sector revenues and expenditures; international agricultural marketing policy; agricultural production policy; agricultural research policy.

TABLE E-4 (Cont.)

AGRICULTURAL ENGINEERING EMPHASIS

(2,2) = Theory, practicum hours per week.

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Plane Surveying Agricultural Mechanics	Farm Machinery	Irrigation and Drainage

Plane Surveying (3 credit hours) (2,2)

Use of engineer's transit, tape and level; differential surveying methods.

Agricultural Mechanics (3 credit hours) (1,3)

Procedures and practices in the agricultural mechanics shop including safety, hand and power tools, hot and cold metal working, arc and oxy-acetylene welding, concrete and wood construction.

Farm Machinery (3 credit hours) (1,3)

Operational theories, lubrication, fuels and oils and preventive maintenance of tractors and small engines; operation, maintenance, adjustments, calibration and use of farm implements.

Irrigation and Drainage (3 credit hours) (1,3)

Pressurized and gravity irrigation systems; water management; pumps and wells; surface and subsurface drainage systems; ponds and dams; erosion control.

TABLE E-4 (Cont.)

(2,2) = Theory, practicum hours per week

HORTICULTURE EMPHASIS

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Plant Science	Plant Propagation	Fruit and Vegetable Production

Principles of Plant Science (3 credit hours) (2,2)

(See course description in plant/crop/soils emphasis)

Plant Propagation (3 credit hours) (1,3)

The regeneration of plants from vegetative and reproductive tissue and organs; horticultural and physiological principles, methods and techniques for laboratory, greenhouse, nursery, field and orchard.

Fruit and Vegetable Production (3 credit hours) (2,2)

Varieties, adaptation, climatic requirements, pollination requirements, thinning, pruning, effects of rootstocks and management of tree and small fruits; seed, plant production, varieties, irrigation, nutrition, harvesting and economics of vegetable production; control of weeds, insects and diseases in fruit and vegetable crops.

TABLE E-4 (Cont.)

(2,2) = Theory, practicum hours per week.

FOOD TECHNOLOGY EMPHASIS

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Microbiology in Food Technology	Food Processing and Human Nutrition	Food Quality Evaluation and Quality Control Systems

Microbiology in Food Technology (3 credit hours) (2,2)

Role of microorganisms in food spoilage, infection and intoxication; basic principles in contamination control and germicidal treatment during processing, preparing and distributing food for consumption.

Food Processing and Human Nutrition (3 credit hours) (2,2)

Methods of processing and preserving fruit, vegetables, meats, dairy products, cereal grains and beverages; relationships of food and its components to health and nutrition of children, young adults, adults and elderly people; relationship of processing methods to nutritional value of foods.

Food Quality Evaluation/Quality Control Systems (3 credit hours) (1,3)

Standards and quality grading; detection, extraction and identification of extraneous materials in foods; principles of quality control; quality control philosophy and systems and application in food industry; use and application of statistical techniques in quality control

TABLE E-4 (Cont.)

PASTURE AND RANGE MANAGEMENT EMPHASIS

(2.21)= Theory, practicum hours per week

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Pasture and Rangeland Resources	Pasture and Rangeland Analysis	Pasture and Range Management

Pasture and Rangeland Resources (3 credit hours) (2,2)

Nature and management of pastures and rangelands in the different regions of the Yemen Arab Republic; integrated land use with emphasis on plant animal - soil interactions; varieties and species grown in each climatic area.

Pasture and Rangeland Analysis (3 credit hours) (2,2)

Evaluating pasture and rangelands; inventory, forage utilization, range conditions and trend; field problems; use of aerial photographs and sampling theory. Requires field trips.

Pasture and Range Management (3 credit hours) (2,2)

Basic physiological characteristics and growth strategies of plants; importance of these strategies in managing rangelands; species and varieties of cultivated and non-cultivated plants; establishment, production and grazing management of improved pastures.

TABLE E-4 (Cont.)

(2,2) = Theory, practicum hours per week

ENTOMOLOGY/PLANT PATHOLOGY EMPHASIS

1st Year	2nd Year	3rd Year	4th Year
Basic Science Block	Animal and Plant Science Classes	Entomology Plant Pathology	Production Agricultural Classes

General Entomology (3 credit hours) (3,1)

Recognition, biology and management of injurious and beneficial insects; biological and microbal controls; chemical controls.

Plant Pathology (3 credit hours) (3,1)

Symptoms, causal agents, diagnosis, prevention and control of plant diseases

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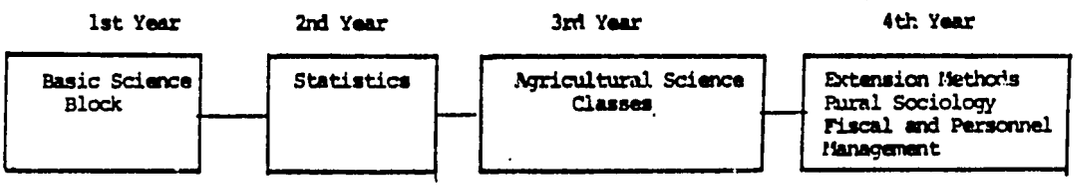
TABLE E-4 (Cont.)

(2,2) = Theory, practicum hours per week

EXTENSION EMPHASIS



Principles of Statistics (3 credit hours) (4,0)

Design of experiments; descriptive statistics; sampling; tests of significance; correlation and regression; nominal, ordinal and interval data; parametric and non-parametric tests.

Extension Methods (3 credit hours) (4,0)

Organization, scope and responsibilities of extension services; adult learning; diffusion and communication processes; social action processes; teaching methods; leadership skills; program planning; visual aids.

Rural Sociology (3 credit hours) (2,2)

Sociological study of rural land use and settlement patterns, farming systems, rural villages, institutions and linkages with the larger society.

Fiscal and Personnel Management (3 credit hours) (4,0)

Financial planning, budgeting and monitoring; enterprise financing; accounting and auditing methods; analysis of personnel objectives; professional growth planning; supervision techniques.

The SPP team has devoted 24 staff days to reviewing the agriculture of Yemen. Observations of agricultural practices and needs have been considered in the design of the coursework and practicum for the FOA.

B. Basic Science Block in the FOS.

Dr. Ali El-Shekeil, Dean of the FOS and the UOS, stated that the FOS can accommodate FOA students in the basic science classes if at least a 5-month notice is given the university on numbers to be expected. The FOS is currently providing science instruction to the faculties of science, engineering, education, medicine, and commerce. Dean El-Shekeil assured the SPP team that the FOS would continue to provide staff to teach the basic science block for the FOA beyond the first year. The only limiting factor at present is space for a greatly expanded enrollment. The new facilities of the FOA will be used in future years with the FOS providing teachers for the classes. Details of basic science classes are described in the following pages.

C. Detailed Curriculum

The details of the technical agricultural curriculum are shown in Table E-3. Each emphasis area is defined in terms of courses offered and the description of each proposed course. The allocation of time for lectures and practicums are shown in parenthesis by each course name.

Computer application will be infused in all curriculum emphasis areas rather than being taught as specific classes. A staff member will be trained in computer application at a U.S. university. It will be the responsibility of that staff member to weave computer applications into all curriculum areas.

D. Vacation Practicums

In addition to the completion of coursework, a student is expected to have minimal competence in the basic skills of agriculture. Three vacation practicums are proposed as a method for acquiring those minimum competencies. Some competencies will be met in the technical classes while others must be obtained during the vacation practicum. A recommended list of agricultural competencies are included in the recommended curriculum (see F-6). Credits for practicums should be variable in accordance with the scope of the individual assignments.

1. Vacation Practicum I

Supervised orientation and field trips to different agricultural regions of the YAR. The purpose is to show students the variability in ecological and climatological conditions under which agriculture is practiced in Yemen and the different farming systems being utilized and under development. Elective credits may be given for this practicum.

2. Vacation Practicum II

Intensive and closely supervised experience on the instructional farm. Students will learn the basic skills of livestock and crop production through "hands on" experience with plants, animals, poultry, soils, machinery, and agricultural engineering projects.

3. Vacation Practicum III

Supervised work experience in a public or private agricultural organization of farm. Students are expected to perform routine duties of a planned work assignment. Evaluation will be based on performance at the job site. Use should be made of MAF demonstration farms, i.e., HITS and PETS in planning student practicums.

E. Vocational Agricultural Teacher Preparation

Currently a Masters' Degree is required to teach vocational agriculture in the three agricultural secondary schools (Ibb, Surdud, and Sanaa). For this reason, a teacher preparation option is not included in the recommended curriculum.

Once the FOA is established, the teacher preparation option can be implemented by requiring an additional semester of study in the folloing classes.

Secondary Teaching Methods (Classroom)	3 credit hours
Secondary Teaching Methods (Practicums)	3 credit hours
Secondary Agricultural Currriculum	3 credit hours
Student Teaching and Internship	9 credit hours
Total Requirements	18 credit hours

If the secondary agricultural programs are greatly expanded in the future, an adequate supply of trained teachers can be prepared through this option. The governmental requirements for teachers would then need to be adjusted to the basis of a B.S. degree in agriculture plus 18 credit hours in teacher preparation.

F. Competencies

Instructors of each instructional area will establish a list of minimum competencies that a student must be able to perform at the end of 4 years of training. Some competencies can be met in the classroom and laboratories of regular classes. Other skills must be learned in the instructional farm and in vacation practicums.

Minimum competency requirements will both support and enhance the agricultural curriculum. These requirements insure that the graduate can "do" as well as "talk" about agriculture. Since the graduates will be involved in extension and teaching activities, the competence factor is critical for success.

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Examples of agricultural competencies and their relationship to the curriculum are shown in the following lists. These lists are an illustration and not intended as a complete requirement for the student. Instructors will modify the competency list until it reflects the needs of Yemen agriculture.

1. Animal and Poultry Science

*Identify body parts of live animals
*Select animals on body conformation
*Evaluate carcass' and cuts of meat
*Slaughter animals and poultry
*Apply sanitation measures to livestock and poultry facilities
*Recognize common diseases of livestock and poultry
*Treat livestock and poultry for parasites
*Take temperature of animals
*Administer injections to animals
*Administer vaccines to poultry
*Diagnose pregnancy in cattle and sheep
*Inseminate cattle artifically
*Administer drenches and boluses to animals
*Spray and dust animals for external parasites
*Assist ewes and cows at parturition
*Treat navel cords of newborn animals
*Graft young animals on foster mothers
*Teach calves to drink milk
*Start young animals on feed
*Castrate livestock
*Apply eartags, tatoos and neck chains for identification
*Band poultry for identification
*Use squeeze and cutting chutes to work animals
*Load and haul livestock
*Feed animals according to their nutrient requirements
*Cull non-layers from a production flock
*Perform beak trimming, dubbing, and specking poultry
*Develop incubator techniques
*Caponize
*Slaughter and process poultry
*Grade, candle, and clean eggs for consumption
*Artificially inseminate poultry
*Brood poultry

2. Plant, Soil, Crop Science, and Horticultre

*Identify common crops and weeds
*Prepare a seed bed for a crop
*Cultivate crops

*Set and move irrigation pipe
*Regulate surface irrigation water on crops
*Identify moisture content of soil by feel
*Recognize maturity levels of crops
*Apply fertilizers correctly (time, amount, and method)
*Formulate and apply pesticides
*Treat seed for planting or storage
*Plant seed at appropriate rate and depth
*Check temperature and moisture content of stored crops
*Identify and control common plant pests
*Conduct germination test on seed
*Read and interpret soil survey
*Identify soil structure and relate to capability
*Determine soil group (alluvial, colluvial, loess, and residual)
*Determine when soil is ready to be tilled
*Determine soil texture
*Identify major areas of a soil profile (topsoil, subsoil, and parent material)
*Determine slops of land
*Test soil ph
*Collect and prepare soil samples for anlaysis
*Determine land use and capability class of soils
*Propagate plants by seed
*Propagate plants by layerage
*Propagate plants by division
*Propagate plants by cuttings
*Propagate plants by budding and grafting
*Prepare planting medias
*Prune trees, shrubs and vines
*Establish and care for turf
*Water nursery and greenhouse plants correctly
*Operate greenhouse environmental control systems
*Fertilize container grown plants
*Plant and transplant horticultural crops
*Sterilize soil and soil media
*Control greenhouse pests by spraying and fogging
*Prepare horticultural plants and crops for marketing
*Operate horticultural equipment (rotovator, rototiller, garden tractor, soil shredder, soil sterilizer, sprayers, and mowers)

3. Agricultural Engineering

*Maintain gasoline and diesel engins
*Hitch and unhitch implements correctly
*Operate tractor and tillage equipment
*Operate tractor and seeding equipment
*Operate tractor and harvesting equipment

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*Check fluid level, couple and service hydraulic units
*Lubricate agricultural implements
*Make minor repairs on agricltural implements
*Adjust plows and mowers
*Calibrate grain drills, fertilizer spreaders, and sprayers
*Construct forms for concrete slabs, walks, and footings
*Construct small farm buildings
*Repair buildings
*Construct fences
*Install a simple electrical circuit
*Use common hand tools
*Use common power tools
*Sharpen and repair hand tools
*Use an arc welder
*Use an oxy-acetylene welder for cutting, brazing and mild steel welding
*Measure, cut, ream, and thread pipe
*Splice and assemble plastic pipe
*Drill and tap holes
*Use a farm level in differential leveling and drainage

4. Agricultural Economics

*Conduct inventories of livestock, poultry, plants, and equipment
*Compute depreciation of buildings and equipment
*Keep production records on livestock, poultry and crops
*Determine cost effectiveness of instructional farm activities
*Maintain accounts of instructional farm (receipts, bills, invoices, and payments)
*Determine efficiency of production for instructional farm enterprises
*Develop budgets for instructional farm operation

5. Extension Methods

*Prepare a tape-slide presentation
*Prepare technical articles for newpaper
*Prepare and conduct demonstrations in all competency areas
*Plan and conduct in-service sessions

G. Workshops, Short Courses, and In-Service Sessions

The FOA will become the focus of technology transfer to the rural population in the YAR. Workshops, short courses, in-service sessions,

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and seminars will be developed according to the needs of rural farmers and disseminated through trained agriculturalists to the various regions of the YAR.

1. Workshops

The FOA will plan and conduct a series of 1-day and 2-day workshops on current agricultural topics and practices. These workshops will be available to MAF staff and other groups in the public and private sector.

2. Short Courses

The FOA will provide short courses for the upgrading and updating of agricultural technicians and other groups. The short courses will offer undergraduate credit in the beginning and possible graduate credit as the UOS develops advanced degree programs. The courses will be intense instruction of 1-3 week duration and carry credit appropriate to the total instructional time. Visiting professors on TDY assignments can be utilized to conduct short courses. Since U.S. university staff will be visiting their graduate students in Yemen it makes TDY assignments more cost effective if that staff member can also conduct a short course during the visit. Short courses will be correlated with established credit classes at the UOS.

3. In-Services

Extension service staff, MAF staff, agricultural instructors and others need constant updating in agricultural technology. The FOA will assess the in-service needs; establish in-service priorities; and conduct in-service sessions within the various regions of Yemen. In-service sessions will be designed to update technologies that will impact Yemen agriculture. In-service will be a function of the extension component of the FOA.

H. Entry and Exit Standards

The UOS has a set of entry and exit standards for each faculty within the UOS. The FOA standards will be consistent with those now used by the FOS.

1. Entry Standards

The UOS will accept students into the FOA from any of the agricutural technical schools or secondary (science option) schools with national exam scores of 60 percent. The passing grade for graduation from secondary schools is 50 percent. The entry standards for each faculty are:

Faculty of Arts	56 percent
Faculty of Science	60 percent
Faculty of Law	62 percent
Faculty of Commerce	66 percent

A student must have met the requirements of the military draft to be accepted in the FOA.

The FOS requires a degree of competency in the English language for entry into its program. The FOS conducts classes in English. The entry requirement for English is not anticipated to be a major limitation for students entering the FOA.

2. Exit Standards

The UOS has established the following standards for completion of a B.S. degree in the FOA.

Completion of 144 semester credit hours;
Minimum of 12 hours of English;
All elective courses must be within the FOA or the FOS;
Six hours of Arabic language;
Three hours of Islamic civilization;

I. Future Expansion of Curriculum

The proposed curriculum is one that meets the needs for general agriculturists in Yemen. A general curriculum offers many advantages during the establishment of an FOA. As trained Yemeni staff return to the FOA with specialized skills, more specialized courses can be added to the curriculum. Each of the curriculum emphasis areas can be expanded into specialized program options. Specialization should not occur until the general curriculum is well established and a full Yemeni staff is in place.

A fisheries program should be considered as part of the FOS. The FOS has a program in marine biology at the present time. With the addition of other courses, the needs of the fisheries industry can be addressed in the FOS curriculm.

J. Evolution Time Frame for Specialization of Curriculum

Enroll students in Sciences Classes (first year program)	Year 2
Add teacher preparation courses	
Add electives according to student enrollment and manpower needs of Yemen	
Offer B.S. degrees in specialized options such as animal and poultry science, and agronomy	
Offer M.S. degrees when curriculum becomes sufficiently specialized	Year 20
Offer Ph.D. degrees in specialized agricultural options when the FOA is fully developed	Year 30

K. English Language Training

The UOS requires that students have adequate preparation in English in order to enter the FOS. A minimum of 12 semester credit hours in English will be required for completion of a B.S. degree in the FOA after initial enrollment. There is no well defined standard for measuring proficiency levels of graduates of the degree program in agriculture.

Graduates of the FOA that wish to pursue a graduate program in the U.S. must have a TOEFL score of 450 to enter an intensive ESL program in preparation for technical training. A TOEFL score of 500 or more is needed for entry into a graduate school program. Engish language proficiency, as measured by TOEFL scores, must become a standard for selection of USAID-sponsored students. The UOS should emphasize ELS training for all FOA students without penalizing those that fail to achieve a high level of English proficiency.

In order to prepare students for graduate programs in English speaking universities, the FOA must establish English language standards that are based on attainment of TOEFL scores of at least 450. A planned continum of English language development is necessary to achieve the minimal levels of proficiency required by American universities.

Past efforts in delivery of ESL to foreign students and trainees show that maximum programs is made when:

1. ESL is a continuous developmental process that extends throughout the duration of the program.

2. Technical vocabulary is introduced gradually, starting early in ESL traning.

Based on the experience of OSU and the U.S. Department of Labor in working with Saudi Arabian trainees, the following conceptual model (Table E-5) is proposed for ESL in the FOA.

The TOEFL should be used as a motivational goal for students and as a measurement of proficiency in determining progress. All students in the FOA will not be expected to reach this ESL goal. Those students that will be going into graduate programs must be aware of the TOEFL requirements.

An ESL staff member has been proposed in the budget. That person's responsibility will be to coordinate the formal English classes with the technical curriculum and to monitor student progress in English proficiency. The ESL staff member will provide English classes with technical vocabulary lists from agricultural courses to maximize the impact of ESL training.

L. Course Load for Students

The proposed curriculum is based on a student involvement of 24 hours per week in classroom and laboratory activities. This time is

TABLE E-5

CONCEPTUAL MODEL FOR ESL

1st Year	2nd Year	3rd Year	4th Year
English Classes 6 credit hours (Required)	English Classes 6 credit hours (Required)	English Classes (Electives)	English Classes (Electives)
Introduce technical vocabulary	Increase use of English in technical ag. classes and practicums	Heavy use of English in lectures, labs and practicums	Total use of English in lectures, labs and practicums of agricultural classes
Administer TOEFL as measure of proficiency	Administer TOEFL as measure of proficiency	Administer TOEFL as measure of proficiency	Administer TOEFL. (Minimum score of 450 required for selection into US-based graduate programs)

consistent with the course load requirements of American universities. The student will be required to take 18 credit hours each semester during the 4-year program in order to fulfill the 144 credit hours for a B.S. degree.

M. Faculty Work Loads

The current faculty work loads at the UOS are assigned on the following basis:

Full Professor	8 credits
Associate Professor	10 credits
Assistant Professor	12 credits

The FOA is designed for teaching, research, and extension. Staffing and training plans have considered the need for development of strong components in extension and research. Based on standards of U.S. universities, some 40 percent of the staff members' time should be devoted to teaching. The remaining 60 percent should be split between extension and research duties.

The credit load was computed for each course in the proposed curriculum. The following formula was utilized in computing credit load:

Credit Load (Lecture credit x sections) + (Lab credit x sections)

The total credit load of all courses was 330 credits.

Twenty-two faculty members are scheduled for overseas training in the future and seven faculty members are currently in training in the United States. When the faculty is fully functional, there will be 29 members of the instructional staff if all trained staff return to the FOA. The SPP Team recognizes that some may not have returned by the end of the subproject.

The credit load per staff member was computed as follows:

$$\text{Credit Load per Staff} = \frac{\text{Total Credit Load}}{\text{Total Staff}}$$

The credit load for each staff member is 11.4 credits per year or 5.7 credits per semester. This figure is consistent with the current work loads at the UOS.

The percentage of time allocated to teaching, extension and research will vary for individual staff assignments depending on the technical area that is being staffed. These percentages will also fluctuate from one semester to another. Such flexibility in staffing will enhance the development of trained staff to the best advantage.

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Table E-6 shows projected faculty work loads for the FOA. This table includes those people that are targeted for training in the U.S.

N. Effect of School Calendar on Curriculum

The instructional program at the UOS is organized by semester. The two semesters are 16 weeks in length with 3 weeks of each semester being devoted to examinations. The actual time for instructional activities is 13 weeks.

Each year, Ramadan occurs 2 weeks earlier than the preceding year. The univesity sets the school calendar 1 year in advance. Although the school starting and closing dates will change each year, the total instructional time will not be affected by Ramadan. The Ramadan holiday lasts approximately 1 month during the school vacation period.

Vacation practicums must be conducted during a 2-month time frame as a result of Ramadan. This will not affect the quality or scope of the planned practicum but will limit the time in which the student must complete the practicum assignments.

O. Need for Teaching and Laboratory Assistants

The staffing plan for the instructional farm includes a technician for each area of instruction. These technicians will serve as teaching assistants during practical instruction on the farm. The planned technicians are adequate to fulfill the need for teaching and laboratory assistants on the instructional farm. There will be some instances in which the technician can be utilized in related on-campus laboratories.

The UOS currently uses teaching and laboratory assistants as direct hires based on the needs of individual laboratories and class loads. Within the developmental years, the need for assistants will not be a critical factor. As the enrollment increases and the curriculum begins to be specialized there will be a need for teaching and laboratory assistants beyond the technicians planned for this project.

The FOS will be teaching the first year curriculum. Classes in the science block will need laboratory assistants in chemistry, botany, zoology, and physics. Most of the laboratory assistants currently in these areas are from Egypt and other Arab countries. The UOS will provide the teaching and laboratory assistants for the science block students as part of their ongoing staffing procedures.

The staffing plan and staff work loads show that teachers will have reasonable teaching loads so that time will be available for extension and research. A reduced work load allows the teacher to spend more time in the supervision of laboratory activities. The need for teaching and laboratory assistants should not be a constraint during the development of the FOA.

TABLE E-6
PROJECTED FACULTY FORECASTS AT MAXIMUM ENROLLMENT
450 Students in Technical Courses

* Include currently qualified staff member at University of Sana'a

Program Area	Emphasis of Training of Yemeni Being Trained in the United States	Courses Assigned from Curriculum	Time Allocation Percentage		
			Teaching	Research	Extension
Agricultural Economics (42 credits)	1. Agricultural Marketing	Agricultural Marketing (10)	40	30	30
	2. Farm Management	Advanced Farming Systems (10)	40	30	30
	3. General Ag. Economics	Agricultural Business Mgmt. (10) Managerial Approaches (6)	70	15	15
	*4. Ag. Economics (Nasser)	Agricultural Policy (6)	25	50	25
Agricultural Engineering (52 credits)	5. Irrigation and Water Relations	Irrigation and Drainage (10)	40	30	30
	6. General Ag. Engineering	(Irrigation and Drainage (4) (Ag. Mechanics (4) (Farm Mechanics (4)	50	25	25
	7. General Ag. Engineering	Agricultural Mechanics (10)	40	30	30
	8. Agricultural Mechanization	Farm Machinery (10)	40	30	30
	9. Soil and Water Management	Plane Surveying (10)	40	30	30
	10. Computer Applications			100	
Agricultural Extension and Education (26 credits)	11. Extension Methods	Rural Sociology (10)	40	30	30
	12. Extension Methods	(Extension Methods (10) (Fiscal and Personnel Dev. (6)	70	-	30
	13. Secondary Education	(Courses to be added at a later date)	-	-	-

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TABLE E-6 (Cont.)

Program Area	Emphasis of Training of Yemeni Being Trained in the United States	Courses Assigned from Curriculum	Time Allocation Percentage		
			Teaching	Research	Extension
Animal Science and Poultry (86 credits)	14. Cattle, Sheep, Goat Production	Animal Production (10)	40	30	30
	15. Animal Nutrition	Feeds and Feeding (10)	40	30	30
	16. Animal Science	Pasture and Range Resources (10)	40	30	30
	17. Poultry Production	Animal and Poultry Science (10)	40	30	30
	18. Layer, Broiler Production	Poultry Production (10)	40	30	30
	19. Livestock, Poultry Breeding	Statistics (6) Animal and Poultry Improvement (10)	70	10	20
	20. Livestock Grazing Management	Pasture/Range Analysis (10) Pasture/Range Management (10)	80	-	20
Crops/Soils/Horticulture/Entomology (90 credits)	21. Cereal, Forage Production	Plant Science (10) Cereal, Forage Production (10)	80	-	20
	22. Plant Breeding and Genetics	Plant Breeding (10) Plant Pathology (10)	80	-	20
	23. Horticulture	Plant Propagation (10)	40	30	30
	24. Citrus, Vegetable Production	Fruit and Vegetable Prod. (10)	40	30	30
	25. Soil Morphology, Fertility	Plant/Growth Fertility (10)	40	30	30
	26. General Soil Science	Soil Science (10)	40	30	30
	27. Entomology	Entomology (10)	40	30	30

TABLE E-6 (Cont.)

Program Area	Emphasis of Training of Yemeni Being Trained in the United States	Courses Assigned from Curriculum	Time Allocation Percentage		
			Teaching	Research	Extension
Food Science and Technology (24 credits)	28. General Food Science and Technology	Microbiology (10)	40	30	30
	29. Food Processing/Human Nutrition	Food Processing/Human Nutrition (10)	40	30	30
	30. Food Chemistry/Processing	Food Evaluation (10)	40	30	30
TOTAL 330 credits		330 credits			

P. Secondary and FOA Curricula

The nature of secondary school curriculum will have an impact upon enrollment in the FOA and student survival within the agricultural curriculum. Many students (estimated 80 pecent) will enter the FOA from the science option secondary school. A comparison of the secondary curriculum and the first year FOA science curriculum is shown in Table E-7. A review of this information will show that a reasonably smooth transition can be made from secondary schools into the first-year curriculum.

The agricultural schools at Ibb and Surdud offer 3 years of training in agricultural subjects and physical education. Graduates of the program receive a regular secondary certificate of graduation. The students meet their science requirements through theory and application. The FOA curriculum includes pasture and range management emphasis that is not included in the agricultural school curriculum. However, the agricultural curriculum does provide a good base for range management through units of agronomy and animal husbandry.

Table E-8 shows the existing courses at Ibb and Surdud as compared with the proposed courses for the FOA by emphasis area.

The Sanaa Veterinary Secondary School offers a highly specialized curriclum for training veterinary assistants. Many of the graduates are expected to enter veterinary schools in Egypt. The relationship of the curriculum at Sanaa Veterinary Secondary School and the proposed FOA first-year curriculum is shown in Table E-9.

VII. Relationships with U.S. LGUs

The long-term success of this subproject is highly dependent upon the training of the faculty members and the extent to which their efforts are responsive to agricultural needs of the YAR. One technique by which this subproject proposes to insure the success of the FOA in increasing rural income in the YAR is to promote a direct linkage between individual FOA faculty members and experienced LGU faculty members in the U.S. These relationships will support the subproject's purpose, subgoal, and the Title XII collaborative management by serving as a vehicle for the long-term exchange of ideas and personnel which will continue long after USAID funding ceases.

Once a participant has been selected for U.S. training, successfully completed 12 to 18 months of academic work, and selected a major advisor, the major advisor and student will be brought to the YAR for a 14-21 day orientation and consultation with USAID, CID and FOA staff. In addition to enhancing the faculty advisors' understanding of the YAR agriculture, the purpose of the trip will be to select a specific agricultural problem that would be appropriate for the participant's research and thesis or dissertation. Alternate training schedules for this procedure are proposed in Table E-10.

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TABLE E-7

COMPARISON OF SECONDARY SCHOOL (SCIENCE OPTION) CURRICULUM WITH PROPOSED CURRICULUM FOR BASIC SCIENCE YEAR IN FACULTY OF AGRICULTURE

Secondary 1/	Faculty of Agriculture
Mathematics (3 years) - includes general math, algebra analytical geometry and calculus.	Mathematics (5 credits)
Biology (3 years)	General Botany (4 credits) Zoology (4 credits)
Chemistry (3 years)	General Chemistry (8 credits)
Physics (3 years)	Physics (3 credits
Mechanics and Statics (1year)	(Relates to agricultural engineering courses of 2nd year of program)
Arabic Language (3 years)	Arabic (6 credits)
Religious Education (3 years)	Islamic Civilization (3 credits)
English Language (3 years)	English (12 credit hours in first and second year)

1/ Secondary curriculum for Hodeidah school.

TABLE E-8

Curriculum Comparison for
Agricultural School/Faculty of Agric.
(Ibb and Surdud)

Curriculum Units for Secondary Agriculture Schools at Ibb & Surdud	Courses Proposed for Faculty of Agriculture
Agronomy (3 years)	Plant Science, Soil Science, Plant Growth/Soil Fertility, Plant Breeding/Cereal-Forage-Crop Production
Horticulture (2years)	Plant Propagation, Fruit and Vegetable Production
Crop Protection (1 year)	Entomology, Plant Pathology
Animal Production (3 years)	Animal Science, Poultry Science, Feeds and Feeding, Animal and Poultry Improvement, Animal Production, Poultry Production
Agricultural Engineering (3 years)	Plane Surveying, Farm Machinery, Irrigation and Drainage
Ag Extension and Rural Sociology (3 years)	Statistics, Extension Methods, Rural Sociology, Fiscal and Personnel Management
Agricultural Economics (1 year)	Farm Management, Agricultural Marketing, Agricultural Business Management, Advanced Farm Management, Agricultural Policy
Food Technology	Microbiology in Food Technology, Food Processing/Human Nutrition, Food Quality Evaluation/ Quality Control Systems
Animal Production (3 years)	Pasture/Range Resources, Pasture/Range Analysis, Pasture/Range Management

TABLE E-9

Relationship of Agricultural Secondary Curriculum to Proposed FOA Curriculum

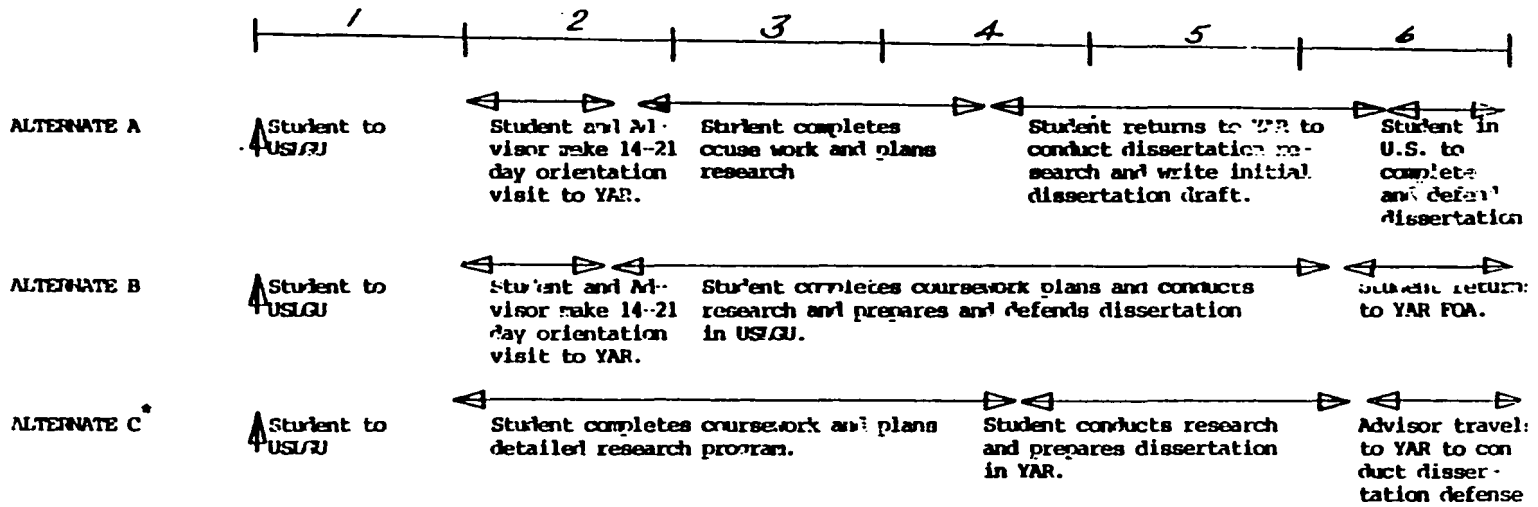
(SANAA VETERINARY SECONDARY SCHOOL)

VETERINARY SECONDARY SCHOOL	FACULTY OF AGRICULTURE
Mathematics (3 years)	Mathematics (4 credits)
Biology	
Anatomy and Histology	Botany (4 credits)
Physiology	Zoology (4 credits)
Parasitology	
Bacteria and Viruses	
Poultry Diseases	
Dairy and Meat Examination	
Veterinary Medicine	
Principles of Surgery	
Bio-chemistry	Chemistry (8 credits)
Animal Breeding	
Animal Policy	
Animal Nutrition	
Vocational Health	
Pathology and Lab Tests	Physics (4 credits)
Dairy and Meat Processing	
Pasture Management	
Feed and Feed Manufacturing	

TABLE E-10

ALTERNATE PARTICIPANT TRAINING SCHEDULES

YEAR OF PARTICIPANT TRAINING



* Assumes faculty advisor's being familiar with agriculture in the Y.A.R.

The balance of the graduate training would proceed as described in Section D of this Annex. The participants' major professor would have the flexibility to return to the YAR for final consultation and assistance in completing the graduate research, before both return to the U.S. to present and defend the thesis of dissertation. In addition, the major professor would be called upon, while in-country, to present special seminars, workshops, and in-service training and his/her area of expertise. Upon completion of the graduate work, the participant trainee would return to the YAR and join the FOA. Alternatively, the final dissertation defense could be held in the YAR by appointing appropriate subproject and CID personnel to the participants graduate committee.

If competent people at both ends were encouraged to participate, this process would result in a cadre of professionals at U.S. LGUs that would become increasingly aware of and involved in the agricultural development of the YAR.. From this awareness and investment, it would be highly possible that U.S. graduate students will be encouraged to focus on agricultural problems in the YAR. A logical extension of such a cadre would be that courses or special seminars on agriculture in the YAR might be designed for integration into the univesity curriculum or program at the LGUs. It would also be likely that library resources would be developed at both ends (YAR and U.S. LGUs) that would further encourage the exchange of ideas and appropriate technology.

The subproject has the provision for the use of consultants from U.S. LGUs at regular intervals. Such contracts would also nurture and strengthen linkages with U.S. LGUs.

Finally, as trained Yemeni participants return to the FOA, it will be important to seek modification in existing policies at U.S. LGUs in order to encourage these young faculty members to serve as graduate advisory committee members in the YARG and eventually major professors for future Yemeni graduate students. Such policies should also extend to CID and USAID professional staff who could be directly involved in the YAR with the FOA.

It is crucial to the success of this subproject that the development of university linkages with U.S. LGUs be given high priority. If this is not done adequately, the impact of the subproject and the overall ADSP could be short-lived, and fall short of its ultimate goal as envisioned in the Title XII legislation.

VIII. Integration of the Instructional Farm

An instructional farm is proposed as an essential and integral part of the FOA. The facility is to be located on a 22-hectare site immediately adjacent to the UOS campus. The strategy and physical aspects of the instructional farm are described in Annex J of this SPP. The farm is essential to the training, research and teaching missions of the FOA. It will include space allocated for demonstrations to students, provide specific skill development experiences for students, provide a training site for extension personnel and farm leaders, and provide an opportunity for the initiation of specific research projects related to agricultural production in the YAR of the following types of activites.

A. Agronomic and horticultural crop production;

B. Livestock and poultry production;

C. Rainfed and irrigated crop production;

D. Mechnical equipment operation and maintenance.

The instructional farm was designed to complement and support the coursework of the curriculum. In each of the emphasis areas, specific competencies are envisioned which will be demonstrated and practiced at the instructional farm. Those competencies are listed in Section G of this Annex.

Beyond development of the specific competencies discussed above, the instructional farm will be used to support overall instructional objectives. This use will be especially critical in the YAR where students are expected to come from diverse climatic, geographical, and agricultural regions of the country. These students may have had little experience in improved agricultural practices outside their home villages.

IX. Institutional Analysis

A. University of Sanaa

The UOS, founded in 1970, is a very young university. It has made remarkable growth in the physical plant on the original campus and has expanded to a new campus. Beginning with nine staff members and 64 students the university has grown to 231 staff members and 6,872 students in the 1982/83 academic year.

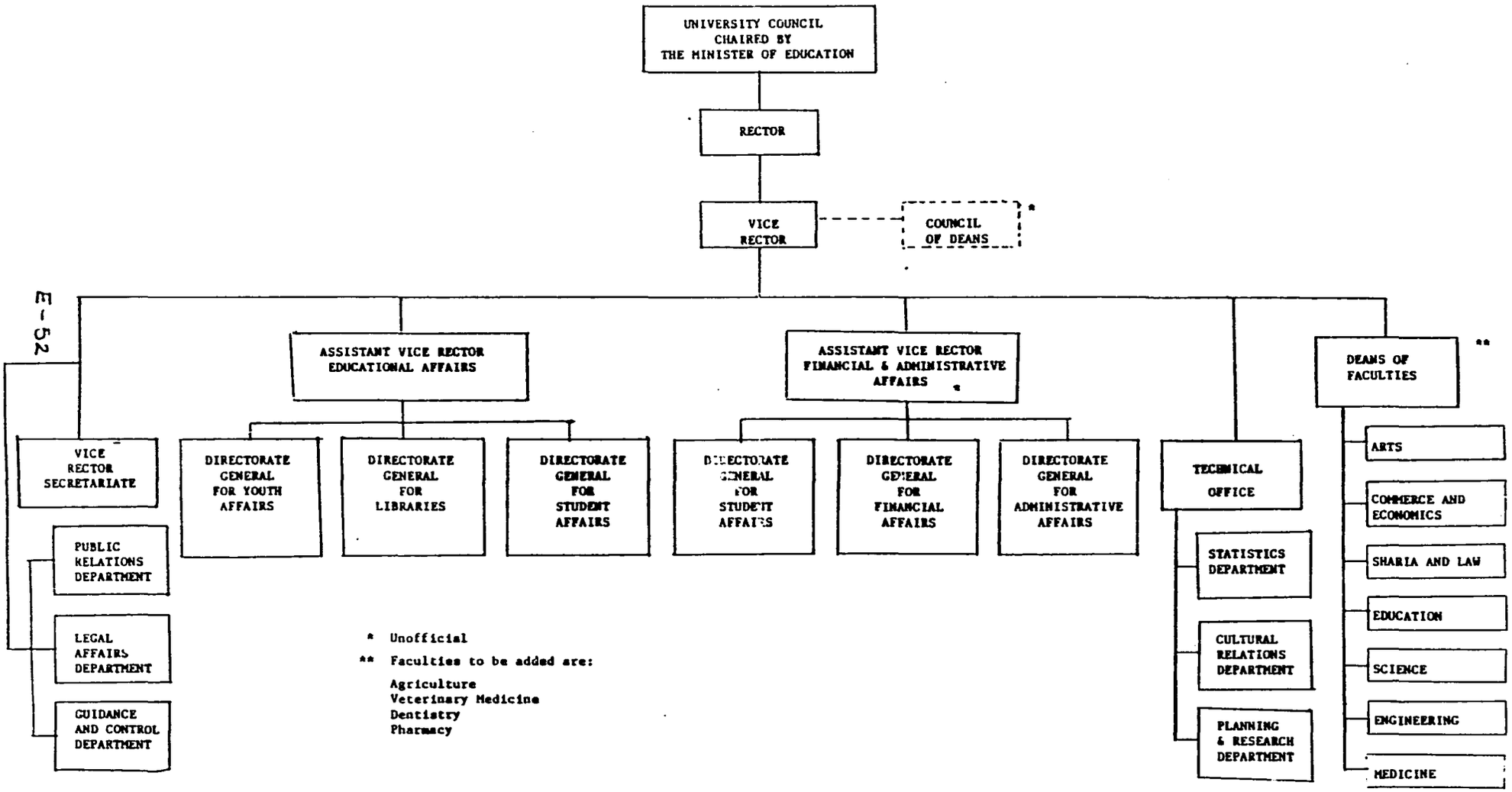
An administrative structure has evolved as shown in Figure E-8. This is a structure similar to that which has proven effective in U.S. LGUs. University policies are prescribed by the University Council which is chaired by the Minister of Education and has as members the Rector, Vice Rector, Deans of the seven faculties, and four members appointed by the Prime Minister from outside the UOS. The latter four are currently the Dean of the Public Administration Institute, Director of the Educational Research Center, a member of the Prime Minister's office and a member of the Presidential Advisory Committee. The UOS was initially part of the MOE. Today, however, it is independent of that ministry but maintains a vital linkage with the Ministry through the Minister of Education chairing the Advisory Council.

There is an informal Deans' Council which is chaired by the Rector. This council meets each week and may submit recommendations to the University Council.

Support services for the entire university are performed by the departments and directorates shown in Figure E-8.

FIGURE E-8

THE ADMINISTRATIVE STRUCTURE OF SANAA UNIVERSITY



* Unofficial

** Faculties to be added are:

Agriculture
Veterinary Medicine
Dentistry
Pharmacy

The UOS submits a calendar year budget request each October to the Ministry of Finance and CPO. Budget submission is independent of submissions from other government entities.

The faculties of Engineering and Medicine were initiated in 1983. The first classes were taught in October, 1983. The UOS is proposing to add four more faculties: Agriculture, Veterinary Medicine, Pharmacy and Dentistry. These will require new facilities and will increase the administrative and operative costs of the university. The administration indicated that they were prepared for this additional load.

A detailed census of university students for the academic year 1982/83 is presented in Table E-12. Note that the number of students varied greatly among faculties, each faculty had female students, and there were 317 international students. Enrollment statistics for the fall semester of 1983 were not available at the time this report was written, but an increase over the previous year was indicated.

The university has responded to the increase in numbers of students with increases in staff. As shown in Table E-13, the number increased from 181 in 79/80 to 231 in 82/83. Many of them are non-Yemeni who will be replaced by qualified Yemeni as they become available. Since 79/80 the rates of non-Yemeni to Yemeni has decreased only slightly. The number of staff members by origin, rank, and sex within each faculty during the 1982/83 academic year is presented in Table E-14. University policy dictates that responsibility for classes and laboratories is assigned only to professors, assistant professors, lecturers, and assistant lecturers. Note that none of the Yemeni held the rank of professor and that four were assistant professors. Among the non-Yemeni 42 were professors (including one female) and 44 were assistant professors. Demonstrators aid in classes and laboratories. In this category there were 38 Yemeni (including three females) and 25 non-Yemeni (including 25 females).

Success of several faculties depends upon the capability of the FOS which performs a vital service role. That faculty teaches courses for students in other faculties as follows:

1. Education: 70 percent of the science education courses;

2. Commerce and Economics: mathematics and some statistics;

3. Engineering: mathematics, physics and chemistry; and

4. Medicine: mathematics, physics and biology.

In the 1982/83 academic year the FOS had 495 students majoring at the undergraduate level in departments of mathematics, physicis, chemistry, and biology (including botany, zoology and marine sciences).

TABLE E-11

NUMBER OF STUDENTS BY YEAR, SEX, AND ACADEMIC YEARS, 1978/80 - 1982/83, UNIVERSITY OF SANAA

Academic Year	1st Year		2nd Year		3rd Year		4th Year		Total		
	M	F	M	F	M	F	M	F	M	F	TOTAL
79/80	2017	214	757	113	525	61	472	61	3771	449	4220
80/81	2000	250	930	113	553	84	528	61	4011	508	4519
81/82	2348	325	1051	139	673	85	354	81	4518	654	5172
82/83	3010	383	1467	182	950	126	638	89	6065	807	6872

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TABLE E-12

GENERAL CENSUS OF UNIVERSITY STUDENTS

ACADEMIC YEAR 1982-83

FACULTY	FIRST YEAR						SECOND YEAR						THIRD YEAR						FOURTH YEAR						SUB-TOTAL						TOTAL		GRAND TOTAL
	Regular		Part-time		Inter-national		Regular		Part-time		Inter-national		Regular		Part-time		Inter-national		Regular		Part-time		Inter-national		M		F		Inter-national				
																									Regular	Part-time	Regular	Part-time					
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F					M	F	M	F	
COMMERCE AND ECONOMICS	476	54	165	13	8	8	278	34	100	5	8	9	172	17	93	4	5	5	162	13	57	1	6	2	1080	415	118	23	27	24	1530	165	1695
SHARIA AND LAW	1294	39			6		675	9			3		377	8			3	1	195	5			2	11	2531		41		14	2	2545	63	2608
EDUCATION	234	46			11	8	165	40			1	2	139	24			2	1	111	22				1	649		132		14	12	663	144	807
ARTS	557	105			53	38	156	63			24	16	89	35			19	5	66	25	3	1	6	6	868	3	228	1	102	65	973	294	1267
SCIENCES	194	68			22	4	50	28			7	3	41	22			10	4	27	8			3	4	312		126		42	15	354	141	495
TOTAL	2745	312	165	13	100	58	1324	147	100	5	43	30	818	106	93	4	39	16	561	73	60	2	17	14	5448	418	665	24	199	118	16065	807	6872

TABLE E-13

NUMBER OF FACULTY MEMBERS BY ACADEMIC YEAR AND ORIGIN, UNIVERSITY OF SANAA

Academic Year	Faculty Members*		
	Yemeni	Non Yemeni	Total
79/80	56	125	181
80/81	67	150	217
81/82	61	149	210
82/83	77	154	231

* Includes faculty ranks of Professor, Asst. Professor, Lecturers, Asst. Lecturer and Demonstrator.

TABLE E-14

NUMBER OF STAFF MEMBERS BY ORIGIN, RANK, SEX & FACULTY,
UNIVERSITY OF SANAA

Faculty	Yemeni												Non-Yemeni												Total	
	Professor		Assistant Professor (Equivalent to US Rank of Associate Professor)		Lecturer (Equivalent to US Rank of Associate Professor)		Assistant Lecturer (Equivalent to US Rank of Instructor)		Demonstrator (Equivalent to US Rank of Teaching Assistant)		Total		Professor		Assistant Professor		Lecturer		Assistant Lecturer		Demonstrator		Total			
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Sharia & Law					3						2		5		4		5		4				13		18	
Arts			1		5		5	1	9	1	20	2	14		16		14	1	1				45	1	65	3
Science			1		3		1		6	2	11	2	18		17		8		4		23	2	70	2	81	4
Education					3			1	7		10	1	1				4						5		15	1
Commerce			2		2		11		11		26		4	1	6		5		2				17	1	43	1
Total			4		16		17	2	35	3	72	5	41	1	44		35	1	7		23	2	150	4	222	9

Courses for majors and non-majors are taught in the FOS facilities on the "old" campus. These facilities are used from 0730 to 1400 hours. The dean of the FOS said that more students can be served by increasing numbers in classes and laboratories and by utilizing laboratories from 0730 until 1800 hours. This expansion can accommodate growth for approximately 2 years at which time the need for additional classroom and laboratory space will be critical.

The FOS began graduate level instruction in the 1983/84 academic year. A diploma will be granted to students completing 24 credits post baccalaureate of science in analytical chemistry or applied geology.

Although the growth of the university has been rapid, the process appears to have been well planned. Discussions are underway for a centralized enrollment and a computerized student record process.

B. Faculty of Agriculture

The FOA, as proposed, is compatible with conditions in the UOS. It should benefit from the administrative structure, policy mechanisms, and services which have evolved in the UOS.

The dean of the FOA will have a challenging task of securing funding for research and extension activities within the UOS budget. These functions will be more significant in the FOA than in the remainder of the UOS and, therefore, probably are not initially well understood by his fellow deans and other university administrators. Funding should also be pursued through the MAF. The Ministry has been supportive of the creation of the FOA.

Women students and women staff members should be readily accepted in the FOA since they are in all the other faculties and fill leadership roles in the MAF.

The FOA will follow the staffing pattern used throughout the university. Initially, the staff will consist of Yemeni and non-Yemeni. The latter will be replaced as Yemeni educated to the Ph.D. level (dictated by university policy) return to Yemen. As many as 29 Yemeni are scheduled to be educated to that level so that they may serve in the FOA.

The FOS has the capability and has expressed a willingness to assume teaching the courses of mathematics, physics, chemistry, botany and zoology in its facilities for a few years since enrollment in the FOA will, initially, be low. However, it is imperative that classrooms and laboratories for these courses be constructed in the facilties of the FOA or elsewhere in the UOS. The demands upon the facilties of the FOS are heavy now and will increase as enrollments in the departments and the faculties it serves increases and other faculties are added. The FOS will provide staff members to teach the courses in the facility constructed for the FOA.

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ANNEX F

SOCIAL SOUNDNESS ANALYSIS

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ANNEX F

SOCIAL SOUNDNESS ANALYSIS 1/

I. The Agricultural Sector of Yemen 2/

A. Geography

Yemen is divided into three major geographical zones. First, the Tihama is the humid, semi-desert plain bordering the Red Sea. The Tihama is intersected by seven drainages or seasonal waterways (wadis) originating in the highlands and extending to the sea. Intensive cultivation of cereals, sugar cane, and tropical fruits is carried out in the foothill wadis. The second zone, bordering the eastern extremity of the YAR, is the arid sandy desert region of the interior Arabian penisula. Population is sparse and limited mostly to nomadic tribes. Between these two regions is the third zone, the highland regions, where 90 percent of the country's population live. The highlands consist of steep mountains, plateaus and sharply eroded wadis. Much of the arable land is extensively terraced and cropped. The people live in fortified rock houses in villages that are perched high on mountain ridges. Annual rainfall in the Tihama varies from 100 to 300 mm in the highlands, and from 1200 mm in the south to 200 mm in the north, and essentially zero rainfall in the arid eastern interior. Agriculture of the country is largely dryland farming. Less than 15 percent of the total cropped area receives some form of irrigation, largely temporary diversion from seasonal monsoons and tubewells.

B. Population

The 1975 census is the only census ever taken in Yemen. Projections based upon this census place the 1982 population near 8 million. About 85 to 90 percent is resident, with the remainder being emigrant labor working in other Arab countries, primarily Saudi Arabia. Net annual population growth is estimated at 2.6 to 2.9 percent. Life expectancy is 42 years but is raising rapidly with improved access to isolated villages, education through mass media and improved health facilities. Ninety percent of the population lives in rural areas, usually in small villages of under 500. The estimated number of households is 10,976,785 with an average size of 7.3 person per household being temporarily absent abroad. Households generally consist of the extended family (parents, children and their families, cousins, aunts and uncles) under patriarchal countrol.

C. Historical Setting and Recent Trends

The nature of agricultural production has not changed in Yemen for more than a thousand years prior to the overthrow of the Imam in 1962. Climate in the highlands is amenable to year-round production but availability of water limits this choice to only 5 to 15 percent of the farmers. Where

water is available, crop production in most of Yemen has consisted primarily of subsistence grain crops, mostly sorghum and millet. Coffee and cotton were grown on a commercial scale but recent labor shortages have seen a decline in both. Livestock, principally cattle, goats, sheep, donkeys, camels, and poultry, have been an integral part of traditional farming. Livestock have been used for meat, dairy products, transport, power for crop cultivation, and dung for fuel. Most production was for family consumption while a limited amount was used for barter or for sale. The traditional system is very labor intensive for all activities, including household chores of fuel and water gathering, cooking, crop production, livestock herding, terrace building and community activities such as road and school construction.

Terrace building was the principal method to preserve and conserve the most scarce productive resourses, land and water. Drought resistant sorghum and millet were the principal subsistence and risk aversion crops. Cows, kept in confinement, utilized crop residues for forage and provided milk and cheese, and dung for fuel. Goats and sheep utilized any available land for grazing and provided meat. Camels, donkeys and cows provided transportation and power for field cultivation and plowing, threshing and well lifts.

Ravaged by the 1962 civil war and a 7-year drought from 1967 through 1973, the country experienced a decline in agricultural production of one-fourth to one-half. Male emigration to the oil rich Arab countries commenced in the early 1970s and continues to this day.

As remittances began to flow back to Yemen from the oil fields, new influences began to change the traditional economic system. Land prices increased rapidly. Availability of water increased marginally as new wells were dug. Water prices increased. Purchases of consumer goods, including food imports, increased. The price of preferred Yemeni food goods, especially fresh chickens and locally grown crops, increased significantly. Large investments in secondary road construction, wells with motorized pumps, trucks for transport, tractors for hire, and home construction have occurred. Since 1970 unskilled labor wage rates have increased from YR 5 to YR 40-70 per day. Skilled labor wages have increased from YR 30 to 300-400 per day.

Other changes have resulted from the switch to a labor scarce and relatively capital abundant market economy. Women are now responsible for most of the agricultural production in Yemen, in addition to livestock and poultry production. In response to consumer demand, a large percentage of the irrigated cropland above 1500 meters has been shifted to qat production, a plant whose leaves are mildly narcotic. Qat leaves are chewed in daily social gatherings that are held each afternoon. While little is known about the effects of qat, it is generally recognized as a stimulant.

Livestock numbers, particularly sheep, goats, donkeys, and camels, have declined for several reasons. Motorized vehicles have replaced donkeys and camels for transportation, except in the most isolated regions. Increases in locally constructed schools have led to more farm children attending school

rather than herding family sheep and goat flocks. Strong growth in commercial broiler production has also occurred since 1979. The average number of livestock per household, exclusive of chickens, typically ranges from five to nine head.

Land holdings are highly fragmented due to tradition such as Islamic inheritance laws and the geography and terracing on steep terrain. Fragmentation also is used by Yemeni farmers as a hedge against variable micro-climates and moisture conditions. The average number of parcels per rural household ranges from 2.7 in the coastal Province of Hodeidah to 6.8 in the Central Highland Province of Dhamar. The size of family holdings varies greatly. More than 90 percent of all family or household holdings are less than 5 hectares. Some two-thirds of all family holdings are less than 1 hectare. While very small holdings dominate the Yemeni scene in total numbers by total area, the size distrubtion of land is skewed toward larger holdings, especially in Dhamar, Hodeidah, Hajjah, and Taiz provinces. Holdings of greater than 5 hectares comprise slightly over 50 percent of all the land area for the six provinces included in the 1981 agricultural census (Dhamar, Hodeidah, Hajjah, Mahweet, Taiz and Ibb). In those six provinces, totally owned holdings comprise over 60 percent of all holdings. Only 12 percent are totally share-cropped, a more common practice in Mahweet and Ibb provinces.

Field crops, primarily sorghum and millet, account for 73 percent of total land use. Permanent crops such as alfalfa and fruit trees account for 5 percent, temporary fallow, 8 percent; and abandoned land, 12 percent of total land use and 2 percent in other uses, according to the census. Some 84 percent of the holdings are totally dependent upon rainfall. Another 8 percent depend totally upon some form of irrigation (springs, pumps, spate). Vegetable and fruit production are common on such irrigated land. The remaining 8 percent employ a mix of rainfed and supplemental irrigation.

Family labor continues to be the dominant labor source. Temporary hired labor and traded labor among farmers comprise the remainder.

Some 85 percent of the holdings use draft animals for field work. Nearly 30 percent hire tractors on a rental basis to handle heavy plowing. Some of the steepest terrace lands will not accommodate existing mechanized traction as evidenced by 14 percent of the holdings using only manual tools. About three-fourths of the holdings in Taiz and Ibb use commercial fertilizer in small amounts. Fewer than 20 percent of holdings in Dhamar and Hodeidah provinces use commercial fertilizers. Farmers are well aware of disease, insects, and fungus problems, but only about 5 percent of holdings in the six provinces use pesticides. Agricultural chemicals have not yet been tested nor are they available to any great extent.

Shortage of labor has led to abandonment of marginal agricultural land, neglect of terraces, some erosions, and adjustment of some terraces to accomodate mechanization.

The fisheries industry, while very small, is thriving because of strong consumer demand and increased catches in recent years. only 3,000 to 4,000 fishermen in 40 communities comprise the industry.

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Forestry is essentially a non-existent economic enterprise. The country has been essentially denuded of trees, so much so that fuel for cooking is sold at a premium. Women spend a significant amount of time collecting limbs from thorny shrubs and scrub trees.

The dominant socio-economic conditions currently influencing Yemen's agricultural sector are summarized as follows:

1. Relative labor scarcity and high wage rates, due to emigration to Arab oil fields, a phenomenon whose growth appears to have peaked;

2. Increased dependency on womens' labor in all agricultural production activities and in the raising of livestock and poultry;

3. High local investments in roads and schools which have increased access to isolated areas;

4. High capital cost of infrastructure development because of mountainous terrain;

5. A bustling private sector with demand for consumer goods and strong preference for Yemen produced food products in spite of higher domestic food prices; and

6. An unspecified, but real, economic impact from rapid expansion of qat chews as a recent social phonomena.

II. Education in Yemeni Society

A. Background

Today, religion plays a relatively minor role in the educational system in Yemen. However, the traditional Kuttab system still exists in towns and villages as it has for centuries. The curriculum includes study of the Arabic language, the Quran, fiqh (Islamis rules), Hadith (words of the Prophet) and elementary arithmetic.

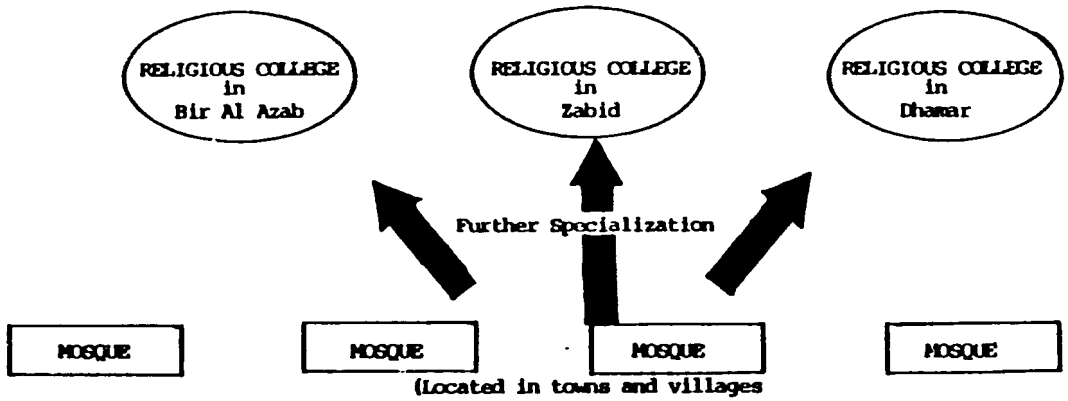
Most Kuttab schools are maintained by religious endowments, waqf, and generally are a part of the Mosque Foundation. Each religious sect has its own mosque where the Shayks pass on religious learning. Oral recitation and memorization are emphasized.

In addition to the religious schools there are three religious colleges in Yemen, where Arabic philosophy, Islamic law, commentary of the Quran, traditions and history are taught. They are located in Bir Al Azab, Dhamar and Zabid (see Figure F-1, "The Religious Education System in the YAR (Kuttab)".)

THE RELIGIOUS EDUCATIONAL SYSTEM

in the

YAR
(Kuttab)



NOTES:

I. Administration of the religious educational system: by the Shaykh or college.
II. Funding: religious donations (wagf) or private contributions.
III. Curriculum: Arabic language, Quran, figh (Islamic rules), Hadith (words of the prophet), elementary arithmetic. College curriculum includes Arabic philosophy and Islamic law (sharia').
IV. Approach: oral recitation/memorization.

SOURCE of DATA: Swiss Technical Cooperation Service, Final Report, 1978.

Figure F-1

In addition to the traditional religious educational system, a secular school system has evolved. A secular grade school system was introduced during the reign of Imam Ahmad which provided a 6-year primary course, a 3 year preparatory course and a 3 year secondary course. Teacher training institutes were also established. However, before the revolution of 1962, there existed no proper budget for education. Teachers depended entirely upon religious donations (waqf), the contributions of private parties and irregular contributions from the Imam. 3/

Institutionalization of the educational system occurred after the Revolution. However, the greatest advances were made after the end of the civil war in 1969. Student enrollments along with the number of primary, preparatory, secondary and teacher training institutes increased dramatically. Technical vocational institutes were established along with the UOS (See Figure F-2, "The Secular Educational System in the YAR").

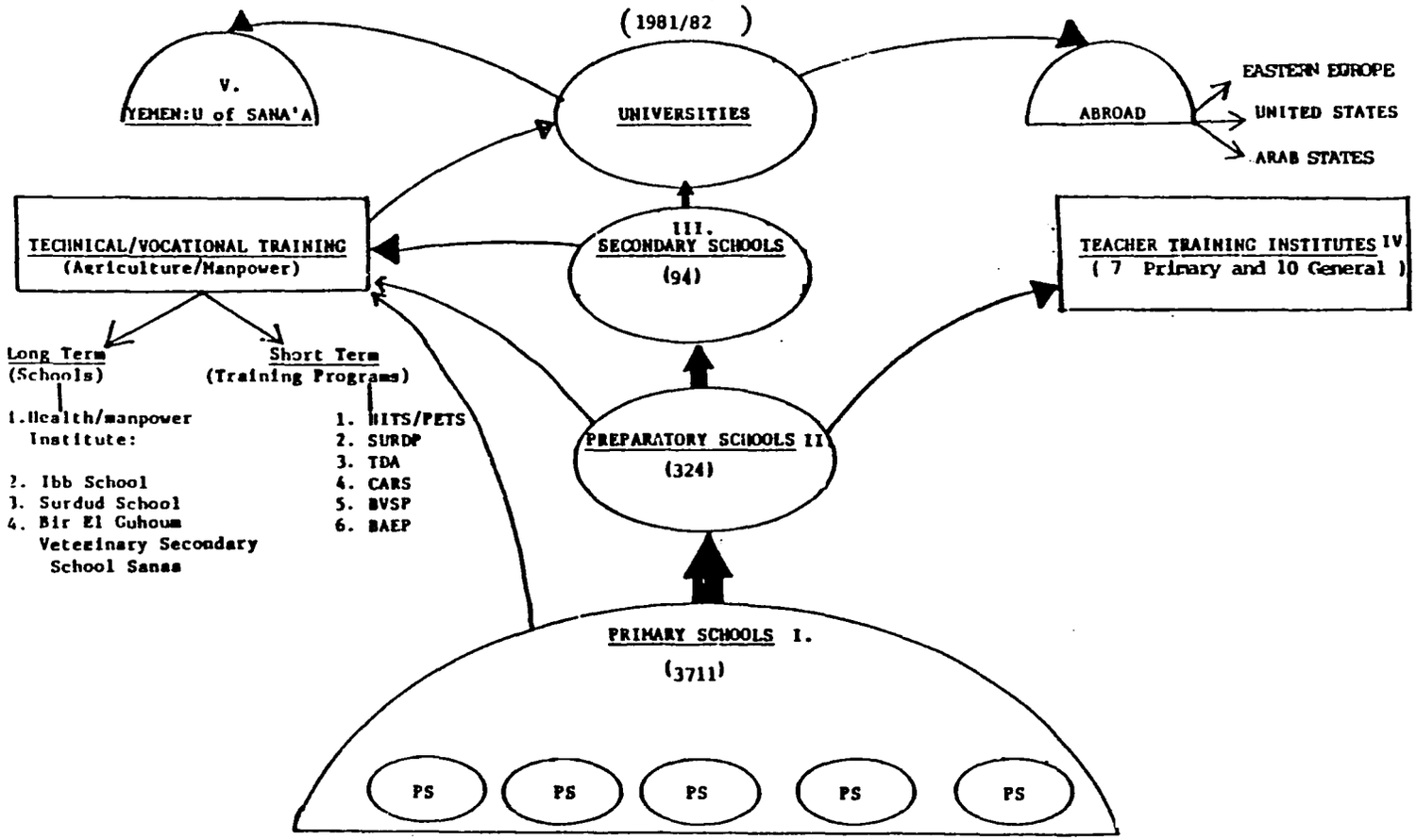
B. Education and Training Needs on the YAR

YAR is desperately short of manpower, at all technical and management skill levels, to implement its ambitious modernization plan. Almost no institutional capacity for education and training existed at any level prior to 1970. At the time of the revolution in 1962, only 919 primary schools existed in the entire country, with enrollment of 61,000 students, as shown in Table F-1. There were only eight preparatory and secondary schools enrolling about 2,000 students. No improvement in this situation occurred until after 1969 with termination of civil war activity.

In the decade of the 1970's, through the initial YARG Three-Year Plan (1973-76) and the FFYP (1976-81), the YARG placed major emphasis upon establishment of an educational system to develop human resources. The system utilizes a year structure of 6, 3, 3, and 4 respectively for primary, preparatory secondary and university levels. Most primary and preparatory structures have been built by LDAs. The number of such schools increased to over 3,700 by 1980/81. The number of secondary schools increased from three in 1962 to 94 in 1980/81. (The number of teacher training institutes totaled 17 in 1981/82. In addition, there are four long term technical vocational training institutes). The schools and institutes have been financed largely by YARG (MOE) and donor assistance.

The UOS, YAR's only university, opened in 1970. Sixty-four students were enrolled in the faculties of Arts (literature), Law and Religion, and Sciences, while the staff numbered 14. In 1973/74 two other faculties were added; Education, Business and Commerce. In 1983, the faculties of Engineering and Medicine were added. Plans exist to add faculties of Agriculture, Veterinary Medicine, Pharmacy and Dentistry. By 1980, there was a total of 4,220 students enrolled in the five faculties of the UOS; 449 women and 3,771 men. In addition, there were 630 students on grants in Arab friendly countries in various specializations in 1979/80 4/. Enormous educational progress has been made in YAR. By 1980, 36 percent of

SECULAR EDUCATIONAL SYSTEM*
in the
YAR
(1981/82)



Source of Data: Ministry of Education

FIGURE F-2

TABLE F-1

GROWTH IN SCHOOLS AND ENROLLMENT IN THE YAR EDUCATIONAL SYSTEM

1962/63 to 1981/82

LEVEL	NUMBER OF SCHOOLS				NUMBER OF TEACHERS				NUMBER ENROLLED (THOUSANDS)			
	1962/63	1971/72	1979/80	1981/82	1962/63	1974/75	1979/80	1981/82	1962/63	1971/72	1979/80	1981/82
PRIMARY	919	1115	2543	3711	-	5825	6727	11700	61	119	335	522
PREPARATORY	5	47	197	324	-	599	1061	1640	1	6	20	32
SECONDARY	3	6	55	94	-	233	480	806	-	1	8	12
UNIVERSITY	-	1	1	1	-	14	153	210	-	1	4	5
TOTAL	927	1,169	2,796	4,130	-	6,671	8,421	14,356	62	127	367	571

SOURCE: Ministry of Education and University of Sanaa
*For 1971/72, 1974/75 Figures were used.

the primary school age population and 4 percent of the secondary school age population were enrolled. Student enrollments increased dramatically, too. (See Table F-1, "Growth in Schools and Enrollment in the YAR Educational System", 1962/63 to 1981/82). Attrition rates of students appears to be high at all levels.

MOE statistics indicate that about 15 percent of the students entering Grade 1 complete Grade 9, and about one-half of the students completing each higher level proceed to the next level of schooling. Nevertheless, the literacy rate has increased to over 20 percent. It should be noted, however, that overall literacy figures are more applicable to the male population than to the female population. For example, in 1975, illiteracy (persons able to read but not to write) was about 74 percent among males and 98 percent among females over 10 years of age. 5/ In 1981/82, females made up less that 15 percent of enrollments at all levels, with the exception of commercial secondary schools and teacher training institutes where they made up 22 to 43 percent of the enrollment respectively. (See Table F-2, "Student Enrollment in the Primary, Preparatory, Secondary, Teacher Training and Technical Institutes and Universities").

In general the participation of Yemeni girls in the formal educational system has been low even in areas where they have access to schooling. The major constraints to educating females in Yemen have been "social attitudes and parental ignorance, family obligations keeping girls at home and the pattern of early marriage". 6/ Families objected to educating daughters on moral grounds. Girls were not allowed to study publically in the presence of boys and male teachers. 7/

Today, it appears that many of these attitudes toward educating females are beginning to change. As more and more women become educated, social barriers will begin to break down. Progress is being made and it will continue.

The quality of schooling is relatively low, reflecting the shortage of buildings, furniture, equipment, teaching materials, and teachers. Teacher shortage is the most critical education problem at all levels. While teacher numbers exceed 8,400, the proportion of expatriates in the preparatory and secondary levels averages about 90 percent versus 70 percent at the university level.

Non-formal education and training also exists. The MOE has primary responsibility for such activity. In addition to the technical secondary schools, MOE has initiated about 100 literacy centers which reached over 2,200 adults in 40 villages since 1979. Such adult classes provide training courses in electricity, carpentry, sheetmetal and welding, construction, automotive and general mechanics, agriculture, health care, home economics, nutrition, sewing, and weaving. Also provided are country-wide literacy classes which are intended to provide Grade 4 literacy and arithmetic skills. Enrollment levels in the literacy classes exceeded 10,400 in 1979/80

TABLE F-2

STUDENT ENROLLMENTS IN PRIMARY, PREPARATORY, SECONDARY, TEACHER TRAINING AND TECHNICAL INSTITUTES AND UNIVERSITIES

SCHOOL	1979/1980					1981/1982				
	FEMALE		MALE		TOTAL	FEMALE		MALE		TOTAL
	Number	% of Total	Number	% of Total		Number	% of Total	Number	% of Total	
Primary	41,707	12	293,542	88	335,249	71,394	14	451,602	86	522,996
Preparatory	2,795	13	17,969	87	20,764	4,571	14	27,995	86	32,566
Secondary	1,046	13	7,183	87	8,229	1,353	12	10,292	88	11,645
Teacher Training (Primary)	303	33	604	67	907	284	43	375	57	659
Teacher Training (General)	285	48	312	52	597	310	35	578	65	888
Commercial Secondary	81	21	313	79	394	96	22	331	78	427
Technical Secondary	1	.3	355	99.7	356	0	0	454	100	454
Ibb Secondary Agricultural School	-0-	-0-	53	100		-0-	-0-	118	100	118
Surdud Secondary Agricultural School	-0-	-0-	35	100	35	-0-	-0-	31	100	31
Bir El Guhoum Veterinary Secondary School (Sanaa)	—	—	—	—	—	-0-	-0-	30	100	30
Sanaa University	449	11	3,771	89	4,220	654	13	4,518	87	5,172
Universities Abroad	-0-	-0-	630	100	630	-0-	-0-	652	100	652

SOURCE: Ministry of Education and The Agricultural Sector Assessment YAR, 1982.

NOTES ON THE SECULAR EDUCATIONAL SYSTEM IN THE YAR

Primary Schools:	6 Year Program; ages of the students 6-11 years. Prior to 1983, primary school graduates could enter primary school teacher training institutes. Now, only preparatory school graduates are admitted to these training institutes
Preparatory Schools:	3 Year Program; ages of the students 12-14 years.
Secondary Schools:	3 Year Program; ages of the students 15-17 years. In addition to the government schools there are seven commercial and three technical secondary schools.
Teacher Training	(Includes primary teacher training institutes). 3 Year Program; ages of the students 15-17 years. The MOE has proposed that the program be increased to a 5 year program and then to a 6 year program.
V. University of Sanaa:	Faculties of Law, Commerce and Economics, Education, Science, Engineering and Medicine. Faculties proposed include Agriculture, Pharmacy, Dentistry, and Veterinary Medicine.

Health Centers provided by the Ministry of Health enrolled 90,000 in 1979/80 in their health classes. Eight community development centers provided training in embroidery, sewing and home economics.

A country's educational system, besides being a training ground for its future manpower, is also the basis for the perpetuation and modification of its own cultural and social value system. With a significant portion of Yemeni teachers at all levels, including the university level, being foreigners, such objectives may not be met. Yemenization of the education system is an important goal to reduce dependency upon other countries and to focus upon problems, problem priorization, and approaches to problem solutions which embody a Yemeni perspective. Yemeni trained abroad do not get a Yemeni agricultural focus, nore are they necessarily provided with the types of technical skills which are matched to the needs of Yemen agriculture. The training of Yemeni through the FOA is intended to address such deficiencies. The faculty will provide educaton for those who will provide the services and leadership needed for developing the agricultural sector.

C. The FOA Subproject Purpose

The primary purpose of the FOA Subproject is to develop the institutional capacity within the YAR to train Yemeni men and women as agriculturists at the baccalaureate level. This is to be accomplished through the establishment of a FOA within the UOS.

The faculty is to be engaged in training, teaching and research activities that will increase the pool of agricultural personnel for the public and private sectors. FOA graduates can provide services to the agricultural sector at all levels in addition to providing the administrative and scientific leadership needed to modernize traditional agriculture in Yemen and thereby increase production.

The FOA Subproject is to generate skilled men and women who are trained with an applied focus. This applied focus is intended to place primary emphasis upon the immediate needs of increasing agricultural production in Yemen. It is important to recognize that a primary performance criteria for FOA operations is on improving production in the agricultural sector. Past experience in the Middle East 8/ points to a number of issues that should be considered including: (1) higher agricultural education, (2) subcollegiate agricultural education, and (3) agricultural extension. The following list provides a summary of the recommendations from past experiences.

1. Conclusions and recommendations for higher agricultural education in the Middle East:

a) Higher agricultural education must include practical field experience during the course of study.

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b) A basic knowledge of human nutrition should be required of agricultural college graduates. (The knowledge may be provided by a required course).

c) Agricultural college students should be trained in community service and development.

d) Agricultural colleges should organize refresher courses, short courses, and round table discussions to be offered on a continuing basis.

e) Agricultural colleges should involve their alumni in evaluating, at regular intervals, the type of training they have received and the training currently being offered.

f) A Significant number of the professional staff of agricultural colleges should be in constant touch with local people and familiar with current rural and agricultural problems in order to improve their teaching and research methods and to guarantee their relevancy.

g) Agriculture college students should be given experience in identifying problems and learning where to find answers (such as effective use of libraries and utlizing research results). Case studies may be used to advantage.

h) Agricultural colleges should place more emphasis on recruiting students from agricultural and rural areas.

i) Professors in the different colleges of the Middle East, after acquiring experience in the area, should write textbooks in their specialities, adapted to local conditions.

j). Professors should attend international congresses and conferences in their field of specilization, and institutions should attempt to seek all possible sources of funding for travel.

k) Additional emphasis in the curriculum of agricultural colleges should be given to communicative skills, human sciences, pedagogy, and international development (such as the world economic order).

l) Agricultural colleges should coordinate their programs with the needs of the employers of the graduates of the colleges.

m) There should be an ongoing exchange of ideas and much greater communication among all agricultural colleges of the Middle East and Arab World.

2. Conclusions and recommendations for sub-collegiate agricultural education in the Middle East:

a) The teaching of agriculture and nutrition in rural areas should be instituted at both the primary and secondary school levels. (This should be accomplished through formal instructional means as well as indirectly through farm youth organizations).

b) The mass media should be utilized to provide learning for all, including those who are illiterate.

c) Fully equipped farms or production training units ranging from small to large, and involving various levels of investment and technology, should be established in intermediate institutions to enable students to learn the required skills.

d) The objectives of each level of education should be agreed upon and publicized.

3. Conclusions and recommendations for agricultural extension in the Middle East:

a) Greater integration and coordination between various development programs in rural areas are high priority needs.

b) Extenion and research personnel should communicate and enter into dialogue so that research findings can easily and promptly be disseminated and applied.

c) Extension must be viewed by national agricultural and rural development leaders as a two-way process so that researchers are made aware of the needs of farmers without delay.

d) Extension should be an important function of university programs, including training.

e) In view of the reportedly slow growth of agriculture in response to extension work over a long period, agricultural universities should do research on factors responsible for this state of affairs.

f) Extension programs should be responsive to the recognized needs and aspirations of farmers and rural people. (This can best be done by getting farmers and villagers involved in both planning and implementation). Emphasis needs to be placed on the training and recruitment

of women extension agents to that the needs of women farmers can be met more effectively.

III. Sources of FOA Students

A. Opportunities for Training in Agricultural Subjects in YAR

Agricultural education in YAR is limited. No agriculture is taught in the primary, preparatory or secondary schools. However, students can take a science option in the secondary school system which includes 3 years of training in mathematics, biology, chemistry, physics, mechanics and statistics. This training provides a sufficient academic background for pursuing further education in Agricultural subjects. Specialized long-term training in agriculture in YAR is available through technical agricultural secondary schools. Short-term training programs are offered by various donor projects.

1. There are three technical agricultural secondary schools: The ISAI, the Surdud Agricultural Secondary School and the Bir el Guhoum (Sanaa) Veterinary Secondary School. 9/

a) The ISAI began operations in 1979 with USAID assistance. The scool offers a 3 year agricultural course for training extension agents and technicians. Graduates can pursue university agricultural studies. Approximate enrollments of students have been: 53 in 1979/80, 78 in 1980/81, 118 in 1981/82, 107 in 1982/83 and 114 in 1983/84. The operating capacity is about 180 students per year.

b) The Surdud Agricultural Secondary School began in 1981. IBRD will finance expatriate staff salaries for 4 years. The school offers a 3 year agricultural course for extension agents and other technicians. The design capacity is for 180 students, although enrollments have been 35 students in 1981 and 31 in 1982.

c) The Bir el Guhoum (Sanaa) Veterinary Secondary School opened in 1982 and is financed by IBRD, including equipment and staff salaries for 4 years. The school offers a 3 year program that integrates animal production and health subjects to produce animal husbandry and veterinary technicians. The design capacity is about 180 students or 60 per year. Student enrollment for 1982 was 10 and for 1983 it was 30.

2. In addition to the long-term institutionalized education programs, short-term training, up to 1 year, is provided under various donor projects in extension, veterinary science and mechnization. Currently the following projects offer training.

a) The CARS has trained about 170 agricultural extension agents between 1974 and 1982, through 11-month courses. The

Sourthern Uplands Rural Development Project (SURDP) recruits about 90 percent of the graduates and the remainder were recruited by other development projects. Currently, about 70 percent of the graduates continue to serve on these projects, while the remainder have gone on to more advanced agricultural studies or other positions related to agriculture. SURDP extension agents can receive refresher courses through CARS.

b) The TDA conducts 11-month extension training in its Wadi Zabid facilities. Approximately 150 agents have received training. Training and refresher course are offered as needed.

c) The British Veterinary Services Project (BVSP) has trained about 100 animal health assistants since 1976 through seven 12-month courses under the MAF auspices. In 1982, 21 students were enrolled. Because of the low demand for this training, the project has had to admit primary school graduates. Attrition has been about 30 percent and only about 50 percent of the graduates have joined the agricultural services. Alternatively, many students have opted to continue higher education in other institutions, often in unrelated subjects.

d) The British Agricultural Engineering Project (BAEP) trained about 20 mechanics between 1978 and 1982 in a one-year course in tractor repair. The trainees are mostly emp.oyees from the public sector. Also the project has trained SURDP extension agents in a one-month course in tractor operation and maintenance. Most all SURDP agents will have this training by the end of 1983. Two-week courses are offered for rural mechanics.

e) The Sourthern Uplands Rural Development Project (SURDP) and TDA offer short-term training of 11 months. Since 1974, 320 extension agents have received such training.

3. Under the ADSP, funded by USAID, two subprojects have provided training opportunities in agriculture: The HITS and the Poultry Extension and Training Subprojects (PETS).

a) HITS began in early 1983, although horticulture training began much earlier. Informal and formal training programs for extension agents, agriculturists and farmers have been scheduled. The informal training programs that have been scheduled include two 3-week courses for extension agents in sub-tropic, tropic and deciduous horticulture in Al Jarouba, Al Irra; and one 3-week course in nursery management in Al Irra. It is anticipated that there will be approximately 30

participants per session; informal 3-day extension courses will be offered for farmers. Extension training also will be provided to farmers via TV programs and video cassettes. In 1983 short training courses for agricultural technicians were given at Al Jarouba. In addition, a 2-month informal training program in nursery management was given in the USA. Four trainees participated in this program.

Formal academic training has been scheduled: eight B.S. students, two M.S. students, and two Ph.D. students are expected to complete their training over the next 6 years in the USA. Currently one student is in the USA working and M.S. degree in Horticulture. Six-month training courses in the USA are scheduled for eight agricultural inspectors/technicians in Horticulture work.

b) PETS began in 1982, and offers formal and informal training. Formal training includes 16-week sessions in poultry management. In the first session, there were seven students enrolled and five completed the courses. Currently five are enrolled in the second 16-week session.

Informal one-hour training sessions in poultry production are offered on a continuing basis in the rural villages. Following the earthquake in 1982, the subproject distributed approximately 2,741 pullets in the Dhamar area. One-hours training sessions in feeding, watering and housing poultry were given to approximately 429 men and 191 women.

Agricultural extension training in YAR was first developed during the 1974-76 period under the auspices of three rural development projects. A total of 36 centers have been established in the area of Hodeidah, Wadi Zabid, Ibb and Taiz. Training for these centers has been carried out be TDA and CARS. In 1982, the MAF proposed a new organization. Under this proposed organization there would be a new structure, the General Administration for Extension and Training. Extension and training offices are to be established at the provincial, district and village levels. Implementation plans are expected to proceed slowly due to a shortage of trained staff. Graduates and trainees of the long and short term training programs discussed above will provide needed staff for the extension service. 10/

Agriculutral education in YAR is inadequate. Improvement at all levels is needed, especially for technicians and B.S. graduates who can fill middle level jobs essential for providing services to farmers. 11/

Of particular concern is an inadequate supply of trained women in agricultural fields. Women are integrally responsible for all phases of the agricultural production in YAR, in addition to being responsible for livestock and poultry production, vegetable gardening, beekeepping, limited

marketing and household chores. Hence, schooling and training for women at all levels is essential for balanced development of Yemen society.

The official policy of YARG encourages women to attend school. However, may traditional families do not support this policy. Traditional Yemeni still believe that schooling is for boys and that girls are to marry at an early age and raise children instead of attending school. Consequently, while overall literacy exceeds 20 percent, that for women is very low, perhaps 2 to 3 percent. New preparatory and secondary schooling for women are available where separate classrooms are provided. In fact, in 1981/82, of the total enrollment in primary and preparatory, and secondary schools, 14 and 12 percent were girls respectively. Furthermore, 13 percent of the students enrolled in the UOS were women (See Table F-2).

The traditional division of labor in Yemeni rural society and extensive male labor in emigration place many women farmers in key production roles. It is important for FOA course offerings to reflect this need. The FOA program will encourage female enrollment and participation in production and management classes in livestock production, food technology, nutrition, agricultural production, and management. These subjects are expected to be of great interest to women who train to be agricultural scientists and/or extension agents. There are 23 women extension agents in SURDP now. Further initiatives by the YARG to encourage female involvement through the MAF and NES are expected to be slow. Observable changes in agricultural production, cropping patterns, and family household patterns require close analysis, as they may affect women and children differently than men. Inaccessibility of women to the market and lack of opportunity to accumulate capital for investment appear to be extremely important economic issues as Yemeni agricuture becomes more market-oriented. 12/

B. Source of Students

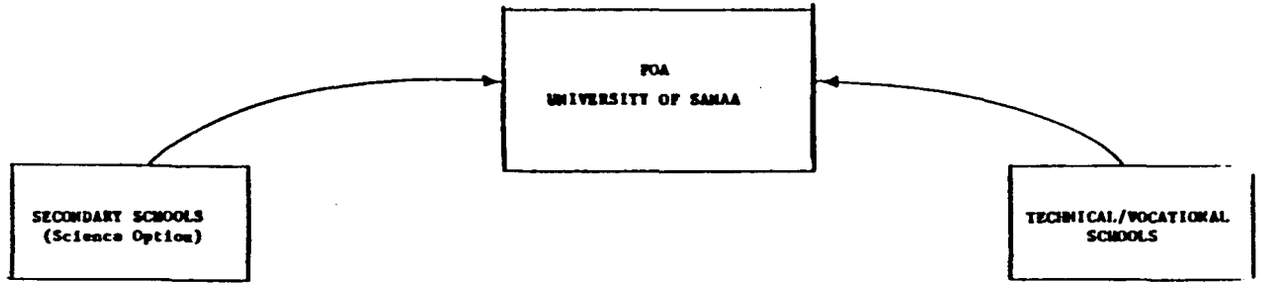
The major sources of students for the FOA will be the graduates from the secondary schools who have taken the science option (see Annex D). In addition, graduates from the long-term technical agricultural secondary schools and trainees from the short-term agricultural training programs who have appropriate academic background will be potential candidates for admission to the FOA (see Figure F-3).

C. Student Educational Preference Study

One important factor in evaluating the likely success of the FOA in the YAR is the interest of secondary students enrolling in an agricultural curriculum. In order to assess this factor a questionnaire (Figure F-4) was designed and administered to students in the scientific stream of the secondary school system, to students in the two agricultural secondary schools and to students in the Sanaa Veterinary Secondary School.

FIGURE F-3

SOURCES OF STUDENTS FOR THE FACULTY OF AGRICULTURE (FOA)



1) Ibb Secondary Agric. School
2) Surdud Secondary Agric. School
3) Veterinary Secondary School (Sanaa)

FIGURE F-4

STUDENT EDUCATIONAL PREFERENCE

QUESTIONNAIRE

English Translation of Questionnaire Presented to Yemen Secondary School Students to Determine Their Educational Plans and Preferences. a/

QUESTIONNAIRE

1. Do you plan to enroll at the University of Sanaa upon completion of your secondary education program? Yes or No

2. If you plan to enroll in the University of Sanaa, please rank the following faculties according to your enrollment preference. Indicate first, second and third choices.

Agriculture
Business and Commerce
Education
Engineering
Islamic Law
Medicine
Veterinary Medicine b/

---

a/ Questionnaire presented to and explained to students in Arabic by an Arabic speaking university faculty member.

b/ This option was offered only to students at the Sanaa Veterinary Secondary School.

1. Administration of Questonnaire

Individual copies of the questionnaire translated into Arabic were provided to each student in the classes selected. Prior to distribution of the questionnaire, an Arabic speaking University faculty member or secondary school official explained the role of the SPP team to the students as well as the details of the questionnaire.

2. Processing of Responses

The initial step in processing the responses was to tabulate them by class as shown in Table F-3. Student responses were tabulated in the order collected and student numbers assigned to facilitate review of recording accuracy. For each student their indication of university plans was recorded along with their ranking of the alternate faculties.

Student responses by class were summarized in Table F-4. For each of the faculties, the number of students indicating it as their first choice, first or second choice, and first, second or third choice were tabulated and reduced to percentage of students indicating plans to attend the UOS.

3. Observations

a) Hodeidah

(1) Over 90 percent of the secondary students sampled indicated an intention of attending the UOS.

(2) Seven percent of the secondary students sampled indicated agriculture as their first choice faculty.

(3) Fifty-eight percent of the secondary students sapled indicated agriculture as being among their top three faculty choices.

(4) Engineering, Medicine and Agriculture were the top three faculty choices, in that order.

b) Taiz

(1) Over 97 percent of the secondary students sampled indicated an intention of attending the UOS.

(2) Fifty-three percent of the secondary students sampled indicated agriculture as their first choice faculty.

(3) Eighty-two percent of the secondary students sampled indicated agriculture as being among their top three faclty choices.

TABLE F-3

INTEREST SURVEY RESULTS FOR THE OMAR IBN ABD ALAZIZ SECONDARY SCHOOL IN HODEIDAH: THIRD LEVEL

Tabulation of data obtained by administration of the educational preference questionnaire to students in third level of Omar Ibn Abd Alaziz Secondary School

School: Omar Ibn Abd Alaziz - Boys

City: Hodeidah

Class: Third level Natural History

Date of survey: 19 October 1983

Student	Plan to Attend Univ of Sanaa	Choices					
		Agr	Bus Commerce	Educ.	Engr.	Islam Law	Med
1	Y	3			2		1
2	Y		3		2		1
3	Y	3			1		2
4	Y	2	3	5	1	6	4
5	Y		1		2		3
6	Y	3		2	1		
7	Y	3			1	2	
8	Y	2		3	1		
9	Y	4	5	6	2	3	1
10	Y	1			2		3
11	Y	1			2		3
12	Y	3	2	6	1	5	4
13	Y	6	5	4	2	3	1
14	Y	3	5	2	4	6	1
15	Y	4	6	5	1	3	2
16	Y	1	2	3	4	5	6
17	Y	1	2	3	4	5	6
18	Y	1	2	3	4	5	6
19	Y	4	3		1	5	2
20	Y	3	4		1		2
21	Y		3		1		2
22	Y		3			1	2
23	Y	5	4	6	1	2	3
24	Y		2		3	1	
25	Y	3			1		2
26	Y	2			3		1
27	Y	3			2		1

TABLE F-4

ANALYSIS OF SECONDARY STUDENT RESPONSES TO POST-SECONDARY EDUCATION PREFERENCE QUESTIONNAIRE, YEMEN ARAB REPUBLIC, NOVEMBER, 1983.

School	M/F (d/v)	City	Class	Number of Students	Number Planning to Attend POS	Agriculture						Business & Commerce						Education						Engineering						Islamic Law						Medicine					
						Top 1		Top 2		Top 3		Top 1		Top 2		Top 3		Top 1		Top 2		Top 3		Top 1		Top 2		Top 3		Top 1		Top 2		Top 3		Top 1		Top 2		Top 3	
						No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Omar Ibden	M	Hodeid-h	3 Natl. History	27	27	5	18	8	30	17	63	1	4	5	18	10	37	0	0	2	7	6	22	12	44	20	74	22	81	2	7	3	11	6	22	7	26	14	52	18	67
Abdalla	M	"	2 Engl. Language	40	40	3	8	10	25	26	65	0	0	4	10	12	30	1	3	2	5	4	10	19	48	34	85	37	93	0	0	0	0	6	15	15	38	26	65	33	83
Bilquis	F	"	2 Engl. Language	34	34	0	0	7	21	15	44	1	3	11	33	17	50	3	10	3	10	7	21	8	24	17	50	23	68	1	3	2	6	6	19	20	59	24	71	24	71
Bilquis	F	"	3 Chemistry	28	26	1	4	8	31	17	65	0	0	1	4	4	19	0	0	1	4	2	8	8	31	17	65	21	81	0	0	3	12	6	23	17	65	21	31	22	85
Faroq	M	Taiz	2 Mathematics	47	47	24	51	32	68	38	81	0	0	7	15	11	23	0	0	1	2	3	6	11	23	24	51	38	81	1	2	3	6	4	9	9	19	23	49	35	74
Faroq	M	"	1 Chemistry	47	47	43	91	45	96	47	100	0	0	0	0	4	9	0	0	0	0	1	2	2	4	24	51	36	77	1	2	2	4	2	4	1	2	18	38	26	55
Bilquis	F	"	2 Engl. Language	38	35	15	43	23	66	29	83	0	0	2	6	8	23	2	6	2	6	3	9	3	9	15	43	21	60	0	0	3	9	3	9	14	40	22	63	27	77
Bilquis	F	"	3 Engl. Language	27	26	3	12	11	42	16	62	1	4	2	8	5	19	0	0	1	0	0	0	7	27	20	77	22	77	0	0	0	0	0	0	15	58	17	65	20	77
S. A. Nasser	M	Sanaa	Physics	31	21	2	10	3	15	12	57	0	0	4	19	9	43	0	0	0	0	0	0	13	62	19	90	20	95	0	0	2	10	2	10	6	29	11	52	13	62
S. A. Nasser	M	"	Math.	63	56	3	5	10	18	31	55	4	7	11	20	23	41	0	0	0	0	0	0	21	38	46	82	49	88	0	0	2	4	6	11	27	48	35	68	42	75
Aarva	F	"	Physics	44	36	1	3	9	25	21	58	2	6	11	31	16	44	0	0	1	3	3	8	2	6	15	42	20	56	0	0	4	11	10	28	28	78	30	83	33	92
Aarva	F	"	English	56	56	3	5	12	21	22	39	4	7	16	29	23	41	4	7	9	16	10	18	17	30	32	57	38	68	2	4	7	13	11	20	26	46	36	64	39	70
Sanaa Veterinary	M	"	1st, 2nd	25	25 1/	4	16	13	52	18	72	0	0	3	12	5	20	0	0	0	0	1	4	0	0	8	32	13	52	1	4	1	4	4	16	6	42	10	40	14	56
Surdud Agric. Institute	M	Surdud	All	95	69	69	100	69	100	69	100	0	0	0	0	2	3	0	0	0	0	0	0	0	0	3	4	3	4	0	0	1	1	1	1	0	0	0	0	1	1
Ibb Agric. Institute	M	Ibb	1st Year	29	[illegible]	14	48	20	69	24	83	2	7	5	17	7	24	0	0	1	3	3	10	8	28	19	66	25	86	0	0	4	14	6	21	5	17	9	31	19	66
Ibb Agric. Institute	M	"	2nd Year	33	33	32	97	33	100	33	100	0	0	8	24	15	45	0	0	0	0	4	12	1	3	15	45	25	76	0	0	0	0	1	3	0	0	7	21	13	39
Ibb Agric. Institute	M	"	3rd Year	27	27	26	89	25	93	26	96	0	0	0	0	6	22	0	0	0	0	2	7	0	0	6	22	19	70	0	0	4	14	5	17	3	10	19	70	22	81

1/ Veterinary Medicine was chosen the Top 1 by 14 (56%), Top 2 by 15 (60%), and the Top 3 by 18 (72%) students.

(4) Agriculture, Medicine and Engineering were the top three faculty choices, in that order.

c) Sanaa: Regular Secondary Schools

(1) Eighty-seven percent of the secondary students sampled indicated an intention of attending the UOS.

(2) Five percent of the secondary students sampled indicated agriculture as their first choice faculty.

(3) Forty-four percent of the secondary students sampled indicated agriculture as being among their top three faculty choices.

(4) Engineering, Medicine and Agriculture were the top three choices in that order.

d) Sanaa Veterinary Secondary School

(1) All twenty-five of the students sampled indicated an intention of attending the UOS.

(2) Fifty-six percent of the students sampled indicated Veterinary Medicine as their first choice faculty.

(3) Sixteen percent of the students indicated Agriculture as their first choice faculty.

(4) Seventy-two percent of the students indicated Agriculture as being among their top three faculty choices.

e) Surdud Agricultural Secondary School

(1) Over 95 percent of the students who responded to the question of their desire for further education responded positvely. They have an almost universal interest in university level training.

(2) All of the students who ranked the alternate faculties selected agriculture as their first shoice.

f) ISAI

(1) All of the 89 students who responded to the questionaire indicated plans to attend the UOS.

(2) Seventy-eight percent of the students indicated the Faculty of Agriculture as their first choice.

(3) Over 93 percent of the students indicated the Faculty of Agriculture as being among the top three faculty choices.

(4) The students were equally divided in their choice of engineers and medicine as alternatives to agriculture.

D. FOA Student Considerations

1. Criteria for Admittance

The following criteria for admittance to the FOA have been established tentatively:

a) Graduation from any of the agricultural technical schools or secondary (science option) schools with national exam score of 60 percent.

Pass	50 percent
Faculty of Arts	55 percent
Faculty of Science	60 percent
Faculty of Law	62 percent
Faculty of Commerce	66 percent

b) Military draft requirements have been met; and

c) Degree of English language competency necessary.

2. Other Issues

At this point a number of unresolved issues remain. It is not clear how equivalent or comparable the secondary (science option) school curriculum is with that provided through the agricultural secondary schools. It appears that the agricultural secondary schools have relinquished required math courses for applied agricultural courses. This, remedial training in math may be required for some students. This may also be the issue in English language training for some. A comparison of national scores would be helpful.

One year military service is required of all able-bodied men. The one exception is for all men who are in teacher training who may substitute the military requirement with 1 year of teaching in primary or secondary schools in rural areas. Adoption of this option may need to be explored for agricultural students if incentives are not adequate to attract sufficient rural based students to the FOA.

IV. Beneficiaries

A. Primary: Students and Faculty

The primary beneficiaries of the FOA Subproject are expected to be the agricultural students trained at the B.S. level who enter the private and public sectors directly or who go on for advanced degrees. Salaries, prestige, personal satisfacton, and upward economic mobility are viewed as the principle economic and esthetic benefits.

The FOA is expected to assist the MOE in identifying the best FOA graduates for future study overseas. Upon return, some M.S. trained candidates are expected to be posted with the MOE as teachers for the agricultural secondary schools and fill proposed specialist positions with the NES in the provincial agricultural offices.

B. Secondary: Agricultural Sector Institution

The secondary beneficiaries of the FOA Subproject are expected to be the people served by agricultural institutions. The FOA will provide trained Yemeni men and women to fill technical and administrative positions for both public and private institutions with greatest intended emphasis upon public institutions. The public institutions include the research and extension components of the MAF, the semi-autonomous regional development authorities, and other public institutions such as the MOE which may require agricultural graduates to serve their program. The MOE is expected to benefit indirectly from the availability of trained Yemeni to staff the three agricultural secondary schools which they administer. People served by the small but expanding agri-business sector of Yemeni, including credit banks, agricultural input supply firms, and agricultural product processing and markeing firms also will be secondary beneficiaries. The extent to which the public versus private sectors will benefit from the FOA is not know at this time. The growth of each sector and the relative salary relationships between them will be contributing factors. A commentary on these expected beneficiaries is provided in Annex H (Manpower Analysis).

C. Tertiary: Farmers and Farmer Groups

The tertiary beneficiaries of the FOA Subproject are expected to be local villages through the improved technical training at the agricultural institutes, FOA research studies and developments, the hiring of graduates of such institutions by the NES, and proposed posting to the provincial and local levels. The local extension centers are expected to test, evaluate, and modify for local conditions the research work conducted at the regional extension station. Several aspects of technology development, including water and public grazing land, likely will involve public (common property) issues for group improvement. Training of local paraprofessionals through technical classes and their employment by local groups (LDAs) may provide a means to enhance sensitivity of training and research to maintain focus upon local needs. Availabilit of television and radio media, even in isolated villages,

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improves accessibility of villages and farmers to new technology. Farm families are expected to be the ultimate, but indirect, beneficiaries through institution building which has the capacity to develop and extend technology of relevance to Yemen agricultural needs. Yemen has an egalitarian tradition based on tribal law. This tradition allows any man direct access to leaders to present a grievance or request a favor. Such an egalitarian ethic is expected to provide direct access to government officials. This tradition is expected to erve not only as an important direct linkage to the FOA, but also as a means by which FOA can link into all of the governorates.

A potential training bias, favoring non-farm village and urban students at the expense of those students with a farm background, is possible. This issue needs to be monitored carefully during the project. Current indications from the ISAI are that 80 percent of the students have farm backgrounds. Just how well those students will fare academically in competition with urban students entering FOA through the secondary school science curriculum is not known. It is expected that up to 80 percent (120 to 150) of the FOA students will come from the regular (science option) secondary schools. However, because many villages are small, a large number of regular secondary school students are expected to have some familiarity with agriculture and are expected to be reflected in the FOA student population.

Of much greater concern is the dearth of productive investment opportunities in rural Yemen 13/. This poses a challenge for the FOA, MAF and NES as the mandate of these institutions is to provide applied technical knowledge of near-term application. The extent to which such issues are near-term in nature, and can be solved satisfactorily, will have a significant impact upon the credibility of the FOA and MAF.

D. The Impact of FOA on Women

Opportunities for educating Yemeni women are increasing slowly. It is important that serious thought be given to encouraging and supporting this trend at all levels of training. This is especially critical since extensive male emigration has placed many women in key production roles. Hence, it is important that women have access to appropriate training in agriculture, in order to improve their individual productivity, which in turn will contribute to the growth of the Yemeni economy.

It is essential that the FOA encourage female enrollment to accelerate their study of the agricultural sciences. In order to accomplish this objective, certain issues need to be addressed, and innovative recommendations proposed in response to the issues raised. Based on extensive field research, in the YAR, the following issues and recommendations are proposed (See footnote 1 which details the data collection undertaken).

In order to encourage women to join the faculty, they need to be informed about the faculty. They need to have a support structure once they enroll, the curricula needs to include courses that will attract women, university research and extension activities must be responsive to the needs

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of rural women and men throughout Yemen, and job opportunities for B.S. graduates must be assessed.

There are several suggestions for encouraging women to enroll in the FOA. First of all, FOA faculty could visit the secondary girls' schools to meet with the third-year science students, in order to inform them about the FOA and provide them with written literature about the faculty. It would be advantageous if this faculty member was a woman. Meeting with the parents could also be arranged.

Housing is another issue that is of particular concern for women. Some women will be able to stay in the womens' dorms with their family approval. For others, this may be more difficult. Assistance with arranging alternative housing with relatives or families would help to encourage the enrollment of women from more traditional families. As more women enroll, and as society begins to accept some of these changes, it will become increasingly easier for other women to enroll. Another incentive for women to enroll would be the availability of financial assistance. This is particularly important for families with several children. Usually the family resources are invested in the education of boys first, then the girls. If alternative assistance was available, it would encourage families to educate the girls also.

Orientation and a support structure for women, once they have enrolled, is extremely important. This can be accomplished through formal orientation sessions and informal group meetings of women students and women faculty members. A woman faculty student advisor could direct and advise women in their scholastic programs, give them moral support, and provide them with a positive role model to observe. It would be impossible for a male faculty to provide this type of support, since they do not face the same constraints as women.

The existence of women faculty members would help attract women students. Therefore, it is recommended that qualified women be identified in all fields of agriculture. Based on the established selection process for selecting participant trainees of the future FOA faculty, qualified women and men could be selected for advanced graduate training. A number of eligible women for participant training have come to the attention of the SPP team. (See Footnote 16 for a list of these women. Also see Table E-1, Annex E for list of the participant trainee positions). Additional discussion on the selection process is discussed in the text of Annex E.

The curricula of the FOA was designed to include courses that will attract women. Based on the assessed interests of women in secondary schools, and the needs of rural women, the recommended curricula for general agriculture is relevant to both women and men. (See Annex E, Table E-3). Because rural women are engaged in all aspects of agricultural and livestock production, food processing, management of farm and family resources, marketing, family nutrition and extension, there is no need to have a dual tract curricula.

University curricula, research and extension activities must be responsive to the needs of rural women and men. In order to accomplish this, it is recommended that women faculty members be represented and/or consulted on the following university advisory boards: the Curricula Review Committee, the Research Advisory Committee and the Extension Coordinating Committee. (See Annex E for further discussion of these committees).

E. Extending Benefits to Farmers and Farmer Groups

The local villages will benefit from the FOA through the improved technical training at the agricultural institutes, the hiring of graduates of such institutes by the NES, and the posting of these graduates to the provincial and local levels. It is at this level that women will find more limited opportunities to work because the traditional families do not allow women to work freely in rural areas.

Trained women can, however, work very effectively with rural women as extension directors, trainers of other women and as extension agents. The FOA can provide training for women in as aspects of agricultural sciences. In addition, training in management and communications is essential. With this background, women can provide the leadership necessary to support and promote an active national extension program that meets the needs of the entire rural population, men and women inclusive.

There are several types of media that are being employed for disseminating agricultural information to rural communities including television, video films, slide shows, printed materials, demonstrations and group meetings. Such media have proven to be an effective means for communicating information in the YAR. Therefore, what is needed are additional materials and more qualified extension personnel rather than new approaches.

Some of the films that are being used by the NES have been produced by the FAO of the United Nations, and by the Egyptian film industry. Other materials are produced locally. The FOA could provide leadership in producing films and other materials that are aimed at the agricultural sector through cooperation of their extension faculty. Men and women students could help in developing such materials through class projects.

Specific attention should be devoted to the preparation of informational materials for rural women by women students. Because of the social constraints that make it difficult for rural men and women to participate together in group meetings, much of the extension materials will need to be prepared with a specific target group in mind.

Also, the purpose for preparing the material must be identified. Television shows, films, videos, slides and printed materials have worked well for identifying and explaining new agricultural information and technology to rural farmers and villagers. In particular, television is an effective extension media since most rural villagers, even the poorest, own televisions

or have access to them. Individual and group demonstrations have provided an effective approach to showing the farmers how to use the new information and technology. Finally, daily or weekly meetings with the farmers provide a means for establishing a dialogue with them, and gives the farmers an opportunity to express their problems, concerns and needs.

F. Employment Opportunities for FOA Graduates

In order to attract students to the FOA, there must be employment opportunities for them after they graduate. It is anticipated that there will be many opportunities for FOA graduates to staff the MAF and possibly the MOE in technical, professional and administrative roles; to staff the on-going donor supported agricultural and rural development projects; to provide personnel for the emerging agri-business sector; to collaborate in the development and staffing of a National Agricultural Extension Service; and to provide technical expertise for numerous LDAs and a growing credit/banking system. (See Annex G for a comparison of salary levels for various occupations in the YAR, 1983).

All of these jobs would be available to both men and women. Already women are employed in the government ministries, private agri-business companies, academic institutions and donor projects. Among the women and men interviewed, there was a general consensus that it would be possible for professional women to work in these jobs.

Educational and job opportunities for Yemeni women have been limited in the past due to social traditions that restricted their activites to the home. However, these traditions are changing slowly. There are men and women pioneers who have taken the initiative to promote changes. They will be the ones who provide the momentum for continuing change and progress in Yemen. Their spirit is strong. Their own words best reflect their commitment towards accomplishing these goals.

> "The best way to protect a [Yemeni] woman is by educating her. She is a person, after all. By educating her, she will be protected from ignorance, disease and poverty, and, in turn, she can protect all of us... her family, her husband and the society. She is our sister...we are all human." (A male UOS faculty member, November 1983).

How fast will this change occur? It will be gradual, but it will happen. A Yemeni extension woman stated firmly:

> "Don't limit your thinking [in the development of the FOA] to what is possible today. The situation [in Yemen] will change over time. Every day and every month there

> are changes. Things are beginning to happen that were impossible before. In 5 years, there will be many more opportunities for men and women than what are available today. We must look to the future with an open mind." (November 1983).

There are Yemeni who are commited to improving their society. They are willing, with adequate training, in part made possible by the establishment of the FOA, and they can succeed.

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FOOTNOTES

1/ Information presented in the Social Soundness Analysis is based on interpretation and analysis of secondary data and primary data. Primary data was collected by administering formal questionnaires and conducting informal interviews and meetings.

Formal questionnaires were administered to students in secondary schools in Hodeidah, Taiz, and Sanaa and secondary agricultural institutions in Surdud, Ibb and Sanaa.

Informal interviews and meetings were conducted with men and women directors of secondary schools, agricultural training/vocational institutes, extension centers, UOS faculty members, Ministry personnel (Agriculture, CPO, Information, and Education), and various donor agencies. The following is a list of these respondents.

I. Secondary Schools

A. Hodeidah:

1. Director of the Omar Ibn Abd Al-Aziz Schools (boys).
2. Mabrouka Hamad Musa, Director of the Bilquis Secondary/Preparatory School (girls).
3. Assistant Director, Bilquis Secondary/Preparatory School.

B. Taiz:

1. Abdul Fateh Gamal, Director of the Farouk Secondary Schools (boys).
2. Anisa Shams, Director of the Bilquis Secondary/Preparatory (girls).
3. Saleh Zokair, Principal of the Mohamad Ali Othman School-Primary through Secondary Levels (Co-educational).
4. Sultana Sultan, Registrar of the Mohamad Ali Othman School.

C. Sanaa:

1. Director of the Gamel Abdul Nassar Secondary School (boys).
2. Director of the Arwa Secondary School (girls).

II. Extension Programs

A. Radaa Integrated Rural Development Project (Dutch Project):

1. Abdulla Hababi, General Manager.
2. Robbert H. Van Schagen, Team Leader.
3. Faiza Al-Nassiry, Women's Extension Agent.
4. Sharon Hart, Extension Specialist.

B. Southern Uplands Rural Development Project:

1. Mohamad Ezzo, Extension Specialist
2. Zeinab Ali Ali Mohamad, Women's Extension Director

C. Tihama Development Authority:

Abu Al-Maw'min Hasshim, Director.

III. Training Vocational Institutes

A. Surdud Agricultural Secondary School:

Omar A.G. Al-Arifi, Director.

B. Ibb Secondary Agricultural Institute (Including Administrative and Teaching Staff):

1. Robert R. Martin, Team Leader.
2. Nabil Al-Ansi, Director.
3. Sunny Langham, Project Director, NMSU.
4. Amin Abusher, Crops and Soils Instructor.
5. Musa Allagabo, Horticulture Instructor.
6. Hassan I. Gasim, Agricultural Instructor.
7. Mohamed Al-Garbawi, Food and Dairy Technology Instructor.
8. Awadallah Yousif Hamid, Animal Science Instructor.
9. Abou Soud Kairy, Agricultural Extension Instructor.
10. Don Swanjord, English as a Second Language Instructor.

C. Veterinary Secondary School (Sanaa):

Omar Mohsen Al-Bakri, Director

IV. Ministries - Sanaa

A. Agriculture:

1. Mohamad Ariani, Director of Extension.
2. Abdull Hafiz Karhash, Deputy Director and Co-Manager.

B. Education:

1. Mohamad Al-Harazi, Director of Agricultural Education.
2. Fatima Fadhal, Director, Women's Education Section.
3. Fawziya Namaan, Director of Women's Secondary Schools.
4. Ashwaq Al-Shabiy, Director of Preparatory Schools.
5. Najat Al-Yarima, Director of Primary Schools.

C. Information:

Ahlaah Al-Mutawakil.

D. Central Planning Office:

Nabila Al-Jarafi, Regional Planning Advisor.

E. Family Planning Institute:

1. Atiqa Shami, Deputy Director and President of the Women's Association.
2. Malika Othman, Family Planning.

V. University of Sanaa

A. Faculty of Commerce and Economics:

Nassar A. Aulaqi, Associate Dean.

B. Faculty of Science:

Ahmad Hamza Al-Yamani, Assistant Professor.

C. Planning Section:

1. Mohamed A. Mohsen, Director, Technical Office.

2. Mohamed Saadi, Assistant Director, Technical Office.

D. _____:

Abubaker Airbi, Vice Rector.

VI. Donors

A. AID:

1. Susan Coleman.
2. Koukab Al-Jofi.
3. Hans P. Peterson, Agricultural Development Officer.

B. American Institute for Yemeni Studies:

Lealand Swanson, Director.

2/ Reference sources for this section include:

a. AID/Yemen, Agriculture Sector Assessment, Yemen Arab Republic, 1982.

b. Swanson, Jon C. and Mary Hebert, Rural Society and Participatory Development: Case Studies of Two Villages in YAR, Cornell, 1981.

c. World Bank, Agricultural Sector Study, November 17, 1981.

d. YAR, Agricultural Census Data, 1977-80, for Six Governorates.

3/ Ministry of Education.

4/ Ibid.

5/ Ibid.

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7/ Ibid.

8/ Agricultural Education for Development in the Middle East, edited by John Ryan and Adeb T. Saad, American University of Beirut, 1980, pp 162-4.

9/ AID/Yemen, Agricultural Sector Assessment, Yemen Arab Republic, 1982, pp. 92-95.

10/ Ibid. pp. 87-88.

11/ Ibid. p. 95.

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13/ Rural Development in the Yemen Arab Republic Strategy Issues in a Capital Surplus - Labor Short Economy, John M. Cohen and David B. Lewis, Development Discussion Paper No. 52. Harvard Institute for International Development, February 1979, pp. 47-54.

ANNEX G

ECONOMIC AND BUDGETARY ANALYSIS

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ECONOMIC AND BUDGETARY ANALYSIS

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ANNEX G

ECONOMIC AND BUDGETARY ANALYSIS

I. OVERVIEW OF ISSUES

A. General

The establishment of an FOA at the UOS is aimed at overcoming critical shortages of professional level manpower in YAR. A discussion of the probable incidence of primary, secondary, and tertiary benefits of the FOA Subproject is included in Annex F, Social Soundness Analysis. However, because of imprecise knowledge of the magnitudes of anticipated benefits and the difficulty of identifying social cost issues, it was necessary to consider an alternative to the formal benefit-cost analysis of the FOA Subproject. In accordance with recommendations in the USAID Handbook, Appendix 3 E, a least cost analysis has been accomplished.

The basis of the analysis is the determination of the cost of achieving the Subproject outputs (a given number of Yemeni trained to the B.S. level in general agriculture) via a set of alternative feasible training approaches. These approaches are:

1. Establish FOA at the UOS and train Yemeni to the B.S. level;

2. Train Yemeni to the B.S. level in already established agricultural programs in Arab countries; and

3. Train Yemeni to the B.S. level in already established agricultural programs in the U.S.

B. Limitations of Analysis

As a least cost (or cost-effectiveness) analysis, the following study falls more within the realm of financial analysis than economic analysis. Both are normally done in the course of project analysis. However, there are vestiges of the economics problem which should be kept in mind as the material in this annex is considered. One problem involves quality considerations. Are graduates of the FOA, and Arab institution, and a U.S. institution strictly comparable? Another issue is salvage value of the FOA at the end of the project life and the planning horizon. In this analysis the facility is completely depreciated in a financial sense over the planning horizon leaving no salvage value to be considered. The anaysis here does not take into account the value of contributions of the Ph.D.-trained Yemeni faculty members to Yemen economic well-being nor does it consider the cost of establishing this small, but highly trained group of professionals as a cost component of the Arab and U.S. alternatives. Third, the issue of subsidization of Yemeni students by USAID and other donors at Arab and U.S. universities is of significance in this study. These issues require careful

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consideration of distinction between financial analysis and economic analysis of institution-strengthening projects.

C. Organization

Following a discussion of relevant variables, parameters, and cost-effectiveness indicators, the analytical procedure is developed. Using base level (most likely) values of variables and parameters, base level set of "least-cost indicators" are derived. These reveal that one alternative will have a lest cost advantage with respect to one or more criteria. Next, by systematically varying the value of variables used in the benchmark analysis, the response of the indicators (and findings of least cost advantage) can be examined. The conclusions of this analysis is then presented. This annex also includes the complete budgetary analysis summarized in the main body of the SPP.

II. LEAST COST ANALYSIS

A. Indicators

Table G-1 (a) shows the four least cost indicators used in the analysis. They are all ramifications of the basic costs of each of the three training alternatives. An alternative's basic cost is defined as the total PV of costs of accomplishing project outputs. The least cost indications each reflect a certain perspective on cost. Depending on which perspective is used, there is a ready indication of how the alternatives compare. Since placing graduates in MAF is thought to be a means of upgrading the capabilities of that organization, this is the basis of one perspective. Retention of graduates in YAR is the basis of another perspective. The consideration of the costs borne by USAID alone as opposed to costs borne by all participants together, (Parallel Donors) is the basis of another perspective. Hence, there are four least cost indicators derived from the basic cost for each alternative.

B. Parameters

The parameters for this analysis (shown in Table G-1 (b)) involve the selection of a project life and a planning horizon, and methods for determining total enrollment and total numbers of graduates.

1. The duration of the FOA Subproject has been fixed at 11 years.

2. Another parametric feature of the analysis concerns the transitioning of B.S. candidates through the educational systems of the FOA with resources from YARG alone (and with only Yemeni staff) over a period of time comparable to the project life. For this reason the planning horizon was set at 21 years.

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TABLE G-1

Least Cost Indicators, Parameters, and Variables

(a) Indicators for Least Cost Analysis

Each of the following four indicators is derived from the total present value cost of an alternative (the sum of present values of the stream of costs of the alternative over time).

1. Total present value cost per B.S. level graduate retained in YAR; cost to AID only.
2. Total present value cost per B.S. level graduate retained in YAR; cost to combined sponsors.
3. Total present value cost per B.S. level graduate joining MAF; cost to AID.
4. Total present value cost per B.S. level graduate joining MAF; cost to AID.

(b) Parameters in Analysis

1. AID Life of Project = 11 years.
2. Planning Horizon = 21 years.
3. Student population dynamics determined by cohort survival model with the same drop-out rate for each of four years in a typical student program.
4. Graduate equivalent function determines number of graduates "in pipeline" at the end of horizon.

(c) Variables in Analysis

		FOA	Arab University	U.S. University
1. Graduates at End of Project Life		480	480	480
2. Annual Rate of Graduates at End of Project Life		120	120	120
3. Four-Year Dropout Rate (percent)		10	20	20
4. Percentage Distribution of Graduates Through End of Project Life	Year			
	6	6	6	6
	7	9	9	9
	8	14	14	14
	9	20	20	20
	10	24	24	24
	11	27	27	27
5. Rate of Change of Prices (Inflation) (percent)		8	8	8
6. Rate of Discount (percent)		10	10	10
7. Rate of Retention in YAR (percent)		100	90	80
8. Rate of Retention in MAF (percent)		80	60	30
9. Annual Cost per Student		Not Applicable	8,000	20,000

10. Schedule of Costs for FOA Alternative ($ thousand)	Year	AID	YARG	OTHER	Arab University	U.S. University
	1	2582	12400	0	Not Applicable	Not Applicable
	2	2909	55	23100		
	3	2660	704	0		
	4	3058	794	0		
	5	2852	874	0		
	6	2311	1107	0		
	7	2033	1249	0		
	8	1249	1412	0		
	9	901	1547	0		
	10	602	1668	0		
	11	403	1794	0		

3. Another parametric feature of the analysis concerns the transitioning of B.S. candidates through the education systems of the FOA, Arab Institutions, and U.S. institutions. Accounting for student population (like costs) is done on a calendar year. In this analysis, both the entering classes and finishing classes are present at the institution during the calendar year, and, therefore, are included in the annual student population. A simple 4-year cohort survival model is used to determine the population of each class in each year given the levels of the graduates assumed in the analysis. More complete models can be approximated by using the experiences of foreign B.S. candidates in the U.S. and Arab institutions as well as the proposed FOA. For example, these can be approximated by an appropriate value for the 4-year dropout rate.

4. Another parameter in the analysis is the function used to obtain the estimate of "B.S. equivalents" at the end of the planning horizon. Assuming this falls at the end of a calendar year (between semesters), the function specifies that 1/8, 3/8, 5/8, and 7/8 of the 1st, 2nd, 3rd, and 4th year of classes, respectively, will be "B.S. equalivents." Both this function and the population dynamics function become significant due to differences in dropout rates among the three alternatives.

C. Variables

In addition to indications and parameters, there are a number of key variables in the analysis (see Table G-1 (c)). Foremost are the project outputs as defined in the logical framework. During the project life, a target number of graduates are anticipated. This figure is coupled here with a percentage distribution of graduates over that time period. From the end of the project life to the end of the planning horizon, a target annual rate of graduates is specified.

There are a number of financial variables to be considered. Most important are the time series of costs for the FOA over the planning horizon derived from the proposed subproject budget. There are separate cost series for USAID, YARG, and other donors. These costs include the actual projected costs and contingency costs, but not the inflation costs. In the period from the end of the project life to the end of the planning horizon, YARG is assumed to operate the FOA at the same "cost to YARG" that occurs in the last year of the project life.

For the Arab and U.S. training alternatives, the key variables are cost per student per year, figures are derived from actual USAID training program costs for Yemen.

The inflation rate and discount rate can be specified for each training alternative. Both are assumed to be constant over the planning horizon.

Lastly, there are key variables which indicate the percentages of graduates (1) retained in YAR and (2) choosing to join MAF for each of the training alternatives. These variables are inferred from experiences that USAID, CID, and MAF have had with trainee programs.

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III. ANALYSIS

A. Procedure

As indicated above, there are three alternate means of training Yemeni to the B.S. level in general agriculture. One alternative, establishment of the FOA, entails a different pattern of expenditures to accomplish this output objective than do the other two alternatives (training in an Arab university and training in a U.S. university). Specifically, the establishment of an FOA involves significant investments prior to the beginning of any teaching activities with relatively lower costs in subsequent years. The other two alternatives call for relatively higher expenditures in later years in order to generate an equivalent number and timing of B.S. degrees.

Figure G-1 is a flowchart showing the computational procedures involved in deriving the least cost indicators discussed previously. The first task is to specify, empiracally, the level and timing of graduates, entrants, and student populations per year as implied in the input variables derived from the stated project outputs. (See Outputs, Logical Framework, Annex B). One facet of this procedure, student population per year, is incorporated in the computation of the annual costs of training Yemeni in the Arab and U.S institutions. Another facet of this computational step is to derive an estimate of the total number of actual graduate and "graduate equivalents". The latter reflects the number of students "in the pipeline" at the end of the planning horizon. Different assumptions about dropout rate for the different alternatives will cause the total number of "graduates plus equivalents" to be different.

The stream of costs for the FOA alternative are adapted from the Subproject Summary budget (Table I.1 Annex I). Care is taken to keep the USAID costs separate from the YARG and Parallel Donor costs. It is assumed that there will be no USAID participation after the end of the project life.

For all three alternatives, the time series of costs are inflated at the rate of inflation applicable to each alternative. The resultant cost in each year is then converted to a PV figure using the appropriate rate of discount. For each alternative the total of annual PV costs is calculated. Note that for the CID alternative there are two total PV cost figures: one for USAID alone and one for USAID, YAR, and Parallel Donors combined.

The next step is to multiply the total graduates and graduate equivalents by the appropriate YAR and MAF retention factors. This yields an estimate of the number of graduates staying in YAR and the number joining MAF after receiving B.S. degrees in each of the training alternatives.

The final step is to compute the least cost indicators by dividing the total PV cost for each alternative (separate figures for USAID costs and Parallel Donor costs) by (1) graduates retained in YAR, and (2) graduates joining MAF for each alternative.

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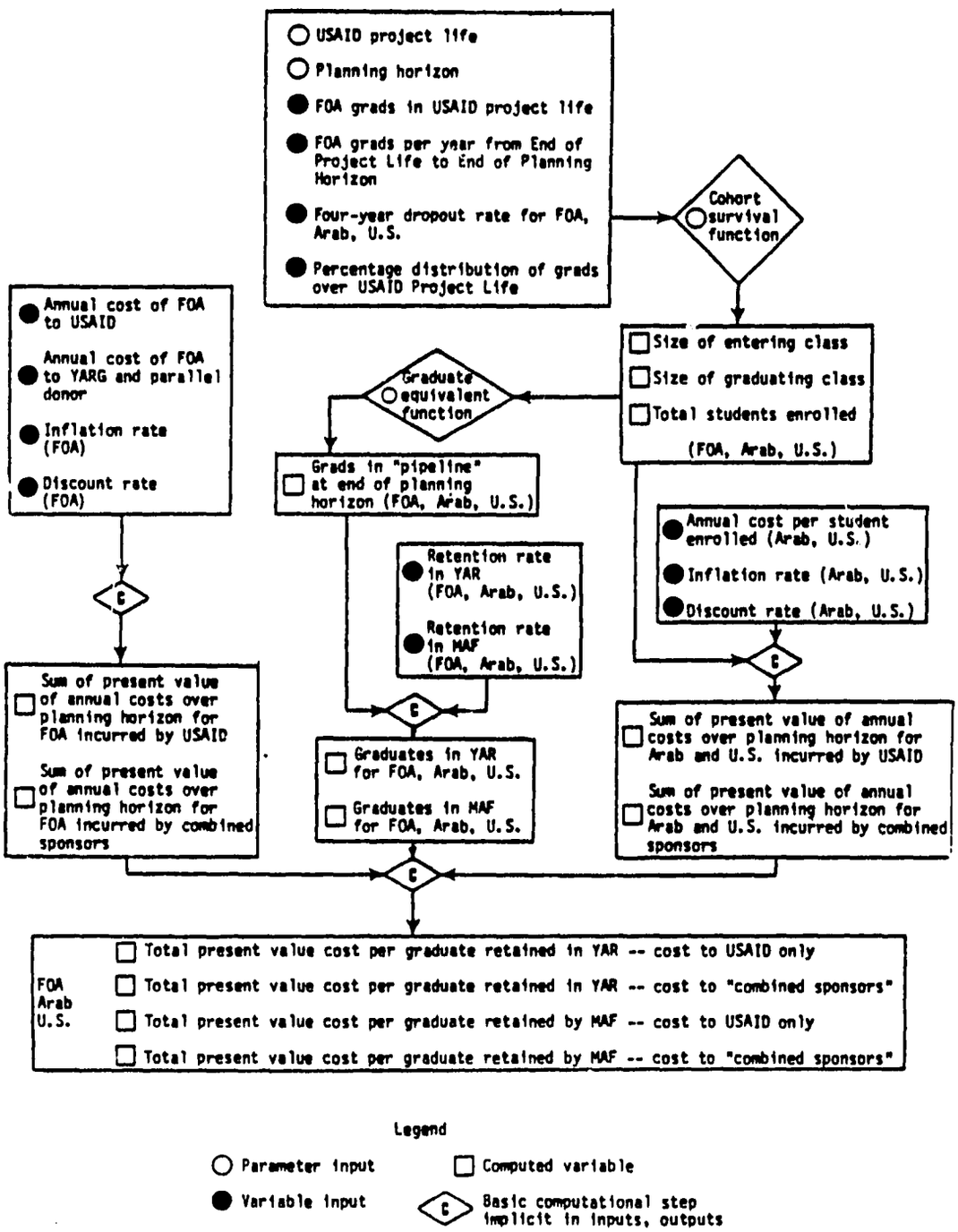
FIGURE G-1

Flowchart Indicating the Computation of Least Cost Indicators



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B. Results for the Base Level Values of Parameters and Variables

A "base level" run of the least cost analysis was performed using "most probable" values of the parameters and variables listed in Table G-1. The following tables and narrative discuss this run. Table G-2 shows the results (graduates, student population, actual costs, inflated costs, PV costs) for the FOA alternative. Note that there are separate columns for USAID costs and YARG and Parallel Donor costs. As shown, the PV of total costs of the FOA is $20,199 to USAID, $56,828 to YARG and Parallel Donor, and $77,027 to the combined sponsors.

Table G-3 shows a similar set of results for the Arab and U.S. alternatives. Note that the accruing costs to USAID are the same as those accruing to the Parallel Donors. That is, USAID is assumed to be paying the full cost of training graduates in the Arab and U.S. alternatives. The PV of total costs is $60,228 for the Arab alternative and $150,569 for the U.S. alternative.

Table G-4 indicates the results of the Graduate Equivalent Function in the analysis. The first three columns show the number of students in each class in the pipeline at the end of the planning horizon. The function determines the number of "B.S. equivalents" in these classes by multiplying them by an adjustment factor. Similarly, Table G-5 is included to show the number of graduates and graduate equivalents projected to (1) remain in YAR and (2) join MAF as derived by use of the appropriate retention rates for each alternative.

The least cost indicators for the base level run are shown in Table G-6. The principal findings are:

1. The U.S. alternative is financially untenable regardless of which least cost indicator is used.

2. From the USAID point of view (line 1 and Line 3) the FOA enjoys a clear financial advantage over the other two alternatives.

3. From the "combined sponsors" point of view the results are mixed:

   a. If the primary indicator is retention of graduates in the YAR, then the Arab alternative exhibits a least cost advantage over the FOA.

   b. If the primary indicator is retention of graduates by MAF, then the FOA exhibits a least cost advantage over the Arab alternative.

TABLE G-2

Costs of Establishing and Operating a
Faculty of Agriculture at University of Sanaa:
Results of the Base Level Analysis

Year	Number of Students			Costs in $US (thousands)				
				Actual[a]		Present Values		
	Entering	Graduating	Enrolled	AID	Combined Sponsors	AID	Combined Sponsors	Total
1	0	0	0	2582	12400	2582	12400	14982
2	42	0	42	3142	23100[b]	2856	21054	23910
3	66	0	106	3103	821	2564	679	3243
4	96	0	197	3852	1000	2894	751	3646
5	120	0	306	3880	1189	2650	812	3462
6	132	34	421	3396	1627	2108	1010	3118
7	142	53	508	3226	1982	1821	1119	2940
8	150	77	583	2141	2420	1098	2340	2340
9	150	96	653	1668	2863	778	1336	2114
10	150	106	673	1203	3334	510	1414	1924
11	150	114	673	870	3873	335	1493	1829
12	150	120	673	0	4183[c]	0	1466	1466
13	150	120	673	0	4518	0	1439	1439
14	150	120	673	0	4879	0	1413	1413
15	150	120	673	0	5269	0	1388	1388
16	150	120	673	0	5691	0	1362	1362
17	150	120	673	0	6146	0	1338	1338
18	150	120	673	0	6638	0	1313	1313
19	150	120	673	0	7169	0	1289	1289
20	150	120	673	0	7762	0	1266	1266
21	150	120	673	0	8362	0	1243	1243
TOTAL	-	1680	-	-	-	20199	56828	77027

[a] Costs from Table G-1 (10) inflated at 8 percent per year compounded.

[b] This figure reflecting the other donor's contribution for the capital cost of the FOA facilities is not inflated as per the overall budget, Annex , page 1.

[c] The cost series for "YARG + other donor" for year 12 through year 21 is derived from the YARG cost for year 11, $ 3,873,000 (in inflated dollars) by continuing to apply the constant rate of inflation (8 percent per year). In other words the uninflated costs are the same from year 11 through year 21.

TABLE G-3

Costs of Training Students Abroad
in Arab and U.S. Institutions

Number of Students						Project Budgets			
Year	Entering	Graduating	Enrolled	Actual Student Costs per yr. in $		Total Annual Cost in $ ('000s)		Present Value of Costs in $ ('000s)	
				Arab	U.S.	Arab	U.S.	Arab	U.S.
1	0	0	0	0	0	0	0	0	0
2	38	0	38	8000	20000	224	560	224	509
3	59	0	96	8640	21600	691	1728	571	1428
4	86	0	179	9331	23328	1474	3686	1108	2769
5	107	0	281	10078	25194	2640	6601	1803	4508
6	118	34	391	10884	27210	4201	10503	2609	6522
7	127	53	475	11755	29387	5701	14252	3218	8045
8	133	77	544	12695	31737	7097	17741	3642	9104
9	133	96	588	13711	34276	8322	20806	3882	9706
10	133	106	612	14806	37019	9343	23359	3963	9906
11	133	114	626	15992	39980	10107	25267	3897	9742
12	133	120	632	17271	43179	10916	27289	3826	9565
13	133	120	632	18653	46633	11789	29472	3756	9391
14	133	120	632	20145	50363	12732	31830	3688	9220
15	133	120	632	21757	54392	13750	34376	3621	9052
16	133	120	632	23498	58744	14850	37126	3555	8888
17	133	120	632	25377	63443	16038	40096	3490	8726
18	133	120	632	27408	68519	17322	43304	3427	8567
19	133	120	632	29600	74000	18707	46768	3365	8412
20	133	120	632	31968	79920	20204	50510	3303	8259
21	133	120	632	34526	86314	21820	54550	3243	8109
TOTALS	-	-	1680	-	-	-	-	60228	150569

TABLE G-4

Results of the Graduate Equivalent Function -- Base Level Analysis

Class	Number of Students Enrolled Last Year of Planning Horizon			Adjustment Factor	B.S. Equivalents in Last Year of Planning Horizon		
	FOA	Arab	U.S.		FOA	Arab	U.S.
1st Year	150	133	133	.125	19	17	17
2nd Year	142	130	130	.375	53	49	49
3rd Year	134	126	126	.625	84	79	79
4th Year	127	123	123	.875	111	108	108

TABLE G-5

B.S. Level Graduates Retained by YAR and MAF: Base Level Analysis

	FOA	Arab	U.S.
B.S. Recepients	1680	1680	1680
B.S. Equivalents	267	253	253
Total	1947	1933	1933
Retained in YAR	1947	1742	1742
Retained in MAF	1559	1161	579

TABLE G-6

Present Value Costs per Retained Graduate: Base Level Run

Least Cost Indicator	Costs ($)		
	FOA	Arab	U.S.
1. Retained in YAR -- Cost to AID	$10,375	$34,614	$ 97,373
2. Retained in YAR -- Cost to Combined Sponsors	$39,562	$34,614	$ 97,373
3. Retained in MAF -- Cost to AID	$12,965	$51,921	$259,603
4. Retained in MAF -- Cost to Combined Sponsors	$49,440	$51,921	$259,603

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C. Discussion of the Base Level Analysis

The base level analysis calls attention to the need to examine more closely the FOA and Arab alternatives of training B.S. level graduates in Yemen. In terms of total PV cost, the Arab alternative exhibits a significant advantage. However, this advantage is diminished in deriving the least cost indicators. This can be attributed to the higher rates of retention of graduates in YAR and in MAF which are obtained for the FOA alternative. The basic relationship of FOA costs and Arab costs, however, results more from the incidence of costs over time. The FOA has high costs in its early years whereas the Arab alternative is, in a relative sense, more costly toward the end of the planning horizon. This difference in the relative incidences of costs over time is in turn dependent upon parameters and variables used in the analysis. These values are derived from investigations under taken by the SPP team in Yemen or were arrived at on the basis of professional judgement.

The forgoing analysis is as valuable for what it can reveal about the response of this model, an institutional financial system, to changes in the variables and parameters as it is for the determination of absolute values in the base level analysis.

IV. A SENSIVITY ANALYSIS

As noted above, the behavioral characteristics of the least cost model hinge largely on the timing and magnitudes of costs for the alternatives considered. There are also some very direct determinates of least cost ranking; for example, the costs per graduate retained in YAR and/or retained by MAF can be directly manipulated by changing the retention rates. Methodological approaches to conducting sensitivity analyses are of two kinds: (1) the recording of percentage responses in outputs in response to given percentage changes in the values of inputs, and (2) recording the amount of change in one input variable (done one variable at a time) necessary to effect a pre-specified change in one or more of the least cost indicators.

The latter approach was taken with respect to several input variables. The results discussed here appear in Table G-7.

A. Response to Arab University Training Costs

The annual cost of training, per student, in Arab institutions is a direct determinante of the total cost of this alternative. The procedure was to increase this cost to a level at which a selected least cost indicator is equal for both the FOA and the Arab university alternative.

Because least cost indicator #4 (cost per graduate retained in MAF; cost to combined sponsors) is significantly favorable to the FOA, no sensitivity analysis had to be performed on it.

In the case of least cost indicator #2 (cost per graduate retained in YAR; cost to combined sponsor), there is an apparent initial advantage to

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TABLE G-7

Summary of Sensitivity Analysis Findings

Response to	Variable Definition	SENSITIVITY TEST 1			SENSITIVITY TEST 2		
		Base Level Value & New Value	Cost per Graduate Retained in YAR; to combined sponsor		Base Level Value & New Value	Total Present Value of Costs	
			FOA	ARAB		FOA	ARAB
(a) Arab University Training Costs	Annual Cost per Student at Arab Institutions	BASE= $8000	$39,562	$39,614	BASE= $8,000	$77,027,000	$60,227,000
		NEW = $9150	$39,562	$39,589	NEW = $10,250	$77,027,000	$77,166,000
(b) Graduates	Number at End of Project Life & Annual Rate	BASE = 480 & 120	$39,562	$34,614	BASE = 480 & 120	$77,027,000	$60,227,000
		MED = 350 & 100	$48,659	$34,509	MED = 340 & 100	$77,027,000	$48,796,000
		LOW = 200 & 80	$63,189	$34,360	LOW = 200 & 80	$77,027,000	$37,383,000
(c) "Real" Rate of Discount	Nominal Discount Rate Minus Inflation Rate	HIGH = 4 %	$36,507	$28,060	HIGH = 4 %	$71,079,000	$48,823,000
		BASE = 2 %	$39,562	$34,614	BASE = 2 %	$77,027,000	$60,227,000
		LOW = 0 %	$43,397	$43,210	LOW = 0 %	$84,494,000	$75,185,000
(d) Length of Planning Horizon	Years	BASE = 21	$39,562	$34,614	BASE = 21	$77,027,000	$60,227,000
		NEW = 25	$33,695	$33,736	NEW = 31	$88,532,000	$89,106,000
(e) Rate of Retention in YAR for Arab Institution Grads	Percent	BASE = 90	$39,562	$34,614	******	******	******
		NEW = 78	$39,562	$39,939	******	******	******
(f) Drop-out Rate in Arab Institution	Percent	BASE = 10	$39,562	$34,614	BASE = 10	$77,027,000	$60,227,000
		NEW = 30	$39,562	$39,259	NEW = 42	$77,027,000	$77,483,000

the Arab alternative. Increasing the estimate of the annual cost per student training in an Arab institution from $8,000 to $9,150 results in equivalency between the two alternatives on the basis of this indicator (referred to as Sensitivity Test #1 in Table G-7). This is the same as saying that the FOA is the least cost alternative provided that the annual cost per student at the Arab institution is at least $9,150.

Similarly, in the case of the overall basic costs of each alternative (total PV of costs), it is necessary to consider even higher values of the annual cost per student at the Arab institution. The FOA and Arab alternatives are financially equivalent on the basis of total PV of costs when it is assumed that Arab annual costs per student are increased from $8,000 to $10,250 (shown as Sensitivity Test #2 in Table G-7).

As indicated earlier, the base level estimate for the Arab university costs are drawn from USAID/Yemen training program allowances and as such are reflective of actual costs.

The SPP team was able to ascertain that the magnitude of subsidies (current operating and planned capital expenses) occuring at Arab institutions is probably significant, but was unable to arrive at a definitive value. Subsidies presumably come primarily from other Arab countries or international donors. USAID does not currently subsidize the operating expenses of the relevant universities. The contribution of YARG for training in Arab institutions usually consists of providing for air transportation from and to Yemen. There may be other subsidies, including the payments of full or partial salaries, if the trainee is a YARG employee.

Attempting to include the value of past USAID subsidies for enhancement of the capabilities of the Arab institutions raises a methodological question as to the value of sunk costs. Normally in a benefit-cost analysis of some future action, such costs are assigned a value of zero. Another problem concerns strict identification of the "combined sponsor" group. If this turns out to be exclusively USAID, YARG, and the Saudi Fund, then the only subsidies which are presumably admissable in this analysis are those coming from members of that group. Given the wide-reaching nature of this development fund, it can not be ruled out that the Saudi Fund is involved in the agricultural education programs in the Arab institutions even in some indirect way.

In summary, it is plausible that the Arab annual per student training costs (i.e. true resource costs) range upwards of $10,000 which would make the FOA option at least as economically preferable as the Arab institution option on the basis of all indicators presented here.

B. Response to Number of Students

In the Logical Framework and the EOPS, it is stated that at the end of the project life, there will be 480 graduates and there will exist the capability to graduate 80 to 120 degree recipients annually. As indicated

above, the base level economic analysis was performed on the basis of 480 graduates at the end of year 11 and 120 graduates per year from year 12 through the end of the planning horizon (21 years in the base level analysis). It was also indicated above that the levels of graduation affect the economic analysis by directly affecting the basic costs of the Arab and U.S. alternatives. The basic cost of the FOA is probably invariant to the number of graduates from the FOA in the range of 200 to 500 graduates by the end of the project life and in the capability range of 80 to 120 per year at the end of the project life. Note, however, that the cost per graduate increases because there are fewer graduates. By having selected values which are near the high end of those ranges for the base level analysis, there is only the opportunity to examine the response of the results to a reduction in the number of graduates and rate of graduates. The response of such a reduction is to lower the costs of both the Arab and U.S. alternatives as shown in Table G-7 (b). With the estimates of the numbers of students which can be supplied to the CID (given in Annex F, Social Soundness Analysis), it is not unreasonable to expect that the values used in the base level analysis can be achieved.

C. Response to Rate of Price Changes (Inflation) and Discount Rate

Anticipating the effects of price changes and the effect of discounting are two important features of a financial analysis. For the purpose of the analysis, the factor used to inflate a given series of costs on one hand is inversely related to the factor used to discount that series of costs. For this reason, these two factors are considered together in the sensitivity analysis. In the normal practice of benefit-cost analysis care should be taken to state the streams of costs and benefits in either entirely nominal (with inflation) terms or entirely real (constant dollar) terms and to ensure that a correspondingly nominal or real rate of discount is used to calculate the total PVs. In this financial analysis, the basic cost series are constant dollar figures. These costs are first inflated at an assumed rate of price changes (a constant 8 percent per year throughout the planning horizon) and then discounted at an assumed rate of discount (a constant 10 percent per year throughout the planning horizon). The net effect of these two steps is to discount the original constant dollar cost series at a constant real rate of 2 percent per year throughout the planning horizon. The object of the sensitivity analysis is to determine the response of the findings as this real rate of discount is decreased to zero and as it is increased to 4 percent per year. In the first case (as shown in Table G-7 (c)), the lowered real rate of discount enhances the least cost position of the FOA. Conversely, increasing the real rate of discount enhances the least cost position of the Arab alternative. These findings are consistent with the fact that the costs of the FOA occur relatively early in the planning horizon whereas the converse is true for the Arab alternative. Choice of an appropriate real rate of discount for investment decision making is contingent on several issues including the nature of the benefits, the nature of capital markets, and economic conditions within the relevant countries. Given the long time horizon over which benefits from an FOA will emerge, imperfect capital market development in YAR, and the granting to YARG of development

loans and operating funds at concessionary terms, it is not unreasonable to conduct the economic analysis at the real rates of discount used here.

D. Response to Length of Planning Horizon

Reflecting the difference in the relative incidence of costs over time between the FOA alternative and the Arab alternative, increasing the length of the planning horizon enhances the least cost position of the FOA. Table G-7 (d) shows that as the planning horizon is increased from 21 years to about 31 years in the base level analysis, the FOA becomes the unambiguous least cost alternative.

E. Response to Retention Rates

The retention rate assumptions used in the base level analysis are essentially qualitative estimates used to establish a relative index of each of the training alternatives in furthering the agricultural and general economic development of YAR. Given the projected staffing levels in MAF, projected staffing levels in other YARG agencies, emerging opportunities in the private sector, and the trend of returning graduates, the base level retention rates appear reasonable.

The rates for the FOA alternative deserve some discussion. The 100 percent YAR retention of B.S. graduates from the FOA is assumed to apply as long as an individual does not choose to continue graduate study. The 80 percent MAF retention rate for the FOA alternative is based on the projected needs of MAF and the projected close ties between the FOA and MAF.

While the rates for the FOA may reflect some optimism, there is probably a greater likelihood of a softening of the assumed YAR and MAF retention rates (90 and 60 percent, respectively) of the Arab alternative. When the YAR retention rate for the Arab alternative is decreased to 78 percent, Sensitivity Analysis #1 (cost per graduate retained in YAR; cost to combined sponsor) shows that the FOA would be the preferred alternative. See Table G-7 (c).

F. Response to Dropout Rates

The FOA is expected to exhibit a 4-year dropout rate similar to what appears to occur at the UOS: 20 percent. This figure is subject to some ambiguity since it is not uncommon for some students (especially in the UOS Faculty of Commerce) to prolong college degree programs to 6, 7, 8, or more years. The Arab university 4-year dropout rate is set at 10 percent based on USAID records of trainees. The Arab dropout rate directly affects the cost of that alternative. An increase in the Arab dropout rate enhances the least cost position of the FOA. However, these rates would have to increase to the 30-40 percent range (as shown in Table G-7 (f)) for any change in the least cost determination. This seems unreasonable given the experience with past and current training programs.

V. BUDGETARY ANALYSIS

A. YARG Development and Recurrent Budget 1/

The economy of the YAR is characterized by a very significant external component. The remittances of workers living abroad is balanced, perhaps even more that, offset by the drain of import expenditures, an important category of which is remittances of relatively high paid teachers and trainers out of Yemen. The internal economy exhibits a relatively small level of gross transactions, most of which takes place in local or sub-regional trade centers.

Remittance economies have become increasingly common over the last decade, yet there is little in the way of theoretically sound planning tools to help guide future development in these countries. For the most part, the flood of remittances have greatly accelerated development of such countries with both desirable and undesirable side effects. In Yemen, fast growing cash incomes opened new markets and provided funds for private investment in housing, transport equipment, agriculture and industry. This coincided with a vigorous expansion of public development expenditures.

The past 10 years, however, have seen some wide swings in domestic and external finance. From the early 1970s gross national savings increased dramatically, peaking in 1979-80. Due to the rapid influx of remittances and a delayed consumer expenditure response, this phenomena was bound to be reversed when remittances stablized or declined and more lavish spending habits developed, as has happened in the early 1980s. The external financial position of YAR is also experiencing the same kind of swings. Foreign exchange was in short supply in the early 1970s, but by 1979-80 there was a substantial balance of payments surplus on the current account. Recently, however, the upswing in expenditures on imports and the remittance inflows have caused a swing toward the negative in the balance of payments current account. In 1983, there have been tighter controls on imports in order to counteract this emerging economic situation.

These developments have important ramifications for the YAR's public sector operations. YAR has received substantial amounts of foreign assistance in the form of grants and loans offered at very concessional terms. While the capital formation growth rate has remained in the range of 35 to 40 percent per annum, debt service on new loans had remained low until 1980. To sustain the same level of capital formation in the 1980s, debt service payments will invariably have to increase, thus exacerbating an already tenuous overall balance of payments situation. Additional concern has been raised about the allocation of investment expenditures in YAR:

> ...officials feel that the economic and social benefits of many projects in infrastructure, industry and agriculture are so obvious, that they need not be demonstrated in studies...

> Priority is, therefore, being given to specific engineering projects on which much progress has been made in the past...2/

There is a certain appeal to making tangible investments and the YARG has logically made investments in transportation and public utilities. It has also, however, launched a vigorous "mixed sector" program involving several industrial undertakings. There is concern that these "mixed sector" projects exhibit a less financially stringent operating strategy than would be found in the purely private sector. One unfortunate outcome of this phenomena is a tendency to not adequately budget for the maintenance of projects. In the FFYP period (1976-1981), effective allocations for maintenance-related items grew at a rate of only 10 percent annually, far below the growth rate for capital formation. The consequences of this budgeting issue are predictive of serious reinvestment decisions in the future.

The issue of inadequate maintenance funds is one manifestation of government current expenditures shackled by an inadequate, historically and culturally, revenue collection system. Other evidence includes the inability of the public sector to match (on a continuing basis) compensation for talented individuals that is now offered in selected (import-related) industrial and commercial sectors. During the FFYP, the YARG current account has fluctuated between minor surpluses and minor deficits (see Table G-8). Grave concern has been voiced about the current budgetary situation in YAR (see, for example ASA, pp. 48-49, 52-53, 59-60). Moreover, in November 1983, Work Bank officials report that an official IBRD financial report to the YARG entails a recommendation for a 12 percent reduction in current expenditures in 1984. In the intermediate term, it is expected that alternative sources of current revenues will be sought by YARG. Implementing new tax measures (taxing irrigated land or qat land, for example) is a possibility. Solicitation of foreign aid from neighboring countries, to bolster the YARG operating budget, cannot be ruled out.

B. Budgetary Allocations to Higher Eudcation (UOS)

In Table G-8, the current expenditures on Health and Education in YARG for the period 1975-76 to 1981 are shown. These expenditures (in real terms) increased at an average annual rate of 28 percent compared to a 15 percent average annual growth rate for all government expenditures. About two-thirds of this line item is devoted to education. About 80 percent of the education operating budget is allocated to current expenditures on primary, secondary, and miscelleanous training programs. Using the 1981 Health and Education current expenditure figure, YR 847 million, it is estimated that higher education was operated that year on a budget of about YR 113 million. An independent estimate of the YARG share of the operating budget of the UOS was YR 58 million in 1981. It is uncertain, however, whether this figure, supplied by university officials, excludes some capital expenditures in 1981. It is believed that the total annual expenses of the UOS is significantly larger since the Kuwait Fund provides a budget for recurring expenditures of the General Administration, Faculty of Sharia and Law, FOS, and the Faculty of

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TABLE G-8

Summary of YARG Current Operations; Financial Condition (YR millions) [a]

	75/76	76/77	77/78	78/79	79/80	80/81	1981[b]	1982 (est.)	1983 (proj.)
1. Domestic Revenue	604	1284	1954	2147	2674	3132	4204	3850	4080
a. Tax Revenues	492	1077	1583	1732	2079	2786			
(1) Import Duties	394	929	1305	1386	1610	2037	2248		
(2) Income and Profit Taxes	23	40	101	139	211	296	347		
(3) Other	75	108	177	207	258	453	483		
b. Other Revenues	122	207	371	415	595	347	1126		
2. Current Expenditures	616	841	1249	1847	2427	3367	3627	4100	4460
a. Defense	304	430	545	794	1018	1332	1333		
b. Health and Education	74	93	200	365	496	718	847		
c. Other	238	318	504	688	913	1317	144		
3. Balance	-11	443	705	300	247	-235	577	-250	-380

[a] Source: Agricultural Sector Analysis, p. 68-69. 1982(est.) and 1983(proj.) figures, see fn. 3.

[b] Calender year accounting period begins in 1981.

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Arts. The Kuwait Fund has allocated significant capital expenditure funds to the univerisity since 1975, and plans to support additional capital and operating funds necessary for the establishment of faculties of medicine and law. The SFYP indicates that the planned capital investment for the UOS will total about YR 750 million over the period 1982 to 1986. This is about 32 percent of the planned capital investment for education and 16 percent of the total planned capital investment for YAR over that period. Although there is risk in inferring support for operating budgets from the level of planned capital spending, there is reason to believe that YAR endorses teaching capability as a necessary complement to the construction of education facilities. In order to support the amitious YAR program to upgrade education, the government is allocating YR 770 million annually to pay expatriate teachers (at all levels), most of which is remitted abroad with significant consequences. Drawing upon these figures and assurances from YARG officials, the SPP team is convineced that the UOS will remain as an indispensible element of the educational sector.

C. Operating an FOA at the UOS: Recurring Costs

The proposed FOA budget was reviewed with officials of the UOS. The first 10 years annual project operating costs assigned to YARG fall within a range of 1 percent to 2.6 percent of the reported YARG allocations for university operations in 1981 (YR 58 million). These officials expressed confidence that even without real increases in the operating allocation over the next 10 years, they would be able to reallocate budgets in order to support the FOA. It was indicated that budget reallocating among faculties was not uncommon even when some presumably dedicated funds are involved. Will the simultaneous implementation of the Faculties of Engineering and Medicine affect operation of the FOA? Indication are that with liberal external donor support for these programs, recurrent costs burdens caused by these other programs on YARG are less constraining than is the FOA. Hence, the SPP team believes the effect will be minimal.

VI. SUMMARY AND CONCLUSIONS

A. Economic Analysis

1. Basic Findings

A least cost analysis of the FOA and two alternatives for training Yemeni to the B.S. level in general agriculture was performed. Four least cost indicators (each derived from the total PV cost for each alternative) were chosen as the criteria for the analysis. The results of the analysis using base level (most likely) parameters and variables are as follows.

a) The FOA alternative is the least cost alternative on the basis of three of four indicators.

(1) cost per student retained in YAR; cost accruing to USAID;

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(2) cost per student retained in MAF; cost accruing to combined sponsors; and
(3) cost per student retained in MAF; cost accruing to USAID.

b) The Arab alternative is the least cost alternative on the basis of one indicator: cost per student retained in YAR; cost accruing to combined sponsors.

c) The U.S. training alternative is the most costly alternative on the basis of all four least cost indicators.

2. Sensitivity Analysis

In order for the FOA to have a least cost advantage in the "cost per student retained in YAR; cost accuring to combined sponsor" indicator (item 2 above), a sensitivity analysis of the institutional and financial model was performed. The FOA would have a least cost advantage in the fourth indicator if the following conditions prevailed.

a) Arab institution training costs increased from $8,000 to $9,150 per year per student. This reflects the amount of subsidization from combined sponsors which may occur in the course of educating Yemeni in an Arab institution.

b) Discount Rate decreased from 10 percent to 8 percent. This sets the discount rate equal to the rate of inflation and has the effect of setting the real (or inflation-free) discount rate to zero. Choice of a discount rate is dependent upon many issues, however.

c) Planning horizon increased from 21 years to 25 years. This reflects the difference in the incidence of costs over time betwen the FOA and Arab alternatives. The FOA has relatively lower costs in the last years of the planning horizon.

d) Rate of retention in YAR for Arab institution decreased from 90 percent to 78 percent. If 12 percent fewer graduates from the Arab institution return to YAR than assumed in the base level analysis, the FOA would have a least cost advantage. Precise measurement of this rate is difficult, however.

e) Four-year dropout rate in Arab institutions increased from 10 percent to 30 percent. Experience indicates, however, that the dropout rate is unlikely to reach this level.

3. Conclusion

The FOA alternative has a decidedly major advantage over the U.S. institution alternative. The comparison of the FOA with an Arab institution alternative leads to an apparently mixed conclusion. However, close examination of quantitative assumptions in the analysis lead to the conclusion that FOA has a clear advantage considering the selected least cost indicators. Chief among those assumptions is the omission (in the base level analysis) of subsidies to Arab institutions.

There are qualitative features of the FOA alternative (above and beyond the requisite output of B.S. level graduates) which significantly add to the economic viability of establishing this subproject. Chief among these is the Yemen-specific (and U.S. model) training given to B.S. students. The cadre of 29 (Ph.D. level) professional staff at the FOA at the end of project life was not an item included in or assigned a cost in the Arab or U.S. alternatives. Although resident instruction duties constitute the major work of this cadre, they are expected to contribute significantly to the general agricultural development of YAR through research and outreach activities. Incorporating the costs of these qualitative features of the FOA into the basic cost of the Arab institution (if it could be done) would likely give a unambiguous least cost advantage to the FOA alternative.

B. Budgetary Analysis

It is known that fiscal conditions prevailing in the YARG in the early 1980s and likely through the end of the decade will require careful budgeting of operating expenditures and a continued search for ways of augmenting public revenues. In spite of these tightened financial conditions, there is evidence from data through 1982 that plans to enhance the educational capability in YAR at all levels are continuing to be carried out in full. Although there is considerable foreign donor support for operating expenditures (at educational institutions) as well as for capital investments in education, it is expected that the YARG will fulfill its resolve to fund whatever is necessary to deliver the educational opportunities to its citizens. The current operations of the UOS reflect this strategy. The addition of the FOA recurring costs represent a minor (perhaps 1 to 3 percent) increase in the overall annual UOS operating budget. From YARG's point of view, the recurring costs are reasonable. Assurances have been provided at various levels in YARG (CPO, MOE, UOS) that YARG's share of the FOA costs will be disbursed in full and on schedule.

FOOTNOTES

1/ Reference sources for this section include:

1. AID/Yemen, Agricultural Sector Assessment, Yemen Arab Republic, 1982.

2. IBRD, Agricultural Sector Study, November 17, 1981.

3. IBRD, Yemen Arab Republic, Report of a Traditional Economy, World Bank Country Study, January 1979.

4. YARG, First Five Year Plan, 1976.

5. YARG, Second Five Year Plan, 1981.

2/ IBRD, Manpower Assessment for Yemen Arab Republic, 1982.

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ANNEX H

SELECTED MANPOWER ISSUES

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ANNEX H

SELECTED MANPOWER ISSUES 1/

I. OVERVIEW

The purpose of this annex is to report on the situation concerning professional and para-professional level personnel in the YAR with special attention to personnel planning in the agricultural sector. Although a review of professional and managerial personnel in YAR might appear to be a fairly narrow study, it is vital to cast it in light of the overall labor demand and supply situation in the country. While studies of a country's professional personnel system usually involve the educational system, it is noted that a complete discussion of the latter issue in this SPP is presented in Annex F, Social Soundness Analysis. This annex, however, addresses other issues important for understanding the ultimate role of the FOA in developing a modern agricultural sector in Yemen. One of these issues, for example, is the nature of professional level personnel and effective staffing in the YAR. Another addresses the issue of effective demand for professional personnel in the private sector.

II. THE REMITTANCE ECONOMY AND PROFESSIONAL PERSONNEL

A. The Remittance Economy

There are both positive and negative consequences to the emergence of a remittance economy in a developing economy. In a society with strong cultural cohesion such as YAR, it provides a stable source of foreign exchange. Moreover, remittances have greatly accelerated the pace of economic growth in YAR which has, in turn, required an enlargement of the public sector responsibilities (provision of services, regulation, dealing with foreign donors, etc). These responsibilities, in turn, have outstripped the public sector's finance capability of YAR.

Sustaining the role of the public sector in YAR depends significantly upon generating public revenues which, in turn, may depend heavily on keeping Yemeni employed abroad, at least in the short to intermediate run. There is a signficant need for more information on the charactericstics of the Yemeni worker's skills, earnings, savings, motivations and aspirations. More information is needed on the current availability of jobs, particularly jobs abroad, which might lead to some instights on how to encourage Yemeni workers to remit more earnings in the form of foreign exchange and to increase the rate of saving.

Another manpower issue related to the remittance economy is the potential for YAR to encourage more productive use of returning workers who may have a variety of highly perfected skills. While this may result in net

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benefits to the national economy, it might also result in worsening the availability of semi-skilled and skilled workers to the agricultural sector. One of the adverse effects of developing an information base for matching Yemeni workers with foreign jobs would be to entice skilled and professional workers to foreign jobs when, in fact, they are desperately needed at home.

B. Wage Levels in the YAR

The overall manpower situation in YAR can also be examined from the point of view of the structure of wages. The exodus of Yemeni laborers to the oil-rich states has created a deficiency in the supply of workers for domestic employment. This has resulted in wages being bid up. In addition, workers returning from abroad tend not to want to work at the older prevailing wage rates.

The impact of higher wage levels has been for the general price level to increase as firms pass along cost increases to consumers. In agriculture, producer prices have increased as higher costs are absorbed. While the total value of production of agricultural commodities in YAR appears to be increasing, it should be noted that most, if not all, of the increase is due to wage-induced inflation.

III PROFESSIONAL AND PARA-PROFESSIONAL PERSONNEL ISSUES IN THE YAR ECONOMY

A. Definitions

There are several approaches to describing and analyzing this upper strata of the labor market in YAR. First, there is a matter of definition. Professional personnel are defined as college graduates or those who have received 1 or more years of post-secondary school training. Para-professional personnel are primarily skilled office workers with 9 to 12 years of general education.

The YAR CPO has used the following classification scheme.

Class	
A1	Professional occupations requiring science and math-based university degree
A2	Professional occupations requiring an arts-based university degree
B1	Subprofessional and technician occupations requiring 1 to 3 years science and math training beyond the secondary school diploma

B2 Subprofessional and technician occupations requiring 1 to 3 years arts-based training

C Skilled office-type occupations requiring 9 to 12 hours of general training plus job training.

The 1975 YAR Census used a different scheme for occupational descriptions. In the professional and para-professional categories, three categories would be included: (1) professional and technical, (2) administrative and managerial, (3) clerical workers. Table H-1 (a) and (b) shows the estimated number of Yemeni in these skill level and occupational groups in 1975. This table (part b) also shows the small number of professionals and paraprofessionals associated with the agricultural sector in 1975.

From 1975 on, however, one must infer the numbers of professionals and paraprofessionals from the various sources. The UOS has been graduating about 300 students per year over the last 7 years since 1975. The number of Yemeni graduates (B.S., M.S., and Ph.D.) from foreign universities who have returned to YAR are difficult to measure with any accuracy. A report of the CPO shows that 2,314 Yemeni were enrolled in foreign universities in 1976/1977. Unfortunately there has not been a more recent country-wide tabulation of students abroad, nor any records of graduates retained in YAR. Some individual agencies (e.g. MAF) and some individual donors (e.g. USAID) have records pertaining to their own programs.

The number of Yemeni who have received training in the Soviet Union and other Eastern Bloc countries is now estimated to total 2,700 with about 200 undergraduate and 120 graduate fellowships being granted per year. USAID, by means of two projects now elapsed and a third newly started successor project, focused initially on special non-degree training. In the first program there were approximately 68 degrees granted, but only 12 from U.S. institutions. The others were largely from Arab institutions. At the end of the second project some 327 trainees had either completed programs or were in progress with 258 in the U.S. and 69 in Arab institutions. Many of these trainees are affliated with major university-related programs such as CID/Yemen, and Eastern Michigan University. In summary, it may be estimated that there are 5,000 to 7,500 Yemeni who have completed college degrees since 1971. If this estimate could be verified, then manpower distributions such as the one in Table H-1 could be estimated for a more recent year.

B. Analytical Issues Concerning Professional Level Personnel in YAR

One of the key analytical issues addressed elsewhere in the SPP, particularly Annex G, Economic Analysis, is the rate at which Yemeni

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TABLE H-1

Estimates of the Number of Professionals and Paraprofessionals in YAR, 1975

(a) CPO Organizational Scheme

Class	Public Sector	Private Sector	Total
A1	515	226	741
A2	2,357	268	2,625
B1	102	57	159
B2	1,202	696	1,908
C	7,359	24,116	31,475
TOTAL	11,545	25,363	36,908

(b) YAR Cens , of Population

Occupation	Agri-culture	Mining Manufacturing Utilities Construction Transport	Trade Finance Services	TOTAL
Professional and Technical	268	630	10,395	11,293
Administrative and Managerial	15	219	4,482	4,716
Clerical	32	838	8,399	9,269
TOTAL	315	1,687	23,276	25,278

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degree-program trainees are repatriated upon completion of their programs. Evidence in several World Bank publications indicated that the attrition rate was sufficiently high in the early to mid-1970 to warrant special government consideration of the problem. One report concluded that:

> ...more recently, an increasing number of educated Yemeni have started to leave for neighboring Arab countries in response to the high incomes that they can obtain abroad. While the absolute number of these skilled and professional level emigrants is low, the country can ill-afford this brain "drain". . . 2/

On the other hand, the SPP team was advised by YARG and USAID officials that the "brain drain" issue was not significant in YAR. Consequently, the SPP team concurs with the recommendation of the World Bank which concluded that this issue should be examined to, first, develop basic records, and second, determine the underlying causes of "brain drain" (e.g. monetary or socio-cultural amenities) if it does exist.

The issue of monetary compensation plays a key role in any discussion of manpower issues. With respect to the public sector, it should be remembered that YAR civil service is still evolving from the formative years of the government. YARG has three times (1971, 1977, and 1979) adopted civil service codes to streamline the system and standardize salary scales. On the average, the salary levels in YARG were more than doubled in 1977 and increased approximately 40 percent in 1979. There has not been any comprehensive salary adjustments since then. There are five types of additional allowances for civil servants. They involve nature of work, specialty, receipt of degree, rural location, and concessionary food prices.

In the private sector, salary and wage levels respond far more rapidly to supply and demand conditions in the market for professional and para-professional staff. No clear pattern has been identified concerning the structure of private sector salaries. Most respondents believed they could secure a higher salary in some private sector firm, usually involving management duties. It is also well-known that securing a position as a Yemeni counterpart to a foreign donor-supported project provides the means to make a significant gain in one's salary. Little is known about what happens to career civil servants who take up such opportunities and then attempt to return to positions within the public sector. A more comprehensive examination of salary and perquisite incentives could reveal more definitive answers as to the ultimate destination of university-trained professionals in YAR. Table H-2 gives a general range of salaries received by holders of B.S. and advanced degrees.

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TABLE H-2

Comparison of Representative Salary Levels for Professionals and Paraprofessionals in YAR, 1983

Place of Employment/Title	Monthly Salary (YR)
University of Sanaa	
Full Professor (Ph.D.)	11,000
Housing	3,000
Assistant Professor (Ph.D.)	8,000
Instructor (M.S.)	5,000
Assistant Instructor (M.S.)	3,000
Ministry of Agriculture & Fisheries	
Base Salary	2,100
With B.S.	3,100
With M.S.	4,400
With Ph.D.	5,900
Salary Increase Every 3 Years	+300
Extension Agent, Secondary Certificate	1,800
Rural Village Allowance	+500
Counterpart for Donor-Assisted Project	10,000
Ministry of Education	
With B.S.	3,500
With M.S.	4,000
With Ph.D.	5,000
Mixed Public/Private Sector	
Mid-level Manager in Commercial Firm	9,000
Journeyman in Skilled Labor Trades	8,000

[a] Source: UOS, MAF, MOE. Except where noted, these estimates do not include fringe benefits.

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IV. PROFESSIONAL AND PARA-PROFESSIONAL PERSONNEL ISSUES IN THE MAF

A. Description

The administrative structure of the MAF is described in the section of the SPP dealing with administrative linkages (see Annex E. Technical Analysis). The MAF has grown from a skeletal organization of less than 500 technical people in 1974 to a total force of 1,350 in 1982. This figure includes some 600 extension service personnel who are affiliated primarily with donor-assisted rural development projects.

There were about 187 professional level employees (B.S. degree or higher) at the MAF in 1982. Of these, 148 were classified as general agriculturalists, with the rest divided among specialties (veterinary, fisheries, engineering, etc.). This total roughly conforms with the total number of employees in civil service grades 11, 12, and 13 in the MAF, those generally assumed to be degree holders. This figure is deceptive since it includes a significant number of expatriate staff. One estimate indicates that only 22 of 106 Yemeni in the top three ranks at the MAF were degree holders 3/.

B. Requirements for Graduate Level Personnel

A fully functional MAF is needed to help develop the agricultural potential of the YAR. The MAF, in turn, requires personnel trained to at least the B.S. level in agricultural fields to plan, carry out, and evaluate the mission of this ministry. Projections of professional level manpower needs in MAF have been prepared as a consequence of the FFYP and the SFYP. The MAF probably needs 300 B.S. level graduates just to fulfill the needs of the FFYP which ended in December 1981. The SFYP (ending in 1986) stipulates a requirement for 600 more B.S. level personnel. Note that these requirements are above and beyond the roughly 200 B.S. level personnel employed at MAF as of November 1983. Only about 50 Yemeni can be counted in this latter figure.

In the period 1984 through 1987 it may be possible for the MAF to retain 200 to 250 more Yemeni B.S. level agriculturalists if current trends are continued. This still leaves a significant number of positions (850 to 900) unfilled when the first class of FOA students graduate.

C. Employer Attitudes at the MAF

While it is difficult to report on the operational capability of a governmental agency without thorough study, it is appropriate to report on responses of both individuals employed at the MAF and those similarly employed by other agencies in regard to position and career choice. In general, there is perceived by professional level personnel to be some general malaise in the MAF (Sanaa headquarters) which inhibits their actively pursuing their areas of

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specialization. Entering degree holders have, in significant, numbers attempted to affiliate with donor assisted projects, join other agencies, or join private sector firms in that order of importance. Some donor-assisted project positions permit continued affiliation with the MAF while others do not. It is unclear whether continued affiliation permits an employee's salary to be "topped-off" by the foreign assistance donor. The MAF would like to discourage "topping-off" arrangements.

The number of graduate level professionals who have left the MAF for other agencies was not estimated due to time constraints. With regard to certain disciplines, however, some inferences can be drawn. Agricultural economists are found in significant numbers in other agencies: CPO (4), Agricultural Credit Bank (ACB) (3), Confederation of the Yemeni Development Association (2) compared to the MAF (4). In at least one instance, an agricultural economist left the MAF for a comparable job, but with a drop in salary. Agricultural engineers are reported to leave the MAF for the Ministry of Public Works in order to be better situated for outside consulting work. It is not clear, however, whether general agriculturalists have opportunities outside the MAF. One can only infer that situation from the training and retention experience at the MAF as discussed below.

The attrition of graduate level personnel from the MAF for positions in commerce and industry is believed to be minimal. The individuals who do make this sort of career change probably leave agriculture due to the (currently) small number of opportunities available in commercial agri-business. Large agri-business concerns (food processing, poultry production, commercial orchards and vineyards) which could conceivably require such personnel are few in number.

D. Training of MAF Graduate Level Personnel.

Of the central ministries, the MAF has one of the largest out-of-country training programs for Yemeni staff. Table H-3 gives an indication of the numbers of degree candidates who have been sent abroad beginning in 1974. The numbers of students expected to return from 1979 (or through 1983) indicates that at least the large numbers of expatriates in the MAF could be replaced by Yemeni degree holders. However, the devastatingly low rate of retention (about 15 percent) leaves doubt that this can be accomplished soon.

There are three major training avenues being used at the MAF. The World Bank's program is geared to supporting the MAF's capabilities in the Yemen Rural Development Projects. A number of MAF employees take advantage of opportunities to train in the Soviet Union or Eastern Bloc countries. The USAID/CID subprojects are currently training about 65 agriculturalists at the B.S., M.S., and Ph.D. levels. About two-thirds of these are training in Arab countries.

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TABLE H-3

YEMENI STUDENTS SENT ABROAD FOR UNIVERSITY TRAINING IN AGRICULTURAL FIELDS FROM 1974 THROUGH 1980, MAF PROJECTIONS OF EXPECTED RETURNS OF SUCH STUDENTS, AND ACTUAL RETURNS TO MAF THROUGH JUNE 1982

YEAR	NO. STUDENTS SENT ABROAD					EXPECTED STUDENT RETURN				ACTUAL RETURN TO EMPLOYMENT BY MAF
	4 YR. AGRI	5 YR VET	4 YR FISH.	5 YR AG ENG	TOTAL	AGRI	VET	IRRIG. ENG	TOTAL	
1974	41		5	2	48					
1975	86	1	2	2	91					
1976	172		10		182					
1977	77	18		2	97					
1978	85	2		2	89					
1979	131	34		3	168	7			7	5
1980	63	10			73	108			108	5
1981						73			73	13
1982						130		2	132	30
1983						115	17	2	134	
1984						109	16		125	
1985						23	7	3	33	
1986						90	15		105	
TOTAL	655	65	17	11	748	655	55	7	717	53

Source: Ministry of Agriculture and Fisheries, June 30, 1982.

V. MANPOWER PLANNING

Manpower assessments in the YAR generally do not address the economic demand and supply and non-economic incentives concerning different classes of labor due to the paucity of such data. Assessments generally fall back on census figures (the latest conducted in 1975) and official projections. Where do these projections come from and how valid are they? Very detailed and technical requirements were made of the development projects expected to operate during the FFYP period (1976-1981). There was, however, scarcely any monitoring of the accuracy of those projections or any policy directives enacted to work toward accomplishment of the plan. The FFYP was deficient with respect to anticipating the needs for trained managerial personnel to supervise the long-range and day-to-day functioning of the ministries. The SFYP was prepared in the CPO's Human Resources Planning Department which is also envisioned to have the capability to monitor the manpower situation in the YAR, including a comprehensive training grant management system. There is recognition, at least, that better linkage of manpower planning projections and training requirements to the selection and monitoring of training grant recipients will lead to the more certain placement of graduates upon the receipt of degrees or certificates. Such a planning capability will also have to recognize the important economic and other incentives that influence trained personnel to take the career options that are observed.

VI. CONCLUSIONS

In the YAR generally, and in the MAF in particular, there is a justifiable need for employing B.S. level agriculturalists. By 1987, there will be a requirement for at least 850 such professionals in the MAF on the basis of official projections at the rate at which requirements are being met. Were it not for the problem of "effective fulfillment" of requirements at the MAF, the estimate above would not be so large. The staffing situation at the MAF is one of more than passing interest since it could have an effecton the overall purposes of the FOA Subproject if not monitored and evaluated carefully. On one hand the economic incentives facing employees of the FOA are no less attractive than in other ministries. On the other hand, non-pecuniary incentives and disincentives at the MAF may be relevant to understanding why the ministry is unable to effectively retain professional staff. The mixed public sector and private enterprise firms in agriculture are currently too few in number to constitute an important element in the overall requirement for B.S. level agriculturalists. Firms which are suppliers to agricultural production are growing in number, but have not achieved the level of size or sophistication at which they would rquire B.S. level agriculturalists. There appears to be no serious obstacles to the supplying of B.S. degree program entrants and graduates in sufficient numbers when there is an operational FOA in place. The first 5 years of the FOA Subproject allow ample time for professional manpower issues to be evaluated more thoroughly. Results from such evaluations could be used to better ensure the accomplishment of the FOA Subproject purposes. It is strongly recommended that such activities be included in the overall program evaluation strategy.

FOOTNOTES

1/ References for this section include:

1. IBRD, Manpower Assessment in the Yemen Arab Republic, 1982.
2. YARG, First Five Year Plan, 1976.
3. YARG, Second Five Year Plan, 1981.
4. YARG, Census of the Yemen Arab Republic, 1975.

2/ IBRD, Manpower Assessment in the Yemen Arab Republic.

3/ Ibid.

ANNEX I

Financial Plan

I. Summary Financial Plan for Faculty of Agriculture Subproject (Table I-1) I-3

II. AID Dollar Budget, Faculty of Agriculture I-4

A. Summary of Detailed Worksheets (Table I-2) I-4
B. Detailed Worksheets of AID Dollar Budget (Table I-3) I-5

III. AID Local Currency Budget, Faculty of Agriculture I-9

A. Summary of Detailed Worksheets (Table I-4) I-9
B. Detailed Worksheets for AID Local Currency Budget (Table I-5) I-10

IV. YARG Budget, Faculty of Agriculture I-12

A. Summary of Detailed Worksheets (Table I-6) I-12
B. Detailed Worksheets for YARG Budget (Table I-7) I-13

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Table I-1 Summary Financial Plan for Faculty of Agriculture Subproject

(Dollars)

SOURCE/CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. AID BUDGET												
A. Pre-Cont./Infl. Subtotal	514075	1211236	1212948	1360960	1395747	1054486	925383	616973	483512	389562	292556	9457437
1. Contingency, 5%	25704	60562	60647	68048	69787	52724	46269	30849	24176	19478	14628	472872
2. Inflation, 8% (Cmpd.)	0	101744	211417	371542	527592	519281	570360	462545	432042	408631	356026	3961180
B. Participant Training, A/E, Core Repayment Subtotal	796100	1126000	1031750	1217720	934830	983320	758835	437835	259605	96915	0	7562910
Subtotal	1335879	2499541	2516763	3018270	2927957	2529811	2300847	1548202	1199334	914585	663210	21454399
B. AID Local Currency Budget	1186400	487080	337935	391310	429860	286440	288985	155895	126965	91760	91270	3873900
1. Contingency, 5%	59320	24354	16897	19566	21493	14322	14449	7795	6348	4588	4564	193695
2. Inflation, 8% (Cmpd.)	0	40915	58902	106820	162407	141057	178116	116874	113450	96252	111071	1125952
Subtotal	1245720	552345	413734	517703	613840	441819	481550	280564	246763	192600	206905	5193547
TOTAL AID BUDGET	2581599	3051890	2930496	3535973	3541797	2971631	2782397	1828766	1446097	1107185	870115	26647946
II. YARG BUDGET												
A. Pre-Cont./Inflat. Subtotal	0	52570	670690	756040	832610	1054040	1189940	1344980	1473180	1588700	1708820	10671570
1. Contingency, 5%	0	2629	33535	37802	41631	52702	59497	67249	73659	79435	85441	533579
2. Inflation, 8% (Cmpd.)	0	4416	116901	206399	314727	519062	733420	1008332	1316360	1666467	2079548	7965631
B. Facilities Development	12400000	0	0	0	0	0	0	0	0	0	0	12400000
TOTAL YARG BUDGET	12400000	59614	821126	1000241	1188967	1625804	1982857	2420561	2863199	3334602	3873809	31570780
III. OTHER DONOR PARALLEL FIN.	0	22000000	0	0	0	0	0	0	0	0	0	22000000
A. Contingency, 5%	0	1100000	0	0	0	0	0	0	0	0	0	1100000
TOTAL OTHER DONOR	0	23100000	0	0	0	0	0	0	0	0	0	23100000
GRAND TOTAL (AID, YARG, OTHER)	14981599	26211504	3751622	4536214	4730764	4597435	4765254	4249326	4309296	4441787	4743924	81318725

Table I-2 Summary of Detailed Worksheets for AID Dollar Budget, FOA
(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. SALARIES AND WAGES	225349	211512	403581	505988	527141	387608	342815	205871	146592	131336	105106	3192899
II. INDIRECT COSTS	102160	91219	195567	210942	237551	160698	161209	36847	75695	63836	49225	1444948
III. ALLOWANCES	82580	88405	240970	262680	320280	200740	157180	83105	71735	29850	37250	1574775
IV. TRAVEL AND TRANSPORTATION	64985	307100	181330	168850	156275	129940	148680	109650	91990	89040	51475	1499315
V. EXP. EQUIP. & MATERIALS	0	12500	23500	31500	29500	27500	23500	21500	18500	16500	13500	218000
VI. NON-EXP. EQUIP.& MAT.	30000	30000	168000	172000	125000	139000	92000	91000	79000	59000	36000	1021000
VII. INSTRUCTIONAL FARM	0	461500	0	0	0	0	0	0	0	0	0	461500
VIII. OTHER DIRECT COSTS	9000	9000	0	9000	0	9000	0	9000	0	0	0	45000
SUBTOTAL	514075	1211236	1212948	1360960	1395747	1054486	925383	616973	483512	389562	292556	9457437
CONTINGENCY, (5%)	25704	60562	60647	68048	69787	52724	46269	30849	24176	19478	14628	472872
SUBTOTAL	539779	1271798	1273596	1429008	1465534	1107210	971652	647822	507687	409040	307184	9930309
INFLATION, (8%, Cmpd.)	0	101744	211417	371542	527592	519281	570360	462545	432042	408631	356026	3961180
SUBTOTAL	539779	1373541	1485013	1800550	1993127	1626491	1542012	1110367	939729	817670	663210	13891489
IX. PARTICIPANT TRAINING	163100	558000	730750	916720	934830	903320	758835	437835	259605	96915	0	5759910
X. A/E CONSTR. & SUPERVISION	533000	568000	301000	301000	0	0	0	0	0	0	0	1703000
XI. CORE REPAYMENT	100000	0	0	0	0	0	0	0	0	0	0	100000
SUBTOTAL	796100	1126000	1031750	1217720	934830	903320	758835	437835	259605	96915	0	7562910
TOTAL AID DOLLAR BUDGET	1335879	2499541	2516763	3018270	2927957	2529811	2300847	1548202	1199334	914585	663210	21454399

Table I-3 Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. Salaries & Wages												
A. On-Campus												
1. Home Office												
a. Proj. Dir.	37500	50000	50000	50000	50000	37500	37500	25000	25000	25000	25000	412500
b. Secretary/Accountant	11250	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	161250
2. TDY												
a. Proj. Dir.	0	0	0	0	0	0	0	0	0	0	0	0
b. Proj. Consult.	26400	6600	6600	6600	6600	6600	6600	6600	6600	6600	6600	92400
c. Grad. Stud. Superv.	32340	0	50820	23100	46200	13860	50820	23100	13860	13860	0	267960
d. Proj. Eval.	0	0	0	6600	0	0	6600	0	0	6600	0	19800
Total On-Campus Sal. & Wages	107490	71600	122420	101300	117800	72960	116520	69700	60460	67060	46600	953910
B. Off-Campus												
1. Proj. Mgr./Team Leader	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	385000
2. Faculty Advisor	0	25000	50000	50000	50000	50000	25000	0	0	0	0	250000
3. Co-Mgr., Farm	33000	33000	33000	33000	33000	33000	16500	0	0	0	0	214500
4. Co-Librarian	0	0	0	27000	27000	0	0	0	0	0	0	54000
5. Expt. Fac., TCN	0	0	74000	148000	148000	111000	74000	55500	18500	0	0	629000
Total Off-Campus Sal. & Wgs.	68000	93000	192000	293000	293000	229000	150500	90500	53500	35000	35000	1532500
C. Fringe Benefits												
1. On-Campus (Acad.,28.2%)	27140	15961	30292	24337	28990	16345	28629	15425	12820	14681	8911	223530
2. On-Campus (Class.,31.5%)	3544	4725	4725	4725	4725	4725	4725	4725	4725	4725	4725	50794
3. Off-Campus (Acad.,28.2%)	19176	26226	54144	82626	82626	64578	42441	25521	15087	9870	9870	432165
Total Fringe Benefits	49859	46912	89161	111688	116341	85648	75795	45671	32632	29276	23506	706489
TOTAL SALARIES & WAGES	225349	211512	403581	505988	527141	387608	342815	205871	146592	131336	105106	3192899
II. Indirect Costs												
A. On-Campus (30%)	66678	47006	104248	76931	101569	57043	88794	53018	48351	44829	31301	719767
B. Off-Campus (19.5%)	27915	37456	76833	118386	118386	91751	60474	36655	21737	14278	14278	618148
C. CID G & A (8%)	7567	6757	14486	15625	17596	11904	11941	7174	5607	4729	3646	107033
TOTAL INDIRECT COSTS	102160	91219	195567	210942	237551	160698	161209	96847	75695	63836	49225	1444948
III. Allowances												
A. Post Diff. (25%)	17000	23250	48000	73250	73250	57250	37625	22625	13375	8750	8750	383125
B. COLA (6%)	4080	5580	11520	17580	17580	13740	9030	5430	3210	2100	2100	91950
C. Sunday Pay (5%)	3400	4650	9600	14650	14650	11450	7525	4525	2675	1750	1750	76625
D. Educ. Allow. ($1570/fm)	31500	39375	78750	126000	126000	94500	63000	39375	23625	15750	15750	653625
E. Move In ($11800/fm)	23600	11800	70800	11800	47200	0	11800	0	11800	0	0	188800
F. Move Out ($7400/fm)	0	0	14800	7400	29600	14800	22200	7400	14800	0	7400	118400
G. Storage ($1500/fm/yr)	3000	3750	7500	12000	12000	9000	6000	3750	2250	1500	1500	62250

Table I-3 (Continued) Page 2, Detailed Worksheet of AID Dollar Budget, FOA

(Dollars)

TOTAL ALLOWANCES	82580	88405	240970	262680	320280	200740	157180	83105	71735	29850	37250	1574775
IV. Travel & Transportation												
A. Per Diem												
1. Domestic												
a. Proj. Dir.	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	24750
Total Domestic Per Diem	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	24750
2. International												
a. Proj. Dir.	6300	9450	6300	6300	6300	6300	6300	6300	6300	6300	6300	72450
b. Proj. Consults.	0	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	31500
c. Grad. Stud. Superv.	15435	0	24255	11025	22050	6615	24255	11025	6615	6615	0	127890
d. Proj. Eval.	0	0	0	3150	0	0	3150	0	0	3150	0	9450
Total Internl. Per Diem	21735	12600	33705	23625	31500	16065	36855	20475	16065	19215	9450	241290
Total Per Diem	23985	14850	35955	25875	33750	18315	39105	22725	18315	21465	11700	266040
B. Travel												
1. Domestic												
a. Proj. Dir.	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	22000
b. Proj. Consults.	0	500	500	500	500	500	500	500	500	500	500	5000
c. Proj. Eval.	0	0	0	1000	0	0	1000	0	0	1000	0	3000
Total Domestic Travel	2000	2500	2500	3500	2500	2500	3500	2500	2500	3500	2500	30000
2. International												
a. Proj. Dir.	5000	7500	5000	5000	5000	5000	5000	5000	5000	5000	5000	57500
b. Proj. Consults.	0	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	25000
c. Grad. Stud. Superv.	17500	0	27500	12500	25000	7500	27500	12500	7500	7500	0	145000
d. Proj. Eval.	0	0	0	5000	0	0	5000	0	0	5000	0	15000
Total International Travel	22500	10000	35000	25000	32500	15000	40000	20000	15000	20000	7500	242500
Total Travel	24500	12500	37500	28500	35000	17500	43500	22500	17500	23500	10000	272500
C. Transportation												
1. Commodities	16500	276375	104500	111100	84150	90750	62700	61050	52800	40700	26400	927025
2. Air Freight	0	3375	3375	3375	3375	3375	3375	3375	3375	3375	3375	33750
Total Transportation	16500	279750	107875	114475	87525	94125	66075	64425	56175	44075	29775	960775
TOTAL TRAVEL & TRANSPORTATION	64985	307100	181330	168850	156275	129940	148680	109650	91990	89040	51475	1499315
V. Exp. Equipment & Materials												
A. On-Campus												
1. Staff Office	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	10000
2. Staff Orientation	0	500	500	500	500	500	500	500	500	500	500	5000
Total On-Campus Exp. E & M	0	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	15000

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Table I-3 (Continued) Page 3, Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

B. Off-Campus												
1. Vehicle & Equip. Parts	0	0	0	4000	4000	4000	4000	4000	4000	4000	4000	32000
2. Office Supplies	0	8000	15000	20000	18000	16000	14000	12000	10000	8000	6000	127000
3. Teaching Materials	0	1000	2000	1000	1000	1000	1000	1000	1000	1000	1000	11000
4. Miscellaneous	0	2000	5000	5000	5000	5000	3000	3000	2000	2000	1000	33000
Total Off-Campus Exp. E & M	0	11000	22000	30000	28000	26000	22000	20000	17000	15000	12000	203000
TOTAL EXP. EQUIP. & MATERIALS	0	12500	23500	31500	29500	27500	23500	21500	18500	16500	13500	218000
VI. Non-Expend. Equip. & Mater.												
A. On-Campus	0	0	0	0	0	0	0	0	0	0	0	0
B. Off-Campus												
1. Teaching Materials	0	4000	8000	7000	7000	6000	6000	5000	5000	5000	4000	57000
2. Library Resources	0	5000	50000	50000	40000	40000	30000	30000	30000	20000	10000	305000
3. Teaching Equipment	0	4000	50000	50000	40000	40000	30000	30000	30000	20000	10000	304000
4. Office Equipment	0	0	50000	40000	30000	30000	20000	20000	10000	10000	10000	220000
5. Misc. Equipment	0	2000	10000	10000	8000	8000	6000	6000	4000	4000	2000	60000
6. Vehicles	30000	15000	0	15000	0	15000	0	0	0	0	0	75000
TOTAL NON-EXP. EQUIP. & MATER.	30000	30000	168000	172000	125000	139000	92000	91000	79000	59000	36000	1021000
VII. Instructional Farm												
A. Irrigation Equipment	0	93900	0	0	0	0	0	0	0	0	0	93900
B. Crop Science Equip.	0	84400	0	0	0	0	0	0	0	0	0	84400
C. Livestock Equip.	0	93000	0	0	0	0	0	0	0	0	0	93000
D. Poultry Equip.	0	3400	0	0	0	0	0	0	0	0	0	3400
E. Farm Shop Equip.	0	35300	0	0	0	0	0	0	0	0	0	35300
F. Gen. Farm Machinery/Equip.	0	151500	0	0	0	0	0	0	0	0	0	151500
TOTAL INSTRUCTIONAL FARM	0	461500	0	0	0	0	0	0	0	0	0	461500
VIII. Other Direct Costs												
A. Arabic Language Training	9000	9000	0	9000	0	9000	0	9000	0	0	0	45000
TOTAL OTHER DIRECT COSTS	9000	9000	0	9000	0	9000	0	9000	0	0	0	45000
SUBTOTAL (For Cont./Infla.)	514075	1211236	1212948	1360960	1395747	1054486	925383	616973	483512	389562	292556	9457437
IX. Participant Training												
A. Degree Training												
1. Grad. Scholarships	163100	522000	730750	916720	934830	903320	758835	437835	259605	96915	0	5723910
Total Degree Training	163100	522000	730750	916720	934830	903320	758835	437835	259605	96915	0	5723910
B. Non-Degree Training												
1. Admin. Intern	0	36000	0	0	0	0	0	0	0	0	0	36000
Total Non-Degree Training	0	36000	0	0	0	0	0	0	0	0	0	36000

Table I-3 (Continued) Page 4, Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

TOTAL PARTICIPANT TRAINING	163100	558000	730750	916720	934830	903320	758835	437835	259605	96915	0	5759910
X. A/E Constr. & Supervision	533000	568000	301000	301000	0	0	0	0	0	0	0	1703000
XI. Repayment to CORE for Implementation Activities	100000	0	0	0	0	0	0	0	0	0	0	100000
TOTAL AID DOLLAR BUDGET	1310175	2337236	2244698	2578680	2330577	1957806	1684218	1054808	743117	486477	292556	17020347

Table I-4 Summary of Detailed Worksheets for AID Local Currency Budget, FOA
(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. SALARIES AND WAGES	0	0	0	0	0	0	0	0	0	0	0	0
II. OPERATIONS	59500	74375	148750	236750	238000	178500	119000	74375	44625	29750	29750	1233375
III. TRAVEL AND PER DIEM	3000	19005	15985	21360	66660	23740	86785	45320	28140	29810	11320	351125
IV. TRAINING	20000	0	22000	4000	24000	4000	24000	4000	24000	4000	24000	154000
V. EXP. EQUIP. & MATERIALS	0	0	19000	17000	15000	14000	13000	11000	10000	8000	6000	113000
VI. NON-EXP. EQUIP. & MAT.	0	0	20000	20000	14000	14000	14000	9000	6000	8000	8000	115000
VII. INSTRUCTIONAL FARM	1103900	381500	0	0	0	0	0	0	0	0	0	1485400
VIII. OTHER DIRECT COSTS	0	12200	112200	92200	72200	52200	32200	12200	12200	12200	12200	422000
SUBTOTAL	1186400	487080	337935	391310	429860	286440	288985	155895	126965	91760	91270	3873900
CONTINGENCY (5%)	59320	24354	16897	19566	21493	14322	14449	7795	6348	4588	4564	193695
SUBTOTAL	1245720	511434	354832	410876	451353	300762	303434	163690	133313	96348	95834	4067595
INFLATION (8%, Cmpd.)	0	40915	58902	106828	162487	141057	178116	116874	113450	96252	111071	1125952
TOTAL AID LOCAL CURRENCY BUDGET	1245720	552349	413734	517703	613840	441819	481550	280564	246763	192600	206905	5193547

Table I-5 Detailed Worksheets for AID Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. SALARIES AND WAGES	0	0	0	0	0	0	0	0	0	0	0	0
II. OPERATIONS												
A. Housing												
1. Rent	45000	56250	112500	180000	180000	135000	90000	56250	33750	22500	22500	933750
2. Utilities	5000	6250	12500	20000	20000	15000	10000	6250	3750	2500	2500	103750
3. Maintenance	7000	8750	17500	28000	28000	21000	14000	8750	5250	3500	3500	145250
4. Retro Fitting	2500	3125	6250	8750	10000	7500	5000	3125	1875	1250	1250	50625
TOTAL OPERATIONS	59500	74375	148750	236750	238000	178500	119000	74375	44625	29750	29750	1233375
III. TRAVEL AND PER DIEM												
A. Travel												
1. Domestic												
a. Faculty Advisor	0	300	600	600	600	600	300	0	0	0	0	3000
b. Co-Farm Manager	0	150	300	300	300	300	150	0	0	0	0	1500
c. Co-Librarian	0	0	50	100	100	0	0	0	0	0	0	250
d. Team Leader/Proj. Mngr.	0	600	600	600	600	600	600	600	600	600	600	6000
Total Domestic Travel	0	1050	1550	1600	1600	1500	1050	600	600	600	600	10750
2. International												
a. Dean	0	0	0	0	2500	0	0	0	0	0	2500	5000
b. Grad. Students (U.S.)	0	0	0	0	17500	0	27500	12500	7500	7500	0	72500
c. Local Grad. Adv. (U.S.)	0	0	0	0	17500	0	27500	12500	7500	7500	0	72500
d. Intern. Participant	0	5000	0	0	0	0	0	0	0	0	0	5000
Total International Travel	0	5000	0	0	37500	0	55000	25000	15000	15000	2500	155000
Total Travel	0	6050	1550	1600	39100	1500	56050	25600	15600	15600	3100	165750
B. Per Diem												
1. Domestic												
a. Team Leader/Proj. Mngr.	0	3780	3780	3780	3780	3780	3780	3780	3780	3780	3780	37800
b. Faculty Advisor	0	1890	3780	3780	3780	3780	1890	0	0	0	0	18900
c. Co-Farm Manager	0	945	1890	1890	1890	1890	945	0	0	0	0	9450
d. Co-Librarian	0	0	315	630	0	0	0	0	0	0	0	945
Total Domestic Per Diem	0	6615	9765	10080	9450	9450	6615	3780	3780	3780	3780	67095
2. International												
a. Dean	0	0	0	0	0	1440	0	0	0	0	1440	2880
b. Grad. Students	0	0	0	0	6720	0	10560	4800	2880	2880	0	27840
c. Local Grad. Advisor	0	0	0	0	6720	0	10560	4800	2880	2880	0	27840
Total Internl. Travel	0	0	0	0	13440	1440	21120	9600	5760	5760	1440	58560
Total Per Diem	0	6615	9765	10080	22890	10890	27735	13380	9540	9540	5220	125655
C. R&R Travel	0	3340	1670	6680	1670	8350	0	3340	0	1670	0	26720
D. Medical Evacuations	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	33000

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Table I-5 (Continued) Page 2: Detailed Worksheets for AID Local Currency Budget, FOA

(Dollars)

TOTAL TRAVEL AND PER DIEM	3000	19005	15985	21360	66660	23740	96785	45320	28140	29810	11320	351125
IV. TRAINING												
A. English Language	20000	0	20000	0	20000	0	20000	0	20000	0	20000	120000
B. In-Service Training/Plan.	0	0	2000	4000	4000	4000	4000	4000	4000	4000	4000	34000
TOTAL TRAINING	20000	0	22000	4000	24000	4000	24000	4000	24000	4000	24000	154000
V. EXP. EQUIPMENT & MATERIALS												
A. Office												
1. Supplies	0	0	6000	5000	5000	4000	4000	3000	3000	2000	1000	33000
2. Equipment	0	0	8000	7000	6000	6000	5000	5000	4000	4000	3000	48000
Total Office Exp. E & M	0	0	14000	12000	11000	10000	9000	8000	7000	6000	4000	81000
B. Instructional Farm	0	0	4000	4000	3000	3000	3000	2000	2000	1000	1000	23000
C. Training	0	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	9000
TOTAL EXP. EQUIP. & MATERIALS	0	0	19000	17000	15000	14000	13000	11000	10000	8000	6000	113000
VI. NON-EXP. EQUIP. & MATERIALS												
A. Equipment	0	0	15000	15000	10000	10000	10000	5000	5000	5000	5000	80000
B. Materials	0	0	5000	5000	4000	4000	4000	4000	3000	3000	3000	35000
TOTAL NON-EXP. E & M	0	0	20000	20000	14000	14000	14000	9000	8000	8000	8000	115000
VII. INSTRUCTIONAL FARM												
A. A & E Design	40000	0	0	0	0	0	0	0	0	0	0	40000
B. Establishment Costs	265000	0	0	0	0	0	0	0	0	0	0	265000
C. Perimeter Fencing	105000	0	0	0	0	0	0	0	0	0	0	105000
D. On-Farm Water Distr.	140000	0	0	0	0	0	0	0	0	0	0	140000
E. Water System to Farm	553900	0	0	0	0	0	0	0	0	0	0	553900
F. Crop Sci. Field Lab./Equip.	0	179300	0	0	0	0	0	0	0	0	0	179300
G. Livestock Field Lab./Equip.	0	139500	0	0	0	0	0	0	0	0	0	139500
H. Poultry Field Lab./Equip.	0	27400	0	0	0	0	0	0	0	0	0	27400
I. Farm Shop	0	35300	0	0	0	0	0	0	0	0	0	35300
TOTAL INSTRUCTIONAL FARM	1103900	381500	0	0	0	0	0	0	0	0	0	1485400
VIII. OTHER DIRECT COSTS												
A. Instr. Farm Recurring Costs	0	0	100000	80000	60000	40000	20000	0	0	0	0	300000
B. Local Core Support	0	12200	12200	12200	12200	12200	12200	12200	12200	12200	12200	122000
TOTAL OTHER DIRECT COSTS	0	12200	112200	92200	72200	52200	32200	12200	12200	12200	12200	422000
TOTAL AID LOCAL CURRENCY BUDGET	1186400	487080	337935	391310	429560	286440	268985	155895	125965	91760	91270	3373900

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Table I-6 Summary of Detailed Worksheets for YARC Budget
(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. SALARIES AND WAGES	0	40500	475000	482500	527500	712500	823500	934500	1045500	1156500	1267500	7465500
II. OPERATIONS	0	0	174000	252000	278000	304000	320000	341000	347000	343000	349000	2708000
III. TRAVEL AND PER DIEM	0	12070	21690	21540	27110	37540	46440	69480	80680	89200	92320	498070
Subtotal	0	52570	670690	756040	832610	1054040	1189940	1344980	1473180	1588700	1708820	10671570
Contingency (5%)	0	2629	33535	37802	41631	52702	59497	67249	73659	79435	85441	533579
Subtotal	0	55199	704225	793842	874241	1106742	1249437	1412229	1546839	1668135	1794261	11205149
Inflation (8%, Cmpd.)	0	4416	116901	206399	314727	519062	733420	1008332	1316360	1666467	2079548	7965631
Subtotal	0	59614	821126	1000241	1188967	1625804	1982857	2420561	2863199	3334602	3873809	19170780
IV. FACILITIES DEVELOPMENT	12400000	0	0	0	0	0	0	0	0	0	0	12400000
TOTAL YARC LOCAL BUDGET	12400000	59614	821126	1000241	1188967	1625804	1982857	2420561	2863199	3334602	3873809	31570780

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Table I-7 Detailed Worksheets for YARC Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	TOTAL
I. SALARIES AND WAGES												
A. Faculty Building												
1. Dean, FOA, 1.0 FTE	0	24000	48000	48000	48000	48000	48000	48000	48000	48000	48000	456000
2. Faculty Members, 5-20 FTE	0	0	0	0	0	185000	296000	407000	518000	629000	740000	2775000
3. Librarian, 1.0 FTE	0	0	0	0	27000	27000	27000	27000	27000	27000	27000	189000
4. Adm. Asst., Fiscal, 1 FTE	0	0	23000	23000	23000	23000	23000	23000	23000	23000	23000	207000
5. Adm. Asst., Pers., 1 FTE	0	0	23000	23000	23000	23000	23000	23000	23000	23000	23000	207000
6. Purchasing Agent, 1 FTE	0	0	14000	14000	14000	14000	14000	14000	14000	14000	14000	126000
7. Budg./Fin. Analyst, 1 FTE	0	0	20000	20000	20000	20000	20000	20000	20000	20000	20000	180000
8. Sec./typist, 3.0 FTE	0	0	51000	51000	51000	51000	51000	51000	51000	51000	51000	459000
9. Translator, 1.0 FTE	0	0	22000	22000	22000	22000	22000	22000	22000	22000	22000	198000
10. Janitor, 2.0 FTE	0	0	13000	13000	13000	13000	13000	13000	13000	13000	13000	117000
11. Bldg. Maint. Pers., 1 FTE	0	0	20000	20000	20000	20000	20000	20000	20000	20000	20000	180000
12. Groundskeeper, 1 FTE	0	0	0	7500	7500	7500	7500	7500	7500	7500	7500	60000
Total Fac. Bldg. Sal. & Wages	0	24000	234000	241500	268500	453500	564500	675500	786500	897500	1008500	5154000
B. Instructional Farm												
1. Manager, 1.0 FTE	0	16500	33000	33000	33000	33000	33000	33000	33000	33000	33000	313500
2. Senior Mechanic, 1 FTE	0	0	16000	16000	16000	16000	16000	16000	16000	16000	16000	144000
3. Maint. Man, Bldgs., 1 FTE	0	0	20000	20000	20000	20000	20000	20000	20000	20000	20000	180000
4. Maint. Man, Grnds., 1 FTE	0	0	17500	17500	17500	17500	17500	17500	17500	17500	17500	157500
5. Drivers, 4.0 FTE	0	0	46000	46000	46000	46000	46000	46000	46000	46000	46000	414000
6. Janitor, 1.0 FTE	0	0	6500	6500	6500	6500	6500	6500	6500	6500	6500	58500
7. Guards, 2.0 FTE	0	0	12000	12000	12000	12000	12000	12000	12000	12000	12000	108000
Total Instr. Farm Sal. & Wages	0	16500	151000	151000	151000	151000	151000	151000	151000	151000	151000	1375500
C. Technicians												
1. Animal Tech., 1.0 FTE	0	0	18000	18000	18000	18000	18000	18000	18000	18000	18000	162000
2. Field Crop Tech., 1 FTE	0	0	18000	18000	18000	18000	18000	18000	18000	18000	18000	162000
3. Horticulture Tech., 1 FTE	0	0	18000	18000	18000	18000	18000	18000	18000	18000	18000	162000
4. Poultry Tech., 1 FTE	0	0	18000	18000	18000	18000	18000	18000	18000	18000	18000	162000
5. Food Sci. Tech., 1 FTE	0	0	18000	18000	18000	18000	18000	18000	18000	18000	18000	162000
6. Agric. Media Tech., 1 FTE	0	0	0	0	18000	18000	18000	18000	18000	18000	18000	126000
Total Tech. Sal. & Wages	0	0	90000	90000	108000	108000	108000	108000	108000	108000	108000	936000
TOTAL SALARIES AND WAGES	0	40500	475000	482500	527500	712500	823500	934500	1045500	1156500	1267500	7465500
II. OPERATIONS												
A. Faculty Buildings												
1. Utilities	0	0	50000	50000	50000	50000	50000	50000	50000	50000	50000	450000
2. Communications	0	0	40000	40000	40000	40000	40000	40000	40000	40000	40000	360000
3. Maintenance & Repair	0	0	0	20000	20000	20000	20000	20000	20000	20000	20000	160000
4. Printing	0	0	15000	25000	30000	30000	30000	30000	30000	30000	30000	250000
Total Fac. Bldgs. Operations	0	0	105000	135000	140000	140000	140000	140000	140000	140000	140000	[illegible]
B. Vehicles and Tractors												
1. Gas. & Petro. Products	0	0	40000	65000	65000	65000	65000	65000	65000	65000	65000	[illegible]
2. Insurance & Licenses	0	0	4000	6000	6000	6000	6000	6000	6000	6000	6000	[illegible]

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(Dollars)

3. Spare Parts & Tires	0	0	2000	3000	4000	5000	6000	7000	8000	9000	10000	54000
4. Outside Services	0	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	9000
Total Veh. & Trac. Operations	0	0	47000	75000	76000	77000	78000	79000	80000	81000	82000	675000
C. Instr. Farm & Motorpool												
1. Road & Yard Maintenance	0	0	20000	20000	20000	20000	20000	20000	20000	20000	20000	100000
2. Bldgs. & Shop Renovation	0	0	0	0	0	5000	0	0	5000	0	5000	15000
3. Exterior Lighting	0	0	2000	2000	2000	2000	2000	2000	2000	2000	2000	18000
4. Recurring Costs	0	0	0	20000	40000	60000	80000	100000	100000	100000	100000	600000
Total Instr. Fm. & Mtrpl. Oper	0	0	22000	42000	62000	87000	102000	122000	127000	122000	127000	813000
TOTAL OPERATIONS COSTS	0	0	174000	252000	278000	304000	320000	341000	347000	343000	349000	2708000
III. TRAVEL AND PER DIEM												
A. Travel												
1. Domestic												
a. Dean	0	300	600	600	600	600	600	600	600	600	600	5700
b. Farm Manager	0	150	300	300	300	300	300	300	300	300	300	2850
c. Librarian	0	0	100	100	100	100	100	100	100	100	100	900
d. Faculty Members	0	0	0	0	0	4200	4200	10800	13800	15600	17400	66000
e. Technicians	0	0	1500	1500	1800	1800	1800	1800	1800	1800	1800	15600
f. ESL Specialist	0	0	0	0	300	300	300	300	300	300	300	2100
Total Domestic Travel	0	450	2500	2500	3100	7300	7300	13900	16900	18700	20500	93150
2. Internl., (Arab Bloc)	0	9100	4700	3500	7000	0	8900	3500	3300	3300	0	43300
Total Travel	0	9550	7200	6000	10100	7300	16200	17400	20200	22000	20500	136450
B. Per Diem												
1. Domestic												
a. Dean, 10 days	0	1575	3150	3150	3150	3150	3150	3150	3150	3150	3150	29925
b. Farm Manager, 18 days	0	945	1890	1890	1890	1890	1890	1890	1890	1890	1890	17955
c. Librarian, 6 days	0	0	0	0	630	630	630	630	630	630	630	4410
d. Fac. Membrs., 18 * 5-20	0	0	0	0	0	13230	13230	34020	43470	49140	54810	207900
e. Technicians, 18 * 4-6	0	0	9450	9450	11340	11340	11340	11340	11340	11340	11340	98280
f. ESL Specialist	0	0	0	0	630	630	630	630	630	630	630	4410
Total Domestic Per Diem	0	2520	14490	14490	17010	30240	30240	51030	60480	66150	71820	358470
2. International												
a. Dean	0	0	0	1050	0	0	0	1050	0	1050	0	3150
Total Per Diem	0	2520	14490	15540	17010	30240	30240	52080	60480	67200	71820	361620
TOTAL TRAVEL AND PER DIEM	0	12070	21690	21540	27110	37540	46440	69480	80680	89200	92320	498070
IV. FACILITIES DEVELOPMENT												
A. Land, Bldg. & Farm	12400000	0	0	0	0	0	0	0	0	0	0	12400000
TOTAL FACILITIES DEVELOPMENT	17100000	0	0	0	0	0	0	0	0	0	0	12400000
TOTAL YARG LOC. CURR. BUDGET	12400000	52570	670690	756040	832610	1054040	1189940	1344980	1473180	1588730	1708820	23071570

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ANNEX J

INSTRUCTIONAL FARM ANALYSIS

A Demonstration Farm Study for The University of Sana'a Faculty of Agriculture

a proposal designed by a
CID/USAID special study team
for the University of Sana'a

Team Members

James A. Vomocil, Professor of Soil Science,
Oregon State University

LeRoy Daugherty, Professor of Agronomy
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CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
Tucson, Arizona Corvallis, Oregon Sana'a, Yemen

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PREFACE

In October, 1981, representatives of the University of Sana'a suggested that a study should be made to determine the attributes of a demonstration and research farm for the proposed Faculty of Agriculture. The committee designated to design the faculty concurred. CID/USAID was asked to provide the expertise from CID universities for this task since the Land Grant University system of the United States bears similarity to the model suggested by the Faculty Design Committee.

Core/OSU provided the following individuals for the project:

Dr. James Vomocil; Professor of Soil Science and Extension Specialist, Oregon State University - Team Leader, with expertise in Soil Physics and Irrigation.

Dr. LeRoy Daugherty; Professor of Agronomy, New Mexico State University, with expertise in Crops and Soils.

Mr. John Leffel; Professor of Animal Science and Agronomy and Extension Specialist, Oregon State University, with expertise in Animal Science, Pasture Management, and Range Management.

The study team consulted officers of the University of Sana'a, the YARG Ministry of Agriculture and Fisheries (MAF), the YARG National Water and Sewage Authority, Food and Agriculture Organization of the United Nations, the World Bank, and representatives of various consulting firms with offices in Sana'a.

The team toured Y.A.R. to familiarize themselves with the agricultural industry and food systems of the nation. Research and extension sites of MAF at Dhamar, Yarim, Taiz, Jaruba, and Surdud were visited. The Ibb Secondary Agricultural Institute (MAF/MOE) was also visited. CID/USAID is involved as a cooperator in the activities at the Jaruba Horticultural Station and the Ibb Secondary Agricultural Institute. With this background, the team deliberated upon a plethora of alternatives and devised the suggestions contained in this report.

EXECUTIVE SUMMARY

University of Sana'a Demonstration Farm Plan

A CID/USAID study team was brought to Sana'a for one month on TDY and given the charge of developing a proposal for a demonstration farm facility to be used by the proposed Faculty of Agriculture at the University of Sana'a. The plan evolved was to contain sufficient detail and be sufficiently specific to become the basis for a proposal to be submitted for funding.

The modus operandi of the study team was to consult with national, local and university authorities, representatives of the World Bank, and various consultants working in YAR province. The team made an analysis of their findings and on the basis of this analysis, developed this plan.

The needs of the faculty and future students of the Faculty of Agriculture at the University of Sana'a were a prime consideration. Of principle concern was the development of an appropriate sized facility to accomodate a sufficient range of interests to meet the needs of a faculty charged with the responsibility of training the future agricultural leaders for YAR. The procedure has two long-term approaches:

First, it was our intention to seek the appropriate level of technology, to put the emphasis on the future, not the past. The significance of the level of technology was demonstrated to us by many references to the current and pending shortage of agricultural labor in the food system of this nation. The second principle was to guarantee an adequate level of flexibility in the use of land and water resources, and the need for physical arrangements to best meet the needs of students, the needs of the Province of Sana'a from the point of view of agricultural extension, and the needs of the future faculty with regards to their activities in research.

The availability of land and water were important factors in generating the attributes of the final system. Land is scarce and expensive. A special effort was made to determine the possibilities of developing an on-campus, rather than an off-campus, farm. Also, it would be desirable to accomodate students with a minimum of transport. There are some concerns about the prospect of water development on the farm site. Alternative proposals and projections which could guarantee the university farm a sufficient quantity, sufficient dependability and long-term security of water supply were appraised.

A projected enrollment of about 800 students in agriculture would require a faculty of about 80 scientists. Twenty-one hectares of land suitably apportioned for teaching and research among the various disciplines in agriculture should suffice.

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Given sufficient water (at least 14 liters per second), one possible pattern of land use would be to assign approximately 3.0 hectares for use in demonstration plots and trials with agroeconomic crops, cereals, pulses, forages, oil seed, and fiber crops. An allocation of 5.3 hectares of land would be available for horticultural crops. The horticultural activities to be considered would include fruits, vegetables, and forestry and landscaping. Approximately 11.0 hectares of land would be available for animal husbandry work with sheep, goats, cattle and poultry. An additional 0.7 hectare of land could be used for student and faculty activities in soil and water management, for trials and demonstrations in tillage and irrigation methods. Approximately 1.0 hectare would be allocated for buildings, principal roads, ponds, yards, etc. Less available water would mean a proportionally smaller farm and a different distribution of land (see Table 4-1).

In the horticultural section, it was considered appropriate to partition the area three ways, establishing a zone for fruit involving approximately ten different kinds of trees, a vegetable section with about 30 different species of shade trees, fire wood trees, ornamentals, flowers, shrubs and turf.

The livestock section would be comprised of a flock of sheep of approximately 25 ewes, 15 goats involving both dairy and meat, and a cattle herd of about 8 milk cows. The poultry flock should have both egg and meat production using a flock of 250 layers and 250 broilers.

The teaching to be undertaken in the livestock section would involve breeding trials and effort on production efficiency and animal nutrition. Close cooperation with the MAF veterinarian service should be developed. The animal science section should provide opportunities for the students to make observations on pasture management and utilization with emphasis on labor-saving methods. Some range management demonstrations should be arranged on leased land, if available adjacent to the university campus.

Some land within the agronomic and horticultural plots as well as outside of those plots should be used for soil management and irrigation demonstrations. Demonstrations in tillage, tillage intensity, depth, and equipment are recommended. There should be demonstrations and trials in irrigation engineering to compare flood, rill, basin, furrow, drip, sprinkler, etc. The students should also have some opportunity to work with irrigation plumbing: pumps, valves, pipes, siphon tubes, open ditches, drop structures, flumes, weirs and so forth. The student should have some exposure to irrigation requirements of crops and to irrigation efficiency with an overall strong emphasis on energy and resource conservation.

For the benefit of the students, for extension activities, and for research activities by the faculty, the farm facilities should include the following buildings:

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(a) Crops laboratory building and offices
(b) Shop and equipment barn
(c) Livestock barn and handling facility
(d) Poultry building
(e) Feed storage building
(f) Completely equipped weather station
(g) Two pump houses
(h) Water impoundment

It would be most appropriate if the facility could retain planning flexibility to be used for future research needs. This proposal needs strong support from the administration, faculty and from other faculties in the University. Looking toward the future, we would visualize the need for additional facilities - perhaps at Mabar, Dhamar, or Yarim and possibly a development at the Sana'a airport.

At the airport, use of chlorinated stabilized effluent may be considered. This should be an inexpensive source of water but it must be used with care.

Below is a Summary of the Budget. Cost estimates are given by category. Details on budget items can be found in the Appendix.

Proposed University Demonstration Farm Cost Estimate Summary

Water System to Farm	-	$ 457,800
On-Farm Water Distribution System	-	112,200
Irrigation Equipment	-	42,900
Irrigation Measurement Equipment	-	34,720
Office and Crop Science Building Equipment	-	217,950
Livestock Center and Feed Building, Equipment	-	192,100
Poultry Building and Equipment	-	25,400
Farm Shop	-	58,310
General Farm Machinery and Equipment	-	125,175
Perimeter Fencing	-	85,000
Establishment Cost	-	215,000
TOTAL COST IN U.S. DOLLARS		1,566,555

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CID	Consortium for International Development
ISAI	Ibb Secondary Agricultural Institute
MAF	Ministry of Agriculture and Fisheries
MOE	Ministry of Education
MOH	Ministry of Health
NWSA	National Water and Sewage Authority
SURDP	Southern Uplands Rural Development Project
TDA	Tihama Development Authority
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WMO	World Meteorological Organization
YAR	Yemen Arab Republic

DISCLAIMER: The CID/ USAID special study team made every effort to make this list complete. We apologize for any omissions and attest that they were inadvertent.

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1. PURPOSE OF STUDY

1.1 Background

Agriculture is the most important production economic sector in the Yemen Arab Republic. According to the World Bank (1979), agriculture accounts for approximately 40 percent of the gross domestic product (GDP). Agricultural practices are undergoing major changes. After centuries of subsistence farming through the efficient utilization of a meager resource base and employment of traditional cultivation techniques, farmers are now faced with new markets, labor shortages, high wages, relatively easy access to capital, and changing consumer tastes. These changes offer new opportunities for agricultural development, especially with respect to the high value crops and livestock.

Table 1-1 shows the relative importance of agriculture to the Yemeni worker. Table 1-2 shows the importance of agriculture to the gross domestic product. The role of agriculture is changing. Much of the change is due to the dynamics of other sectors, to emigration of rural labor, and to structural changes within agriculture itself. The relative share of the GDP for agriculture has fallen from an estimated 53 percent in the years 1969 and 1970 to a 1979 level of 40 percent. These changes do not reflect a stagnation or even a decline in the agricultural output. In the first half of the 1970's agricultural production increased by approximately 50 percent even though the labor force employed in agriculture declined significantly during the same period. Much of the change can be attributed to an improvement in weather conditions and in a shift from traditional subsistence farming to the production of high-valued cash crops. An increased use of modern inputs such as improved seeds, fertilizers, and pesticides caused the yields of some crops to rise. In some areas there have been substantial investments in irrigation. Increased use of female labor and mechanization partially compensated for the emigration of male labor from rural areas to other countries such as Saudi Arabia. These changes were further stimulated by a generally favorable economic climate with rising farm prices reflecting increased demand. The government is also providing increased institutional support. Agriculture is adapting quickly to the changing structure of the economy.

Commodities grown in the Yemen Arab Republic are significantly more expensive than imports and comparable commodities on the world market even though quite often the Yemeni products are lower in quality (Pratt, 1976). Substantial advances will need to be made in increasing yields coupled with decreasing production costs if local goods are to retail at realistic prices while maintaining returns for farmers. Currently, local commodities are becoming increasingly vulnerable to foreign competition on internal markets.

Even though there are substantial physical constraints, the present low level of agricultural productivity suggests potential for development even with limited and erratic rainfall. The World Bank (1979) considers significant increases in crop yields possible. Better techniques in animal husbandry and animal health care will most likley increase weight gains of animals and increase milk production.

Table 1-1: Percentages of the 1,127,572 economically active Yemeni engaged in various occupations in 1975. (CPO, 1981)

Employment Area	Percent
Agriculture	73.6
Mining	0.1
Manufacturing	3.0
Electricity	0.1
Construction	4.7
Trade	6.1
Transport	2.2
Finance	0.2
Social Services	7.6
Not Stated	2.4
TOTAL	100.0

Table 1-2: Comparison of agricultural and total industrial output for YAR in 1979-80. (COP, 1981)

	Agriculture (million YR)	Total Industrial
Gross output at producer prices	4024	13,591
Gross domestic product at market prices	3458	8,721
Net domestic product at market prices	3416	8,442

In planning for increases in agricultural production through the introduction and development of new techniques, it must be kept in mind that the existing systems of agriculture have evolved through more than 3,000 years of experience. Suggestions for change should be carefully considered. It should be noted that there have been rapid changes in resource availability and in the relative prices for products. Many, if not most, of the existing farm systems have not sufficiently adjusted to new technological opportunities. Many of these new opportunities have not been sufficiently demonstrated to the farmers.

In order to meet the changing needs of a developing agriculture, the Yemeni people must be better educated. According to the Central Planning Office (CPO, 1981), the literacy rate in Yemen is very low (see Table 1-3). There is a serious shortage of trained professionals and technicians required to staff the new agricultural institutions and provide needed services. In information compiled by the World Bank (1979), the Ministry of Agriculture and Fisheries (MAF), in 1976, had only 72 university-trained agricultural specialists, which included veterinarians, and 219 agricultural technicians. There was a projected need for 288 professionals and 876 technicians by 1981, or four times the 1976 complement. This additional staff could not be provided each sufficient speed by present educational arrangements. Rapid increases must be made in the output of universities and other training institutes. Unless this is accomplished, the manpower in agricultural administrations and agricultural public institutions will be in short supply. Table 1-4 shows the estimated requirements for university-trained people in the agricultural sector from 1977 to 1981. It also shows the projected supply of university graduates during the same period and the projected shortfall. Table 1-5 and 1-6 show the educational structure and the number of students in Yemen from the primary level through the university level. Table 1-7 shows the number of students on grants in other countries in various specializations.

The University of Sana'a is the only institution of higher learning in the Yemen Arab Republic. It was established in 1970. It was opened with an enrollment of 61 students and a staff of 15 in three colleges: law, science, and arts (Nyrop et al., 1977). It has since added faculties of commerce and education. It has been determined that there is a critical need for the development of a Faculty of Agriculture at the University of Sana'a (Aulaqui et al., 1981). When established, the Faculty of Agriculture will provide YARG with the technological, scientific, and academic resource base for development of research programs to meet the needs of the Yemeni farmers, to increase agricultural production, to make more efficient use of Yemeni soil and water resources and a curriculum and teaching program to meet the needs of academically qualified Yemeni students interested in pursuing a career in agriculture. Initially, the Faculty of Agriculture will most likely provide program specialization in four departments: (a) animal production, (b) plant production, (c) soil, irrigation and mechanization, and (d) agricultural economics (farm management, marketing, cooperatives, extension and vocational agriculture).

Table 1-3: Education status (1975) for the Yemeni population over 10 years of age. (CPO, 1981)

Illiterate	Read Only	Read & Write	Primary	Preparatory	Secondary	University	Not Stated	Total
			- - -	Percent	- - -			
				Male				
65.0	10.8	21.6	1.0	0.6	0.4	0.2	0.4	100
				Female				
97.3	0.7	1.3	0.1	0.1	0.03	0.02	0.02	100

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Table 1-4: Estimated number of university trained people for agriculture compared to estimated need for the four-year period 1977-1980 (World Bank, 1979).

Specilization	Estimated need	Estimated supply	Deficit
Crops	16	5	11
Livestock	15	4	11
Fisheries	27	5	22
Forestry	10	-	10
Horticulture	19	4	15
Plant Protection	23	9	14
Ag Statistics	26	-	26
Extension	27	3	24
Mechanization	8	-	8
General	24	100	+76
Irrigation Eng.	15	2	13
Veterinary	25	-	25

Table 1-5: Distribution of pre-university students in 1979/80 (CPO, 1981).

Type School	Students			Classrooms	Schools
	Female	Male	Total		
Primary	41,707	293,542	335,249	9,650	2,543
Preparatory	2,795	17,969	20,764	655	197
Secondary	1,046	7,183	8,229	249	55
Technical Secondary	1	355	356	16	2
TOTAL	45,549	319,049	364,598	10,570	2,797

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Table 1-6: Students and faculty at the University of Sana'a during 1979/1980 (CPO, 1981).

	Students					
	Year					
Faculty	1	2	3	4	Total	Staff
Commerce & Economics	616	322	231	205	1,374	25
Law	513	155	108	136	912	17
Arts	546	164	81	47	838	60
Science	272	46	24	14	356	67
Education	284	183	142	131	740	12
Total	2,231	870	586	533	4,220	181

Table 1-7: Students on grants in foreign countries in various specializations during 1979/80 (CPO, 1982)

	Speciality								
Country	Tech.	Educ.	Com.	Vet.	Agr.	Sci.	Phar.	Eng.	Med.
Egypt	-	43	29	5	18	14	2	-	-
Iraq	-	-	-	7	33	10	2	17	15
Syria	13	-	6	10	59	12	7	39	4
Libya	-	-	-	-	4	-	-	3	2
Kuwait	-	-	-	-	-	-	-	1	2
Sudan	-	1	-	-	-	-	-	-	-
Saudi Arabia	-	-	-	6	9	-	4	61	-
U. of Beirut	-	-	-	-	-	-	-	62	-
China	-	-	-	-	-	-	-	4	-
Romania	-	-	-	-	-	-	-	2	4
Pakistan	-	-	-	6	8	-	18	39	37
Total	13	44	35	34	131	36	33	228	64

It is presumed that the agricultural program will begin with 30 entering students. It is hoped that after approximately 15 years, as many as 150 students would enter the program each year. A general program is planned which would allow students to enter any area of specialization after four years.

Professional agriculturalists trained in extension techniques are probably the most critical need. The Yemeni farmers are highly industrious and skillful in their traditional ways of cultivating crops and caring for livestock. However, they are not knowledgeable or experienced in modern agricultural practices. Even when new techniques are successfully demonstrated, the farmers are not always ready to take the risks involved in the adoption of new practices. To move from subsistence agricultural systems to a market-oriented system based on cash crops, continuing extension guidance will be necessary.

1.2 Purpose

The University of Sana'a administration has determined that a Demonstration Farm should be designed to serve the Faculty of Agriculture. A design team from the Consortium for International Development (CID) was designated to plan the demonstration farm. The farm should be mainly for demonstration of existing technology. It will serve research needs of the Faculty of Agriculture.

1.3 Objectives

The Demonstration Farm could be located on the new campus of the University of Sana'a at the intersection of Ring Road and Wadi Dhar Road. Up to 25 hectares should be available for the farm. The farm should serve the needs of the disciplines planned for the Faculty of Agriculture: agronomy, horticulture, irrigation and mechanization, and animal husbandry.

In general, the demonstrations should represent as much diversity as possible. The climatic conditions of YAR are diverse; thus local conditions pose some limitations since Sana'a is on a high mountain plain. Most of the demonstrations should have widespread, immediate application. The physical and economic resources available to the farmers should be considered in designing demonstrations.

A Demonstration Farm at Sana'a campus cannot totally represent the diversified agriculture of the entire country. A network of demonstration and research farms throughout the Yemen Arab Republic is planned for the future. The planned demonstrations on the Sana'a campus should show optimum and deficit irrigation and simulated rainfed agriculture.

1.4 Significance

The students of the Faculty of Agriculture need "hands-on" exposure to the technology of modern agriculture. The farm background of most students will not be in modern agriculture. Eventually, as many as 300-400 students will need access to the demonstration each year. They will do many of the demonstrations themselves, providing much of the labor. Most of the demonstrations should have immediate practical significance so that the students can carry the knowledge to the farmer for direct application. Some of the demonstrations, however, will introduce new concepts not immediately acceptable to the producer. Some demonstrations will show problem situations. As far as possible, all crop and horticultural commodities produced in the Yemen Arab Republic should be demonstrated.

1.5 Study team procedure

The Faculty of Agriculture will have an organizational structure similar to that used in the Land-Grant System of the United States. Teaching, research, and extension components are planned. Members of a design team familiar with the U.S. Land-Grant System are the authors of this report. Interviews with University officials, Ministry of Agriculture Officials, local agriculture officials, National Sewage and Water Authority representatives, Food and Agriculture Organization United Nations representatives, World Bank representatives, and numerous consultants for agriculture, hydrology, and engineering were conducted. Well drilling companies were also interviewed. Field trips were taken to gain perspective of YAR agriculture.

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2. GEOGRAPHY OF YAR AND THE STUDY AREA

2.1 Location

The Yemen Arab Republic is located in the southwestern corner of the Arabian peninsula between 12° 40' and 17° 26' north latitude and 42° 3' to 46° 31' east longitude. This country of nearly 8.5 million people is bounded on the west by the Red Sea, on the north and east by the Kingdom of Saudi Arabia and on the south by the Peoples Democratic Republic of Yemen, commonly called South Yemen. Some of the boundaries of the country toward the east with both Saudi Arabia and south Yemen have not been officially demarcated. Depending on the reference cited YAR has an area of between 135,200 square kilometers (Bernhardt, 1980) and 200,000 square kilometers (CPO, 1980). The study center for this report is located in Sana'a, the Capital of the Yemen Arab Republic.

There are at least three principal geographic regions in the YAR: The Tihama, which is a 400 kilometer long narrow coastal plain, the high mountain plains, and the eastern high desert.

The coastal lowlands of the Tihama cover an area 30 to 60 kilometers wide along the Red Sea. The elevation ranges from sea level to approximately 200 meters at the foothills. It ranges from a plain to slightly undulating foothills and is intersected by dispersed wide, shallow wadis draining from the central mountain range toward the sea. This narrow, hot, semi-arid, almost waterless strip extends along the entire sea coast from Maydi on the northern frontier with Saudi Arabia to the Bab Al Mandab at the country's southern limit and occupies approximately 10 percent of the country. Seven major wadis permit limited agricultural activity (Nyrop, et al., 1977).

The high mountain plains have been formed as a result of block faulting along a north-south axis parallel to the Red Sea and along an east-west axis parallel to the Gulf of Aden. The resultant uplift has formed a central mountain range starting around Taiz. The mountainous area can be divided into three regions, each with distinct climatic and vegetational characteristics. These are the foothills and middle elevations of the central mountain range, the central highlands, and the eastern semi-desert plateau.

The foothills and middle elevations of the central mountain region are situated between the Tihama and central highlands within the elevation range of 200 to 1500 meters. The landscape is very rugged, cut by deep wadis running through narrow gorges with very steep and long slopes.

The central highland regions comprise the higher reaches of the central mountain range exceeding 1500 meters in elevation. This area extends from Ibb in the south, into Saudi Arabia in the North. A chain of the high mountains is found between Ibb and Sana'a with several peaks exceeding 3,000 meters. Yemen's highest peak, Nabi Shu'Ayb (3,760 meters) also the highest peak on the Arabian peninsula is located in this zone. Topography to the west of the range is very rugged. The eastern slopes

of these mountains are more gentle and terminate at the high mountain plains of Sana'a, Mabar, Dhamar, and Yarim. These high plateaus are all above 2,000 meters in elevation. The central highlands, especially the area around Ibb, were in the past referred to as Felix Arabia or happy Arabia because of the moderate temperatures and the large amount of precipitation. This area has more cultivatable acreage than any other part of the peninsula. It should be remembered, however, that the description "happy" is applied relative to the general aridity of the rest of Arabia. The highlands, like most mountain areas, exhibit substantial ecological diversity (Swanson, 1979).

The eastern semi-desert plateau slopes gently toward the east and forms rolling country dropping in elevation to approximately 1,000 meters. It borders the "empty quarter", Rub El Khali of Saudi Arabia.

The geology of the YAR is quite varied. The country lies over a complex of igneous and metamorphic rock, consisting mainly of micas, schists, gneisses, quartzite, and marbles across which run massive intrusions of granitic and basaltic dikes. There are Jurassic beds and Tertiary rocks consisting of Cretaceous sandstones, volcanic tuffs, and basalts. There are also several quaternary volcanic lava flows. The more recent deposits are alluvial formations on the plains in the central part of the country and the coastal plains of the Tihama. Also of recent origin are the sand dunes of the edge of the empty quarter (Al-Thoor and Dewan 1978; Nyrop et al., 1977; CPO , 1981).

2.2 Climate

The climate in YAR is determined by the country's location and topography, with mountains rising from sea level along the Red Sea to an elevation of more than 2,700 meters within a distance of only 100 kilometers. Rainfall depends upon its position on the northern rim of the Indian Ocean monsoon system. Rainfall occurs at two maxima, one during March through April, and the second lasting from July through September. This summer rainfall is mainly influenced by moist air masses of the monsoon circulation systems which flow from the southwest against the Yemen highlands and cause heavy precipitation on the mountain slopes exposed to the west, mainly above 1500 meters. During the period October through February, the dry air masses originating with the central Asian anti-cyclone, are the main reason for the rainless season. Because the rains are borne on southwesterly winds, the amount of rainfall in the highlands decreases as one moves north.

Ibb in the south is known as the green province. It receives more than one meter of rain each year. Further north in Sana'a, however, rainfall averages only one-tenth to one-third as much as in Ibb. Tables 2-1 and 2-2 illustrate the rainfall distribution for Yemen. Most of the rainfall occurs as very heavy localized showers in the afternoon which are usually confined to limited areas. The frequency and intensity of rainfall decreases on the lee side of the western highlands, towards the central highlands and the eastern semi-desert plateau.

Climatic records for Yemen are limited. Data available indicate that rainfall is quite variable for a single location as illustrated in

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	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
							Rainfall						
							---------- mm ----------						
Taiz													
Mean	1.3	11.8	15.9	73.6	97.6	83.9	60.9	66.8	83.7	60.9	14.3	9.7	580.4
Max	15.2	84.5	60.9	138.6	213.4	149.8	134.7	141.7	137.1	130.0	53.9	36.5	831.4
Min	0.0	0.0	0.0	0.0	30.4	22.8	10.2	25.4	25.4	5.6	0.0	0.0	308.9
Zabid Camp													
Mean	5.0	0.7	5.4	21.9	29.1	4.4	35.7	80.7	128.4	36.9	2.4	1.6	352.2
Max	22.0	3.0	17.0	80.0	51.1	15.0	102.0	206.0	281.0	124.0	10.0	11.0	546.0
Min	0.0	0.0	0.0	0.0	0.0	2.0	12.0	68.0	0.0	0.0	0.0	0.0	226.0
Yarim													
Mean	2.0	16.3	51.3	66.0	65.0	45.2	65.5	132.9	35.1	4.9	9.7	3.8	497.6
Max	9.1	37.2	104.6	202.1	178.3	109.5	114.5	242.36	65.2	23.4	48.6	14.5	667.9
Min	0.0	0.0	2.4	10.7	2.4	4.3	4.3	69.7	5.3	0.0	0.0	0.0	356.8
Ibb													
Mean	10.1	17.1	46.3	124.7	219.2	246.2	246.7	250.0	193.5	68.9	35.8	9.9	1,468.4
Max	43.4	42.9	76.6	291.0	402.0	367.0	414.3	426.3	335.9	174.8	120.5	33.6	2,228.5
Min	0.0	0.0	0.0	44.6	77.5	185.5	174.2	199.2	109.8	15.5	0.0	0.0	1,050.1

Table 2-2: Precipitation for Sana'a from 1963-1981. (World Bank, 1979).

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
							Rainfall						
							mm						
1963	14.3	3.8	10.6	13.0	128.0	80.8	20.9	81.5	0.0	0.0	47.2	14.5	414.6
1964	2.2	4.0	1.7	38.3	12.5	8.0	39.9	8.2	5.0	0.0	1.6	10.9	132.4
1965	0.0	0.0	25.9	56.4	0.0	0.6	28.5	88.9	0.0	0.0	11.7	0.0	212.0
1966	3.9	11.3	9.5	35.3	7.2	0.0	24.3	65.6	4.3	0.2	1.1	0.0	162.7
1967	-	-	-	-	-	-	-	-	-	-	-	-	nd
1968	0.0	0.0	8.4	84.1	11.1	14.9	0.0	0.0	1.0	0.0	3.0	0.0	122.5
1969	9.0	16.4	1.1	25.2	13.5	0.0	19.4	28.5	0.0	1.5	0.0	0.0	114.6
1970	4.1	0.0	1.0	1.7	1.0	1.0	0.0	136.7	12.5	0.0	0.0	0.0	158.0
1971	23.9	0.0	23.8	21.5	4.9	0.0	17.3	9.0	0.0	0.0	10.2	0.7	111.3
1972	0.0	3.0	10.3	83.1	6.0	0.5	0.0	6.9	0.5	0.0	6.0	0.5	116.5
1973	0.0	0.0	0.5	5.6	10.0	3.0	36.0	101.0	5.0	0.0	0.0	2.0	163.1
1974	0.0	0.0	34.8	44.2	89.1	0.0	1.5	45.8	0.0	0.0	0.0	0.0	215.4
1975	1.0	2.0	35.8	109.4	0.2	1.9	84.5	102.0	13.8	0.0	0.0	0.0	350.6
1976	0.0	1.1	27.7	32.0	36.6	0.0	18.5	3.7	0.0	0.0	31.5	3.0	154.1
1977	-	-	-	-	-	-	-	-	-	-	-	-	nd
1978	1.0	7.5	15.2	29.9	10.4	10.0	16.6	0.0	0.5	0.0	5.4	0.0	96.5
1979	18.5	1.0	21.5	0.2	20.3	4.0	9.5	20.9	0.0	0.0	0.0	0.0	95.9
1980	0.0	14.1	36.3	42.4	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	98.6
1981	0.0	0.0	112.9	18.9	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	139.7
Min	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Max	23.0	16.4	112.9	109.4	128.0	80.8	84.5	136.7	13.8	5.8	47.2	14.5	-
Mean	4.6	3.8	22.2	37.7	21.1	7.3	18.6	41.1	2.5	0.4	6.9	1.9	168.1
On-1	7.4	5.3	26.6	30.6	34.8	19.4	21.4	45.4	4.44	1.4	13.0	4.2	89.0

Source: World Bank (1979); Sana'a Airport; Central Planning Office.

Table 2-3: Temperature for Sana'a

Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
--Degrees Centigrade--												
Mean Temperature 1971-1976												
12.7	14.5	16.3	17.4	18.6	20.0	20.5	19.8	17.7	14.2	14.2	13.0	16.5
Minimum Temperature 1979-1980												
0.0	0.0	4.0	7.0	7.0	11.0	10.5	12.0	9.8	4.0	-1.0	0.0	-
Maximum Temperature 1979-1980												
27.0	28.6	30.0	31.0	29.8	31.2	32.0	30.2	31.4	29.0	28.0	36.0	-
Soil Temperature at 100 cm Depth 1976												
19.9	20.5	21.4	21.5	21.5	23.4	23.9	23.7	24.1	22.8	21.8	20.5	22.0

Source: CPO; Zschintzch (1978).

Table 2-4: Land Use in the Yemen Arab Republic (CPO, 1981)

---- Land Use ----				
Cultivated land	Marginal area	Forest & shrub	Other	Total
---Hectares---				
1,515,000	2,000,000	1,600,000	14,885,000	20,000,000

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ɔle 2-5: Type of agricultural land (CPO, 1981)

	---- Type Water Application ----			
infed	Flood	Perennial	Well	Total Ag Land
		---Hectares---		
		Sana'a		
728,000	-	20,000	7,200	400,000
		Yemen		
265,800	120,000	73,000	56,200	1,515,000

Table 2-6: Production of the main crops in YAR and in the Province of Sana'a for 1979/80 (CPO, 1981)

Crop	Yemen			Sana'a		
	Prod. 1000T	Yield T/H	Area 1000H	Prod. 1000T	Yield T/H	Area 1000H
Sorghum & millet	692.1	0.9	790.6	109.9	0.7	191.0
Legumes	79.6	1.1	71.5	14.8	0.8	19.0
Maize	99.4	1.6	63.7	2.9	1.4	2.0
Barley	57.2	1.0	58.1	27.5	0.9	30.0
Wheat	52.6	1.0	51.5	17.1	0.8	20.9
Vegetables	253.7	9.6	26.4	49.5	8.2	6.1
Fruits	75.1	5.3	14.2	6.8	4.8	1.4
Grapes	55.0	4.8	11.5	43.5	4.8	9.0
Potatoes	127.2	12.0	10.6	4.7	7.9	0.6
Sesame	6.0	0.6	10.1	0.1	0.5	0.2
Tobacco	7.0	1.1	6.1	-	-	-
Cotton	2.8	0.9	3.0	-	-	-

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Table 2-7: Major plant commodities consumed in YAR (CPO, 1981, Pratt, 1976)

*Alfalfa
Almonds
*Apricots
Banana
*Barley
*Beans (white, red, broad)
*Cabbage
*Carrots
Chickpeas
Chilies
Citrus
Coffee
Coriander
Courrat
Dates
*Eggplant

*Fenugreek
*Grapes (raziky, assimi, white, black)
*Green Beans
Ground fenugreek
Jaw's mallow
Kahtah
*Lentils

*Lettuce
*Linseed
*Maize
Mint
*Mustard
*Okra
Olives
*Onions (red, white, green)
Parsley
*Peas
Peanuts
*Pomegranates
*Potatoes
*Quince
*Radish
*Sorghum (red, white, yellow, shami)
*Spinach
*Squash

*Sweet Melon
*Tomato
*Watermelon
*Wheat

*Commodities grown on highland plateau.

Table 2-2 for Sana'a. Varying data have been reported for any given year depending on the location of the rain gauge within a small geographic area (Berhardt, et al., 1980; Nyrop, et al 1977: Swanson, 1979; CPO, 1981). The rainfall data for Sana'a indicate that it would be very risky to attempt rainfed agriculture or surface water harvesting for a demonstration farm in that area.

Table 2-3 indicates the temperature for Sana'a. Although temperatures rarely get much below freezing, local frosts do occur during the winter months. Low winter humidity and low pressure in the highlands causes rapid evaporation which in turn results in surface frost even when atmospheric temperatures are above freezing (Swanson, 1979). The incidence of frost, therefore, varies considerably with altitude and exposure. In any given village, some fields may freeze while adjacent ones do not. These microecological differences play an important role in determining cropping strategy.

2.3 Agriculture of Yemen

The following is summarized from Bernhardt et al. (1980), World Bank (1979), U. of A. (1981), Swanson (1979), Pratt (1976), and the CPO (1981). Yemen is not richly endowed in agricultural resources. Labor intensive and sophisticated agricultural techniques have been practiced for centuries on the slopes of steep and rugged mountains. The Yemeni farmers have spared no effort to gain maximum profit from the scanty rainfall, even on difficult terrain. Out of the total land area of approximately 20 million hectares, only 1.5 million hectares or seven percent of the total area are regularly cultivated (see Table 2-4). An additional two million hectares of marginal agricultural land is cultivated only during high rain fall years. Woody vegetation or scrub growth covers approximately 1.6 million hectares. The rocky mountainous semi-arid to arid rangelands with very sparse vegetation cover about 15 million hectares.

The rainfed agricultural land comprises about 1.2 million hectares (see Table 2-5). The spate irrigated and spring-irrigated areas are estimated to cover 120,000 hectares and 73,000 hectares respectively. The area of pump-irrigated land has been increasing in recent years and occupies 50,000 to 60,000 hectares. The actual amount of cultivated land varies from year to year depending on rainfall.

Much of the agricultural land is on highland landforms of basically two types: (1) rugged mountain areas with relatively steep slopes and meadow valleys which are typically bisected by wadis and (2) broad highland plains. In the mountain valleys there is the invariably extensive terracing with step-like agricultural fields climbing from the valley floors up the slopes. Such terraces maximize the absorption of precipitation while minimizing soil erosion. Irrigation is likely in the valleys from water diverted to the lower terraces by damming the wadi upstream. On the highland plateaus, terracing is practiced to a far lesser degree or sometimes not at all.

A variety of agricultural crops is grown in the YAR. Table 2-6 lists the major crops and the production values. Table 2-7 lists the main commodities consumed in YAR and the main commodities produced on the highland plateau. Wheat, barley, maize, and sorghum are the main crops. Potatoes, vegetables, and fruits are also grown. The grains occupy about 90 percent of the total cultivated land in the country.

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Of the grains, sorghum is by far the crop of preference. Maize produces approximately 50 percent more grain than does sorghum but the unreliable rainfall in most of the country makes maize a risky crop. The advantages of sorghum are that it is highly resistant to drought while at the same time producing grain for human consumption and fodder for animals. Its major disadvantages are that it requires six months to mature and grain yields are low. Of the other grain crops grown, only wheat produces less grain than sorghum. Barley has a far shorter growing season than sorghum, slighly over two months, and produces significantly more grain. As in the case of wheat, however, barley does not provide animal fodder. This is a major consideration in an economy where animals play an important role. Maize produces both fodder and slightly more grain than sorghum provided it receives ample water. Barley is usually limited to the higher terraces with poorer soils. The terraces are planted with sorghum after the first significant rain of the monsoon season. If however, as sometimes happens, these rains do not materialize, barley is planted during the next summer maxima of rainfall.

Pulses are important crops but do not account for a large percentage of the agriculture. The most important are lentils, fenugreek (hilba), peas, and beans.

Commercial market-oriented agricultural production is limited to a few enterprises such as cotton, hides, skins, coffee, qat, vegetables, fruit and livestock. Although subsistence agriculture predominates in the highlands, a limited number of these cash crops are grown. In the highlands, the cash crops are generally leeks, radishes, alfalfa, and qat. Aside from chilies and green tomatoes, these are the only vegetables consumed in rural areas.

In order of importance, the common domestic animals are cattle, sheep, goats, chickens, donkeys, camels, cats and dogs. Cattle are a source of milk, draft animals, and meat. Most bull calves are butchered shortly after birth to conserve milk and fodder although a few are castrated and allowed to mature into oxen which are the principal agricultural draft animals in the highlands. Camels are often used as draft animals in the Tihama. Cows, on the other hand, are more highly prized for their milk which is almost never drunk fresh but is transformed into clarified butter and buttermilk.

Sheep and goats are reared for their wool and hair, meat and milk. In general, they play a less central role in that agricultural regime than do cows. It appears that the decreased sheep and goat production are a result of migration-induced labor shortage.

3. PREMISES FOR DEMONSTRATION FARM

3.1 Assumptions

3.11 Uses and Objectives

In order to develop a working premise of the University of Sana'a Demonstration Farm, the CID study team found it essential to make certain assumptions about the University of Sana'a Faculty of Agriculture. It was visualized that the University of Sana'a will be the intellectual center for the training of future leaders of the agricultural industry in Yemen. These leaders will be responsible for the decisions affecting the growth of agriculture and changes in the agricultural industry, changes in the products of the nation, and the entire fabric of the agro-industrial complex underlying the food system of Yemen. Thus these individuals should be trained in the basic sciences and principles not only to understand current research, but to analyze new ideas, new perspectives, and inventions for their significance and usefulness in the agricultural complex of YAR. The Demonstration Farm needs a level of sophistication and complexity which allows it to look to the future.

It was assumed that the University of Sana'a will be the educational and cultural center of the nation for many decades to come. We thus felt that the agricultural faculty of this university would engage in both basic and applied research. The Demonstration Farm should provide opportunities for research, teaching, extension, and demonstration in agronomy, horticulture, animal science, agricultural economics, and the associated sciences of plant protection, soil science and agricultural engineering.

It was considered important that all of the students have hands-on experience at an appropriate technology level. As we toured YAR and spoke with agricultural leaders, we were reminded constantly that a shortage of agricultural labor currently exists and that, as educational opportunities in arts, sciences, and industries in the nation develop, this shortage of agricultural labor would likely persist for some decades in the future. Thus we felt that there was an appropriate level of technology which should be introduced into Yemen agriculture with the university agricultural faculty asisting and promoting the process of appropriate mechanization of the industry.

3.12 Water Supply

Observations on land use in the vicinity of Sana'a as well as consultation with municipal, national, and agricultural leaders indicated that a reliable supply of water may be one of the limiting factors for the development of the Demonstration Farm. Our impressions are that the ground water supply in the vicinity of the new university campus is limited, so the drilling of new wells is not promising. Harvesting of surface water is not considered sufficiently reliable for the purposes of the Demonstration Farm. We were forced to consider the advantages and disadvantages of locations for the University Farm near or somewhat removed from Sana'a. The possibilities of piping water to the University Farm were also considered. These considerations and deliberations are discussed under the appropriate headings in the report.

.2 Consultary Evidence

Our conferences with the faculty representatives from the University f Sana'a provided a framework for the structuring of the institution.

3.21 Faculty of Agriculture

3.211 Long Range Plans

Discussions with the President of the University of Sana'a nd several staff members indicated to us some long range plans. It is ikely that the ultimate size of the College of Agriculture, the student ody working under the direction of the Faculty of Agriculture, would omprise 800 to 1,000 students. In addition to this teaching load, the aculty of Agriculture, in order to keep themselves abreast of the latest levelopments in their particular sciences, should participate in both basic nd applied research activities. They will also engaged in consultation ith the Ministry of Agriculture as well as other branches of federal and rovincial governments. The faculty should, on occasion, consult with arious private institutions of the emerging agricultural industry. They hould participate in extension, address audiences of farmers and agro-usiness leaders, and work with extension workers from their own institu-ions and from the Ministry of Agriculture.

With this work load, it is reasonable to expect that the ltimate Faculty of Agriculture would consist of 80 to 100 professional cientists.

3.212 Short Range Plans

During the early formative years of the faculty, the student ody would range from perhaps 50 to 200 students. The initial faculty ould probably have one individual specialist in one of the plant sciences, either an agronomist or a horticulturalist; one professional responsible for the area of animal science and maintenance care in animal health; one individual with a mechanical orientation responsible for student instruction in soils, irrigation and agricultural engineering; and a fourth faculty member, a professor in agricultural economics and extension.

This faculty would be capable of handling 100 to 150 students and operating, with appropriate staff, a small demonstration farm appropriate to the needs of a student body that size.

With the passage of time and growth of enrollment in the College of Agriculture, the Faculty of Agriculture would grow. Additions to the faculty would be needed and a second professor in plant science should be added. Very early, faculty members should be added in the area of plant protection and in entomology or plant pathology. Also, one of the early additions should be a professor of agricultural extension.

3.213 Faculty Research Demonstration Farm Facility

It is essential that the Faculty of Agriculture stay abreast of agricultural science and technology for optimizing production in the nation's food system. The Demonstration Farm must provide opportunity for faculty research in plant breeding, animal breeding, plant protection, crop fertilization, animal nutrition, irrigation, mechanization, and other aspects of appropriate technology.

The long range plans for the University of Sana'a call for the development of a School of Veterinary Medicine. The School of Veterinary Medicine should have close rapport with the Faculty of Agriculture.

3.22 Considerations from Topographic Maps and Soils Information

The study team consulted with authorities and solicited their assistance in finding information about soils and relief of the land available for the University Farm. This information was needed to make judgments about the appropriate location, shape, size, and positioning of individual portions of the operation. It was noted that the soils information, information on the location and characteristics of the terraces, the location and size of the various land units that could be cultivated, irrigated and operated was available. Adequate information was found to develop our recommendations.

3.23 Climatic Information

Climatic information was gathered to make decisions with an appropriate margin of safety, taking into account the observed level of variability. We noted, as is typical for regions of low rainfall, especially those which lie close to the equator, that there were large spatial and temporal variations in air temperature, length of growing season, precipitation, pan evaporation, relative humidity, soil temperature and other kinds of climatic data (see Chapter 2). As will be indicated in the following sections, adjusted means were used in making recommendations with respect to irrigation requirements. We considered it important for the Demonstration Farm to be in a position to operate every year irrespective of the weather conditions. Each year a new group of students will have to be instructed. It was judged to be appropriate to be conservative rather than to risk the prospects that some students would be denied a crucial opportunity to learn due to lack of water.

3.24 Water Information

Consultation with the National Water and Sewage Authority, representatives of the Yemen Oil and Mineral Resources Corporation, representatives of American and British water development consultants, representatives of the Ministry of Agriculture, and representatives of the Province of Sana'a Department of Agriculture indicated concerns about ground water status in the Sana'a basin, especially on and around the site of the new campus. When information regarding the ground water recharge rate is combined with the projected population growth in the basin, questions arise with respect to the appropriate allocation of the ground water resources. Demographic projections indicate that by 1995, the population of YAR will probably be on the order of 8,000,000 with some 20 percent of the population living in the Sana'a basin. The projected population for the basin is 1,600,000 compared to an estimated population of 900,000 in 1980 (World Bank, 1979). Considering this prospect of population growth, it is important that the development of the Demonstration Farm be done very carefully with respect to the future water supply. It is our judgment that while other agricultural use of water in the basin might be denied in the future, the utilization of water by the Demonstration Farm should have a very high priority. The reasoning for this will be further emphasized in a later section of this report.

3.25 Crops Information

Consultation with agricultural authorities for the YARG as well as with consultants and agricultural officials of the Province of Sana'a indicated that dietary trends, assuming an increasing affluence of the Yemeni, will find increased emphasis on fruit and vegetables, meat, milk products, and eggs and decreasing emphasis on cereals in the food system. This dietary trend will become economically feasible with increasing affluence and is nutritionally a reasonable development. This change will require shifts in agricultural land use. Associated with this will be an emphasis on increased productivity, a shift toward horticultural crops and pulses, and the need for more livestock feed. Coupled with this must be greater utilization of fertilizers, particularly nitrogen and phosphorous, and an increased in efficiency of water utilization. This may be available through modification of water management techniques.

3.3 Analysis of the Agricultural Scenario

A cadre of professional agriculturalists is one of the most pressing needs of YAR. The professional leaders who will comprise the Ministry of Agriculture as it grows and the current leadership retires and the analysts and decision-makers who will influence the growth of the Yemeni food system to the point of diminishing dependence on foreign sources must be trained by experts. This faculty should be located where it is best able to use its talents, where it has access to some of the best thinking in the nations, and the collegial atmosphere of a full-fledged university. The development and appropriate and efficient use of such a faculty is a very significant concern to the YAR.

3.31 University Farm Location

Many factors become significant in the evaluation of where the agricultural faculty and the associated Demonstration Farm should be located. It is not our intent to dwell on this subject but observations by some of the leaders of the YAR will be stated. The collegial atmosphere and the association with the influential and articulate members of the existing University of Sana's faculty is important during growth and strengthening of the posture of the developing Faculty of Agriculture. Furthermore, the agriculture in the vicinity of Sana'a is itself not insignificant. There is a very significant agriculture on soils and with climate not too different from that available at the University of Sana'a.

Because of the combination of the arguments cited above, the Demonstration Farm study team made a serious effort to design the most practical and best possible Demonstration Farm facility on the new campus of the University of Sana'a. It would be most appropriate to develop a major facility there. Other secondary facilities might be added later at other locations as needed.

3.32 Water Supply

One of the most limiting factors in planning a Demonstration Farm at the Sana'a campus is the problem of finding an appropriate water supply to irrigate an adequate area for demonstration of the multitude of crops and to provide students, perhaps as many as 800, with the opportunity to maintain and operate a parcel of land to obtain experience in irrigation, fertilization, crop selection, plant protection, and animal care, feeding, and health.

The study team considered a number of alternatives with respect to the development of water supply. This will be more fully elaborated on in Chapter 5.

The concept of water harvesting was seriously considered and reviewed with respect to local rainfall probabilities. Runoff was considered not sufficiently dependable to be source of water for the Demonstration Farm. The possibility of drilling a new well on the new campus of the University was also considered. People familiar with the local water supply discouraged us from counting on any large supply of water from an on-campus well.

After consultation with a large number of firms and individuals in and outside YARG, we concluded that an on-campus well was not likely to produce more than one or two liters per second. This is far less than the amount of water needed for the irrigation of the University Demonstration Farm.

A third alternative was moving the University Farm to another location. This was rejected because of problems of logistics. In addition, the cost of land was a consideration in appraising alternate sites.

A fourth possibility examined as a water supply the development of a well about ten kilometers from the campus and transport of water through a pipeline. This has a certain appeal although the cost of this project is high. It was identified and considered by the study team to be an option worthy of detailed consideration.

Finally, there is the possibility of a combination of an on-campus well providing a small amount of the water with supplement water from a nearby well. This would provide the opportunity to enlarge the farm to its optimum size as the faculty and student body grow in number. This last consideration appears to be the most promising of various sources of water considered. It has the added attraction of offering a reserve supply of water in case of the failure of one well or pump. Both sources of water should be proven before development of the Demonstration Farm begins.

3.33 Climatic Representativeness

The climate at Sana'a is highly variable and representative of only some areas of YAR. These factors have to be taken into account as one plans a University Demonstration Farm. Adequate information about air and soil temperature, rainfall, relative humidity, and pan evaporation was available to make reasonable estimates of means and variances to provide a margin of safety appropriate for an institution like the University Demonstration Farm. The team was conservative in the selection of options of utilization of the farm as will become clear in chapters following.

3.34 Topographic Information

Examination of the site of the University Farm indicates that the present terraces should remain in place. The consequence of leveling them could be insufficient soil depth in some portions of the area. Pipelines or open channels are needed to conduct irrigation water to the various terraces from a single outlet. The topography in the vicinity of the Demonstration Farm and within the boundaries of the University

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property lends itself to the development of an impoundment for storage of water to provide a buffer between the well capacity, pump capacity, and the intended use of the irrigated area. The demonstration of the use of a buffer in the water system could be a relatively important part of the students education, particularly in soil and water management and agricultural engineering.

The shapes and sizes of the existing terrace units will have some effect on the size and location of individual plots and the development of modules for an arrangement of these plots. This is a design consideration, the details of which can be worked out later.

3.35 Soil Descriptions

Significant attributes of soils are the texture and the depth. The combination of soil texture and depth are governing factors in the development of the water storage capacity which in turn is an important variable in the design of the appropriate irrigation program. Thus, this information should be used in the design of the irrigation system and in the design of water control practices. The soil was found to be at least 75 cm deep at all locations tested on the chosen site.

3.36 Crop Information

In the proposal which the study team has developed, an effort was made to assure that no significant crop was left out. In the general organization of the farm there will be an agronomic section comprised of a production and a research section. In the horticultural section it is believed desirable to have subsections for vegetable crops, fruit orchards, and ornamental crops. A livestock section would also incorporate some development of forages and possible rotation of fodder cereals. In the planning of land allocations for the different programs, the study team made both short-term and long-term projections and made suggestions with respect to the potentially usuable crop rotations and soil management practices.

4. THE DEMONSTRATION FARM PLAN

4.1 Constraints

Before going into the details of the proposed farm plan, some of the conditions which limit the size and flexibility of the proposed agricultural operation must be considered. It is important that the readers develop an appreciation for the perspective which evolved during the deliberations about the possible Demonstration Farm.

The Demonstration Farm design team assumed that the growth of the farm will be synchronized with the growth of the Faculty of Agriculture and of the student body. It would be an excessive load on a faculty of four or five members to operate a farm of 21 hectares. Thus, the development of plots can be postponed until a larger faculty and student body is present. However, the land and water should be available immediately. The land could be irrigated in larger blocks to establish a partitioning in an appropriate fashion and to appraise the best use of the available water. The land use patterns should remain flexible.

4.11 Water Flexibility

As has been already mentioned, one of the considerations in the evolution of the farm plan was the concept of minimizing risk. Risk reduction was deemed necessary to assure fair and impartial treatment for each of the successive groups of students who will use the facility. It would be unfair to burden random groups of students with the impact of a drought, for instance. Therefore, adequate water supply must be assured for teaching and demonstration purposes year after year. It is also important that the water utilization efficiency be maximized, that is, that the maximum amount of land is appropriately irrigated with a minimum amount of water. It is important that the students develop an appreciattion for maximizing efficiency of the utilization of the precious water resource. The farm should also have land for rainfed agriculture to be randomly irrigated as runoff or rainstorms create an adequate supply of water. These dry land areas could be used for management of grazing areas. They could be used for areas in which to study the action of tillage implements and other trials related to soil and water management. If excess water becomes available, these areas could occasionally be irrigated and operated with induced vegetation and limited utilization of the organic residues in efforts to develop varying levels of soil organic matter content to demonstrate the effect of this variable on soil tilth and management practices.

4.12 Land Availability

The detailed map of the new University of Sana'a campus indicates that the total area of the proposed campus is approximately 170 hectares (Figure 4-1). Our projection for the ideal farm area requires a maximum of 21 hectares. This farm area provides adequate space for a wide variety of agronomic crops, horticultural crops including fruit, vegetables, and landscaping and ornamental materials. Trees for firewood or construction materials could also be grown. Such an area would require a relatively

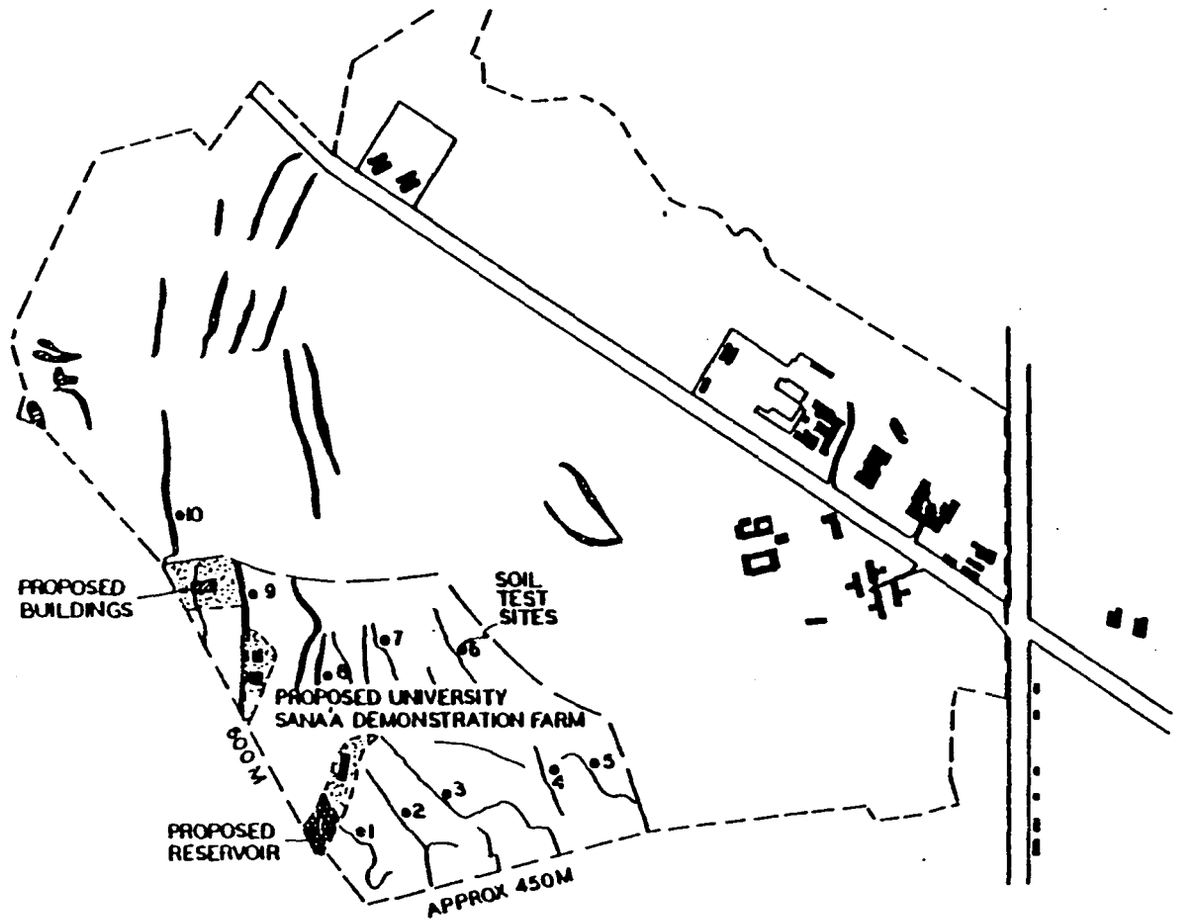

Figure 4-1: Map of Demonstration Farm

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large well, one which should produce at a rate of at least 14 liters per second (14 l/s). A combination of two wells which would produce about 14 liters per second would be acceptable. Twenty-one hectares would provide opportunities for research plots in plant and animal breeding, plant and animal protection, and plant and animal cultures as well as in irrigation and fertilization practices in addition to student plots and demonstration plots.

Another constraint on available land area might be soil depth or stoniness. The study team did not have sufficient time to make a detailed examination of the proposed site in the southwest corner of the campus (Figure 4-1). Cursory examination indicated that all terraces had soils at least 75 cm deep. Some portion of the area may prove too stony or too shallow for successful utilization. Manifestations of this constraint or further details of this constraint are in Chapter 6.

The proposed Demonstration Farm area has a series of existing terraces. The study team deemed it appropriate that these existing terraces remain in place. Plots should be arranged to fit the parcels delineated by the existing terraces. This approach is consistent with the characteristics of agricultural land use in the central highlands.

The Sana'a climate precludes the utilization of certain crops on the Demonstration Farm. For others, the climate is marginal. The design team suggests that the number of species and varieties demonstrated on the farm be maximized to the limits of the climatic constraints.

There will be other constraints on the farm plan. The area must be organized in relatively small plots to allow for the very large number of plots necessary for the many kinds of crops, the various conditions for their growth and development, and numerous agricultural practices associated with their culture. This means that special arrangements must be made for water control. It is important to make every effort to maximize the flexibility of the system and to allow relatively small plots to be irrigated individually while other plots in the vicinity are kept waterless. Simultaneously, it is important that access be provided for individual plots. Some significant fraction of the total available area will have to be allocated to roads and paths.

4.2 Analysis of Constraints

The constraints of water availability, soil quality (depth, texture), topography; climatic, parcel size must be accounted for in the farm plan. The most limiting constraint is that of water availability. If the farm is located on the new campus of the University of Sana'a, as recommended by the study team, an understanding will have to be developed between the University and the National Water and Sewage Authority (NWSA) with respect to the water rights and the priorities of the University. As the asin population increases, this constraint, if not pre-negotiated in a satisfactory and binding fashion, will become more limiting and more serious. This is one of the reasons it is important that the Demonstration Farm be developed in conjunction with the new campus so that it can have articulate spokesmen among its defenders. The battle for water will be difficult but must be concluded with vigor on behalf of the future agricultural leaders of YAR.

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The agricultural Demonstration Farm requires approximately one-seventh of the total campus. This appears to be reasonable in a country where agriculture is the number one industry. The development of effective and intelligent stewards of the nation's land resources and continuing food supply must be assured.

Living with the constraints due to soil depth and/or rockiness and the constraints associated with the existing terraces is a matter of appropriate and judicious placement of individual plots and/or related clusters of plots. The placement should be left to the implementation of the farm and should not be fixed at the present time. The study team cautions the developers to exercise great care in the selection of terraces for certain plots so as to minimize the constraints due to unsuitable soils on the existing terraces.

4.3 Basic Recommendations

The design of the Demonstration Farm depends totally on the development of a water supply. Therefore the study team recommends that the detailed design of the Demonstration Farm be postponed until after an adequate, dependable, secure water supply has been developed.

4.31 Well Development

The first step in the development of the University Farm must be the drilling, testing, and pumping of a well on the university property. The university should proceed immediately with the drilling of a well at a location on the university property identified by a competent practicing hydrologist. The site should preferably be near the southwest corner of the property.

The university should develop a second well north of the campus. The land area to be irrigated by each well can be judged on the basis of the production of the well by using the relationship that a well production of one liter per second is, in the climate of Sana'a, adequate to irrigate an area of 1.5 hectares. After both wells are in production, the determination of farm size and land allocation can be made.

The size of the land area to be developed depends on the combined production of the two wells. The allocation of the land area to agronomic, horticultural, and livestock production should be done after the well production and thus the total farm area is known. Examples of allocations are in Table 4-1.

4.32 The Second Well

The second well should be several kilometers north of the campus in the vicinity of the NWSA well fields. (Figure 4-2). There is a good probability that a well developed in this location would yield from ten to fifteen liters per second. This water should be piped to the southwest corner of the University Farm site. Chapter 5 provides recommendations for the development of a pipeline and transport system to water from this second well to the farm.

After the development and testing of a second well, it will be possible to proceed with the development of corresponding land areas which can efficiently utilize the production of both wells. Examples of allocations are in Table 4-1. It was concluded that approximately 21 hectares of farm area can be irrigated with water from the two wells at a production of 14 l/s. Of these only about 13 hectares are actual plot area. If the

Table 4-1: Allocation of Demonstration Farm land (as hectares, underlined numbers) to various uses. Total area of the farm will depend on water supply. Differing allocations of land are recommended depending on the amount of water available. Water supply values are in liters per second, (l/s).

WATER SUPPLY (l/s)	FARM* AREA	AGRONOMY REG. (3)	AGRONOMY SPEC. (4)	HORTICULTURE FRUIT (5)	HORTICULTURE VEG. (6)	HORTICULTURE F&L (7)	(1)	LIVESTOCK	SM & I (2)
14	21	2.4	0.6	1.8	3.0	0.5		12.0; 50 sheep, 30 goats, 16 cows, 250 layers, 250 broilers	0.7
7	10.4	Yes	2.2 (8) Yes	1.0	1.3	0.3		5.2; No's ½ of above chickens same	0.4
3.5	5.2	Yes	2.0 Yes	Yes	2.2 Yes	Yes		1.0 Same proportion, reduce numbers	No
1.7	2.6	0.8	No		Yes	No	1.5	0.3 Reduced numbers	No
0.9	1.3	0.3	No	Yes	Yes	No	0.7	0.3 Reduced numbers	No

(1) Forestry and Landscaping
(2) Soil Management and Irrigation
(3) 14 crops, 18 plots/crop, 5x10m plots; cereals, pulses, forges, etc.
(4) 6 crops, 12 plots/crop, 5x10m plots; genetics, oilseed, fiber, etc.
(5) 10 crops, 12 plots/crop, 5x20m plots; grapes, almonds, etc.
(6) 30 crops, 12 plots/crop, 5x10m plots; salad, root, cole, fruit
(7) 10 crops, 6 plots/crop, 5x10m plots; shade, wood, shrubs, flowers, turf
(8) Written in this fashion means the number between arrows is split between adjacent columns. for example 2.2 means some kind of partitioning of this area (2.2 hectares) between regular agronomic crops and specialty crops.
* Total area including plots, roads, paths, fences, ditches, etc. Some of the non-plot area could provide livestock feed.

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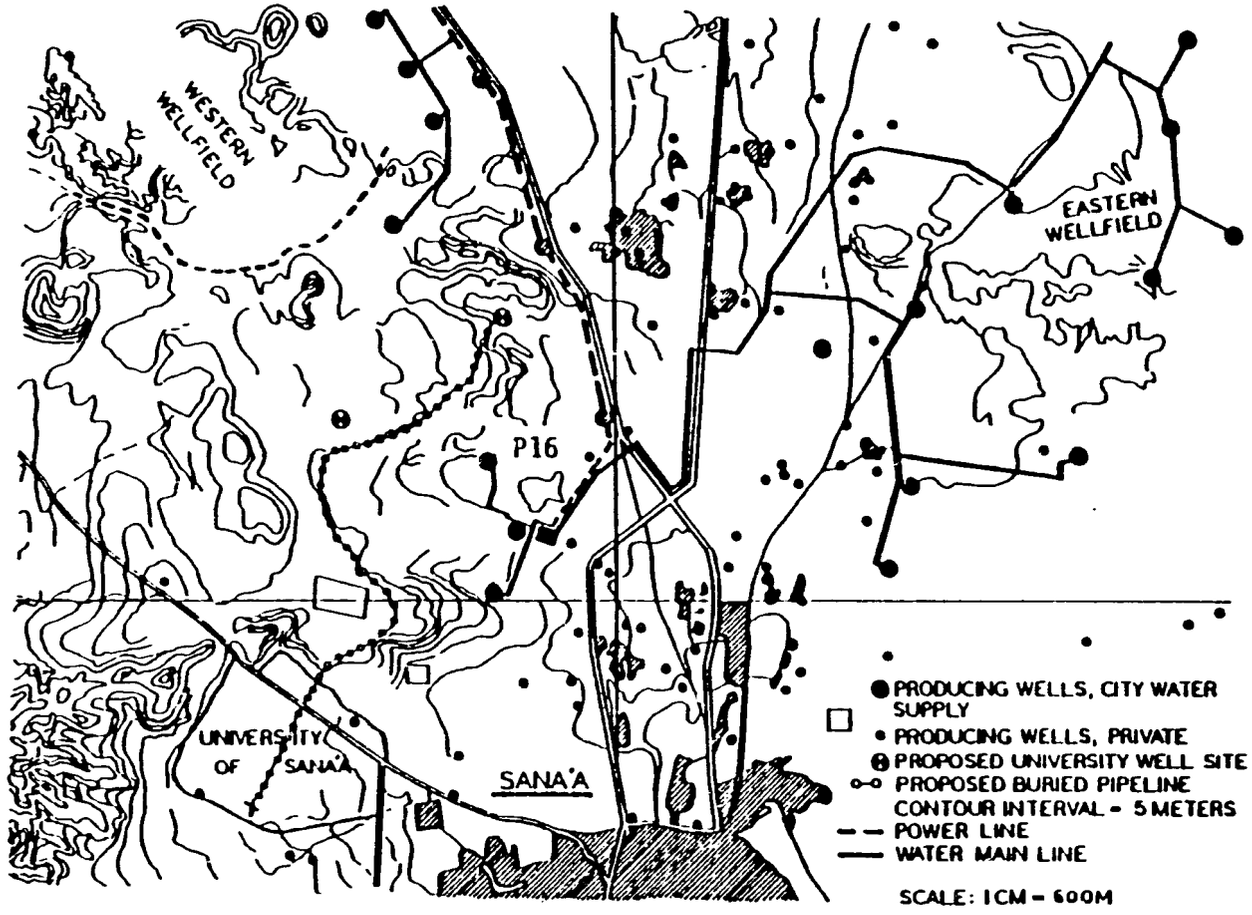

Figure 4-2: Off Campus Well Location

combined well production is 7 l/s, the irrigated area could be approximately 10.4 hectares. This smaller area would be partitioned differently than the larger total farm area. Approximately half of the total area, about 5.2 hectares, would be allocated to various aspects of livestock production demonstrations. The other half would be devoted to the culture of agronomic and horticultural crops. A small irrigated area could be allocated to a soil and engineering practice area to provide students with the opportunities to study soil tilth and tillage and to examine various water management techniques; border check, basin, rill, furrow, flood, sprinkle, drip, trickle, etc. Additionally, this area might be used to demonstrate the effects of poor water quality on soil characteristics.

4.33 Water and Land Use Matrix

The relationship of land use to water supply is shown in Table 4-1. Farm sizes ranging from 21 hectarers down to 1.3 hectares are considered in a series of steps. The major emphasis is on horticultural crops when the water supplies are small.

The study team considers the 11 hectare farm to be the minimum size acceptable for an agricultural faculty enrollment of 800 to 1,000 students. The optimum size is the 20 to 22 hectare farm. It needs a water supply at the rate of 12 to 15 liters per second.

It is important to understand that these are suggestions. The Faculty of Agriculture should retain the maximum flexibility so that land use can be planned which is consistent with the needs of the students enrolled in their classes.