XD-ABU-461-A
47607

THE HASSAN II INSTITUTE OF AGRICULTURE AND VETERINARY MEDICINE

Institutional Development with International Partnership

AN IMPACT ASSESSMENT STUDY

Prepared by

John H. Eriksen
Lawrence Busch
Jack W. King, Jr.
Jim B. Lowenthal
Rolland P. Poirier

April 1986

24

THE HASSAN II INSTITUTE OF AGRICULTURE AND VETERINARY MEDICINE

Institutional Development with International Partnership

AN IMPACT ASSESSMENT STUDY

Prepared by

John H. Eriksen
Lawrence Busch
Jack W. King, Jr.
Jim B. Lowenthal
Rolland P. Poirier

April 1986

25

THE HASSAN II INSTITUTE OF AGRICULTURE AND VETERINARY MEDICINE

Institutional Development with International Partnership

I. AN HISTORICAL INTRODUCTION TO THE INSTITUTE AND THE AID ASSISTANCE PROGRAM

The institutional building process leading to the establishment of the Hassan II Institute of Agriculture and Veterinary Medicine, Morocco's largest and only graduate level school of agriculture and veterinary medicine, began with the issuance of a directive in the Throne Speech of His Majesty Hassan II on March 3, 1963. At this time, His Majesty envisaged the creation of a National Institute of Agriculture which would be composed of scientific disciplines relevant to Mediterranian agriculture, would train both Moroccans and foreign students, and would deliver professional degrees fully equivalent in rigor to those granted by European universities, i.e., the Ingenieur Agronome degree.

This Institute was to respond to the pressing need in Morocco to train government agricultural agents in a local institution. Prior to 1962, all higher level agents in agriculture, with the exception of a very limited number trained in Meknes at the National School of Agriculture, were trained abroad. In 1962, the opening of the Lycee Moulay Youssef's preparatory course in agriculture (for entry into French agricultural universities) permitted Moroccan students to reduce their training abroad from three to two years. The creation of the Institute was seen as the next logical step in the process of "Moroccanizing" agricultural education in that training of higher level agricultural agents, i.e., Ingenieurs de l'Agriculture Marocaine, would now take place entirely in Morocco. The Institute was seen to offer the following advantages for the country:

1. Agricultural students would no longer be dispersed in many countries, often distant from Morocco, for training but would be in Rabat under the direction of the Ministry of Agriculture and Agrarian Reform (MARA);

2. Their training would be made more efficient and profitable in that they would no longer have to devote time to the problems of adapting to another country before and while studying abroad;

3. The Institute's programs would be more adapted to local conditions and the students' training would be more sharply focussed on Moroccan agricultural problems;

4. Higher level agricultural training in Morocco would ensure greater uniformity in agricultural agents and eliminate the problems and misunderstandings engendered among Moroccans trained under widely differing foreign systems;

5. The Institute would be able to train not only the necessary agricultural agents for the sector but also the future Moroccan professors to replace the European expatriates then dominant in the local educational system and to ensure a stable cadre for all Moroccan agricultural schools;

6. The Institute was seen from the start as linking essential functions in agricultural training and research for the accelerated development of Moroccan agriculture.

The Institute thus embarked upon its development process with a clear mandate issued directly by the King. It was to be a public institution under civil law and with substantial administrative and financial autonomy under the tutelage of MARA. Students were to be trained in conformance with the stated needs of the Moroccan agricultural sector, chiefly for public employment of agents, as articulated by MARA and the Institute's Board of Governors.

The Institute's Board of Governors was to be composed of the Ministers of MARA (as president), National Education, and Finance; the directors of the various services concerned with agricultural extension, research, professional training, and forestry; and the director of the national office of manpower training. Program development and content at the Institute was similarly to be directed by an Advisory Committee composed of senior representatives of public and parastatal agencies, Institute faculty, and appointed members from the private sector.

The Institute Director was to be named directly by the King and was to be the executor of decisions taken by the Board of Governors. He was legally authorized to undertake all necessary actions in his own name and to represent the Institute vis-a-vis the State and with respect to both public and private agencies at all levels. The Director was to be given authority to appoint all Institute faculty and other personnel, with the concurrence of the Minister of MARA, and to contract with outside parties within the statutory limits set by MARA and the Ministry of Finance. Financial support for the Institute was seen from the outset to come from four sources: direct government budgetary support, payments for Institute services rendered to clients, revenues from farms and other facilities under Institute control, and project support negotiated with foreign aid donors and other external sources.

The Institute began initial instruction for entering students in 1966 in collaboration with the Mohammed V University faculty of science and using classrooms and laboratory facilities at the university. The Institute's main campus in Rabat was constructed between 1965 and 1968 with French assistance. Early foreign donor support for the teaching and research programs was provided by European donors, principally France and Belgium.

Initial support for the Institute from American sources started in 1969 when the Agency For International Development (AID) and the Institute entered into the first of three successive projects. The first project (and all succeeding

ones) have been implemented through contractual relationships between the Institute and/or AID with the University of Minnesota. Initial goals were to enable Morocco to "improve the quality of its higher education in agriculture by providing exposure to modern teaching, research, and problem-solving methods and to provide highly trained Moroccan manpower to assist in the development of the agricultural sector". The purpose of the project was to assist the Institute in planning its curriculum and in developing Moroccan advanced teaching and research capabilities in soil and plant sciences relevant to Morocco's agricultural development needs.

Priority orientation in teaching and research under the first project was given to the needs of the third-cycle students, i.e., students in the fifth and sixth years of their six year program, training for the Ingenieur d'Etat degree, a degree roughly equivalent to an American Master of Science degree. Additional stress was put on the training of ten Moroccan faculty members for the two departments through Ph.D. training programs in the United States. Less attention was paid to instruction for second-cycle students, i.e., students in their third and fourth years studying for their Ingenieur d'Application (or Bachelor of Science) degrees.

The Institute, in the decade of the 1970s, saw both the first fruits from its local degree program (with the first class of six students graduating in 1972) and an enlargement of its training and research mandate. In 1973, both the Institute's program and the AID project's scope were enlarged to include horticulture. In January 1974, the program was broadened to include veterinary medicine, making the newly titled Institute of Agriculture and Veterinary Medicine one of the few examples in the world of a school combining full curricula in veterinary medicine and agricultural sciences in the same program and with students sharing a common body of coursework and practical field studies during their first two years.

In January 1974, IAV's faculty were authorized by the King to begin preparations for a graduate program which would result in the granting of a Moroccan Doctorate in Science. Although the first of these doctorates was not granted until 1984, the possibility of such a program gave additional impetus to the Institute's collaborative program with AID and the University of Minnesota. The efforts to accelerate the process of training Moroccan faculty to the American Ph.D. level and to deepen IAV's capacity to conduct quality agricultural research became more intense and involved many more Moroccans in participant training programs at American land grant institutions. Moroccan candidates in American Ph.D. programs rose from a single student studying soil conservation in 1972-1973 to 99 students having studied or presently studying for their Ph.D. degrees in 14 fields in 1986, with 65 of those having already finished their comprehensive preliminary examinations. Twelve of these candidates have already completed all requirements for and been awarded the IAV Doctorate in Science. In addition, the three successive AID projects have permitted the training of 25 Moroccans to the Master of Science level and the supplementary instruction of 190 Moroccan third-cycle students in various scientific fields at American land grant universities.

Over the period from 1970 to 1986, the Institute's program gradually became more diversified with course offerings added in such fields as food technology, biochemistry, rural engineering, surveying, agricultural machinery, and marine

science. IAV has also continued to supply student candidates for the Ingenieur d'Application degree to the National School of Forestry (ENFI) in Sale and the National School of Agriculture in Meknes. Finally, in 1982, IAV's Horticultural Center in Agadir opened its doors as the first major agricultural school in southern Morocco.

In sum, then, the Institute has evolved in the space of two decades from twelve students taking their basic science training from non-Moroccan faculty in temporary facilities at Mohammed V University to its present status with approximately 2,300 Moroccan students and 346 faculty members (of which 85 percent are Moroccans) on its own campuses in Rabat and Agadir. IAV now offers the Moroccan equivalents of the American B.S., M.S. and Ph.D. degrees in agriculture and a doctorate in veterinary medicine. In addition, it trains approximately 250 non-Moroccan African students under the same conditions as its Moroccan degree candidates -- and pays the scholarship costs of all of these students from Government of Morocco (GOM) budgetary allocations.

II. THE FACTORS IDENTIFIED AS INSTRUMENTAL IN THE SUCCESS OF THE INSTITUTE TO DATE

In reviewing the evolution of the Institute, the impact assessment mission was impressed by the astounding growth and development in instructional and research programs, trained Moroccan faculty, and the size of the student body. In the short span of twenty years, IAV has grown to a size and complexity in operations which equals or exceeds most of the American land grant institutions. It has done so while building four very credible degree programs and developing a Moroccan faculty essentially from the ground up. As such, the Institute is one of the premier examples of institutional development in agricultural education in Francophone Africa.

The logical questions we posed to Institute faculty and students, AID staff, University of Minnesota resident professors, and other people in public and private life in Morocco were:

1. How was all this growth and development achieved so quickly?

2. What were the key factors in the success of the Institute to date?

After sorting through and digesting the contents of well over 200 individual interviews conducted in January and February 1986, the team ascertained that the following factors (in priority order) have been instrumental in the success of the Institute.

1. The Institutional "Sense of Mission" and the Commitment to a Uniquely Moroccan Institute

One of the things which was most evident to the team members was that IAV in 1986 is not a carbon copy of the idealized American land grant university— i.e., based on the classical American teaching, research and extension model.

It is a unique hybrid institution which has been built on the foundation of a geniuinely Moroccan sense of what is appropriate for Morocco in undergraduate

and graduate education in agriculture. The Moroccans decided for themselves exactly which elements of the higher education systems of United States, France, Germany, Belgium, and several other countries were worthy of adoption and incorporation into their evolving Institute. This process of investigation, evaluation and adoption/rejection of outside elements has given the Institute both a feeling of uniqueness and an enormous esprit de corps among faculty, administrators and students.

2. The Leadership of Certain Individuals in Institutional Development

The Institute has benefitted during its first twenty years from an unusual degree of continuity in leadership from several outstanding individual leaders.

The second IAV Director, Mr. Abdallah Bekkali, held his position for eighteen years. During much of this time, he held a joint appointment as the Director of the Office for Agricultural Education in the MARA and thus had substantial influence over the evolution of the entire system of agricultural education in the country.

It is evident that Mr. Bekkali's unique style of personal leadership allowed him to defend vigorously the Institute's mandate and interests vis-a-vis outside and competing individuals and agencies. At the same time, he allowed his carefully selected and highly motivated faculty members the latitude to develop their own skills and contribute to the Institute's development -- often through rigorous and extended debates on controversial issues with the Director himself. Finally, Mr. Bekkali started investigating the merits of the American system of higher education in agriculture as early as 1962 and was thoroughly grounded in what could be expected from cooperative endeavours with land grant universities when he assumed the Directorship in 1966.

Other leaders have also contributed to the Institute's intellectual development and attitudinal orientation. Mr. Paul Pascon, the late Director of the Institute's Rural Development Division, contributed enormously to development of the unique system of practical field exercises -- or "stages" -- in which students seek to utilize the observational and analytical skills they have developed at the Institute in actual village situations during each of their first four years of study. The prevalent attitudes among faculty and students, that they must remain close to the agricultural conditions in Morocco if their teaching and research are to be relevant and that such work is best conducted in multidisciplinary groups, can be directly traced to Mr. Pascon's influence.

Finally, the leadership of individuals like Mr. Larbi Firdawcy, the Institute's current Secretary-General, in bridging the generational gap between the older leaders of the 1960s and 1970s and the emerging leaders of the 1980s and beyond should not be overlooked. The ability of Mr. Firdawcy, himself a product of the educational reforms in France in the late 1960s, to play this tricky and difficult role of transition figure in articulating new ideas and carrying on the process of self-appraisal has been critical to the evolving institution.

3. The Selectivity Displayed by the Institute in Choosing Faculty and Students

IAV has been particularly fortunate in being able to select from among the best available secondary school graduates for its students. Unlike the situations in many other countries where agricultural higher education is often viewed as the undesirable last alternative for many students, competition for admission to the IAV program has been very keen. This appears to be, in equal parts, a function of IAV's age -- i.e., it is one of the older Moroccan institutions of higher education -- its reputation for high quality education, and the certainty students have had until recently of job placements after graduation. Moreover, the rigorous selectivity in the academic program continues throughout a student's career with a strict rating system for overall performance and end-of-the-year examinations.

The faculty members, too, are highly selected at IAV. Former Director Bekkali and senior faculty members set high standards for teaching and research performance from the start and these standards have been consistently applied ever since. Faculty have been selected not only for their academic merits but, in part, for their willingness to take the initiative, to seek aggressively research support, and for their commitment to the Institute.

4. The Institute's Commitment to Quality and the Drive for International Recognition

The assessment team was enormously impressed by the willingness displayed by both IAV's founders and its present faculty to base teaching and research programs on accepted international standards of content and quality. The IAV orientation has consistently been in the direction of degree requirements which are at least as strict and comprehensive as those of top-rated American and European agricultural universities. Doctoral committees and final degree granting reviews at IAV are directed and staffed by distinguished international and Moroccan professors. Finally, the IAV faculty's research outputs are published in international referreed disciplinary journals to assure recognition, relevance and high quality.

5. The Institute's Degree of Autonomy in External Negotiations

From the start of IAV operations in 1968, its formal mandate provided for a very considerable degree of autonomy in daily operations and long-term planning. However, considerable variances often exist between formal grants of authority and the realities of daily control, with real power being held by supervisory ministries or national financial authorities. In this case, under the leadership of men like Mr. Bekkali and Professor Pascon, IAV managed to preserve and enlarge upon the Institute's initial degree of autonomy in its formative years by utilizing informal networks of supporters and contacts to defend the Institute's budgets and perogatives. This tradition has been upheld admirably by IAV administrators under the present considerably straitened economic conditions in Morocco.

The leadership at the top has had a cascade effect on the IAV faculty. It has allowed faculty members to show high degrees of skill and aggressiveness in

identifying and obtaining important resources from outside sources and in developing a unique style in institutional operations.

6. The Incremental Nature of Institutional and AID Project Development

We believe that IAV, AID and the University of Minnesota have been well served by the incremental nature of IAV development and AID project assistance. As mentioned above, IAV administrators have been careful in developing necessary preconditions at the Institute before expanding the teaching and research programs. Both course and degree offerings have been added only as institutional capacities have been developed to handle them.

Similarly, AID assistance has been incremental, with the University of Minnesota staff initially participating only in soil sciences and agronomy and then only in collaboration with similar assistance from Belgium. Only as the proferred American assistance demonstrated its credibility and relevance to IAV's development in the initial disciplines were targets of opportunity explored and additional assistance provided in veterinary medicine, forestry, animal sciences, and other disciplines.

This approach allowed project development from the bottom up, with the result that the University of Minnesota has only recently become involved in providing IAV faculty instruction in university administration at the University of Minnesota. Given that expertise on how the academic departments actually function at IAV and what constrains their operational efficiencies developed gradually over fifteen years, the present assistance in university adminstration is much more relevant and effective than if it had it been imposed on the Moroccans in the early years of project assistance.

7. Efficient Management of Multi-Donor Resources and those of Other Domestic Agencies by Moroccan Administrators

Since IAV's evolution has depended heavily, in terms of both financial and human resources, for its success on external donor support, effective management of these diverse resources has been absolutely essential. IAV administrators have proven themselves very effective in negotiating effective support without relinquishing effective control to the donors of either individual departments or the entire IAV program to the donors. Moreover, they appear to have succeeded admirably in resolving potential conflicts between donors with different approaches to higher education and in providing leadership which facilitated coordination between expatriate staff on the campus.

8. The Long-Term Commitment by AID and American Universities to the Institute's Development

One of the most striking elements of the IAV/AID/American universities relationship has been its continuity. We found the evidence of AID's "stick-to-it-iveness" in this case very refreshing. The fact that substantial assistance continued to flow through three successive projects with IAV over fifteen years, despite a very negative first project evaluation and several major differences of opinion on how IAV should evolve, is remarkable. We known of few other instances in AID's institutional history of support for higher

education where assistance has been both so lengthy and continuous.

The commitment of the participating American land grant universities has similarly been outstanding. Aside from certain instances of 211d assistance to higher education during the 1960s and early 1970s, we are not familiar with any other case where so many universities have participated in training such a group of students from a single country. Site visits to the university campus and interviews with over twenty faculty members and adminstrators confirmed the authenticity of this commitment.

9. The University of Minnesota's Role at the Institute and in Project Development

The University of Minnesota's role as the lead university in the project over the entire fifteen years of assistance and collaboration must set some record for American higher education. The dedication of Minnesota faculty and staff to the success of IAV is obvious in many ways. The length of stay for staff resident in Morocco has been considerably longer than the normal sabbatical plus one additional year of departmental leave. Several faculty members have served more than one tour at IAV -- often with several years between tours -- and have served as faculty advisors in Minnesota during the intervening periods. Moreover, the university appears to have gone to considerable lengths to assure that faculty members serving in Morocco would not be penalized in their academic careers for their participation in the project — and, in fact, at least, two such faculty members received tenure at Minnesota during or shortly after serving in Morocco. In addition, one has recently been promoted to full professor based almost entirely on academic achievements in Morocco.

The university's role in arranging and coordinating the participation of over thirty other land grant institutions in training and research efforts with IAV is also to be highly commended. Since the number of Moroccans studying at any single American institution, other than the University of Minnesota itself, is relatively low — i.e., one to five — placement and supervision of students is a labor-intensive and complex task which could not be feasibly accomplished by IAV from Morocco. Furthermore, we doubt that the recent transition from issuance of American Ph.D.s to the granting of only the IAV Doctorate in Science to Moroccan degree candidates, even where the bulk of their graduate work was accomplished at American universities, could have been successfully affected without the participation of the University of Minnesota as an intermediary with its sister institutions.

10. The Entrepreneurial Attitudes of Institute Faculty in Seeking Resources and in Building Support Constituencies

The history of American land grant institutions reveals a strong dose of entrepreneurial opportunism. Deans and researchers at these universities aggressively sought federal, state, county and private funds for agricultural research (Busch and Lacy, 1983; Rosenberg, 1976). They actively pursued potential clientale in agriculture and government throughout the country and this activity, without question, contributed to their success by establishing for their universities clear, definable, and mobilizable constituencies.

This same type of behavior appears quite markedly among administrators and faculty at IAV. Instead of contenting themselves with aid from a single external donor, they have actively sought to create scientific and financial linkages with a wide range of donors, thereby reducing their dependency on any particular one. Instead of acquiescing to static annual budget proposals from the government, they have, with a few exceptions, argued for significant budget increases. Finally, they have been willing to push the bureaucracy to its limits, rather than passively accepting administrative decrees that have been handed down.

11. The Institute's Organizational Structure and Flexibility in Program Development

IAV has developed an organizational structure that is unique to Morocco in several ways:

a. Agricultural sciences, veterinary medicine, and forestry studies are united in a single institution, thereby creating a single strong center capable of articulating its needs to government officials.

b. IAV, with over 350 faculty and 2,300 students, is a very large institution by both Moroccan and international standards. If it were an American land grant university, it would rank in the top ten in size.

c. IAV has gradually developed something approximating a matrix organizational structure. Thus, lines of authority appear to be quite flexible resulting in sharing of resources and information when appropriate.

d. The structure of the Institute permits and encourages scientists to take the initiative. For example, a scientist may initiate negotiations for funding a particular research project by going directly to a funding organization.

e. Extramural funds are managed separately from direct government budgetary support. A special account, managed directly by IAV, is used for this purpose. Thus, these extramural funds represent a supplement to IAV's budget rather than a reduction in direct government support.

12. The Integrated Curriculum Model

The curriculum at IAV is unusual in that it exposes students to virtually the full range of agricultural sciences before focussing on a particular specialty. As such, it differs significantly from the American and French models in which students develop competence within a relatively narrow area. Given Morocco's overall level of agricultural development and the likelihood that students may be placed in positions somewhat removed from their particular specialization, this appears to have been a wise development decision.

In addition to classroom instruction, IAV has a series of progressively more

difficult field training exercises -- i.e.,"stages" -- that all students must successfully complete. This program exposes students to the realities of Moroccan agriculture and village life and encourages them to apply theoretical knowledge obtained in classes to real problems as members of multidisciplinary work teams.

These curriculum innovations have had the twin effects of creating a real espirit de corps among the students and establishing IAV's reputation as a unique national institution.

13. The Openness of Institute Personnel to Permanent Evaluation Linked to Quality

IAV administrators and faculty have shown themselves to be exceptionally open to evaluation by outsiders. Given the number of donor agencies involved in various aspects of the IAV program, frequent evaluations are perhaps a fact of life at IAV. Nevertheless, we were impressed by the receptivity of IAV personnel to our questions and comments. And, we understand that this behaviour is reflective of IAV's general attitude toward continual self-evaluation, adaptation of useful outside ideas, and improvement of the existing program.

14. The Institute's Growth During a Period of Expansion in the Moroccan and World Economies

Though it was most certainly not planned that way, IAV grew during a period of relatively sustained economic growth in both the Moroccan and international economies. This was of enormous importance in that it permitted the Institute to grow without having to compete for an increasing share of a static or shrinking economic pie. This was true both for the domestic budget and foreign aid availabilities. It also meant that Institute graduates could be guaranteed immediate employment by government agencies and parastatals and that faculty members could find support for further study, for research, and for special needs with relative ease.

Conversely and unfortunately, the Institute has now reached its maximum size as world and domestic economies have slumped. Adjusting to static or declining resource availabilities will not be an easy task.

15. A Supply of Students from a Well-Developed Secondary School System

Finally, it must be pointed out that the selectivity which IAV has been able to sustain in student and faculty recruitment has been made possible by the prior existence of a widespread and quality secondary school system. For example, the fact that the Moroccan secondary school system produces a large crop of graduates with diplomas in science and/or mathematics allows IAV to require that type of diploma as a precondition to application for admission to the Institute. This factor should not be underestimated since IAV in many years denies admission to more potential students with science and/or mathematics diplomas than are actually graduated from the secondary schools of many other African countries.

III. DIRECT INDICATORS OF THE INSTITUTE'S IMPACTS ON THE MOROCCAN AGRICULTURAL SECTOR

Although IAV, both directly and indirectly, is beginning to influence the agricultural sector in Morocco and the wider world, the team wishes to underline here as a preface that IAV is still a very young institution. The first Doctorates in Science were only granted in 1984 and the process of "Moroccanizing" faculty positions is not yet complete. Faculty with their doctorates have just begun their academic careers and most graduates in government service and the private sector have been in their jobs for considerably less than ten years.

These facts, therefore, have been considered by the team members in assessing the impacts of IAV to date. We feel that IAV is now generating the types of impacts on the sector that one would expect from an institution less than fifteen years after graduating its first class. In this sense, impacts to date are clearly superior to those that were evident at American land grant institutions ten to twenty years after their founding.

1. Impacts Through the Process of "Moroccanization" and Acceptance of the University Community as a Valuable National Resource

The major direct impact of IAV on the agricultural sector in Morocco is quite simply that a quality agricultural institution now exists in the country, where none existed twenty years ago. Moroccans constitute 85 percent of the administrators and faculty at the Institute and the process of "Moroccanization" will be complete within five years.

For the first time in Moroccan history, therefore, a university-level agricultural institution exists which is staffed by Moroccans, focusses on solving Moroccan crop and livestock problems, and is recognized by both Moroccans and outsiders as a valuable national resource. IAV now ranks as the equal or superior of many universities in the country with far older histories and is unique as a repository of agricultural knowledge.

The impacts from this development in cost savings to the Government of Morocco alone in being able to train virtually all agricultural students at the B.S. and M.S. levels in-country have been substantial. Access on a full-time basis to Moroccan agricultural specialists for consulting and research activities, as related below, is also an impact and a direct consequence of IAV's growth and development in the past fifteen years. IAV's existence has also made possible for the first time development of linkages between the separate Moroccan agencies charged with agricultural education, research, and extension.

Although these linkages are still preliminary in structure and long-term relationships are not yet fully articulated, there is now enormous potential in Morocco for a well-integrated system for agricultural planning and development at all levels and with all local crops and livestock.

2. Impacts Through the Formation of Professional and Alumni Associations and the Creation of a Moroccan Scientific Community in Agriculture

In creation of a Moroccan scientific community in agriculture, IAV has taken the lead in the establishment of both an IAV alumni association and many professional associations grouped by discipline or around agricultural problems.

The IAV alumni association is fast becoming an important link between agricultural sector activities, government administrators, and the IAV -- with important impacts in all three directions. Feedback from alumni has already led to changes in IAV's curriculum directed at producing graduates with more practical experience in agriculture and more prepared for positions in the private sector. The alumni association has also developed into a significant support group vis-a-vis the government in advocating both adequate budgetary support for IAV and better ways of linking agricultural education with research and extension activities. Finally, the presence of an active alumni association promotes the rapid dissemination of new ideas and technologies in the agricultural sector for discussion, refinement and promotion to crop and livestock producers.

Similarly, newly created professional agricultural associations, like the National Association for Animal Production, have been instrumental in bringing debates on national agricultural problems outside the corridors of government agencies and into the public arena. For example, the aforementioned association sponsored a well-attended national debate on the pros and cons of using Moroccan barley and other foodgrains for livestock feeding versus utilization for direct human consumption. It is also participating in ongoing discussions on the roles of imported beef breeds and artificial insemination in the development of a Moroccan beef industry.

In another field, the National Horticultural Association, in collaboration with IAV faculty in Agadir, has been working on a process for local production of high quality potting materials for vegetable seedlings. Previously, all of these potting materials were imported from Europe at an annual cost of approximately 30,000,000 dirhams. With this new collaboration, a cheaper process has been found to produce a local substitute for the imported materials, testing is nearly completed, and a local private company will be formed to produce the new potting materials for local vegetable growers.

3. Impacts Through Faculty Members on Sectoral Planning and Project Development

As might be expected at this stage in IAV's institutional development, the individual impacts made by faculty members in agricultural development are somewhat easier to isolate than those made through associations and other groups.

In sectoral planning activities, for example, the IAV's present director, Dr. Sedrati, is the president of the livestock sub-sector analysis committee and individually has had a major voice in changing legislation to allow Moroccan veterinarians to open private practices and to put all government work

on a specific contractual basis in the future. Similarly, Mr. Larbi Firdawcy, the IAV secretary-general, is a ranking member of the national committee on human nutritional planning. As a final example, Mr. Driouchi Ahmed, a doctoral candidate and faculty member at both IAV and ENA, has recently completed work on an AID-sponsored study of impacts of government agricultural pricing policies in Morocco which proposed major recommendations for policy changes.

With respect to sectoral activities and project development, the formal linkages between IAV researchers and the INRA/MIAC dryland agricultural project in Settat have resulted in greater emphasis being placed upon integration of crops and livestock in the area. This is the result of joint research which showed, among other things, that local farmers deliberately overplanted their grain fields and then thinned their plant stands to desired densities while using the thinned plant materials as early rainy season feed supplements for their animals. When properly evaluated, this system produced greater overall returns for the farmers than the one initially proposed by the project and based strictly on agronomic considerations.

In another instance, investigations by IAV faculty members uncovered a company in Agadir selling banana suckers with heavy nematode infestations to unsuspecting local farmers. When presented with the evidence, the government stepped in to close down the company and now approximately 5,000 disease-free banana plants are being produced in Agadir annually by the producers association itself.

With establishment of a highly competent soils science department at IAV, faculty members have been heavily involved in the first widescale soil mapping exercises in Moroccan history and have set up a soil analysis laboratory for local farmers. Similarly, other faculty are presently conducting studies of the efficiency and losses from traditional underground grain storage systems and improved designs for common farmstead structures.

4. Impacts Through the Division of Rural Development

At IAV, the Division of Rural Development serves a unique function as the organizer of faculty and student activities at the development project and farm levels. Its stated purpose is to make concrete changes in the rural sector. Examples of its activities include the following at present:

a. Field work with the World Bank-sponsored Middle Atlas project centered on developing acceptable management schemes for lands held collectively for cropping, livestock grazing, and forestry activities.

b. Technical and socioeconomic research with the Gharb irrigated agriculture project to determine why new techniques proposed for cereal production in the area have not been adopted by local farmers.

c. Several water development activities where faculty members have consulted on the optimal layouts and operating procedures for both village water supplies and small irrigation perimeters.

d. An international project with the Government of Mauritania to introduce improved water lifting devices into desert oases using Moroccan artisans and techniques developed in collaboration with IAV hydraulics specialists and sociologists.

5. Impacts Through the Institute's Documentation Center and Library Resources

With substantial assistance from the United States, Canada and the FAO, IAV has developed the finest agricultural library and documentation center in Morocco. While still modest by American standards, the library and documentation center are recognized as the repository of agricultural information for the country. As such, they are integrated into a national system of information centers serving not only the universities but government agencies and the general public.

The IAV center has made agricultural information available to a broad spectrum of clients over the first full year of its operation. In the twelve months preceding the team's mission, the center had serviced almost one hundred specific documentation requests from thirty-six clients outside IAV including various government ministries, parastatals, private companies, and individual technicians and researchers. This listing -- see Annex G -- does not include use of the IAV library resources, including its large file of periodicals, by walk-in clients other than students.

We believe, as the IAV library resources grow and more clients become aware of the materials available, that this center may well become one of the most important and long-lasting contributions that AID has made to the Institute and indirectly to agricultural development in Morocco. All of the team members can cite numerous examples from their consulting experiences of programs and projects being designed without sufficient knowledge of local conditions and/or similar efforts in the same or adjacent countries. The IAV center holds out the distinct possibility that such mistakes can be eliminated in Morocco's case.

6. Impacts Through Present Students and the System of Practical Field Work

As stated previously in this report, all students at IAV are required to participate in annual field exercises as an integral part of their training. In the third and fourth years of these exercises, the concentration is on detailed analysis of constraints to agricultural production at the farmer and village levels. Students are required to work in groups to analyze the constraints and propose solutions to local problems based on their own theoretical knowledge and after consultations with their faculty advisors. These proposed solutions are then discussed in detail with the concerned local people -- both at the village and during farmer visits to IAV.

In discussing these field exercises with students and faculty, the team was convinced that many small and incremental changes have taken place in Moroccan villages as a result of this IAV program. Unfortunately, as yet, the data from notebooks of the students have not been computerized and the team did not have the time to read enough of the individual notebooks to gain any comprehensive picture of actual impacts. A thorough investigation of these notebooks, however,

would be a very instructive exercise for a researcher endeavouring to learn about farm-level constraints in Morocco and their possible solutions.

IV. INDIRECT INDICATORS OF THE INSTITUTE'S IMPACTS ON THE MOROCCAN AGRICULTURAL SECTOR

1. Impacts Through Former Students

IAV, in collaboration with ENA and ENFI, has graduated approximately 2,500 four year agricultural technicians, 300 veterinarians, and 1,000 six year agricultural specialists since 1970. Of these graduates, 75.5 percent are employed by government ministries and agencies, 13 percent are employed at agricultural training institutions, and 11.5 percent work in the private sector.

For all categories, over 75 percent of the graduates have been in their current positions for less than five years. Most have not attained sufficient seniority in leadership positions to be individually responsible for major impacts on the agricultural sector. There are, however, several examples of graduate impacts on the sector -- as detailed below -- and which we believe are early indications of the types of impacts many more IAV graduates will have in the medium term.

a. Improving Desert Agriculture

Separated from the more populous areas of the country by the Atlas Mountains, the date palm growing areas of Morocco are among the more marginal parts of the agricultural system. About 1,500,000 people depend on date palms for their livlihoods. Moreover, date palms are grown almost exclusively in oases where they form the "roof" for a complex microclimate. Under them are planted citrus trees and cereal crops. Since the 1880s, a fusarium virus, which results in the death of infected date palms, has been noted. Only in the last twenty years, however, has it assumed significant proportions. It is now estimated that 10,000,000 million trees -- or two-thirds of the total palm plantations -- have been affected by this virus.

Scientists trained at IAV and in the United States are now working at the INRA research station in Marrakech -- and its sub-stations in several oases -- to develop resistant date palm cultivars and raising cereal crop yields. They have already succeeded in producing the fusarium in vitro and in culturing date palms from tissue cultures with a 95 percent success rate. The cultured plants are infected and those that show resistance to the virus are grown out. As date palms normally take ten years to mature, it is too early to tell if the research has been successful. Nevertheless, introduction of tissue culture techniques has speeded up what otherwise would have been an extremely lengthy breeding program.

Success has already been achieved in developing an improved wheat variety for the oases. The new variety was field tested on farmers' fields where it yielded 3,000 to 3,500 kilograms per hectare, a significant improvement over the traditional varieties. Farmers are now multiplying the seed and selling it to their neighbors. At the same time, a germplasm bank of local landraces has been

established at the station to preserve displaced varieties.

b. Innovation in the Private Sector

Mr. Berriga is a 1976 food techology graduate of the Institute. After several years as a government official, he broke his contract (which then required eight years of government service) and went to work for OLEOR, a major producer of edible oils. He is now in charge of production, maintenance, and materials purchasing at OLEOR, a totally Moroccan company employing 250 workers.

As head technician, Mr. Berriga realized the potential for using wastes from the plant to manufacture soap and designed and installed that system. He also realized that substantial energy savings could be had by redesigning the oil processing system so as to use wasted heat from the cooling process to heat incoming oil. He designed, built and installed equipment to do just that, and was able to increase production speed by 50 percent as well. The Italian company that built the original equipment was astonished at the soundness of his plans and the low cost involved in the redesign.

Mr. Berriga has also been a founder of the IAV alumni association. He believes IAV's education is not yet practical enough and is encouraging reform while defending its value as an institution.

c. Improvement in Dryland Agriculture

IAV graduates are involved in many efforts to improve both crop and livestock production in the rainfed agricultural areas of Morocco. For example, the joint INRA/AID dryland agriculture project and Aridoculture Center in Settat are almost wholly staffed on the Moroccan side by IAV graduates. The researchers are actively working on a broad array of problems prevalent in the rainfed areas, including the technical and economic aspects of weed control, improved varieties and better cropping systems for forages, cereals breeding for Hessian fly resistance, soil fertility analyses to formulate improved inorganic fertilizer recommendations for local farmers, and computer modelling of wheat growth patterns tied to sixty years of weather records to limit the scope of necessary field trials.

In addition, the core group of cereals breeders within INRA -- again almost all IAV graduates -- has developed twelve new varieties of barley and wheat. These varieties are now going through the final steps in the Moroccan varietal cataloguing process and are being multiplied for distribution to cereals producers in the near future. Similar breeding programs are also underway for alfalfa and other forage varieties, and for several grain legumes.

d. Improving Capacity for Agricultural Planning

One of the major constraints to effective technical planning in regional development projects in Morocco has been the lack of soil and land capability maps for key agricultural areas. Prior to IAV, the country had no local capacity to conduct soil and land mapping and classification exercises. Both the government and donor agencies had to hire international firms at considerable expense to map specific small project areas -- i.e. irrigated perimeters.

Since 1970, IAV has produced a cadre of Moroccan soil specialists and land mappers which is now capable of handling all local mapping operations. In collaboration with IAV faculty, this group has already classified and mapped over 300,000 hectares of land in the Settat and Meknes areas, in addition to virtually all of the irrigated perimeters. This work has been particularly important in allowing provincial officials to formulate integrated regional development plans and to implement them with donor assistance.

e. Creating a Modern Dairy Industry

To be economically justifiable in Morocco, any local dairy industry must be highly productive and economically efficient. Three major components of any such dairy industry are top notch herd management, access to superior genetic materials, and modern dairy recordkeeping systems. In all three areas, IAV animal science graduates have been industry leaders.

A very high percentage of all dairy unit managers on the irrigated perimeters are IAV graduates trained in modern herd management techniques. Other graduates are serving as technicians in the dairy breeding program, which is bringing international genetic materials into the country both through importation of Holstein sires and heifers from Canada and frozen dairy semen from American artificial insemination centers. Finally, IAV graduates have strongly promoted and been responsible for the installation of a national Dairy Herd Improvement Association (DHIA) program -- modelled on the American system -- to allow herd managers to maintain adequate herd records, to compare their individual performances to a national average, and to cull inefficient cows rapidly to improve herd efficiencies.

f. Creating a National Capacity in Veterinary Medicine

Since 1971, IAV has trained and graduated just under 300 local veterinarians. These graduates have displaced the expatriate veterinarians who staffed local veterinary services through the mid-1970s. Training of these Moroccan veterinarians is heavily oriented to on-farm practice of domestic livestock and the Moroccanization has led to several changes in local veterinary practices and has saved the government money in several instances.

For example, previous treatments for liver flukes in cattle and small ruminants were administered in the spring because French-trained veterinarians assumed that such infestations occured in Morocco at the same time they occured in France. Local IAV-trained veterinarians, however, discovered that the liver fluke infestations in fact occured at other times of the year -- because of pronounced differences in rainfall patterns -- and that treatments administered in the spring were essentially useless in control of this parasite. Treatment schedules have since been adjusted in line with the findings of this local research.

g. Improving Agricultural Operations

Although IAV only graduated its first class of agricultural machinery technicians in 1982, the team heard reports all over the country about the effectiveness of these men and their immediate usefulness to both government

operations and the private sector. Not only are these technicians establishing quality programs in use and maintenance of agricultural machinery on state and private farms, they are also participating in a broad program of research and field testing of new techniques in farm mechanization. Elements of this program, which is assisted by the Federal Republic of Germany, center on improved methods for soil manipulation to improve timing of field operations at the start of the growing season in rainfed areas, investigating solar energy applications in irrigated agriculture, and increasing the efficiency of crop harvesting techniques through introduction of improved machinery.

2. Impacts Through Institute Prestige in Attracting International Interest in Collaborative Endeavours.

One of the more significant impacts of IAV's development over the last two decades is the drawing power of its growing reputation in attracting international interest in collaborative research programs and regional outreach activities. For example, Morocco was selected as one of a handful of countries in the world to participate in the AID-supported Small Ruminants Collaborative Research Support Program (CRSP) largely because IAV faculty members were willing and able to join with international researchers in studies of small ruminant breeding, production and management. Moreover, an IAV is currently serving on the international board of directors for this worldwide program.

Another example of such participation is the planning currently underway for a regional center for irrigation technology to be established in southern Morocco under the direction of IAV and Utah State University. This center is anticipated to serve as a training and research center in irrigation systems technologies specifically for technicians from both north and Sahelian African countries.

Thirdly, IAV faculty and administrators continue to provide leadership for the Association of Faculties of Agriculture in Africa. This association, which was founded in 1973, brings together seventy-two faculties and institutions of agriculture in the continent of Africa for the purpose of increasing the effectiveness and efficiency of such institutions in national and regional development. It has sponsored, in collaboration with many international organizations, seminars and workshops on a wide range of general development issues and specific problems related to higher education in agriculture. A partial listing of these activities includes:

a. A training course on "Teaching Methods in Crop Protection" for lecturers and post-graduate students from Francophone institutions in July 1977.

b. A six week course on "Pedagogic Training for Lecturers of Anglophone and Arab Speaking Countries" in 1978.

c. An AFAA taskforce on the "Integration of Population Components in the Research Training and Extension Programs of Faculties of Agriculture in Africa" in 1980.

d. A "Comparative Study of All Institutions of Higher Agricultural Education in Africa" in 1980.

e. A workshop on "The Revision of Higher Education Curricula and the Introduction of Social Sciences in Agricultural Teaching" in 1983.

f. A workshop on "The Role of Women in Rural Development in Africa" in 1983.

g. And, finally, a workshop on "Food Security in Africa" in 1984.

3. Impacts Through Publishing in International Journals and Enlargement of of the Scientific Body of Knowledge

A survey of publications listed in project reports from 1976 through mid-1985 showed 73 publications by IAV faculty. Twenty-four of the senior authors for these publication were Moroccans. Seventy-one percent of these Moroccan senior authors appeared in the last two annual reports. By far the greatest amount of published work to date (58 percent) has been done on subjects relating to plant pathology for a wide range of cereal and horticultural crops. The remainder of the papers are evenly divided between field management and veterinary medicine.

4. The Institute's Role in Regional Development

IAV activities in teaching, research and extension often have impacts beyond Morocco's borders. Unfortunately, the team's schedule and available resources did not permit observation and assessment of these activities. We have had, therefore, to content ourselves with a listing of potential indirect impacts to be fully evaluated at a later date.

Clearly, the most fertile area of indirect impacts elsewhere in Africa is through the hundreds of non-Moroccan IAV graduates who have returned to their own countries. For example, in Senegal, as observed by one team member in the context of another consultancy, several IAV graduates are now employed as crop researchers with the Senegalese Institute for Agricultural Research (ISRA). Senior ISRA researchers in March 1986 expressed great satisfaction with the results of the IAV training programs and are currently investigating ways of expanding such bilateral cooperation, particularly with respect to development of irrigated perimeters in the Senegal River Basin.

Another example of regional cooperation is in the development of appropriate technologies for Mauritanian oases. IAV faculty and local Moroccan artisans are now working at four oases in the Mauritanian desert installing and testing improved water-lifting systems and complementary irrigation technologies. This project is apparently so successful to date that the Government of Mauritania is actively seeking international donor support to extend the improved technologies to all oases in the country.

Finally, many faculty members at IAV are currently working on research projects in collaborative efforts with researchers from international research centers such as IITA in Ibadan, Nigeria; ICRISAT in Patancheru, India; ICARDA in

Aleppo, Syria; and CIMMYT in Lourdes, Mexico.

5. Unsolicited Requests to IAV for Assistance and Information from Moroccan Sources

Another way to gauge the impact of IAV on the agricultural sector is to identify situations in which individuals or organizations seek out productivity-enhancing assistance or information from the Institute. To the extent that these requests are demand-driven, i.e., they flow from needs defined by agricultural producers, they represent an indication of the value of IAV for these users. The team found two such examples of unsolicited requests for assistance. The first example, which occured during the stay of the team in Rabat, involved the visit of a group of small farmers to the office of the chairman of the Food Sciences Department to inquire about bio-gas technology. The farmers, who had heard about the research of the particular faculty member in this area, had travelled three hours from south of Settat to IAV to invite Dr. Sinhadji to visit their farms and to make recommendations on the application of bio-gas technology in their farming operations.

The second example involved the visit of a citrus grower to the Agadir Horticulture Complex to request soil analysis assistance before launching an extensive banana producing operation.

Both of these examples demonstrate the existence of an aware client population which believes that IAV can make a contribution to agricultural productivity. In the future, IAV will have to test the market value of this assistance in the interest of extending services to a wider range of beneficiaries -- see Annex C on IAV's financial status.

V. THE PROBLEM OF INSTITUTIONAL FRAGILITY

Although not strictly part of an impact assessment per se, the team members felt that the following section is appropriate for inclusion in this report. While IAV has had a very successful evolution over the last fifteen years, it is still a young and fragile institution. Given this situation we believe that both the Government of Morocco and participating aid donors should remain aware of the fact that IAV will continue to require assistance in the medium-term as administrators and faculty strive to consolidate the gains of the past and chart a future in the uncertain economic climate of the late 1980s. We have, therefore, described below, with brief commentary, what we see as the potential major problems for IAV in the period through 1990.

1. Sustained Leadership, Flexibility and Consolidation of Past Gains

IAV in 1986 is clearly an institution in transition, passing from a period of rapid initial growth and development under charismatic leadership to a period of maturity as a large and complex agricultural university. The generation of leaders who brought IAV to this point in its history is rapidly passing from active participation in Institute affairs. The new administrators and faculty, under the leadership of Dr. Sedrati, are faced with the challenges of creating administrative systems to run the larger and much more complex institution while preserving the measure of flexibility in daily operations necessary to inspire

full participation by faculty and students in IAV affairs. Given the uncertain economic conditions in Morocco at present, a successful transition is by no means guaranteed and we believe there will be ample scope for creative donor assistance in the field of university planning and administrative systems.

2. Effective Control over Institute Research Activities

As implied above, a large percentage of the funds available for IAV research is effectively tied to donor projects and other externally financed programs. To date, IAV researchers have used these funds creatively in research activities. However, the fact remains that IAV itself neither generates nor controls any substantial quantity of research monies and the Government of Morocco is unlikely in the medium term to be able to supply such funds, given its debt repayment and other macroeconomic problems.

As the Institute continues to evolve, we see two potential problems in this situation. First, promising and highly motivated faculty members will be increasingly unable to secure sufficient funding to carry on their individual research programs and therefore will become increasingly disillusioned with the prospects of academic life. Second, IAV will be unable to control the directions of its overall research programs due to declines in the total availability of aid funding for Morocco. It is likely that aid donors would not be sufficiently comprehensive in their appreciation of agricultural problems in the country to fund certain areas of needed research.

We do believe that one possible solution to this problem is the creation of a donor-supported fund that would constitute an effective endowment for future IAV research programs.

3. Local Budget Problems and Coverage of the Institute's Recurrent Costs

Due to a problem of political stalemate between former IAV director Bekkali and the Ministry of Finance, IAV's operating and equipment budgets failed to keep pace with the needs of the Institute -- i.e., the budget was static or declining in real terms during the period from 1979 to 1984. Dr. Sedrati, the present director, has reopened negotiations and has promoted major increases in the Institute's budget. He has also taken steps to streamline the operations of the Institute's three farms -- which were millions of dirhams in debt -- and they will turn a small profit this year. Finally, he is endeavouring to unify IAV's accounting systems and improve financial management as an essential step to future planning.

Even with these constructive steps, however, the fact remains that the Government of Morocco contributions to the Institute's total annual budget are limited. Excluding government contributions to the investment budget and donor assistance, the total budget is composed of four parts: the operating budget— 87 percent of which is personnel salaries, receipts from sales and services, external grants, and supplementary appropriations in 1984/1985. The supplementary appropriations are always decided upon late in the year, making it impossible to forecast for purposes of planning and guaranteed expenditures. The 1985 budget contributed from all Moroccan sources -- i.e., exclusive of external support of any kind -- is only 50,000,000 dirhams, a sum estimated by Institute

administrators to be at least 10,000,000 dirhams short of what is necessary to fund adequate IAV operations.

What is most disconcerting at present, however, is that IAV would essentially be unable to function as a training and research institution in 1986 if external assistance grants -- in cash and kind -- were to be withdrawn or reallocated to other activities in Morocco. IAV administrators, moreover, are the first to admit that, given the uncertain economic conditions in the country, there is virtually no hope that the Government of Morocco could sustain the full recurrent costs of Institute operations at any time in the foreseeable future.

While, the team's purpose was not to analyze fully all these budgetary issues, this problem mentioned over and over again in our interviews. Given the enormous success of the Institute to date, we believe that IAV will continue to be a extremely valuable asset for the country in the future, but that future can only be assured when IAV is put on a sound financial basis.

4. Incentives and the Retention of Qualified Faculty

Related to the overall financial crisis is the problem of providing adequate incentives to retain IAV's highly trained and motivated faculty members. All of these professionals have high opportunity costs for their services both in Morocco and in the international community. One of the incentives for these faculty members in the past was a salary scale which was up to 30 percent higher than their colleagues with comparable credentials and seniority in other government positions. As of this year, these differentials have been eliminated through government salary reforms. Moreover, IAV personnel have not had a general salary increase in five years and, consequently, there has been a considerable decline in the living standards of the IAV faculty and staff in both absolute terms and relative to colleagues. Finally, IAV faculty currently work on eleven month appointments and cannot receive direct payments for outside consulting assignments. By contrast, other university faculty of equal status now receive equal salaries for nine month appointments and can do consulting during the other three months of the year.

5. The Potential for Faculty In-Breeding and Lack of Cross-Fertilization

After carefully questioning respondents at IAV and elsewhere, we are concerned about the potential for faculty in-breeding if the Institute makes an IAV Doctorate in Science the effective sine que non for appointments to the faculty in the future. Just as the AID projects have been criticized in the past for the very high percentage of participant trainees who received their academic coursework at the University of Minnesota -- to the virtual exclusion of other land grant universities -- we believe IAV must take steps to assure that academic diversity at the doctorate level is maintained and that all faculty are not selected exclusively from the available pool of IAV graduates. This problem has the potential to loom ever larger as the Institute increasing takes over both the coursework and research components of the local doctoral programs.

6. The Potential for Adaptation to the Needs of the Moroccan Private Sector

Until very recently, the students at IAV were deliberately programmed into and

obligated to an overall manpower development plan of the government and were guaranteed employment on successful completion of their degree programs. The Government of Morocco is no longer in a position to offer these employment guarantees and the expectations now are that an ever increasing portion of each year's graduating class will have to be employed in the Moroccan private sector.

While we are certainly favorable to the notion that any national agricultural institute should be capable of training students for both government and private sector employment, this rather sudden transition in the manpower situation has generated adjustment problems for the Institute. Our interviews revealed that many potential private sector employers of IAV graduates are not yet convinced that:

a. Current graduates have sufficient and immediately applicable practical skills in agriculture to justify the higher salaries demanded by these new degree holders.

b. IAV is putting sufficient emphasis on development of decision-making skills among its students so that they might assume roles as middle-level managers at all levels of the economy.

c. Most graduates have little or no appreciation of economic factors in agriculture and therefore are poorly prepared to function in private sector situations where losses cannot be transferred to the national treasury or otherwise conveniently written off the company books.

While none of these problems are inherently insurmountable in the Moroccan situation, we believe more consideration must be given to them in the near future if the Institute's training programs are to be truly relevant to the changing employment patterns in the country. In this situation, we also feel that there may be a useful donor role in supporting survey of present and potential private sector employers of IAV graduates to determine both the qualitative factors they value in their potential employees, the salary levels which could be expected for different types of agricultural skills, and some appreciation of the likely dimensions of the total private market for IAV degree holders at all four levels.

7. Program Balance and Weaknesses in Response to Moroccan Development Problems in Agricultural Extension, Natural Resources Conservation and Utilization, and Economic Analysis at all Levels in the Agricultural Sector

Our review of the composition and quality of IAV training programs seems to indicate considerable inbalances in outputs compared to the range of Moroccan development problems. The three areas of weakness generally recognized in our interviews were in agricultural extension, natural resources conservation and utilization, and economic analysis of agricultural conditions at all levels.

In all areas, the weaknesses in training and research are generally reflective of deficiencies in the agricultural sector itself. The shortcomings of the existing agricultural extension system are presently the subject of intense discussion within the government and many different modifications have been proposed. In the field of natural resources conservation and utilization, the

existing manpower pool is poorly deployed and employed. Prior legislative decisions which give authority for resource utilization to local groups have not been effective in promoting concomitant responsibility from these groups in preserving the national resource heritage. In economics training, much of the subject matter and techniques taught appear to be irrelevant to the analytical needs of the economy -- both at the government and private sector levels.

In all areas, IAV administrators and faculty demonstrated serious concern about the weaknesses, a willingness to modify Institute programs, and a desire to participate actively in wider reform efforts in the government and with the assistance of the private sector.

VI. LESSONS LEARNED

In addressing the lessons learned from the foregoing analysis of IAV and its evolution over two decades, we have attempted to place ourselves in the position of an AID project design team. This hypothetical team is charged with analyzing the possibility of a major AID investment in agricultural higher education in a developing country other than Morocco. It wishes to draw upon the IAV experience in its design effort, however, to isolate and categorize those factors leading to IAV's success and to assess their relevance to the new situation. Our analysis sorts the key factors into the following categories.

1. Factors Under a Degree of Control by AID

Our analysis of IAV leads us to believe that the following factors are endogenous to most design situations in agricultural higher education and largely under AID's control. A design team's members, therefore, must resolve in their own minds at the outset of the project design AID's own degree of commitment with respect to the following factors.

A. The Necessity of a Long-Term Commitment to Institutional Development

Is AID willing to seriously entertain and plan for financial and human commitments of fifteen to twenty years duration in development of the institution in question?

Is it realistic to assume that any such AID commitment is sustainable over that period?

B. The Incremental Nature of Institutional and Project Development

Is AID willing to start the project with limited objectives and in one or two academic departments in the expectation that larger commitments may evolve over time as mutual trust and expertise develop between participants?

C. Setting the Conditions for Participation by American Universities

Can AID set conditions for a contractual relationship between one or more American university contractors and a host institution which will

strongly encourage both commitment and flexibility by all parties in a long-term effort?

2. Factors Essential to Success

The following factors are endogenous to most project design situations. They are, in our minds, also essential prerequisites for the success any higher education project. Based upon the IAV experience, we would caution against proceeding with any project design where conditions locally and in the United States did not indicate that the following characteristics would be present from the start of project implementation.

A. A "Sense of Mission" and Commitment to Development of an Institutional Structure to Serve Unique Local Needs

B. Demonstrated Capacity for Leadership by Local Personnel in Institutional Development

C. An Institutional Commitment to Quality Program and Personnel Development

D. A Degree of Institutional Autonomy in Relations with External Donors and vis-a-vis Local Government Ministries and Agencies

E. A Demonstrated Institutional Capacity for Efficient Management of Mult-Donor Resources by Local Administrators

F. Demonstrated Interest and the Strong Prospect of Long-Term Commitment and Flexibility by one or more American Universities in the Particular Institution Building Process

G. Flexibility and a Capacity for Self-Criticism on the Part of All Parties to the Institutional Development Process

3. Factors Desirable in the Institutional Development Process

We believe that the following factors are highly desirable and, if present at the outset of the design process, are strong indicators of potential project success. If such factors are not present initially, concentrated efforts should be undertaken in project design to build them into institutional orientations and activities.

A. A High Degree of Selectivity in Choosing Faculty and Students

B. A Willingness to Establish Institutional Measures of Quality based upon by International Standards

C. Entrepreneurial Attitudes in the Leadership and Faculty Oriented toward Seeking Necessary Resources and in Building Needed Support Constituencies

D. An Organizational Structure Which Encourages Maximum Participation by and Multidisciplinary Linkages between Faculty Members, Administrators,

and Students

E. Curriculum Models Which Integrate Teaching, Research and Practical Field Work for Students and Faculty

F. An Openness to Permmanent Evaluation Linked to Quality Program Development

4. Exogenous Factors of Importance to Program Development

We feel the following factors must be assessed by any design team. Although usually exogenous to the institutional situation itself, they are certainly key elements in the success or failure of any higher education project, as demonstrated in the case of the Institute.

A. Reasonable Prospects for Economic Growth during the Institutional Development Process

B. A Secondary Education System of Sufficient Scope and Quality to Consistently Produce the Necessary Student Candidates

REPORT ANNEXES

VII. REPORT ANNEXES

ANNEX A

AN ANALYSIS OF THE INSTITUTE'S EVOLUTION AND KEY EVENTS IN THE INSTITUTIONAL DEVELOPMENT PROCESS

by Dr. Rolland P. Poirier

The Hassan II Institute of Agriculture and Veterinary Medicine (IAV) has had a relatively short academic history. Having only formally opened its own doors to students in 1968, it has had an evolution which has permitted fast growth and greater reliance on Moroccan faculty members.

This short description highlights only key points in IAV's evolution.

1. Agricultural Education in Morocco During the Period of the French Protectorate

The IAV did not suddenly spring from nowhere as an agricultural institution and it is easier to understand certain aspects of its development if one recalls some events which took place before its creation.

Morocco's history before the French Protectorate of 1912 did not contain a concept of formal education strictly applied to agriculture as food and livestock production. It is only in 1912, with the creation of an Agricultural Service within the Public Works Department, that we see the first elements of an agricultural extension activity directed towards farmers. In 1915, a further step was taken with the setting up of a Department of Agriculture, Commerce and Colonization, which was to supply French farmer/colonists with agricultural credit and give them technical advice. Through the primary school system, the French also tried to provide rudimentary agricultural training in order to improve the quality of the Moroccan manpower hired by these French farmers.

In 1940, the Phillipe Petain Center was created in Meknes, Morocco. Its sole objective was to train the sons of French colonists. The Center required the highest level of secondary school diploma -- i.e., the baccalaureat -- for admission. Its coursework lasted for three years.

Later, it was renamed the National School of Agriculture (ENA). The school produced 120 agricultural graduates -- i.e., ingenieurs -- in the period between 1945 and 1956 but only two of these were Moroccans. it was only after independence in 1956 that significant numbers of Moroccan students were permitted to attend classes at ENA.

2. Agricultural Education in Morocco Between Independence Day in 1956 and 1968

Immediately after independence in 1956, there was a struggle between the

Ministries of Agriculture and Education for control of Moroccan agricultural training. The Ministry of Agriculture put forward a proposal oriented toward practical education in agricultural skills. The Ministry of Education, on the other hand, was in favor of a more academic approach oriented toward teaching the theoretical aspects of the agricultural sciences. In 1958, a decision was made in favor of the Ministry of Education.

During this period of direction of agricultural education by the Ministry of Education, a convention was signed with France (1962) which enabled a limited number of Moroccans to receive the degree of Ingenieur d'Etat in French agricultural schools. These individuals, upon graduation, were employed by the Moroccan government as teachers at ENA. As a result of this influx of Moroccan teachers, the school in Meknes was able to extend its curriculum from three to four years and was authorized to grant the title of Ingenieur d'Application -- i.e., the Moroccan equivalent of an American Bachelor of Science degree in agriculture.

In the early 1960s, there was more and more discussion about Morocco's developing greater capacity to implement a full system of higher education in agriculture. In 1962, the opening of the Lycee Moulay Youssef's preparatory course in agriculture for entry into French agricultural universities permitted Moroccan students to reduce their training abroad from three to two years. Then, on March 3, 1963, His Majesty Hassan II in his Throne Speech made the following declaration:

> We forsee the creation .... of a National Agricultural Institute based on disciplines of particular relevance to Mediterranian agriculture; prepared to receive Moroccan, as well as foreign students; and to deliver a degree rigorously equivalent to that of the European Ingenieur Agronome degree.

In the following few years, France sent several missions of experts to Morocco to assist in the planning of the proposed Institute. This activity led to the signing of a convention by which France generously accepted to finance a large part of the building costs for the new Institute and to provide faculty and other staff.

Finally, the control of the Institute — and the rest of the agricultural education system -- was transferred from the Ministry of Education to the newly created Ministry of Agriculture and Agrarian Reform (MARA). The first students for the Institute began their studies at Mohammed V University's Faculty of Science in 1966, while awaiting the completion of the Institute's new campus in Rabat.

3. Formal Creation of IAV in 1968 and its First Five Years

The Institute was formally inaugurated by Royal Decree on April 8, 1968. This decree contained the following phrase:

> The Institute is to teach the scientific, economic and social disciplines which are relevant to agriculture, to conduct studies and research, and to train specialized Ingenieurs Agronomes.

The overall plan from the start, then, was to train students in three different stages:

1. An initial cycle of one year of common study in basic sciences by all students.

2. A second cycle of three years in a specific agricultural discipline after which a Bachelor's level degree in general agriculture was to be granted.

3. A third cycle of two more years with more specialization leading to a Master's level degree.

In 1966, thirty-five candidates for admission presented themselves for the Institute's first entrance examination and only twelve were accepted. By 1969, the number of students had grown to 119. And by 1972, student enrollment stood at 378 students, broken down into 194 first cycle students, 155 in the second cycle, and 26 students in the third cycle. The third cycle students were then still obliged to travel to overseas agricultural universities for the two years of their specialization. Thus, these students were actually enrolled at six different institutions in France, two in Belgium, and one in the United States (under the first AID project which had started operations in 1970).

4. IAV during the Period 1973 to 1980

In January 1974, the Institute's curriculum was broadened to include veterinary medicine. This innovation made the renamed Hassan II Institute of Agriculture and Veterinary Medicine (IAV) the first and only example in Francophone Africa of a school of higher education combining full curricula in veterinary medicine and agricultural sciences in the same program and with all students sharing a common body of scientific coursework and practical field studies in their first years.

Later in 1974, IAV faculty were authorized by the King to begin preparations for a full graduate program which would result in the granting of a Moroccan Doctorate in Science degree. Although the first of these degrees was not granted until 1984, the possibility of such a program gave additional impetus to the Institute's collaborative program with AID and the University of Minnesota. The AID project entered its second phase in 1975 with efforts to accelerate the process of training Moroccan faculty to the American Ph.D. level and to deepen IAV's capacity to conduct quality agricultural research. As a result, many more Moroccans entered participant training programs at American land grant institutions during this period.

Over the period, IAV's program gradually became more diversified with course offerings added in such fields as food technology and biochemistry, rural engineering, surveying, agricultural machinery, and marine science. The Institute also began to supply student candidates in quantity for the Ingenieur d'Application degree to the National School of Forestry (ENFI) in Sale and the National School of Agriculture (ENA) in Meknes.

By 1975, there were 1,050 students in the system of higher agricultural education in Morocco, including 40 non-Moroccans from other African countries. The students were distributed among the three schools as follows:

1. IAV had a total of 770 students -- i.e., 293 in the first cycle core science courses; 175 students in different programs for the Ingenieur d'Application degree; 76 in the veterinary medicine specialization; and 226 in the agriculture specialization for the Ingenieur d'Etat degree.

2. ENFI had 69 students in the forestry specialization for the Ingenieur d'Application degree.

3. ENA had 167 students in programs for the Ingenieur d'Application degree.

There were also 44 third cycle students studying at foreign institutions for their fifth and sixth years (i.e., 25 in France, 10 in Belgium, and 9 in the United States).

In 1975, IAV also began the first exercise in tieing projected government agricultural manpower needs to quotas for its training programs, with these needs being detailed in the Government of Morocco's five year development plan. As future trained manpower requirements were developed, a series of student quotas was established with a minimum number of students to study in each training category every year. Moreover, all Moroccan students had to sign a work agreement with the government for a minimum number of years of required employment after graduation.

5. IAV from 1980 to the Present

With inauguration of the Plan for Economic and Social Development (1981-1985), the IAV quota system for agricultural training reached its most complex stage. IAV and its sister institutions, ENFI and ENA, were linked together in an overall training plan. The quota system was seen as the main source of the trained agricultural and livestock specialists needed to implement the planned agricultural development.

This most recent agricultural manpower development plan, which had just been completed as our impact assessment mission took place, provided for the following training:

	Annual Quota
1. Third Cycle Students	
Agriculture in twenty different specialities	100
Veterinary medicine	50
2. Second Cycle Students	
Food technology	50
Rural engineering	40
Surveying	40
Agricultural machinery	10
Horticulture	25
Landscape architecture	5

Plant protection	20
Marine Sciences	10
3. Second Cycle Students at ENA	
Agricultural techniques and development	60
Animal production	40
4. Second Cycle Students at ENFI	
Forestry and water management	20
Total students to be trained after passing the First Cycle basic science coursework	470

Given this general manpower training plan, student enrollment in the Moroccan higher education for agriculture and veterinary medicine for 1983-1984, the last year for which we have complete information, looked like this:

1. 2,145 students at IAV in Rabat and at the new horticultural complex in Agadir, which opened in 1982.

2. 250 students at ENA in Meknes.

3. 150 students at ENFI in Sale.

Of this total of 2,545 students, approximately 14 percent were non-Moroccans and 19 percent were women.

Over the last five years, the most important change at IAV has been the increasing capacity of the Institute to conduct all necessary training for its students through the Ingenieur d'Etat -- i.e., Master of Science -- degree level. Each year the number of students having to go abroad for M.S. level training has been declining - as can be seen from the numbers in the University of Minnesota participant training program where annual input of M.S. degree candidates has dropped from 25 in 1982 and 26 in 1983 to only 9 in 1985.

With the greater concentration now on developing a fully qualified Moroccan faculty at the Ph.D. level, the current and third successive AID project (1980-1990) has progressed rapidly. To date, 130 actual and potential faculty members from IAV, ENFI and ENA have participated in doctoral studies in the United States. As of the end of 1985, fifteen of these candidates had actually received their doctoral degrees (six from U.S. land grant universities, five from IAV, and four from both U.S. and IAV doctoral programs).

In sum, then, the IAV has gone from a start in 1966 with twelve students taking their basic science training from non-Moroccan faculty in temporary facilities at Mohammed V University to its present status with over 2,100 students and 346 faculty members (of which 85 percent are Moroccans) on its own campuses in Rabat and Agadir. The Institute now offers degrees at the Moroccan equivalents of the American B.S., M.S. and Ph.D. degree in agriculture, includ-

ing veterinary medicine. In addition, it trains over 200 non-Moroccan African students under the same conditions as its Moroccan degree candidates -- and pays the scholarship costs of all of these students from Government of Morocco budgetary allocations.

Table A-1

The Moroccanization of the IAV Faculty: 1966-1985

Year	Moroccan Faculty	Foreign Faculty	Total Faculty	Moroccans as % of the IAV Faculty
1966/1970	3	22	25	12
1970/1971	6	49	55	11
1971/1972	11	36	47	23
1972/1973	15	51	66	23
1973/1974	24	77	101	24
1974/1975	36	74	110	33
1975/1976	44	117	161	27
1976/1977	62	110	172	36
1977/1978	80	111	191	42
1978/1979	104	109	213	49
1979/1980	146	101	247	59
1980/1981	194	103	297	65
1981/1982	225	81	306	74
1982/1983	257	70	327	79
1983/1984	279	60	339	82
1984/1985	291	53	344	85

Source: IAV Records, 1986

ANNEX B

THE INSTITUTIONAL PROGRAM: CURRICULUM AND THE PRACTICAL FIELD WORK

by Dr. Lawrence Busch

As is common in many countries, entry to IAV requires passing a special examination that is open to all secondary school math and science graduates. Competition is quite substantial for the limited places at the Institute. The first year of the program, since 1971, consists of a "preparatory year of higher education in agriculture" -- see Table B-1. The purposes of this year are:

1. To assure a smooth transition between secondary and higher education.

2. To provide an education in the basic sciences and the rural social sciences.

3. To help students decide on their choice of specialization.

At the end of the first year, students take final examinations and select, by order of preference, their academic specializations. Those with high grades, especially in the selected subject matter, are generally assigned their first choice. The students with lower grades tend to receive their second or third choices until all the available places are filled, according to the manpower needs estimates set in conjunction with the Ministry of Planning and MARA. A computer program is now used to aid in the selection process. Approximately 80 percent of the students are assigned places in this manner. The rest are dropped from the program.

A central part of the IAV program is its field training -- or stage-- program. The purpose of this program is to give students direct experience with the rural world and to familiarize them with experimental methods and scientific reasoning.

The first year field experience -- i.e., "discovery of nature" -- is designed to familiarize students with working as a team under difficult field conditions. In teams of ten, students are given maps and walk a total of eighty kilometers over a period of eight days. During this period, students are checked on by their teachers at fixed points each day. During the walk, the students are expected to take detailed notes on Moroccan flora, fauna, geology, topography, and human settlements. The various roles in the group are rotated so that each student gets to try each role over the eight days.

The second year field experience -- i.e., "initiation to rural life" -- is accomplished in groups of three students. Each group is sent to a rural village chosen by the faculty. The three students have to get admitted to the village, providing a small sum to some village family for room and board. Then they must make detailed observations on weather, technology, nutrition, social and economic relations, and the history of the village. Observations are formally recorded on special forms and in a group notebook. These documents are later graded by the faculty and the students receive a group grade for the exercise.

The third year field experience is designed to confront students with the problems of operating a farm from the viewpoint of the farmer. In groups of two,

students spend two weeks each in autumn, spring and summer in the countryside. A lengthy report on the agronomy, livestock, ecology, socioeconomic conditions, nutrition, and technology of the farm is produced. In addition, the participating farmers are invited to the Institute -- with transport, room and board provided-- where they spend three or four days with the students, discussing the fine points of the group's report and being introduced to IAV operations.

In the fourth year, students are introduced to the problems of development of the region in which they examined a farm during the previous year. Through a series of questionnaires and interviews, the students attempt to determine the principal problems of the region. A faculty member accompanies each team to the field and local technical services are invited to contribute to the study.

Thus, over the course of their first four years, students are exposed to a wide variety of problems in several different regions of the country. In addition, the field training serves as a kind of "rite of passage", developing a strong feeling of group cohesiveness among the participating students.

The field training program constitutes the backbone of the pedagogical program of the Institute by demanding that students integrate materials from diverse disciplines. It is also provides students with the requisite experiences from which to ask faculty members challenging questions in class.

From the second year onwards, students are organized into groups depending upon their field of specialization. Within each field, students take a specific group of courses, in a manner more reminiscent of American medical or law schools than colleges of agriculture. For example, the agronomy specialization begins with the basic sciences, followed by courses in ecology, irrigation, engineering, crop production, animal production, social sciences, and field training -- see Table B-2. All students must take all courses within a given program. This reduces flexibility for the student in coursework -- i.e., there are no elective courses -- but makes possible a much more integrated and broad-based program than exists in the United States. This breadth is reflected in the wide range of expertise present in the faculty -- see Table B-3.

Each academic year is broken down into trimesters and each of these is scheduled as follows:

1. Forty days of coursework.

2. Fifteen days of field training.

3. Fifteen days of reflection on the field training and additional coursework.

4. Ten days of examinations.

In addition to regular coursework, each student is expected to complete a personal thesis during their terminal year -- e.g., either their fourth or sixth year depending on their academic degree program -- see Chart B-1.

The choice of subjects for this thesis -- or memoire -- is proposed by the teachers and is often linked to ongoing research projects or specific needs of

government agencies. Laboratories, experimental fields, means of communication, and calculators/computers are made available to the student as necessary to complete his or her thesis work. Students defend their thesis before a jury of four to five persons, including their advisor, another member of the faculty from the same department, and two or three persons from outside the Institute. The outside persons may be researchers or professionals having an interest in the subject.

A novel feature of the IAV program is that students initially selected for and completing the four year B.S. level program may, after three years in professional service, pass an examination and be readmitted to the Institute to complete the six year M.S. level program. Thus, many of the six year program students bring significant field experience to their studies.

Recently, the Institute has begun to offer the Doctorate of Science degree. For this program, most coursework — usually two years beyond the M.S. — is taken abroad and a dissertation is prepared and defended in Morocco. For this degree, a jury composed of both Moroccan and international specialists in the specific disciplines is formed and it is their sole responsibility to recommend award of the doctorate. IAV expects to be able to eliminate over time much of the overseas coursework but to retain the jury mechanism for the doctorate.

Table B-1

Typical Coursework for the Preparatory Year at IAV

Subject	Course Hours	Hours of Directed Coursework	Hours of Practical Work
Mathematics			
Algebra	45	45	
Analytical Work	45	45	
Physics			
Mechanics	50	50	
Electricity	30		30
Chemistry			
General	40	20	
Organic	40	20	16
Cell Biology	40		
Crop Biology	30		
Animal Biology	40		
Geology	25		30
Geography	20		
Design	20		

Source: IAV, Rapport d'Activite: Pedagogie, IAV, Rabat, Morocco, 1984.

Table B-2

Agronomy Curriculum at IAV

Subject	Course Hours	Second Year Hours of Directed Work	Hours of Practical Work
Mathematics	35	20	
Statistics	35	20	
Physics	60	30	
Inorganic Chemistry	25	15	32
Physical Chemistry	15		
Biochemistry	80		40
Crop Physiology	20		10
Animal Biology	40		40
Animal Physiology	40	15	32
Geology	20		40
Geomorphology	25		
Economics	40		
Regional Geography	34		
Fieldwork	"Introduction to Rural Life"		

Subject	Third Year Course Hours	Laboratory and Field Work
Crop Physiology	20	10
Soil Microbiology	20	
Genetics	25	10
Applied Statistics	14	16
Introduction to Soil Science	22	2
Soil Chemistry	20	10
Crop Ecology	20	
Crop Systematics	16	28
Zoology	20	12
Agronomy	30	24
Plant Pathology	25	42
Virology	15	
Entomology	12	18
Animal Hygiene	10	
Animal Anatomy	12	4
Animal Physiology	18	
Reproductive Physiology	18	
Animal Nutrition	26	20

Table B-2 (continued)

Subject	Third Year Course Hours	Third Year Laboratory and Field Work
Agricultural Machinery	26	4
Materials Sciences	26	20
Fluid Mechanics	30	10
Farm Management	24	16
Sociology	16	
Rural Institutions	28	
Economics	14	6
English	30	
Field Training		300
Sports		80

Subject	Fourth Year Course Hours	Fourth Year Laboratory and Field Work
Computer Use	12	22
Biometrics	14	16
Nutrition	30	
Applied Pedology	16	17
Soil Conservation	15	
Marine Fisheries	10	4
Biological Control	20	
Pasture Management	30	
Weed Science	6	4
Animal Production	38	10
Animal Genetics	20	8
Animal Products	14	2
Cultural Practices	30	
Plant Improvement	25	6
Plant Pathology	14	
Major Crops of Morocco	14	18
Arboriculture	16	6
Agricultural Machinery	30	
Hydraulics	35	20
Intro. to Food Technology	38	
Theories of Social Development	30	
Sociology of Development	15	

Table B-2 (continued)

Subject	Fourth Year Course Hours	Fourth Year Laboratory and Field Work
Food Planning	28	
Production Economics	15	
English	30	
Field Training		300
Sports		80

Source: IAV, Rapport d'Activites: Pedagogie, IAV, Rabat, Morocco, 1984.

Table B-3

Sections and Departments of IAV as of 12/31/1984

Academic Field	Number of Faculty
Basic Sciences	
Biochemistry and Chemistry	10
Animal Biology	11
Crop and Cellular Biology	16
Geology	5
Mathematics	7
Applied Mathematics	5
Physics	9
Social Sciences	11
Field Training	5
Agronomy	
Crop Ecology and Pasture Management	10
Water and Forests	3
Soil Sciences	9
Zoology Laboratory	8
Plant Pathology and Entomology	7
Crop Production	
Plant Improvement	3
Agronomy	10
Animal Science	8
Veterinary Medicine	
Microbiology and Contagious Diseases	4
Pharmacology and Toxicology	4
Anatomy	4
Physical Therapy	4
Medical and Surgical Pathology	11
Reproduction	7
Parasitology	4
Hygiene	4
Histology	3
Food Technology and Human Nutrition	34
Marine Fisheries	7
Horticulture	4
Irrigation and Rural Works	15
Agricultural Machinery	14
Topography and Geodesy	13
Horticultural Complex at Agadir	30
English	6
Electron Microscopy Laboratory	1
Experimental Farms at Gharb and Tadla	2
Sports	1

Source: IAV, Rapport d'Activite: Pedagogie, IAV, Rabat, Morocco, 1984.

ANNEX C

THE INSTITUTE'S FINANCIAL SITUATION AND SOURCES OF INCOME

by Dr. Jim B. Lowenthal

1. INTRODUCTION

Increasingly, IAV is facing a crisis of recurrent costs. The regular allocations from Morocco's budget to support ongoing operating costs of the Institute are inadequate to maintain the quality of the teaching and research program and may even jeopardize the sustained commitment of faculty to produce at consistently high levels. Contributions to the investment budget have also lagged behind, resulting in a deterioration in IAV's plant and equipment.

IAV has been able to avoid "bankruptcy" by mobilizing funding from external sources. The principal resource has been the support of foreign donors with whom the IAV leadership has negotiated effectively for prolonged and generous commitments. AID's projected twenty-year involvement is a striking example of this commitment. At the same time, IAV's Rural Development Division has established relationships with an increasing number of Moroccan and foreign entities to carry out specific contractual research and consulting assignments. The income from these two sources has served to offset the deficits in national budgetary support for ongoing operations.

The material presented below provides a glimpse at the structure of financial obligations incurred by IAV and the sources of income which are mobilized to meet these obligations. Where available, historical data are presented to demonstrate the deteriorating financial solidity of the Institute.

2. ANNUAL ALLOCATIONS

Each year, the national budget — under the direction of the Ministry of Finance — allocated a portion of MARA's resources to operate IAV. As indicated in the text of this report, these allocations are determined through a process of negotiations between IAV, MARA and the Ministry of Finance. Regardless of the outcome of these negotiations, the actual spending authorization for IAV occurs late in the fiscal year for which the budgetary resources are intended. In recent budgets, the Ministry of Finance frequently renews the previous year's amount despite the augments presented by IAV leadership. For example, the library and teaching supply line items have remained stagnant for the past ten years — i.e., at 325,000 and 620,000 dirhams, respectively — although the number of students has increased almost tenfold.

An analysis of a typical annual operating budget is indicative of the difficulties faced by the IAV administration. The major elements of the 1982 Operating Budget are displayed in Table C-1.

Table C-1

1982 IAV Operating Budget

Line Item	1982 Authorization	Percent
	(in 000 dirhams)	
Equipment	5,047	14
Personnel	31,164	76
Supplies and Utilities	1,170	3
Transportation	2,276	6
Other Costs	555	1
TOTAL	37,126	100

As can be seen from these data, over three-quarters of the 1982 budget was allocated to personnel payments. By 1985/1986, this share for personnel salaries in the total operating budget had climbed to 87 percent. The annual increases for IAV from the national budget for operating expenses have essentially kept pace with the expanding Moroccan faculty but other key support elements of the budget have been almost totally neglected -- see Table C-2 for the evolution of operating expense allocations. For the first time in 1985, IAV has had to utilize funds from one of its research/consulting contracts to pay the logistical costs of the innovative field training component of the curriculum.

The difficulty IAV administrators have in keeping pace with actual expenses can be seen from the development of the plant and equipment budget during the five-year plan period (1981-1985) -- see Table C-3. Over that period, actual allocations represented only 46 percent of what was requested and 61 percent of what was ultimately agreed to by the Ministry of Finance.

3. FOREIGN SUPPORT

IAV has relied on external support to provide advanced degree training for its faculty and students, to develop the teaching and research capabilities of the departments, and to meet the operating cost deficits. Table C-4 displays the current levels of support for the major external donors. The most significant changes over the levels of support as reported in the 1983 RONCO project evaluation have been in funding from AID and the Federal Republic of Germany. In 1985, AID increased its commitment from $ 9,750,000 to $ 28,500,000 and extended the

life of the project from five to ten years — i.e. from 1980-1985 to 1980-1990. In 1984, the Federal Republic of Germany made available $ 500,000 in support of the Department of Agricultural Machinery. With the exception of AID agreement, much of the ongoing foreign support for IAV is scheduled to terminate in 1986 and 1987.

Table C-2

Operating Expense Budget Allocations: 1969-1985

Budget Year	Budget Allocation (in 000 dirhams)
1969	2,455
1970	2,852
1971	2,940
1972	3,050
1973	4,000
1974	5,200
1975	7,120
1976	11,253
1977	12,440
1978	14,956
1979	19,046
1980	25,336
1981	28,461
1982	35,559
1983	33,663
1984	37,736
1985	38,736

Table B-3

Evolution of the Plant and Equipment Budget: 1981-1985

Year	Requested	Planned	Received	Shortfall
		(in 000 dirhams)		
1981	10,600	4,600	4,600	0
1982	9,800	8,300	3,500	4,800
1983	8,800	7,196	4,500	2,696
1984	8,700	7,096	5,400	1,696
1985	8,500	7,890	3,300	4,590

In addition to the support made available from foreign donors in the context of bilateral and multilateral agreements, IAV has increasingly mobilized resources through research and consulting agreements. These agreements or contracts are funded either through national budgetary allocations to a local agency— i.e., an ORMVA irrigated perimeter — or through consulting funds available in the context of a project agreement. Table C-5 presents the list of research and consulting agreements for the period 1980 to 1985.

A review of these agreements appears to indicate that IAV is charging only for direct operational costs, excluding salary, a fact which reduces enormously the cost of IAV technical support — as compared with the use of expatriate consultants. These contracts are important because they provide support for research and for field training, which could not otherwise be financed through the national budgetary allocation. Over the past five years, contracts and agreements amounting to approximately 12,500,000 dirhams have been established by IAV, an average of 2,500,000 dirhams per year — or equivalent to the entire transportation budget for the year. Discussions with Division of Rural Development personnel demonstrate that IAV is establishing increasing credibility with local organizations and that funds from this source may become even more important in the future.

The success with which IAV has mobilized external resources presents, paradoxically, a threat to the institutionalization of long-term national support for its research and training programs. From the beginning of our study, IAV faculty were reluctant to discuss the level of resources which have been generated from outside sources. These faculty feared that the Ministry of Finance would substitute soft money support from these external sources for a portion of the normal national budget allocation for IAV. While the team could not ascertain the accuracy of this impression, the current economic circumstances of Morocco will cause budget analysts to seek reductions where possible.

Table C-4

Contributions of Foreign Donors to IAV: 1981-1986

External Donor	Total Project Funding in Dollars	Duration of Project	Nature of Assistance and Recipient Department
United States	$ 28,500,000	1980-1990	Five advisors, participant training, commodity support, broad institutional development
Canada	N/A	1986	Six visiting professors, training in forestry and geodesy
Federal Republic of Germany	560,000	1983-1986	Funding support for five veterinary medicine students; and five experts and five students in agricultural engineering; commodities
Belgium	40,000	1986-1987	Logistical support only; three student training slots, 20 visiting professors, 8 experts associated with the University of Gembloux-Louvain in soils, biometrics, veterinary medicine, hydrology, and horticulture
United Kingdom	N/A	1983-1986	Two student training slots per year and five visiting professors
Sweden	N/A	1983-1986	One visiting professor and one student training slot
CIHEAM	N/A	N/A	Six student scholarships, two each in France, Spain and Italy

Table C-4 (continued)

NRSP	6,000	1982-1985	One development project with the Dutch Government and one with the Univer sities of Amsterdam and Wageningen
France	60,000	1983-1987	Thirteen experts, twelve volunteers, 30 scholar-ships, 65 visits by French professors, 15 exchange visits by Moroccans, logistical support and library support

4. CONCLUSIONS

Despite the impressive progress achieved by IAV in establishing an internationally recognized teaching and research program, the inability of the government to provide the minimum level of operational support now and in the near future is threatening the viability of the Institute. Clearly, external donors will be called upon to continue funding both specific and broad aspects of the program.

In addition, three areas of support appear promising:

A. IAV can continue to expand its research and consulting practice, pricing these services closer to market levels. Agreements should include support for overhead and faculty salaries. One could also envision incentives for continuing faculty involvement -- similar to summer salary or consulting day arrangements at American universities.

B. IAV can begin marketing services to the private sector — i.e., the Agadir complex has tremendous potential for the production of tissue- cultured bananas.

C. By increasing the number of foreign students financed at market prices by either their own governments or external donors, IAV could mobilize substantial support for its teaching program. At the present time, IAV provides scholarships from its national budget allocation for about 200 non-Moroccan students each year. The average per student cost is $ 4,000. Since the government commitment to hire IAV graduates is no longer in effect, one might reasonably expect a reduction in Moroccan students and the opening up of additional spaces for foreign students. One assumes that donor agencies operating in Francophone Africa might find it beneficial to finance scholarships at IAV rather than in Europe or the United States, where the average cost of training per year is often $ 25,000.

Ironically, the greatest threat to the viability of the Institute has become apparent at the moment of IAV's claim to institutional maturity. To prevent the erosion of the investments made in IAV, it is critical that both IAV and its collaborating donors address the recurrent cost issue immediately. While donor support has prevented the collapse of the high-quality teaching and research programs to date, the needs for support and the inability of the national treasury to meet those needs have become more pressing. The entrepreneurial skills, which have been so important in the past, will be even more important in the future. Concommitantly, the authorities will have to recognize the necessity of management structures which allow IAV to deploy newly mobilized financial resources in a creative manner to confront its fiscal crisis.

Table C-5

IAV Research and Consulting Contracts: 1980-1985

Project Funded	Supporting Donor(s)	Participating Department
Chaouia	AID/MIAC	Rural Development
Ounein	FAO	Rural Development
Aqua	UNICEF	Rural Development
Hassi	FAO	Rural Development
RAB	UNDP	Rural Development
MAC (Middle Atlas)	World Bank	Rural Development
CRSP/Small Ruminants	AID	Animal Sciences and Veterinary Medicine
Animal Reproduction	AEAI	Veterinary Reproduction
Animal Physiology	AEAI	Veterinary Physiology
Animal Parasites	AEAI	Veterinary Parasitology
Potasse	IPC/France	Agronomy
Regional Soil Microbiology Courses	FAO	Soil Sciences
Foreign Student Support	FED	Administration
Agronomy Training	ACCT/France	Agronomy
Animal Parasites	EEC	Veterinary Parasitology
Faculty Research Support	FIS	Several
TOPO	Oman	Topography
Ecoles Coraniques	Canada	Social Sciences
Newcastle Disease	EEC	Avian Diseases
El Hajeb	World Bank/MARA	Pedagogy

Table C-5 (continued)

Pedology Settat	MARA	Soil Sciences
ABDA/HMAR	MARA	Several
Genetique Lait	COMAGRI	Animal Sciences
Frumat	Frumat	Food Sciences
Recyclage en Electro-mecanique	MARA/ORMVA	Hydrology
ARD	MARA	Social Sciences
Douar	MARA/ORMVA	Hydrology
Regional African Center for Technolgy	United Nations	Food Technology
MAB	UNESCO	Several
Career Profiles	AID	Pedagogy
MIRCEN	UNESCO	Soil Sciences

TOTAL FUNDING AVAILABLE : 12,499,389.83 dirhams

AVERAGE YEARLY FUNDING DURING THE FIVE YEARS : 2,499,878 dirhams

ANNEX D

A PROFILE OF INSTITUTE GRADUATES AND THEIR ORIENTATIONS IN POST-TRAINING ACTIVITIES

Table D-1

Employers of 1572 IAV Students Graduating in the Period 1972-1982

Employer	Percentage of All Graduates
Ministry of Agriculture and Agrarian Reform	14
Provincial Departments of Agriculture (DPAs)	28
Regional Irrigated Perimeter Offices (ORMVAs)	18
State and Parastatal Enterprises	2
Other Ministries	4
Other Offices	3.5
INRA	6
Agricultural or Other Training Institutions	13
Laboratories	2
Private Sector Companies	8
Other	1.5

Source: Firdawcy, M.L., Profils des Carrieres Professionnelles des Laureats de L'Institut, IAV, Rabat, Morocco, 1985.

ANNEX E

USE OF THE DOCUMENTATION CENTER AND LIBRARY RESOURCES

by Dr. Lawrence Busch

The IAV has a library and documentation center with about 30,000 volumes - not counting the small departmental libraries whose collections are not catalogued. It is hoped that the system will have 70,000 volumes within five years. IAV also has subscriptions to 300 serials -- with plans to increase serials to 600 with help from AID and the Moroccan government. Rising costs, however, may temper both of these projections.

A central feature of the Documentation Center is its HP3000 computer system. The computer was furnished by AID with software provided by Canada. The software is compatible with that used in many other agricultural libraries, FAO, and AID for cataloguing and accessing agricultural documents.

As the national agricultural library for Morocco, the Documentation Center uses AGRIS worksheets to catalogue documents and forwards copies to FAO for entry into their data base. It also provides AGRIS bibliographic searches for faculty and other requestors. Finally, the computer serves as an on-line listing of all current agricultural research in Morocco. It functions in a manner similar to the Current Research Information System at the United States Department of Agriculture.

The Documentation Center appears to play a truly national role. During the calendar year 1985, eighty-seven walk-in requests by persons or agencies outside the IAV were filled by the Documentation Center. This count does not include unfilled requests or requests to departmental libraries. It also does not include walk-in requests for journals which are not recorded. Among the users of the Documentation Center were the following:

Documentation Center User	Number of Requests
Ministry of Agriculture and Agrarian Reform	4
Ministry of Energy	2
National School of Agriculture at Meknes	4
National Forestry School at Sale	3
Horticultural Complex at Agadir	1
National Agricultural Credit Bank	2
Department of Water and Forests in Rabat	1
National Seed Company	2
National Institute for Agronomic Research	7
National Company for Irrigation Engineering	1
University of Rabat	13
University of Casablanca	6
University of Mohammedia	6
University of Marrakech	1
School of Information Sciences	6
National Institute of Architecture and Urbanism	5

E-2.

National Institute of Statistics and Applied Economics	1
National School of Administration	2
In-Service Training Institute at Kenitra	3
Institute of Journalism	1
Other Miscellaneous	16

ANNEX F

AN ANALYSIS OF CHANGES IN THE CROP SECTOR RELATED TO IAV ACTIVITIES

by Dr. Jack W. King, Jr.

Three facts should be kept in mind when considering the influence of IAV on the crops/soils sector in Morocco:

1. The role of the Institute has been primarily teaching with the goal of supplying personnel for government programs.

2. The duration of IAV activity has been short in terms of the time required to see results in this sector.

3. Personnel developed at the Institute are working at a wide variety of jobs and in many instances have joined ongoing programs or have worked in association with personnel who were not trained at the Institute. In such circumstances, it is difficult to identify and gauge the contribution of IAV trained personnel.

A short specific list of developments/influences which show promise for becoming or nurturing impacts would include the following:

1. An improved barley variety on the point of being released.

2. Work on Hessian fly resistant wheat for Morocco.

3. Use of tissue culture techniques for screening and propagation.

4. Introduction of Medicago forages for fallow land and grazing areas.

5. The use of soil and land classification to help predict the transferability of field research.

6. Work on "Bayoud" disease (Fusarium oxysporum f.sp. albedinia) of date palm.

The majority of IAV graduates are working in the public sector and are generally more appreciated there than they are in the private sector. However, IAV has competed successfully with private firms to participate in development projects. It is apparently in companies dealing with engineering and soils that IAV departments relating to crops and soils have made the most progress in working with the private sector.

The single most impressive fact relative to IAV's program is the quality of people which IAV is supplying the crops/soils sector. With very few exceptions, they were enthusiastic about their work and could explain exactly what they were doing and why. Most laboratories showed a high ratio of available equipment in use. Offices showed evidences of writing in progress. These are incidental and informal but also convincing indicators of well directed activity.

ANNEX G

AN ANALYSIS OF CHANGES IN THE LIVESTOCK SECTOR RELATED TO INSTITUTE ACTIVITIES

by Dr. Rolland P. Poirier

As we have pointed out in Annex A., IAV, with its sister institutions, has already graduated approximately 1,000 Ingenieurs d'Etat, 300 veterinarians, and 2,300 Ingenieurs d'Application since 1970. Of these trained personnel, the veterinarians and approximately 150 livestock specialists have been trained specifically in aspects of animal production. Many of the others, however, have received some training in animal husbandry and, within their more general duties, have a role in improvement of the livestock sector in Morocco.

In Morocco, the livestock sector is an important part of the agricultural picture. It employs 21 percent of the agricultural work force at present versus only 10 percent in 1960. The sector uses approximately 35 percent of the total non-desert land in the country. Demand for livestock products is increasing and is projected to grow at a rapid rate for the next twenty years -- i.e., 3.5 percent per year for red meat, 2.4 percent for dairy products, and as high as 5.1 percent for eggs. This is due in large part to the continuing increase in urbanization which tends to favor higher protein and more convenient foods.

In this annex, we intend to present some of the changes which have occurred in the livestock sector and try to relate them to IAV activities.

1. Changes and improvements in the sector which can be linked more directly to the actions of the IAV

The most important change that IAV has created in the livestock sector is certainly to put in place a cadre of trained specialists who can address the problems and challenges of livestock production in Morocco. The expertise can now cover the gamut of production from the very small peasant farm of five hectares and a few animals to extensive pastoral systems to intensive livestock production under irrigated and industrial conditions.

There is also a series of timely IAV actions which have improved Moroccan livestock production and allowed it to progress from a very artisanal state in the 1960s to the point where many of new technologies are available to a large proportion of livestock raisers. Examples of such actions are:

A. IAV has unified professional training in animal sciences and veterinary medicine

The IAV is one of the few institutions of higher education in the world where animal sciences and veterinary medicine are not only taught on the same campus but have an integrated curriculum where many of the disciplines useful to both types of specialists are jointly taught. Moreover, the faculty members from both disciplines often work together on common problems and conduct joint research.

projects. All this has produced graduates for the livestock sector who do not live in the isolation of two different disciplines once their careers start and who have better understandings of the complementarities of their professional training experiences.

B. Important livestock association located at IAV

The National Association for Animal Production, a professional association which has had a real impact on the formulation and implementation of government sector policies and on the dissemination and discussion of technical and scientific information, has its headquarters at IAV. A faculty member is its secretary-general. Frequent meetings and seminars take place on the IAV campus and they bring benefits to the teaching staff and the student body. Recent seminars have dealt with genetic improvement in local livestock, improved feeding techniques for ruminants, better use of available agricultural and industrial byproducts, mineral supplementation, animal health, and control of eco- and endo-parasites.

C. Convention between IAV and the Livestock Service at MARA

In 1984, IAV signed a convention with the Livestock Service at MARA which allows the parties to collaborate in solving the numerous problems related to the extension of research results and other technical information to all levels of Moroccan livestock producers. This work is just beginning but the objective of closing the gap at the end of the chain of information through more effective extension work is very important to the future of the sector.

D. Outreach contracts undertaken by the veterinary group at IAV

The faculty veterinary group at IAV presently is implementing four contracts with livestock producer groups and more are expected in the near future. These contracts enable the group to follow on a daily basis the production cycles and problems of approximately 1,500 dairy cows and to collaborate with a large pastoral association in bringing modern technologies to very traditional livestock producers. Participation in such contracts allows the veterinary group to gather valuable field data for teaching and research purposes and to participate at the practical level in development of useful innovations for producers.

E. Research projects

The entire livestock group at IAV, including veterinarians and animal scientists, is presently active in a large number of research activities directed at finding solutions to basic constraints in the livestock sector. In the field of genetic improvement, the group is involved in upgrading the local dairy breeds through crossbreeding with French Pie-Noire and Dutch Friesian cattle. It is also presently analyzing the main characteristics of the more important breeds of Moroccan sheep, in close collaboration with the AID Small Ruminants CRSP. One sheep breed with a high degree of prolificity has already been identified with two pregnancies per year and, in many cases, twins, triplets and even quadruplets. The ultimate goal of this research is to produce by crossbreeding a composite sheep breed which can be distributed to Moroccan producers to greatly improve small ruminant productivities.

The livestock group has also contributed to the improved efficiency of systems for delivery of livestock health services, including parasite controls, mineral supplementations, and methods of improving reproductive performances. At the IAV Gharb farm, the group has developed and promoted a practical system to supply a well-balanced ration for the livestock on a continuous basis through hay, green-cropped forages, and silage production under a zero-grazing scheme.

2. Changes and improvements in the sector which can be indirectly linked to IAV through its graduates

A. The Dairy Plan

Fifteen years ago, Morocco had to import approximately 80 percent of the dairy products domestically consumed. The annual capita consumption of these products amounted to 33 kilograms in the rural areas and only 25 kilograms in the cities and towns. In response to this situation, the government formulated a dairy plan aimed at simultaneously raising consumption of dairy products on a per capita basis and producing a higher percentage locally of total consumption.

Today, the annual per capita consumption of dairy products is estimated to have increased to 46 kilograms in the cities and towns while remaining constant in the rural areas. Moreover, more than 50 percent of all dairy products are now produced in Morocco and the country has developed a system of milk collection points and processing plants. Most of the milk is still consumed in pasteurized fluid form but certain of the processing plants have started to manufacture butter, cheese and milk powder.

The most important challenge to dairy expansion remains a better distribution of milk production through the year. Presently, the rainy season lactations are sometimes double those of the dry season ones. Better management of the reproductive cycles of the cows, together with more efficient methods of feed conservation for the dry season, are now being promoted to farmers, with the result that a certain number of the better farmers have already established more uniform milk flow patterns in their operations.

Much of the successful work in this area can be attributed to the IAV graduates who are now working at the level of the irrigated perimeters throughout the country and heading up dairy production units in both the public and private sectors.

B. Animal health

The recent influx of large numbers of well-trained Moroccan veterinarians from IAV has enabled Moroccan agriculture to improve the health status of its livestock population. There are now a number of regional service laboratories staffed wholly by IAV graduates and necessary vaccines can now be produced by local technicians in Rabat. Moreover, while much of the delivery system for animal health care is still in the hands of government or parastatal organizations, Moroccan veterinarians have recently been successful in convincing the government to allow them to set up their own private practices. This would eventually mean that all animal health care in the country would be handled by private veterinarians working directly with their own clients or on contracts with the govern-

ment for specific tasks.

Finally, this large core group of professionals trained at IAV has not only kept the livestock of Morocco free of serious epidemic disease problems but it also has seen to it that local animal products reach consumers in a clean and hygienic form through a strict product inspection service.

C. Artificial insemination

This modern breeding technique, which has proven so useful for genetic improvement and better reproductive management of cattle under intensive production systems, is now at the disposition of a certain number of Moroccan dairy and beef cattle producers. This system of artificial insemination is largely run by IAV graduates and trained manpower exists to go one step further and introduce ova transplants in cattle when and if this method should become useful and economically warranted.

D. Genetic improvement of livestock

IAV graduates are presently involved in many activities dealing with genetic improvements in local livestock. With dairy cattle, there is a program to upgrade the local breeds by crossbreeding with French Pie-Noire and Dutch Friesian sires. In addition, breeding programs are using imported Holstein sires and frozen semen from the United States and Canada to upgrade dairy cattle on the irrigated perimeters.

This program has permitted substantial increases in milk production capacities of a good number of local cows. For example, on the COMAGRI dairy complex in the Gharb area, improved genetic potential and better dairy cow management have resulted in an increase in annual mean milk production from 3,350 liters per cow in 1981 to 5,250 liters in 1984. Furthermore, this complex has become recognized as an excellent source of dairy heifers for local dairy producers and has bred and sold over 8,000 improved females in the area. The complex manager and his staff were almost all IAV graduates.

Breeding work is also proceeding with the progressive introduction of Santa Gertrudis beef-type cattle into Morocco. These animals -- originally breed at the King Ranch in Texas -- thrive under Moroccan conditions and to date have proven to be quite resistant to the prevalent local diseases. So far, the total Santa Gertrudis herd numbers about 20,000 head and further improvements are being achieved by importing semen from a supplier in California. This program has made a contribution to increasing the supply of high-quality beef for the local market.

E. Poultry production

From 1970 to 1985, annual production of poultry meat in Morocco has gone from 30,000 tons to 120,000 tons. Egg production has similarly gone from 300 million to 800 million units. Such a rapid expansion was made possible by creation of a modern industrial-type poultry industry based on basic genetic lines imported in Morocco but with all hatching and multiplication being done incountry. The main poultry complexes are now large vertically-integrated operations with internal

capacities for reproduction, rearing, and processing of both layers and broilers.

One of the principal reasons that this local poultry capacity could be put into place over such a relatively short period was the technical competence of Moroccans trained at IAV and ENA. At present, these graduates are working with expatriate specialists from international poultry companies but there is every expectation that, with additional experience, the local poultry operations will be entirely "Moroccanized".

F. Pastoral production

A significant portion of the meat and milk produced in Morocco is stilled produced under extensive grazing schemes where animals are herded from place to place to take advantage of short-lived vegetative covers. While exact methods vary between sites and between systems, the only practical ways of improving such production is by supplying animal health services and improving pastures and their utilization.

In Morocco, pasture improvement has often been an integral part of development projects but the task has been a very difficult one and results have often been disappointing. The better results will only come when the pastoral groups themselves realize that they must impose a certain level of discipline on their members in order to improve finally their common production systems and raise their standards of living. In this respect, the problem may be one initially requiring more sociological than technical inputs.

IAV, in collaboration with the AID/University of Minnesota project, has provided excellent training for the cadre of range scientists now in Morocco. Without these people, the pastoral situation would probably be even worse than it is at present but much remains to be done before the problem of deteriorating range conditions is reversed.

In summary, then, we can say that the livestock sector in Morocco has very recently begun to move away from traditional, extensive production methods toward more modern and intensive systems. The transition has been led by the poultry and dairy industries, followed by beef and sheep production. It is far from complete and the possibilities for improvements of all sorts are present everywhere. What is different in Morocco, however, is that the usual shortage of trained scientific personnel for various aspects of livestock production is not a binding constraint on further progress, due in very large measure to the excellent training opportunities afforded Moroccans through IAV programs.

ANNEX H

A LIST OF UNIVERSITY OF MINNESOTA AND OTHER LAND GRANT UNIVERSITY PARTICIPANTS IN THE "PARTNERSHIP" RELATIONSHIP WITH THE INSTITUTE

Tables H-1 and H-2 below provide a summary of activity for the last five years for American land grant universities faculty members in Morocco under the auspices of the IAV/University of Minnesota contract and a sample of American faculty activities in Morocco during the period October 1984 to September 1985.

TABLE H-1

SUMMARY OF AMERICAN FACULTY ADVISOR VISITS TO IAV IN MOROCCO: 1981-1986

	Calendar Year					
Field of Study	1981	1982	1983	1984	1985	1986
Agronomy		1	2		3	
Animal Science	1	1	3	2	2	1
Cereals Breeding		1		1	2	
Cereals Pathology		1				
Forestry			1		2	2
Horticulture	1		7		6	1
Hydraulics			1	1	13	4
Library Science		1			2	
Nutrition		1	3	3	5	
Plant Pathology	1		1	2	4	1
Plant Physiology		2				
Range Resources			1			
Range Management		3			1	
Range Science					1	
Ruminant Nutrition		2				
Soil Conservation		1	1			
Soil Microbiology	2	2				
Soil Science			2	1	1	3
Veterinary Medicine		2	2	4	4	
Watershed Management		1	1	1		
Fisheries				2	3	
Entomology				1		1
Agricultural Economics					2	
Computer Science					3	
English				1		
Total Advisor Visits	5	19	25	19	54	13

Source: Annual Reports 1981/1982/1983/1984/1985, IAV/University of Minnesota Project

TABLE H-2

VISITS TO MOROCCO BY AMERICAN FACULTY ADVISORS
OCTOBER 1984-SEPTEMBER 1985

Faculty Advisor	Dates of Visit	Discipline	Advisee
O. Strack	10/6-20/1984	Engineering	A. Debbarh
T. Murashige	10/7-20/1984	Horticulture	M. Hallatou
M.C. Latham	10/26-11/3/1984	Food Science	A. Lemtouni
W.B. Voorhees	11/2-9/1984	Soil Science	M. Oussible
R. Blasingame	11/12-24/1984	Library Science	A. El Bakkali
D. Robertshaw	12/9-19/1984	Veterinary Medicine	R. Zine Filali
R. Goodrich	12/7-22/1984	Animal Science	M. Bourfia
G.L. Voss	12/5-15/1984	Fisheries	M. Baddyr
N.A. Voss	7/9-16/1985	Fisheries	M. Baddyr
R.A. Robinson	12/6-23/1984	Veterinary Medicine	B. Chaarani
F.G. Hatfield	12/7-22/1984	Engineering	H. El Bartali
S.R. Simmons	2/7-20/1985	Agronomy	A. Chafai
E.L. Stewart	2/3-3/6/1985	Plant Pathology	M. Achouri
I. Thomason	2/6-18/1985	Nematology	M. Ammati
E. Stadelmann	2/9-22/1985	Horticulture	H. El Attir
E. Bradford	2/10-28/1985	Animal Science	M. Bourfia
E. Senauer	2/16-27/1985	Agricultural Economics	M. Amane
A.S. Csallany	2/17-3/9/1985	Food Science	M. Rahmani
A.H. Markhart	3/14-4/16/1985	Horticulture	R. Choukr-Allah
J. Keller	3/25-4/6/1985	Irrigation Engineering	M. Ait Kadi
W. Hackett	4/15-5/1/1985	Horticulture	D.L. Walali
A.R. Roelfs	4/8-5/1/1985	Plant Pathology	B. Ezzahiri
D.D. Briske	5/4-29/1985	Range Management	O. Berkat
F. Lauer	5/11-6/3/1985	Horticulture	A. Hilali
W.R. Walker	6/11-29/1985	Irrigation Engineering	R. Essafi
W.R. Walker	9/20-23/1985	Irrigation Engineering	R. Abdellaoui
R.W. Jeppson	6/23-7/3/1985	Irrigation Engineering	M. Ait Kadi
R.W. Jeppson	9/20-23/1985	Irrigation Engineering	R. Abdellaoui
R.J. Jones	6/25-7/1/1985	Agronomy	S. Ouattar
C. McClain	6/23-7/1/1985	Nutrition	M. Essatara
T. Hughes	6/23-29/1985	Irrigation Engineering	M. Ait Kadi
L.R. Rittenhouse	7/1-8/14/1985	Range Science	A. El Aich
A.R. Ek	7/17-27/1985	Forest Inventory	D. Benssalah
C.T. Scott	7/17-27/1985	Forest Inventory	D. Benssalah
T. Roe	9/14-14/1985	Agricultural Economics	A. Driouchi
D. Savaiano	9/12-10/1/1985	Nutrition	M. Essatara
N. Rangeson	9/20-30/1985	Irrigation Engineering	R. Abdellaoui
R. Hill	9/20-30/1985	Irrigation Engineering	R. Abdellaoui
D.E. Larson	9/22-10/1/1985	Agronomy	M. Qussible

Table H-3

American Technical Assistance to IAV: 1970 - 1986

Individual/Field	Year 1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Pierre Antoine/ Soil Science	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX									
Jean Molina/ Soil Science		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
John Cadell/ Plant Breeding		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
Ben Lockhart/ Plant Pathology		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX								
Dave Young/ Horticulture						XXXXXXXXXXXXXXXXXXXXXX				
Joe Vavra/ Soil Science						XXXXXXXXXXXXXXXXXXXXXX				
Lynn Gallagher/ Plant Breeding								XXXXXXXXXXXXXXXXXXXX		
Jim O'Rourke/ Range Science									XXXXXXXXXXXXXXXX	
Aly Lasheen/ Horticulture									XXXXXXXXXXXXXXXX	
Erv Berglund/ Soil Conservation									XXXXXXXXXXXXXXXX	
Jim Burliegh/ Plant Pathology									XXXXXXXXXXXXXXXX	

Table H-3 (continued)

Individual/Field	1980	1981	1982	1983	1984	1985	1986
Ben Lockhart/ Plant Pathology		XXXXXXXXXXXXXXXXXXXXXXXXXXXX					
Lynn Gallagher/ Plant Breeding	XXXXXXXXXXXXXXXXXXXXXXXXXXXX						
Jim O'Rourke/ Range Science	XXXX						
Aly Lasheen/ Horticulture	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX						
Erv Berglund/ Soil Conservation	XXXXXXXXXXX						
Jim Burliegh/ Plant Pathology	XXXXXXXXXXXX			XXXXXXXXXXXXXXXXXXXXXXX			
Don Johnson/ Veterinary Medicine		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX					
Kent Crookston/ Agronomy					XXXXXXXXXXXXXXXXXXXX		

ANNEX I

REPORT METHODOLOGY AND LIST OF PERSONS INTERVIEWED

by Drs. Lawrence Busch and Jack W. King, Jr.

1. Report Methodology

Given the short history of IAV and the time constraints on the impact assessment team - i.e. the mission in Morocco was conducted in the period January 20-15 February 1986 - a snowball sampling approach was taken during the mission. Using this approach, in-depth interviews are conducted in which desired information is solicited and then suggestions for additional contacts are requested. This has the effect of rapidly broadening the field of respondents and maximizing variance so as to obtain as complete a response range as possible within the time alloted.

In this specific instance, initial interviews were conducted at IAV in Rabat. After obtaining an overview of the Institute's structure and operations, the team split into two groups and conducted interviews on the campus. To maximize use of the time available, groups were interviewed together whenever possible. As Institute interviews were completed, additional interviews within driving range of Rabat were conducted. Then, during the third week of the mission, the team split into two travel groups, with one going northeast to the Meknes-Fez-Moyen Atlas area and the other going south to the Marrakech-Agadir-Haute Atlas area. In the interviews, most of the principal agricultural regions of the country were represented as were the IAV campuses in Rabat and Agadir, the ENA in Meknes, and the ENFI in Sale. Wherever possible former students, farmers, and users of IAV research information where contacted. The final week of the mission in Morocco was spent drafting a report for presentation to IAV and USAID officials, as well as filling in gaps with a few additional interviews.

In addition to the formal interviewing, a written questionnaire was distributed to all Moroccan degree participants in the IAV/University of Minnesota graduate training program. Approximately fifty of these questionnaires were given to respondents present in Morocco. Information derived from the returned forms was incorporated into the team's conclusions.

Finally, additional interviewing was conducted by three team members at the University of Minnesota (19-21 March 1986) with university senior administrators staff of the project office, faculty representatives, and Moroccan graduate students studying at the university.

The final report was written in the United States during the period February 17-April 5, 1986.

2. A Partial List of Persons Interviewed by the Impact Assessment Team

A. Ministry of Agriculture and Agrarian Reform

His Excellency M. Ottman Demnati	Minister
T. Bensouda	Director of Agricultural Extension
A. Elgharbaoui	Chief of the Animal Production Service
E. Haimer	Provincial Director of Agriculture for Settat Province
A. Marsile	Director of Livestock Service
M. Mouline	Director of Agricultural Education
M. Naanani	Chief of the Planning Division
A. Rabih	Director of the Work Center in Settat
A. Rami	Director of Crop Production
A. Sasson	Chief of the Division of Economic Affairs

B. Hassan II Institute of Agriculture and Veterinary Medicine

M. Sedrati	Director
M.L. Firdawcy	Secretary-General
A. Abdellah	Food Sciences
M. Achouri	Horticulture (Agadir)
M. Agbani	Crops
M. Alaoui	Rural Development
M. Baddyr	Horticulture (Agadir)
El A. Bakkali	Documentation Center
M. Bauderbala	Rural Development
M. Besri	Plant Pathology
El H. Bourarash	Agricultural Mechanization
R.E. Choukrallah	Horticulture (Agadir)
M. Dakkak	Veterinary Medicine
H. El Attir	Horticulture (Agadir)
M. El Othmani	Horticulture (Agadir)
R. Elouadili	Student returned from Oregon State University
M. Essatara	Human Nutrition
M. Fagir	Sociologist (Agadir)
F. Guessous	Animal Sciences
A. Hammoudi	Human Sciences
A. Hilali	Deputy Secretary-General (Agadir)
El M. Khyari	Rural Development
A. Lahcen	Food Technology
A. Lahlou	Veterinary Medicine
J. Marechal	Belgian Team (Agadir)
M. Merzook	Soil Sciences
M. Oussible	Crops
S. Quattar	Crops
M. Rahmani	Biochemistry
M. Salhi	Academic Programs
P. Scholz	Chief of German GTZ Program
F.A. Senhaji	Food Science
M. Sirjacobs	Chief of Belgian Team (Agadir)

M. Stittou	Soils
A. Zahour	Crops
A. Zouggari	Human Sciences

In addition, over twenty-five IAV students — both Moroccan and non-Moroccan— were interviewed by the team. These students were in their fourth or sixth years of training.

C. National School of Agriculture in Meknes

M. Rochdi	Director
M. Ben Bella	Agronomy
M. Boulif	Plant Pathology
A. Chafai	Agronomy
B. Charaani	Animal Health
A. Driouchi	Agricultural Economics
A. Filali	Irrigation Engineering
A. Ilham	Ruminant Nutrition
A. Kabbali	Animal Breeding and Meats
M. Mouncif	Range Management
A. Narjisse	Range Management

D. National School of Forestry in Sale

D. Ben Sallah	Director
O. Aboulabbes	Soil Science
D. Benessalah	Forestry
M. Hachimi	Forestry
A. Ibnattya	Range Management
S. Messat	

E. University of Minnesota

D. Johnson	Chief of Party (Rabat)/Veterinary Medicine
J. Burleigh	Plant Pathology (Rabat)
K. Crookston	Agronomy (Rabat)
A. Lasheen	Horticulture (Rabat)
C.E. Allen	Dean of the College of Agriculture and Associate Director of the Agricultural Experiment Station
M. Boehlje	Agricultural Economics
R.D. Cook	Applied Statistics
C. Eberlein	Agronomy and Plant Genetics
T. Kommedahl	Plant Pathology
J. Orf	Agronomy and Plant Genetics
D. Rasmusson	Agronomy and Plant Genetics
R. Sauer	Vice-President for Agriculture, Forestry and Home Economics
J. Sentz	International Agricultural Training
G. Wardlow	Project Training Officer

D.E. Welsch	Director of International Programs
R.D. Wilcoxson	Project Director

F. United States Agency for International Development in Rabat

R. Chase	Mission Director
J. Dorman	Agricultural Economist
M. Hanafi	Project Officer
C.W. Johnson	Deputy Mission Director
M. Matthews	Mission Controller
M. Purvis	Agricultural Development Officer
W.S. Rhodes	Program Officer
R. Stryker	Deputy Agricultural Development Officer
R. Thompson	Program Development Officer
D. Watts	Agricultural Officer

G. Moroccan Company for the Management of Agricultural Farms (COMAGRI)

M. Bekri	Chief of Zone for Ain Aouda
A. Elhousni	Animal Husbandry Specialist
M. Hamdaoui	Chief of Zone for Gharb
A. Rossaky	Agricultural Engineer

H. National Institute for Agricultural Research (INRA)

H. Farej	Director-General
G. Beauchasne	Plant Tissue Culture Unit in Marrakech
D. Benatya	Project Chaouia in Settat
A. Benjamaa	Director of Research Center in Agadir
M. El Hadi	Head of Cereals Department in Marrakech
A. Janati	Station Head in Marrakech
M. Mazhar	Forage Crops in Settat
M.H. Sedra	Head of Plant Pathology in Marrakech
A. Tantaoui	Plant Pathology in Marrakech
A. Zaid	Head of Tissue Culture Laboratory in Marrakech
E. Zoutane	Director of Aridoculture Farming Center in Settat

I. Mid American International Agricultural Consortium (MIAC)

R. Riddle	Sociologist
L. Romman	Forage Crops
E. Smith	Senior Cereals Breeder
P. Soltanpour	Soil Scientist
W. Swanson	Agricultural Equipment Specialist
D. Watts	Chief of Party

J. Regional Irrigation Authority Office (ORMVA)

L. Akrim	Bureau Chief for Horticulture
A. Aomar	Service Chief for the Equipment Service
A. Belfiquih	Office Chief for Sugar Plantations
M. Berriga	Technical Director for Division of Fats and Oils
R. Bouabouia	Technician at Major Crops Office in Haouz
A. Ezzamiti	Office Chief for Agricultural Economic Studies
M. Fakir	Service Chief for Plant Production in Agadir
M. Laghrib	Agricultural Engineer for Canal Network Management and Services
O. Lahlou	Director for Gharb ORMVA
A. Outassourt	Office Chief for Horticulture in Haouz
H. Said	Office Chief for Equipment Studies and Services
A. Soufi	Office Chief for Major Crops in Haouz

K. National Society for Livestock Development (SNDE)

B. Bouamar	Director-General

L. Society for the Management of Agricultural Lands (SOGETA)

E. Hassan	Director of Training
S. Zbitou	Chief of Animal Production Division

M. Other Respondents

M. Ajana	Farmer in Agadir
M. Belhaj	President of the IAV Alumni Association
M. Bijjaad	Secretary-General of Ministry of Planning
A. Bouhdoud	President of Citrus Growers Association in Agadir
M. Ghilam	Secretary for Economic Affairs in the Office of the Prime Minister
M. Kerdoudi	Director of Manpower Training in the Ministry of Equipment and Training
A. Moubled	Farmer
A. Bekkali	Senior Government Advisor and Former IAV Director

ANNEX J

REPORT BIBLIOGRAPHY

1. AID, Final Evaluation Range Management Improvement Project 608-0145 Morocco, AID, Washington, D.C., November 1985.

2. AID, Noncapital Project Paper: Higher Agricultural Education, Morocco-Project Number 608-11-110-088, AID, Washington, D.C., July 28, 1969.

3. AID. Project Paper Higher Education Project 608-0134, AID, Washington, D.C., September 15, 1975.

4. AID, Project Paper: Morocco: Agronomic Institute 608-0160, AID, Washington, D.C., April 1980.

5. AID, Study Design for Institute of Agronomic and Veterinary Sciences Morocco, AID, Washington, D.C., December 1985.

6. Alpert, D., "Performance and Paralysis: The Organizational Context of the American Research University", Journal of Higher Education, Vol. 56, No. 3, May/June 1985.

7. ANAFID, ANPA, ANAPPAV et Institut Agronomique et Veterinaire, Hommes, Terre et Eaux: Revue Marcoaine des Sciences Agronomiques et Veterinaires, IAV, Rabat, Morocco, various issues.

8. Anon, Ceremonie de remise des diplomes par S.M. le Roi aux laureats de l'Institut agronome et Veterinaire Hassan II le Juin 1975, undated.

9. Arrif, A., Pratiques Pedagogiques et Pratiques Sociales dans la socialisation des eleves-ingenieurs en agriculture: le cas de l'Institut Agronomique et Veterinaire Hassan II Maroc, Doctorat de Troisieme Cycle, Tomes I et II, Universite de Paris I, Pantheon-Sorbonne, UER Science Politique, Paris, France, December 1982.

10. Association of Faculties of Agriculture in Africa, AFAA Addresses of High and Middle-Level Agricultural Education Institutes in Africa (with Addresses of Some Veterinary Institutes) General Directory, Association of Faculties of Agriculture in Africa, Rabat, Morocco, January 1986.

11. Association of Faculties of Agriculture in Africa, AFAA/FAO Rockefeller Foundation and Alexandria University, Egypt Workshop on Home Economics in Rural Development in Africa, Alexandria, Egypt, 17-22 October 1983, Association of Faculties of Agriculture in Africa, Rabat, Morocco, February 1984.

12. Association of Faculties of Agriculture in Africa, AFAA Ten Years of AFAA Activities 1973-1983, Presented at AFAA 5th General Conference, Swaziland 22-28 April 1984, Association of Faculties of Agriculture in Africa, Rabat, Morocco, April 1984.

13. Bawden, R.J., "Systems Thinking and Practices in the Education of Agriculturalists", Agricultural Systems, 13 (1984), p. 205-225.

14. Bell, R.D., W.E. Splinter and G.E. Thierstein, Report of the Agricultural Engineering Program Review Team - INRA-MIAC Dryland Farming Applied Research Project, MIAC, Settat, Morocco, January 1986.

15. Bouderbala, N. et al., La Question Hydraulique, 1. petite et moyenne hydraulique au maroc, Presses de Graphitec, S.A., Rabat, Morocco, 1984.

16. Buddemeier, W.D. et al., Overview of Development and Future Needs of Hassan II National Institute of Agriculture and Veterinary and of the Ministry of Agriculture Morocco, AID, Washington, D.C., October-November 1978.

17. Busch, L. and W. Lacey, Science, Agriculture, and the Politics of Research, Westview Press, Boulder, Colorado, 1983.

18. Casas, J. and J. Baeza, L'Institut Agronomique et Veterinaire Hassan II Ou Les Promesses de l'Etablissement d'Enseignement Superieur Agricole Marocain, OAA/FAO, Rome, Italy, July 1980.

19. Commission de l'Adequation Entre la Formation Professionnelle et l'Emploi, Rapport de la Sous-Commission Systeme d'Information sur la Formation Professionnelle et l'Emploi - Synthese et Recommandations, Ministere de l'Equipement, de la Formation Professionnelle, et de la Formation des Cadres, Rabat, Morocco, undated.

20. Direction du Developpement Rural, Chaouia Project II - The Socio-Economic Component of the Dryland Agriculture Applied Research Project 608-0136 Integrated Plan of Work 1984-1985, Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco, April 1985.

21. Direction du Developpement Rural, Chaouia Project II - The Socio-Economic Component of the Dryland Agriculture Applied Research Project 608-0136 Integrated Plan of Work 1985-1986, Insitutut Agronomique et Veterinaire Hassan II, Rabat, Morocco, December 1985.

22. Direction du Developpement Rural, Objectifs, Organisation et Bilan d'Activite de la Direction du Developpement Rural, Institut Agronomique Hassan II, Rabat, Morocco, May 31, 1985.

23. El Bakkali, A., Report of Outside Users of the CDA at IAV, IAV, Rabat, Morocco, January 24, 1986.

24. El Gharbi, R., "Honneur Royal A L'Institut Agronomique et Veterinaire Hassan II", Maroc-Business, October 1983.

25. Eriksen, J.H., Consultant Report - A Review of Selected Agricultural Policies in Morocco, KONCO Consulting Corporation, Washington, D.C., November 4, 1982.

26. Firdawcy, M.L., Association des Facultes Agronomiques d'Afrique: Un systeme de Formation integree des cadres de l'Agriculture - Cas du Maroc, IAV, Rabat, Morocco, June 1979.

27. Firdawcy, M.L., Profils des Carrieres Professionnelles des Laureats de L'Institut, Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco, 1985.

28. IBRD, Kingdom of Morocco Education and Training Sector Survey (in six volumes), Volume IV: Agricultural Education and Training, Report No. 4105-MOR, IBRD, Washington, D.C., June 10, 1983.

29. IBRD, Memorandum on Morocco's Agricultural Sector: Identification of Issues and Bank Strategy, Report No. 2667a-MOR, IBRD, Washington, D.C., May 2, 1980.

30. IBRD, Report and Recommendations of the President of the International Bank for Reconstruction and Development to the Executive Directors on a Proposed Loan in an Amount Equivalent to US$ 100.0 Million to the Kingdom of Morocco for an Agricultural Sector Adjustment Loan, with Technical Support Volume Covering Adjustment Program and Policies, Report No. P-4032-MOR, IBRD, Washington, D.C., May 28, 1985.

31. IAV, ACTES de l'Institut Agronomique et Veterinaire Hassan II - Revue Scientifique et Technique Multidisciplinaire, IAV, Rabat, Morocco, various issues.

32. IAV, Compte Rendu d'Activites, IAV, Rabat, Morocco, various issues from September 1966 to 1972-73.

33. IAV, Conference Secheresse, Gestion des Eaux et Production Alimentaire, IAV, Agadir, Morocco, 21-24 November 1985.

34. IAV, Rapport d'Activite, IAV, Rabat, Morocco, various issues from 1973-1974 to 1983-1984.

35. IAV, Rapport d'Activite - Pedagogie, IAV, Rabat, Morocco, various issues from 1982-83.

36. IAV, Rapport d'Activite - Recherche, IAV, Rabat, Morocco, various issues from 1982-1983.

37. IAV and University of Minnesota, Sixth Annual Work Plan and Budget - Agronomic Institute - Morocco (608-0610) October 1, 1985 — September 30, 1986, IAV and University of Minnesota, Rabat, Morocco, 1985.

38. Keller, J. and M.A. Kadi, International Irrigation Center/Morocco - Concept Planning Document, IAV, Rabat, Morocco, December 1, 1985.

39. MIAC, INRA-MIAC Aridoculture Project Integrated Work Plan 1985-1986 - Dryland Agriculture Applied Research Project: Project No. 608-0136, MIAC, Settat, Morocco, 1985.

40. MARA, Le Message - Vulgarisation Agricole, MARA, Rabat, Morocco, undated.

41. Ministry of Planning, Plan of Economic and Social Development 1981-1985, Vols. I and II, Ministry of Planning, Rabat, Morocco, April 1982.

42. Pascon, P., 30 Ans de Sociologie du Maroc (Textes anciens et inedits), Bulletin Economique et Social du Maroc, Rabat, Morocco, Janvier 1986.

43. Pascon, P., Etudes Rurales: Idees et enquetes sur la campagne marocaine, SMER, Rabat, Morocco, 1980.

44. Pascon, P., Le Haouz de Marrakech, Tomes 1 et 2, IAV, Rabat, Morocco, 1983.

45. Pascon, P., La Maison d'Iligh et l'Histoire Sociale du Tazerwalt, SMER, Rabat, Morocco, 1984.

46. Pascon, P. and H. van der Wusten, Les Beni Bou Frah: Essai d'ecologie sociale d'une vallee rifaine (Maroc), IURS/IAV, Rabat, Morocco, 1983.

47. Pattinson, I., Potential USAID Activities in the Fertilizer Sector of Morocco, USAID, Rabat, Morocco, December 20, 1985.

48. Popp, H., La Question Hydraulique, Tome 2 et Atlas des Cartes, IAV, Rabat, Morocco, 1984.

49. Practical Concepts Incorporated, Evaluation of AID/Morocco Assistance to Hassan II Institute of Agronomy and Veterinary Science - Final Report, Practical Concepts Incorporated, Washington, D.C., May 1975.

50. RONCO Consulting Corporation, Mid-Project Evaluation Project 608-0160 "Agronomic Institute" Morocco, RONCO Consulting Corporation, Washington, D.C., September 1983.

51. Rosenberg, C.E., No Other Gods: Science and American Social Thought, Johns Hopkins University Press, Baltimore, Maryland, 1976.

52. Royaume du Maroc, Institut Agronomique et Veterinaire Hassan II - Textes Reglementaires, Royaume du Maroc, Rabat, Morocco, undated.

53. Schuh, G.E., "Revitalizing The Land Grant University", paper presented at the Colloquium, Strategic Management Research Center, University of Minnesota, St. Paul, Minnesota, September 28, 1984.

54. Skogerbee, G.V., International Irrigation Center/Morocco - Activity Proposal for FY 1986-87, Utah State University, Logan, Utah, August 1, 1985.

55. Suisse-Guillaud, A., Rapport des Semences des Cereales, USAID, Rabat, Morocco, December 1985.

56. Tantawy, A.O. (ed.), Proceedings of the AFAA Fifth General Conference on Food Security in Africa, Swaziland - 22-28th April 1984, Association of Faculties of Agriculture in Africa, Rabat, Morocco, December 1984.

57. University of Minnesota, Agronomic Institute Project Morocco Fifth Annual Report, 1984-1985, University of Minnesota, St. Paul, Minnesota, January 1986.

58. University of Minnesota, Annual Report Morocco Agronomic Institute Project-1983/84, University of Minnesota, St. Paul, Minnesota, January 1985.

59. USAID, Country Development Strategy Statement: Annex 1 Description of the Moroccan Agricultural Sector, USAID, Rabat, Morocco, December 1985.

60. Wardlow, G.W., J.C. Sentz and J.D. Wilcoxson, Proceedings: Morocco - Partnership Program on Institution Building - The Mid-Program Conference - May 6 and 7, 1985 University of Minnesota, University of Minnesota, St. Paul, Minnesota, 1985.

61. World Bank, Agricultural Research and Extension: An Evaluation of The World Bank's Experience, The World Bank, Washington, D.C., 1985.