

**UNIVERSITY LINKAGES IN SCIENCE & TECHNOLOGY
FOR THE ASIA AND NEAR EAST BUREAU**

by

Matt Seymour

Division of Education and Human Resources
Office of Technical Resources
Bureau for Asia and the Near East
Contract ANE-0249-G-00-8029-00
June 17, 1988

**UNIVERSITY LINKAGES IN SCIENCE AND TECHNOLOGY
FOR THE ASIAN AND NEAR EAST BUREAU OF AID**

EXECUTIVE SUMMARY

This paper attempts to define the concept of linkages, review how AID has used them in the past, and explore how the ANE Bureau can sponsor linkages currently. Linkages are discussed primarily in terms of science and technology (S&T), and between universities and related institutions in the US and those in the Asian and Near East region. The paper responds to a growing concern in AID and the donor community regarding the problems of internal efficiency, stagnation and isolation in higher education in developing countries. Another concern is the need for a flexible mechanism to deal with the Advanced Developing Countries (ADCs) in the region which place high priority on S&T to accelerate economic growth. This is not to preclude continuation with assistance to LDCs in the region regarding educational development. University linkages, then, as planned institutional cooperation, are suggested here as an alternative (i) to assist higher education at relatively low cost, (ii) to widen options in dealing with the ADCs, and (iii) to focus S&T activities in all countries in the region to increase economic growth.

Two types of linkages are discussed in the paper - internal and external. Internal linkages refer to relationships developed between US and host country universities and are considered internal because they lie within the boundaries of university operations and activities. External linkages refer to relationships developed between the university, invariably in the host country, and a productive institution outside the university in the public or private sector. These are considered external because the linkage connects the university and an institution which has a different purpose such as specialized research in an institute or manufacturing in a fertilizer plant. Internal linkages usually have a specific educational objective such as to improve teaching, research or outreach, or more general ones such as mutual enrichment or understanding. External linkages usually have an objective of developing a product or service, often with a target community in mind, and in collaboration with a productive institution. Thus a university might engage in geological research with a petroleum company or in pesticide use with an agribusiness firm.

Two propositions guide the presentation of the evidence and the arguments for the use of linkages:

- o internal linkages between US and host country institutions of higher education contribute to improved quality of teaching, research and outreach in both;
- o external linkages between host country universities and productive institutions contribute to economic growth under certain conditions. (Most notably, these are government support, immediate incentives, and fulfillment of real needs.)

The evidence is drawn from evaluations of past institution building projects where selected linkages played a significant role. Most of these projects were from the ANE region. The most substantial evidence came from AID impact evaluations, but final project evaluations were also used. Unfortunately no data were collected from fieldwork on linkage effectiveness, and this is an obvious shortcoming of the paper.

The following are lessons learned which emerged from a review of these evaluations:

- o AID and US universities must make a long term commitment through a linkage to assist effectively host country universities;
- o individual leadership and the quality of interpersonal relations contribute significantly to developing and sustaining a linkage;
- o organizational flexibility and innovation are encouraged in linkage arrangements;
- o host country universities need political support from the central government that will permit them to be proactive institutions and for their external linkages to be effective with organizations, agencies and clients;
- o internal accountability and external pressure groups can accelerate universities to develop external linkages.
- o sustainability, as the capacity of an institution to operate increasingly on its own, is related to six factors: favorable government conditions, counterpart trust, autonomy, an entrepreneurial approach, quality standards and a "demand-driven" awareness.

These lessons provide a basis and perspective for developing linkages.

Internal linkages are varied and flexible and can be adapted to address institutional needs. They can be simple with the exchange of a few teaching or research faculty much like the University Affiliation Program of USIA, or they may be complex with linkages between departments, universities or even groups of universities (consortia). In addition to teaching and research activities, they may also include faculty upgrading, student training, joint research projects, curriculum development, information development and exchange, and administration strengthening. For LDCs the purpose is more likely to be development such as the strengthening or upgrading of a department or function; for ADCs it could be the same or be more general such as mutual enrichment or understanding. ADC linkages may also include other objectives, perhaps political or economic in nature, in addition to academic ones.

External linkages are more complicated, and may in fact consist of linkages with an US university to assist the host country university develop a product or service with an outside agency. They may be expressed through joint research programs, or provision of services such as standards testing or contract research to public or private sector institutions. Client agencies benefit from university services and expertise while universities benefit through exploitation of research opportunities or being able to adapt their curricula and outreach programs to the world of work. However, external linkages are difficult to achieve, for they require research management in addition to substantive activities. AID missions must also plan and monitor them more carefully than internal linkages.

The paper concludes that the use of linkages makes good development sense. Evaluation evidence indicates that internal linkages can improve teaching and research in local universities, while their flexibility and relatively low cost make them attractive mechanisms for assistance to higher education. While more difficult to assess, external linkages can contribute to economic growth through targeted and specific projects. The ANE Bureau is encouraged to consider proceeding with developing university linkages in science and technology, and six steps are suggested to do this.

**UNIVERSITY LINKAGES IN SCIENCE & TECHNOLOGY
FOR THE ASIA AND NEAR EAST BUREAU OF AID**

- I. Introduction
- II. Linkage Concept
 - A. Definition
 - B. Rationale
 - C. Guidelines
- III. Review of AID University Projects
 - A. Lessons Learned
 - B. Projects in the ANE Bureau
 - C. Agricultural Impact Studies
 - D. Sustainability
- IV. Second Generation Linkages
 - A. Institutional Stagnation
 - B. Returned Participants
 - C. Proposals
- V. Developing Linkages
 - A. Caveats
 - B. Internal Linkages
 - C. External Linkages
- VI. Conclusion and Next Steps

DEFINITIONS

Science	study and knowledge of natural and physical processes and phenomena.
Technology	the application of science to extend human capabilities using any tool, technique, physical equipment, process or method.
Research	systematic development of new knowledge.
basic	pursuit of knowledge or understanding of fundamental aspects of phenomena and observable facts without specific applications toward processes or products.
applied	pursuit of new information necessary for determining the means by which a recognized and specific need may be met.
development	application of scientific knowledge gained from basic and applied research toward the production of useful materials, devices, systems or methods including design and development of prototypes.
Innovation	introduction of ideas, objects or processes to an organization or setting where they previously were not used or recognized.
Technology transfer	movement of technology between settings
High tech	technology resulting from the application of research at the cutting-edge of knowledge. High technology often involves the use of sophisticated (computer) specialized equipment
Biotechnology	life science technologies applicable to agriculture, human and animal health, and energy.
End-users	the people who ultimately employ a technology, whether locally developed or transferred.

(Courtesy of Janet Rice, ANE/TR/ST)

"...in the final analysis, science involves a collection of human conjectures which are communicated in an elaborate social system and which are ultimately accepted or rejected, not on the bases of formal logical criteria, but rather in accord with the psychological and sociological principles which circumscribe our behavior as humans..."

-- Michael J. Mahoney, 'Psychology of the scientists: An evaluative review.' **Social Studies of Science** 9:349:75, 1979.

I. INTRODUCTION

The purpose of this paper is to define, review and explore how AID can sponsor linkages, primarily in science and technology (S&T), between universities and related institutions in the US and those in the Asian and Near East (ANE) region. This paper makes no pretensions of being a concept, strategy or position paper for the ANE Bureau; rather it is a step in the process of pulling together a sizeable quantity of information on how AID can forge closer institutional relationships to promote S&T activities for sustained economic growth. Hopefully it will contribute to the generation of linkages, activities or projects in this regard.

Such a paper would be more credible if there were a distinct "problem" which it responds to. Unfortunately this is not the case. Rather, there are three distinct but related problematic areas or concerns which have contributed to the need for such a paper. These concerns are: (i) a renewed interest in higher education; (ii) a need for greater flexibility within AID to deal with the Advanced Developing Countries (ADCs); and (iii) an interest to do more in the way of S&T activities and projects.

HIGHER EDUCATION. After more than a decade of relative neglect, AID is reconsidering the role of higher education in development assistance. Certainly there will be no return to 50's and 60's when institution-building established and strengthened post secondary educational development. However, there is a concern both within and outside of AID, that something should be done to revitalize LDC higher education, particularly those institutions that AID and other donors once supported and were sources of inspiration but now have become stagnant or even regressive. The donor community recognizes that many LDC higher education institutions are not what they were established to be, for they are beset with problems of internal efficiency, eg. repetition, dropping out, ineffective teaching, outdated curricula, etc. and are increasingly isolated from other institutions in their environment.

Selective assistance characterizes this concern in terms of limited and targeted assistance to certain universities or even faculties within universities which show potential for productive teaching, research or outreach activities. Research and development institutes in the public and private sectors would also be likely targets for assistance. Long term assistance or relationships between US and host country institutions also characterize this concern to insure quality improvement and mutual benefit.

ADVANCED DEVELOPING COUNTRIES: The developing world of today is considerably more complex, diverse and dynamic than it was when AID began in 1961. Relationships upon which developing countries once relied are disappearing (raw materials interdependency) and theories of comparative advantage are being re-examined. Trade, investment, monetary and exchange policies have a more pronounced impact upon development than in the past, and so AID needs to be open to new trends, and flexible policy responses. Some countries in Asia, the Near East and Latin America are partners - even competitors - in production, trade, investment and policy-making with the US. Their relationship with the US has changed from one of dependency to cooperation and competition. In addition, they carry greater political influence than they did before in their respective regions.

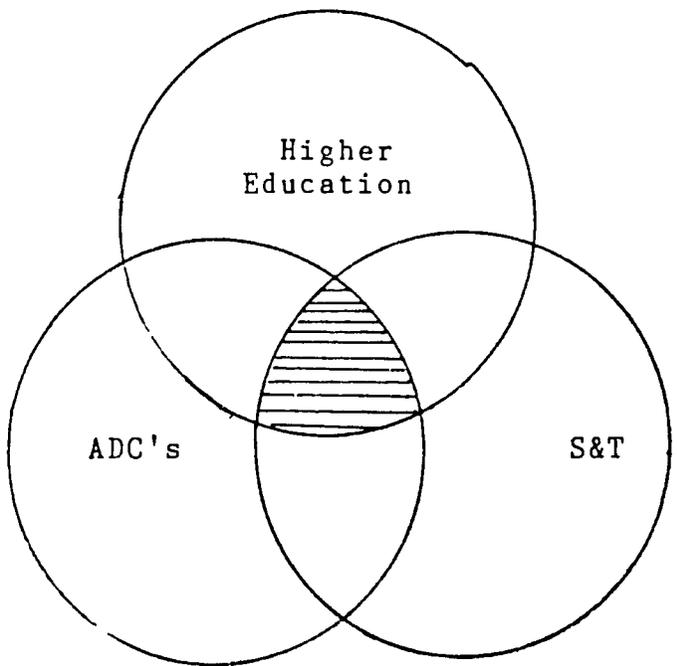
In response to these changes, the ANE Bureau has been reconsidering its role with the ADC countries from one of providing development assistance to one of cooperating through economic, commercial, scientific and educational exchange for mutual benefit. Institutional linkages - including universities and research institutes - are one mechanism to address mutual economic and political needs without losing sight of development problems - particularly those relating to urbanization, environment, population growth, agriculture, health and unemployment to mention only a few.

SCIENCE AND TECHNOLOGY: S&T is the third concern related to the establishment of institutional linkages between the US and ANE region. Science and technology are considered broadly here with the distinction being that science produces knowledge, while technology applies scientific knowledge to produce wealth. Science is "know-why" while technology is "know-how". Both contribute to economic growth: science provides the pool of basic knowledge and understanding on which technology depends; technology contributes to production and growth through the more efficient use of resources, skills, methods and machines. S&T disciplines are also considered broadly and include the "hard" sciences such as physical and biological sciences, medicine and engineering; the "soft" sciences such as the social sciences, education and management; and related sciences of mathematics, statistics, and computer and library science.

The concern regarding the ANE Bureau is how to use S&T efficiently for a developmental thrust, particularly in agriculture, health, population, energy, environment and education; and for a private sector thrust to promote technological production (eg. "high tech"), trade and

investment, and commercial marketing. Hence exchange of technology and scientific collaboration will be emphasized. The challenge is to develop S&T linkages between educational institutions, research labs, product development centers and related institutions so as to contribute to the development, acquisition, and adaptation of new technologies in the ANE countries, particularly those at the ADC level. Lack of scientific and technological knowledge is seldom a critical limiting factor. Rather, the main obstacles to application are economic and social, including education, communications, acceptability of new ideas, administrative effectiveness, business enterprise and political leadership. Only within this broader context of development, can science and technology make an effective contribution.

These three themes - higher education, ADC's and S&T - as they relate to the development of university linkages might be portrayed as three overlapping circles. Each is separate and distinct, yet they converge, relate to and reinforce one another. This convergence is the subject of this paper and is illustrated as such:



Section II will define what is meant by linkages both as they apply to universities, and between universities and productive institutions outside the universities. It will also present a rationale for AID to pursue linkage activities as well as tentative criteria to help define a linkage. Section III will review institutional building

projects involving US and local universities in the region during the 50's and 60's as well as impact studies of agricultural institutions. This review should identify a few lessons learned which should then set the stage for a more detailed look at linkages. Section IV and V will explore - as a systematic search - and analyze linkage concepts, alternatives and examples. Section IV will discuss "second generation linkages" and the advantages of renewing contacts with returned participants, while Section V will analyze internal and external linkages and their hypothesized relation to improved institutional quality (host country as well as US) and economic impact. Section VI will offer some conclusions and suggest next steps to develop university linkages.

Limitations of the paper are obvious. There is no clear cut problem which the linkages as modalities address -- only the convergence of the three themes. To some extent the cart has been put before the horse. Further, much of the exploration and analysis is speculative without documented case studies or substantial evidence to argue that the linkages will be effective. Finally, data were gathered only from AID documents, interviews with personnel in the ANE Bureau and from secondary sources. No fieldwork was undertaken though it certainly is needed. Nevertheless, it is hoped that the paper will shed some light on linkages and their use in the region, and what next steps should be taken to develop them.

II. LINKAGE CONCEPT

This section briefly defines the concept of a linkage, discusses types of linkages and a rationale for having them, and offers guidelines for their development.

A. Definition

The term "linkages" has acquired a variety of meanings. Linkages are defined simply as planned institutional cooperation. They are direct operational ties, arrived at through mutual agreement, providing mutual benefit, and requiring mutual investment of resources. Unlike predominantly one-way linkages developed in institutional building projects, linkages imply a two-way exchange for satisfaction of mutual needs. Emphasis is upon mutuality, transaction and collaboration.

Linkages may occur at different levels. They may develop informally between individuals from the linking institutions and then become formalized as the relationship becomes routinized. More often, linkages occur between components of institutions, such as departments, faculties or specialized units. At a more inclusive level are linkages between institutions as a whole. They may even occur between groups of institutions, or consortia, as for example a linkage which developed between ten US engineering universities and the Kanpur Indian Institute of Technology in India (see Section III).

Two types of linkages are discussed in this paper -- internal and external linkages. Internal linkages refer to relationships developed between a US and host country university or related institution. This is considered internal because the linkage lies within the boundaries of university operations and activities (although strictly speaking the link goes outside the university to another university). External linkages refer to relationships developed between the university, invariably in the host country, and a productive institution outside the university in the public or private sector. This is considered external because the linkage lies between the university and an institution which has a different purpose such as specialized research in an institute, or such as manufacturing in a fertilizer plant. The latter institution, in effect, lies outside of the general teaching, research and extension functions of the university.

This distinction is important because from the host country perspective internal linkages usually have as a main objective the improvement of internal efficiency -- or how well the university uses resources to achieve outcomes which are specifically educational. External linkages usually

imply more immediate economic impact in that the university and a productive institution collaborate in applied research or delivery of services to a target group such as petroleum exploration for petroleum companies or pesticide research for farmers.

As the main subject of this paper, these two types of linkages can be summarized by two hypotheses:

- **internal linkages between US and host country institutions of higher learning contribute to improved quality of teaching, research and outreach in both;**
- **external linkages between host country universities and productive institutions contribute to economic growth under certain conditions.** (Most notably, these conditions are government support, immediate incentives and fulfillment of real needs).

Internal linkages are defined and achieved more easily for they deal with academic objectives which both parties can identify and recognize when they are achieved. New instructional techniques, curriculum development or research projects are palpable activities within the grasp of administrators and faculty. External linkages, however, are more difficult to achieve. These involve links between the university and outside research organizations or those in industry and agriculture. They may be expressed through joint research programs, or provision of services such as standards testing or contract research. Client agencies benefit from the services of the university while the latter benefit by exploiting research opportunities and being able to adapt the curriculum more appropriately to the realities of the workplace. But, as will be discussed below, external linkages may require government support or at least, the setting of conditions for effective implementation. In addition, if the linkages are demand-driven, market forces may be at odds with academic objectives and responsibilities of the faculty and thus disrupt or stall the activities.

B. Rationale

The inherent flexibility of institutional linkages -- be they projects or mere exchanges -- can achieve a number of purposes which go beyond the limited and specific ones associated with institution building projects of the past. Academically, there are advantages to both host country and US institutions. For the former, linkages offer:

- o exposure to the American educational system which emphasizes the applied as well as the theoretical in unique combinations of extension and service;
- o interdisciplinary problem solving;
- o faculty and staff upgrading;
- o American faculty to work on curriculum and research as well as longer-term academic planning for development;
- o suitable and tailored training for students which exposes them to modern and up-to-date knowledge and skills yet enables them to concentrate on home research problems;
- o all of the above benefits for modest local investment.

For American institutions, linkages offer:

- o overseas experiences for faculty and students which broadens and deepens understanding to the direct benefit of teaching, learning and research.
- o research opportunities in area and cultural studies, economic and social development, and scientific and technological problems associated with economic development or with tropical environments;
- o increased teaching focusing on international development problems;
- o opportunity for sustained dialogue with the international scholarly world;
- o rotation of tenured and nontenured faculty;
- o opportunities to include a wider range of US institutions such as those specializing in science and technology.

Linkages meet developmental purposes by focusing on a particular aspect of institution building. This can be the improvement of one department, provision of technical assistance or even a modest transfer of commodities such as computers. For the ADCs the developmental purpose may be less pronounced, or even non-existent, while a political purpose may be achieved through the mere presence and visibility of a US university in partnership with a host country university. A linkage can also have an economic purpose, as for example when a US university collaborates

with a local industrial or manufacturing institution to develop or improve a product which becomes commercially linked to international business, and thus widens prospects for US trade and investment.

In addition to its flexibility of purpose a linkage is cost-effective. At relatively low cost, when compared to the cost of equivalent projects involving technical assistance, training and commodity transfer, it can develop into a long term relationship. USIA grants, for example, under the prestigious University Affiliation Program may not exceed \$60,000 for one year and carry the possibility of renewal for three years. Under this faculty exchange arrangement, USIA funds are used only for participant travel costs and maintenance expenses; yet countless linkages have been forged and sustained since 1961 through this Program in its effort to "increase mutual understanding between the people of the United States and people of other countries."

C. Guidelines

It would be presumptuous here to lay out an explicit set of criteria for the development of linkages. Reviews and evaluations of linkage activities, both within and outside of AID indicate there are many factors which contribute to successful linkages, and that they vary depending upon the type and conditions of the linkage. In addition, many of the factors, particularly those articulated by host country personnel, require a personal touch which is so essential yet difficult to categorize let alone to program. Nevertheless, there are some re-occurring themes which may serve as useful, though general, guidelines.

1. Priority areas - Linkages reflecting S&T concerns clearly are of priority. This would include internal linkages which support teaching, research or development of "hard", "soft" or related sciences as noted in Section I. It would also include external linkages in the application of S&T through research, service, policy-making or related activities which would have economic and social benefits for target groups or the larger society.

2. Congruence of objectives - One of the most frequently heard complaints from LDC educators about university linkages has been the lack of a clearly defined purpose with mutual benefits and a commitment of resources (Harrington 1978:91). Participating institutions have sometimes worked at cross-purposes with misunderstandings or "hidden agendas" cropping up during the course of the activity. Complaints refer to a lack of overall planning by US institutions, the absence of principal faculty to provide sufficient attention either in the US or overseas, and projects or coursework which reflect individual concerns and not those of the LDC institution (IBID). From the beginning the linkage should

be founded upon clearly expressed and mutually agreed upon objectives toward which both the US and host country institutions are willing to commit adequate effort, time and resources to achieve.

3. Reciprocity - Essential to a successful linkage are the elements of parity, joint planning and mutual access to resources. In the words of one LDC Vice Chancellor:

The time has come when university relationships should no longer contain traces of the donor-receiver mentality. Universities in the developing world want equal relationships with their counterparts in the developed countries, and are seeking to join in mutually beneficial cooperative projects (IBID:94)

In effect, trust is expressed by both parties through the commitment and use of resources to establish a working relationship on a project or activity of mutual interest.

4. Collaboration - Closely related to, and following from the above is the element of individuals working together on scientific or technological problems of development. Especially appropriate are collaborative research, teaching and curriculum development. Even though there may be a need for improvement in these areas in the host country university, the idea of working jointly reduces the "donor-recipient" mentality (see Kanpur project in Section III for an example of full collaboration).

5. Continuity - Just as LDC educators strongly expressed a desire for a long term relationship with a US university, so did they react to "quick shot" action projects. Sufficient time must be allowed for developing relationships, monitoring and evaluating activities, and continuing staff training. Where formal arrangements for linkages cease, their continuation through informal arrangements and contacts can be useful.

6. Cost-sharing - Where AID sponsors a linkage, both participating institutions must demonstrate a financial investment which would, at least, include salaries and omit consulting fees and administrative costs. In addition the universities would provide faculty housing and, in some cases, transport. Clear evidence would also include a scheduled escalation of payments by the universities as AID de-escalates payments for linkages spread over a few years (see Pakistan Institutional Grants in Section III).

7. Multiplier Effects - Successful linkages demonstrate positive, though in some cases, unintended "spin-offs" where participants seize opportunities as they arise to develop additional linkages or new facets to the existing linkage.

For example joint pesticide research between a State Agricultural University and agricultural firm in India led to the creation of a new product and marketing venture for that firm.

8. Sustainability - To the extent possible, an AID sponsored linkage should demonstrate evidence of being able to maintain the linkage, or a variation thereof, once AID funding terminates. Successful cost-sharing and multiplier effects contribute to sustainability, as evidenced by the ability to capitalize on unforeseen opportunities and to overcome constraints. More generally, it refers to the participating institutions' capacity to develop new strategies, programs, courses, projects and activities that insure quality and continued performance.

III. Review of A.I.D. University Projects

This section reviews project and impact evaluations of past institution building projects to identify quality characteristics of internal and external linkages. Selection of projects followed two criteria. First, only university institution building projects were selected, and second, the quality of information from the project evaluations dictated whether the project would be included. Impact evaluations have far more depth and insight than the project Performance Evaluation Summaries (PESs), and so all of the former were used while the latter were used selectively. In addition, PESs were reviewed only from the ANE countries chosen for study, which are India, Indonesia, Pakistan, Thailand, Nepal, Tunisia, Jordan, Yemen and Bangladesh. As would be expected the PES evaluations bring out the project "process" of organizational and personnel arrangements, while the impact evaluations emphasize the project "substance" of achievements and impact.

Subsection A summarizes the lessons learned from the review, while B and C summarize relevant aspects of the project and impact evaluations respectively. Subsection D discusses project sustainability in light of this review.

A. Lessons Learned

The following six lessons are relevant for AID to consider when developing future university projects so as to increase their impact. They flow from the evaluation summaries in subsections B and C. The first two lessons apply to both internal and external linkages, three and four apply more appropriately to internal linkages, and five and six to external linkages.

1. AID and US universities must make a long term commitment to assist effectively host country universities.

Virtually every evaluation subscribes to this assertion, and it has become a truism in the institution building literature. The remarkable success of the Hassan II Institute of Agriculture and Veterinary Medicine (IAV) of Morocco is the 15 year relationship between this institution and the University of Minnesota which "...must set some record for US higher education." In addition, this relationship appears to be one marked by trust and mutual understanding. Clearly this accumulation of trust, reinforced by commitment and performance, enabled both IAV and Minnesota personnel to explore and test out a variety of options within a long term planning framework. This also appears to be the case among the engineers in the Kanpur Indian Institute of Technology project. No such framework

existed between Bunda College of Malawi and the Massachusetts faculty, nor between the faculties of Kasetsart and Oregon State. The ad hoc nature of these relationships contributed to weak design, planning and programming.

1.1 A corollary to a long term commitment is the effectiveness of **incremental project development**. It may be that short term activities and funding requirements are necessary at first between a US university and host country university to establish trust and to agree upon a long term commitment; or it may be that when a long term commitment is first established, then a series of short term activities are necessary to test out options for the development of an operational plan. In either case, it seems best to develop university projects or activities from the bottom up so that the success of each small, but meaningful activity reinforces the credibility of the donor and the mutual trust of both parties. IAV was marked by limited objectives and satisfactory completion of one activity after the other so that their successful accumulation produced new activities and opportunities. Eventually this led to larger project activities and a commitment for extended development.

In addition, incremental funding appears to foster an entrepreneurial attitude among local administrators and faculty. In the cases of the Superior Institute of Agriculture (ISA) in Dominican Republic and IAV, both actively sought scientific and financial linkages with multiple donors instead of relying on funding from AID only. In fact, AID support to ISA is a result of its own aggressive initiatives in seeking such funding.

1.2 A second corollary to long term commitment -- and one central to this paper -- is that AID needs to **rethink the conditions and incentives** for developing stable long term relationships between US and host country universities. The institution building model underlying the reviewed projects is now out of date and is inappropriate certainly for ADC countries. New models for sharing common problems and the mutuality of benefits for all participants need to be formulated and applied. Both the Kasetsart and the State Agricultural Universities (SAUs) of India evaluations refer explicitly to the need for generating sister relationships between American and host country universities as a way of meeting the long term commitment. As the former notes:

American university contractors in our opinion tend to produce their best results when presented with long term opportunities for institutional collaboration under conditions of clearly set, incremental objectives; stable funding; and a minimum of day-to-day supervision by AID staff. Ideally, such opportunities should start with a collaborative program design effort

and continue through several incremental implementation phases, with periodic peer review (p.25).

2. Universities which reflect the following characteristics are likely to have internal and external impact.

2.1 "Sense of mission" - the university has a commitment to go beyond education, research and training, and is committed to develop an institutional structure to serve local needs.

2.2 Development Plan - the university has a Five-year (or specified time-frame) plan which identifies needs, targets, activities and funding requirements in key areas. Some of these might be program (curriculum, research, extension), faculty, facilities, plant, administration and services.

2.3 Administration - the university has key administrators, deans and board members who have a vision of this mission and capacity to realize it.

2.4 Quality standards - the university is committed to achieving excellence in teaching, research and outreach programs and rewards superior performance by faculty and staff for implementing these programs.

2.5 Autonomy and support - the university is able to exercise certain autonomy regarding policy-making, research and programming without jeopardizing its government support

2.6 Integrated curriculum - the university encourages a balance between theory and practice in its science, technology and management curricula; and it requires a core curriculum for all students within discipline areas yet allows adequately for specialization.

2.7 Management - the university demonstrates capacity (or programs to strengthen its capacity) to administer, budget and manage academic and support services.

2.8 "Openness" - the university remains open to external stimuli and evaluation, is self-examining, and encourages opportunity for experimentation and innovation.

Clearly these are prerequisites for success for most any higher education program. The idea here is to identify characteristics which host country universities demonstrate to some degree, so as to be eligible as candidates for an AID funded linkage with an American university. Those universities which show these characteristics would increase the probability that the linkage will be a successful one; and that it will have positive impact.

INTERNAL LINKAGES

3. Individual leadership and the quality of interpersonal relations contribute significantly to developing and sustaining a linkage.

While obvious, most evaluations attributed success to strong and committed leaders from the US and host country institutions. Two individuals from the Minnesota team in the Morocco IAV project were singled out as contributing significantly to the 15 year relationship with the Hassan II Institute, while a determined Chief of Party turned a faltering Management Institute project around in Tunisia. Conversely, weak leadership in the Bunda College and Kasetsart University projects accounted for the lack of long term planning and US commitment. In other projects, the qualities of trust, reliability, dedication, adaptability and flexibility also seemed to contribute to sustained working relationships between the two sets of personnel. The Indian Institute of Technology project in Kanpur reflected an intense, continued and genuine commitment by both parties and achieved extraordinary levels of collaboration in planning, implementation and evaluation.

4. Organizational flexibility and innovation are encouraged in linkage arrangements.

The project evaluations suggest that variation in linkage arrangements can overcome the constraints of limited resources and multiple demands. In Indonesia a knowledgeable resident manager at Bogor Agricultural Institute planned, programmed and followed up a series of carefully orchestrated short term consultancies to maximize their benefits at minimum cost. Also in Indonesia, the Communications Technology project cut costs by combining technical assistance with participant training when US professors accompanied Indonesian students home and continued to teach them while also developing curricula in their resident university. Rather than creating a new Institute of Education in India, the Teachers College Columbia University team consolidated relevant departments from six existing education institutes and research centers. Again in Indonesia, the Kentucky and UCLA teams responded to Indonesia's complexity and diversity by concentrating on strengthening the engineering faculties of leading institutions, and then managed the build-up of faculties in lesser institutions through the efforts of the trained faculty from the leading institutions.

EXTERNAL LINKAGES

5. Host country universities need political support from the central government that will permit them to be proactive institutions and to have an impact upon external organizations, agencies and clients.

The most effective universities externally -- ISA, IAV and during the early years, the SAUs -- all have political support from the central government and are under the control of agencies in the Ministry of Agriculture. In effect each university has a strong linkage with its primary bureaucratic constituency and so has access to a policy, funding and institutional forum supportive of its research and outreach goals. Hence the Ministry of Agriculture provides incentives for university personnel to conduct applied research which is congruent with national development objectives; and for them to extend research, training and services to farmers, farmer collectivities, agribusiness and related groups for effective outreach. In effect, Ministry directives, support and incentives seem to be necessary conditions if external linkages between the university and other organizations are to emerge.

Conversely, the least effective universities externally -- the African universities -- lack political support from the central government. They are under the control of the Ministry of Education, yet the locus of resources and decision-making for agriculture resides within the Ministry of Agriculture which is their "bureaucratic constituency". The MOA's have built their own parallel research structures that consume most research resources. The Ministries of Education -- the primary funding agencies for the African universities -- have no agricultural expertise for assessing research and extension programs. Nor is there any effective link between the MOA and the MOE. Hence teaching becomes the priority for the faculty so as to meet the need of their internal constituents, the students. There is little incentive or support for faculty to conduct applied research outside the university or to supply services to farmers through an extension program.

6. Internal accountability and external pressure groups can accelerate the universities to develop external linkages

Where the development of external linkages -- be they in the form of extension services, research with outside organizations or reciprocal arrangements with agribusiness -- is tied to the university's charter and is sanctioned by its leadership, there is a chance for that development to succeed. ISA's leadership, for example, has exercised its support and influence to insure ISA's outreach to the

private and public sector and to remain attuned to the needs of the rural sector.

External groups, such as alumni groups and livestock or horticultural associations sensitized IAV to special needs in the Moroccan agricultural community. Alumni feedback encouraged the development of a more practical approach to training in certain disciplines. The associations requested assistance in terms of service or research from appropriate faculties so that the latter became demand-driven. An exception to the lack of extension in the African universities is at Ahmadu Bello University in Nigeria where the government transferred existing research and extension organizations to the University so that they became elements of a larger agricultural complex. This was because the government decided to make this university a regional extension center to meet the demands from the large concentrations of farmers and herders in the area.

In the absence of, or instead of external groups, donor pressure can encourage external linkages. AID and other donor funding established at the outset for ISA to extend its services to the rural sector as part of project activities. Thus, funding for projects was contingent upon outreach ventures to the public and private sectors. The Malawi evaluation argued that, despite the absence of strong government directives for outreach, had AID incorporated outreach activities in the project design and pressured Bunda College to implement them, it probably would have insured their existence.

B. Projects in the Asia and Near East Bureau

Section B identifies and describes the types of university projects which A.I.D. has sponsored in the ANE region for the past thirty years. Information was obtained from the Abstracts of project documents and this goes back only fifteen years. It was also obtained from narratives in the Congressional Presentations going back to 1961. The information is sketchy and so only the barest details are presented with reliability. As a result not all the countries selected for study are included.

There were very few, if any, projects limited strictly to "science and technology". Hence, the terms are used broadly here to include the sizeable number of linkage-type projects in agriculture, health, education and engineering. These are, after all, applications in a most practical sense, of scientific and technological developments. There are a few approaches and twists in these early projects which might be useful for rethinking linkage activities.

1. Institution Building Projects

The main objective of university projects in the 50's and 60's was institution building. The developing world simply did not have the trained manpower to manage and operate the technical agencies in the key sectors of agriculture health and education. Hence the purpose of most of these projects was to strengthen an existing institution so that it could train more and better scientists and technicians to either work in their respective sectors, mostly at the mid or upper mid-level; or to train others to do the same. Even when accounting for inflation, projects seemed to be less costly when compared to those today. With exceptions, most ran from \$2 to \$8 million and ran over periods of 5 to 10 years. These projects fell sharply in number in the 70's as AID was obliged to concentrate on projects which met basic human needs under the New Directions policy.

Profiles for institution building projects were relatively uniform. Typically, inputs included construction of buildings or rehabilitation of facilities and substantial commodity transfer in the way of books, materials and equipment. They also included a healthy dose of technical assistance (5-10 persons for small projects, 10-20 or more for larger projects), usually because a number of disciplines had to be established, developed or improved. In addition, participant training was also large with emphasis on MS and Ph.D. study in the target disciplines. Narratives refer more than once to the need to synchronize training with technical assistance to insure coordination between the participant while studying in the U.S. and the American technician in the project; and to insure the participant completes his study to pick up project duties when the technician returns to the U.S.

Outputs included completed construction and use of buildings or facilities, and the installation and functioning of laboratories, equipment or materials. They also included curriculum development - often in several disciplines or even faculties; the formulation of syllabi, teaching plans and instructional procedures; and their implementation through new programs charged with an American as opposed to a British or French approach. Research plans were formulated and carried out with an emphasis upon integrating theory with practice. Extension programs were developed to provide practical learning experiences for students as well as to begin outreach activities - however new and modest - to surrounding communities. In some cases, internal management and administration were strengthened, particularly through improved accounting and budgeting practices.

Especially apparent in this review is the personal involvement, even enthusiasm, between technical assistance and counterpart teams. For example, U.S. specialists would teach classes with their counterparts, would observe them, and would plan with them courses for the term. Similarly, research and extension activities would be planned and carried out jointly with members of both teams working through the research or extension process. Perhaps, more than anything else, this personal touch to teaching, research and extension activities between U.S. and counterpart teams facilitates the flow of ideas, the transfer of techniques and the acceptance of different perspectives.

2. Countries: India, Indonesia, Tunisia and Pakistan

Because of sketchy information about strategies, mechanisms, or evaluations of the projects, what follows are descriptions from a few projects which are relevant to rethinking university linkages. (The relevant characteristics are highlighted before the project title.) Only four countries are included, partially as a result of this sketchy information, and because the least developed among those countries selected for study -- viz., Yemen, Nepal, and Bangladesh -- had no higher education activities or were undergoing the travails of civil war. Curiously, Jordan had nothing in the way of university development until 1979 when a Faculty of Agriculture project was finally developed. (The Thailand Kasetsart University project is discussed in the next section under impact studies).

This distinction between the more and less developed countries within the region persists today so that some are clearly ADC countries while others are LDC countries. This might have implications for defining different types of university linkage programs in science and technology.

INDIA

An effort in planned collaboration - Indian Institute Technology, Kanpur (IIT/K) project

This project is distinctive by the way it incorporated Indian engineers from the beginning of the project into decision-making aspects on a parity basis with American engineers. This was embodied in a collaborative mechanism comprised of key U.S. and Indian engineers. The mechanism was responsible for recruitment of Indian faculty for IIT as well as selection of participants for U.S. training. Similarly, it approved: the curriculum and course offerings; the charter and procedures for the faculty senate; identification of equipment needs and specifications of procurement procedures; and the creation of an innovative

faculty structure and administration to handle the complexities of the new Institute. Thus, the mechanism -- the Kanpur Indian-American Program (KIAP) -- not only coordinated the activities of a larger number of engineers from nine U.S. universities, it collaborated Indian and U.S. decision-making regarding project planning, implementation and evaluation.

Regarding participant training, project documents reveal that KIAP wanted to return the first participants in the projects back to the U.S. for refresher courses. Now as administrators, KIAP felt these technicians needed management training in addition to refresher courses in engineering.

**Implementation through consolidation -
National Institute of Education (NIC) project**

The contractor, Teachers College of Columbia University, was charged with establishing a nation-wide, policy-making body in education. This body was to set policies, advise on standards, create training programs, write basic texts and teachers' manuals, and carry out research and evaluations. In the absence of any such body, it assisted in consolidating six education institutes and research centers to form the NIE. This avoided the problem of creating one institution de novo and provided opportunities for existing institutions to channel their energies into more comprehensive areas.

INDONESIA

**Spreading technology - Department of Science and Engineering
Colleges project**

In this as well as in agricultural projects, Indonesian projects developed the "Pembina" (builder) concept. Because of Indonesia's distances, diversity and dispersed population concentrations, the projects focused on developing faculties in leading institutions first, and then assisted these faculties in developing faculties in lesser and more remote institutions. Thus, U.S. advisors would assist counterparts, who in turn would assist country counterparts in the second tier institutions. This was further-developed in the Agricultural Education for Development project where two other "Pembina" faculties linked with lesser known and smaller faculties in Western and Eastern Indonesia. In addition, the lesser known faculties formed administrative networks or associations to facilitate the flow of information and services from the "Pembina" faculties.

Second generation assistance - Graduate Agriculture School project

Building upon ten previous years of work at the Bogor Agricultural Institute (IPB), technical assistance was provided through a selective and flexible plan. A single resident manager, already familiar with IPB, planned, programmed and managed an extended series of short consultancies (3-4 weeks each) by Wisconsin faculty in crop production, nutrition science, watershed development, and extension. Wisconsin committed thirty consultants to make short visits to IPB, who usually returned with their counterparts to Wisconsin for more and diverse consultation. The flexibility included the programming on site of new activities when the project was extended because of construction delays. The travel and work by Indonesians at Madison and other MUCIA faculties, where the Indonesians were afforded visiting professor status, strengthened ties between Wisconsin and IPB.

In addition, the manager built up links between IPB and the MOA, and arranged to have short term consultants work with counterparts there. Consultants would assist in specialized work and encourage MOA officials to collaborate where possible and useful with respective IPB faculty. These outward looking arrangements from IPB hinged on the technical and programming expertise of the one resident manager.

This project was the only one reviewed in the PES abstracts as a "success".

Technical Assistance combined with training - Communications Technology

The technical assistance subcontractor - USC - collaborated with the University of Indonesia (UI) to complete the participant training component. Participants began their longterm coursework at UI. Then they would take up to 50% of their coursework at U.S.C. Finally, they would return to UI to complete their degree. Numerous "waves" or groups of participants completed this three step training program.

The unique feature is that USC faculty returned with the participants to UI not only to continue instructing participants there but also to assist UI faculty in curriculum and instructional development. By conducting half of the training in Indonesia, training costs were cut substantially. In addition, USC faculty strengthened UI's capability to offer graduate training in communication technology. It also helped strengthen ties between the two faculties by designating the participant training as a joint degree program.

TUNISIA

Long term institution building - Management Education and Executive Development project

AID contracted for two types of technical assistance from the University of Illinois to support its management education project in Tunisia: (1) placement of Tunisians in doctoral programs in the US and (2) provision of faculty to participate in the development of the project. The American professors on contract in Tunisia never numbered more than three at any given time; they were to be replaced and the faculty was to be expanded by returning Tunisians with American Ph.D's.

The project's original purpose was to establish a graduate school of business administration now called L'Institut Supérieur De Gestion (ISG); but this expanded into a more general purpose of "increasing productivity and profits in both public and private enterprises." Nevertheless, solid technical assistance and participant training kept the project on target to improve faculty, to develop quality curricula, and to train superior students, many of whom now hold key managerial positions in the public and private sectors.

The University of Illinois had some difficulties with its contract with AID. Personnel frictions were a problem until an outstanding Chief of Party took hold of project implementation and influenced curriculum designs, seminar programs, library holdings and research programs. This person continues to lecture and serve faculty review boards at the University of Tunis today.

The conclusion is very simple: this project was very successful, although its evolution diverged from the original plans. In effect, ISG symbolizes Tunisian modern management, market forces and upward mobility, and its positive impact upon Tunisian economy and society continues today.

PAKISTAN

A pioneering effort in cost-sharing - Institutional Grants

This grant provided support to cooperative programs between Colorado State (CSU) and University of Peshawar (UP) under a 3-year (1967-70) program of diminishing support. The two universities budgeted funds to supplement USAID's contribution during the first year and increased budget allocations over the next two years to sustain institutional relationships from their own resources by the end of the

third year. The grant's objective was to lessen impact of U.S. withdrawal while allowing universities to find alternative sources of funds for their own cooperative programs.

The grant was renewed for 1976-1978 to improve Peshawar's Faculty of Engineering. There has been a long term relationship between the two faculties, since 1954. The cost sharing objective was not achieved because of diminishing foreign exchange reserves within Pakistan and not because of project design or implementation. In fact, the grant was renewed and at the end was rated as 70% successful in: faculty upgrading; strengthening undergraduate exchange program for UP members at CSU; seminars and workshops conducted by short term CSU consultants; UP research activities; and the acquisition of library materials.

C. Agricultural Impact Studies

Impact evaluations of projects provide greater depth and insight into the characteristics and causes of successful university projects than do standard end-of-project evaluations. AID is currently conducting impact studies of higher agricultural education projects, and so a review of the completed ones would be appropriate here.

A standard format will be used. The review will be limited to those aspects which relate to the transfer of science and technology through university linkages, and the impact which host country universities have on their economy as a result of the transfer. Each study will be summarized with attention to the role of the US university, characteristics (internal and external) of the successful agricultural university and factors lending to its success.

The Hassan II Institute of Agriculture and Veterinary Medicine (IAV) in Morocco

This appears to be a model case for university collaboration, and by all standards IAV is successful. The first project (and two succeeding ones) began in 1969 with Minnesota providing assistance for more than 15 years. Beginning with basic teaching and research in soil and plant sciences, the IAV's program expanded and diversified to offer a full curriculum in veterinary medicine, agricultural sciences and related fields in rural development. Institutional expansion was characterized by incremental assistance from AID and Minnesota managing inputs systematically and completing activities before beginning others. In addition, Minnesota encouraged long-term

collaboration with a small but dedicated staff, and rewarded university staff for remaining overseas. Two individuals in particular played important roles in maintaining continuity.

Within the Institute, success means recruitment of select students and faculty as well as high standards in teaching-learning and research. In addition an integrated curriculum provides solid grounding in agricultural and veterinary sciences for all, yet allows for specialization and practical fieldwork. IAV also has a substantial library and information center. Externally IAV is linked to the Moroccan farmer indirectly through agricultural planning and research programs and directly through extension and outreach activities. Graduates are immediately recruited into agricultural or related positions in the public and private sector and are rapidly making an impact in their respective fields. Importantly, an alumni association and other professional groups focus the Institute's research and extension activities on practical problems, and some entrepreneurial farmers have requested research assistance from the Institute.

Contributing to this success is a sense of mission at the Institute and a belief in the primary role of agricultural education for Morocco. Indeed, a committed and dedicated leadership emphasizes international standards in research and quality in teaching. Perhaps most important, IAV has preserved its own autonomy so that it can direct teaching and research according to these high standards; yet it uses informal networks of supporters to defend its budgets and prerogatives as well as to seek assistance from many donors. In effect the Institute has been entrepreneurial in gaining external support from friendly constituencies.

Dominican Republic: The Superior Institute of Agriculture (ISA)

In the early 60's AID collaborated with a private agricultural group to create a model training institute for agriculture. After the project began Texas A&M was contracted (1965-73) to provide considerable technical assistance to ISA. Texas A&M made major contributions, emphasizing rigor in the classroom, practical hands-on training on the school farm, discipline and an ethic of service to society. This early commitment to practical learning and service to the community has persisted until now. Following Texas A&M were a series of AID contracts and loans to assist ISA's expansion in agricultural education, research and outreach to the rural sector. Currently ISA has autonomous university status with Madre y Maestra Catholic University though it uses teaching resources at the University.

ISA indeed lives up to its name - superior. ISA benefits from continuous intellectual leadership, quality faculty (often the best ISA graduates), and a select student body. Its curriculum is organized around problem areas in agriculture. However, some faculty demonstrate a theoretical bias so that occasionally practical aspects of the curriculum do not emphasize field experience. Externally, ISA has made a significant impact upon Dominican society. Texas A&M advisors initiated adaptive research in tomatoes and rice both of which are grown widely. In addition ISA has contracts with agribusiness firms to conduct a variety of research. Most employers rank ISA's training as superior and so ISA graduates are in demand in the public and private sectors.

The main factor contributing to ISA's success is the support received from the Secretariat of Agriculture since its inception. The Secretariat has coordinated a division of labor in agricultural education and has encouraged ISA to develop its own education, research and outreach program. In addition, the Secretariat has channeled outside funding to ISA, and conversely many of the AID projects with ISA were funneled through the Secretariat to build linkages between ISA and the Secretariat. Secondly, the leadership of ISA has balanced the teaching and research activities with a firm commitment to address the needs of the rural sector.

**Universities for Development:
Report of the Joint Indo-US Impact Evaluation
of the Indian Agricultural Universities
A Synthesis of the Team Reports**

During the twenty years between 1952 and 1972, AID sponsored a most ambitious project in rural development. Six Land Grant Universities of Illinois, Kansas, Missouri, Ohio, Pennsylvania, and Tennessee entered into agreements to assist India to develop nine state agricultural universities (SAUs) at a total cost of \$31 million in US dollars and \$11 million in US owned Rupees. During the twenty years of cooperation, some 337 US faculty members were assigned to posts in India. At the same time, more than 1000 Indian students received graduate degrees from these same US universities.

Today there are 26 SAUs and a host of specialized institutes. Each SAU is a state institution that receives funds from the respective state, the central government, and other sources (such as grants, contracts, foundation seed and farm product sales, etc.). Each has a complex university administrative structure under the direction of the Board of Management and led by the Chancellor. And all

have the administrative guidance and support of the Ministry of Agriculture through the Indian Council for Agricultural Research (ICAR).

Since their inception, the SAUs have made numerous achievements in education, research and extension. They have created one of the largest systems of agricultural universities in the world in less than 30 years. They have developed the capacity to train students through the Ph.D. level, and with ICAR they have established the second largest agricultural scientific establishment in the world. This establishment includes numerous scientists of international reputation as leaders in various agricultural sciences. Few other nations, if any, can attest to achieving this within such a short time. Finally, and perhaps most significantly, the SAUs have provided technical support to the state extension services and have contributed to substantially to India's status as food producer.

The SAUs have had considerable impact upon agriculture and rural life in India. Among them are:

- increased manpower for veterinary services
- improved poultry and egg production
- increased opportunities for women
- development of trained staff for government services
- development of regional research stations
- use of artificial insemination to improve cattle breeding
- major increases in milk production
- animal feed improvement
- increases in selected areas of sorghum and millet production
- greater use of biofertilizers and biological control methods
- creation of farmer demand for extension as a result of radio, TV, bulletins and farm fairs
- creation of a cadre of skill agricultural loan officers for the banks

Contributing to these achievements is the outstanding and strong leadership and support provided by ICAR as well as that from the state governments. In addition, the agrarian structure of the various states has changed such that there is a demand for agriculture graduates. AID and other donors have lent substantial funding support, and within India the commitment of university leaders and the quality of incoming students have also contributed to a quality product. Finally the SAUs themselves are open institutions subject to regular evaluation.

Indian (and world) agriculture has changed considerably since the inception of the SAUs in the mid 50's. The new worldwide challenge is to complement current production

orientations with an emphasis on productivity and sustainability and to move from a relatively stable to a constantly changing mission. Hence the SAUs will have to reexamine the strategies and structures they have used in the past.

They will also have to address major issues. These include: the need to improve management regarding planning, university isolation, centralization, faculty upgrading, information resources and administration; the role of women; integration of social sciences in the agricultural curricula and expansion of the basic science curricula; instructional methods; research directions; and employment opportunities for graduates. Explicit recommendations are made for the need to establish linkages among the SAUs and between the SAUs and universities in the advanced nations.

Kasetsart University in Thailand

AID assistance to Kasetsart began in 1951 through a contract with Oregon State until 1960. Sixty percent of the funding went for construction, development of facilities, and procurement of materials while the remainder went to technical assistance and participant training. Assistance included the strengthening of teaching in the core agricultural curriculum and assistance to research, extension and demonstration. In 1962 Hawaii was contracted until 1965 to strengthen the research capability of faculty. There was a lack, however, of effective institutional planning and program coordination, and the disjointedness in the two contracts appears to have contributed to this.

Kasetsart has demonstrated formidable achievements in adaptive research which have had a significant impact on Thailand's agricultural economy. These include improved maize varieties, fruit crop cultivation and disease control, bee-keeping and silkworm production, and higher productivity in straw mushroom culture. In addition, different faculties in Kasetsart have collaborated with outside agencies in biological control, soil mapping, remote sensing and development of high protein food supplements. The biggest single impact of Kasetsart are its graduates (38,270 since 1943) with over 60% filling private sector positions in the poultry, tomato, dairy and flower agribusiness.

Contributing to this positive impact has been the quality and quantity of international participant training for its faculty, its high quality physical plant, location near Bangkok, and the quality of its in-coming students. Unfortunately, there is a gap between the University's great potential and its actual impacts. Negative factors contributing to this are weak leadership and an overemphasis

on teaching at the expense of research and extension. In addition, there is a lack of research planning and setting of research priorities as well as limited incentives for quality research work and academic advancement. In terms of AID's assistance through the US universities, there was no long term collaboration where objectives were clear and incrementally formed under provisions for stable funding.

**African Agricultural Universities:
Ahmado Bello (Nigeria), University of Ife (Nigeria),
University of Nigeria at Nsukka,
Bunda Agricultural College (Malawi)**

All four universities received substantial AID funding after their respective countries became independent in the the earlyh 60's, but AID terminated assistance to the Nigerian universities during the civil war. It has continued assistance to Bunda College until 1982. Each had a US university contractor in the 60's which for the Nigerian universities was a productive experience. Bunda College's relationship with Massachusetts was productive but lasted for only four years; AID arranged for a subsequent contract with a US educational exchange organization to provide technical assistance and training, but this was unsatisfactory.

Institutional development essentially meant the establishment or strengthening of core agricultural teaching faculties. This was done successfully in all cases. All universities graduate substantial and qualified numbers of agriculturally trained students who until recently have found public sector employment. While Bunda's development was not designed to link the Colleege with policy and research structures within the agricultural sector, it was done so in the case of the Nigerian universities. However, the latter has had only partial impact on agricultural problems in Nigeria, notably regarding research in production economics, livestock nutrition, and animal health at Ahmado Bello University. Otherwise the transfer of the Land Grant model, with the exception of Ahmado Bello, has been unsuccessful regarding extension services to farmers and collaboration with government agencies.

Three factors contribute to this unsatisfactory result. First, and most important, the universities are under the Ministry of Education, yet the locus of resources and decision-making for agriculture resides within the Ministry of Agriculture. Second, the constituents of these universities lie within themselves -- the students -- and so the primary motivation for the universities is to serve them with quality teaching. There exist few, if any, promotion and incentive systems to reward research and outreach.

Third, the financial status of the universities affects their impact. All are under financial straits, reflecting declining government revenues which can be budgeted for agricultural education.

D. Sustainability

Sustainability is a much used concept. Here it refers to the ability of an institution or linkage to continue to operate on its own with **decreasing** assistance from outside sources. "Decreasing" as opposed to "no" assistance is preferred because it is realistic. Few, if any, development projects continue to operate completely on their own resources without some assistance be it from the government, an interested constituency or a foreign donor. So, sustainability refers to "more or less" rather than a discrete category.

Dynamically, sustainability implies an interaction of three forces: performance, capacity and environment. These are:

performance - measurable action or execution of a task

capacity - latent ability or reservoir of skills; also adaptability by way of responding to environmental stimuli or information

environment - elements beyond the control of a project or institution that nevertheless affect its functioning (exogenous variables).

Dynamically, then, sustainability implies an interaction between performance and capacity in response to environmental forces. This interaction is positive when performance draws upon internal resources (capacity) which in turn reinforce and improve performance. Environmental forces, in terms of incentives, or a favorable structuring of conditions, enables - even stimulates - this positive and accelerating interaction between performance and capacity. Limitations in capacity or negative stimuli from the environment in terms of disincentives or constraints will decelerate this interaction and thus curb performance. The project then will become less self-reliant and more dependent upon outside assistance. Sustainability declines or even grinds to a halt.

When this interpretation of sustainability is applied to the universities and their linkages with American universities in the impact studies, some universities are more sustainable than others. Placed on a continuum from more sustainable or dynamic to less sustainable or static (and with some Procrustean arbitrariness), the universities might appear as follows:

Dynamic	-----	Static
ISA	IAV* SAUs Kasetsart	Ahmado Bello Ife, Nsukka Bunda
Dom Rep	Morocco India Thailand	Nigeria Nigeria Malawi

(*While included because of two past AID projects, IAV currently has a large project with AID.)

Based upon information from the impact evaluations about institutional performance, ISA would seem to be the most dynamic, and Bunda College the least. While all the institutions have maintained quality standards in teaching, the more dynamic and sustainable ones have excelled in research and extension work. In effect, ISA, IAV and the SAUs have had a positive impact on their environment through applied research and service, while Bunda College and Ife and Nsukka universities have been relatively isolated from farmers and rural development programs. In addition, government funding and incentives as well as requests for services from clients have reinforced the external linkages from the dynamic universities, while their absence has contributed to the self-contained nature of the static ones.

Also, based upon the impact evaluations, the following six factors seem to contribute to institutional sustainability:

- 1. Government support** - This has been discussed in Lesson #5 in terms of the university linkages (or lack of) with their bureaucratic constituencies - the Ministry of Agriculture. Of crucial importance is regular and adequate funding from the government to support recurrent costs and needed capital costs for expansion and improvement. In addition, access to foreign exchange, especially dollars, would be advantageous to the host country university if it intends to share costs in a long term linkage with a US university. Lack of foreign exchange was the main reason why the cost-sharing Institutional Grants project in Pakistan could be sustained and had to be renewed by AID.

2. Long term assistance - As discussed in Lesson #1, this is necessary to insure successful transfer of skills, techniques and approaches as well as more deep-seated attitudes and orientations. In fact, dynamic institutions - University of the Philippines at Los Banos and the SAUs - which had long term relationships with Cornell and Land Grant Universities respectively, are now (1988) seeking to review or secure new linkage arrangements with US agricultural universities. From the US side, the activities of strongly committed faculty, who will contribute more than what is expected in their contracts, also help sustain a linkage.

3. Autonomy - While the dynamic universities operate with government support, they do so with some independence. This allows for freedom to formulate policies, program objectives, faculty activities, and research agendas.

4. Entrepreneurial approach - Related to autonomy is the need for a dynamic institution to seek out contracts from public and private sector clients as well as funding from more than one donor. IAV, ISA and Kasetsart actively sought and obtained research contracts, while limited government funding prompted ISA to solicit funds from a few donors. In addition these universities aggressively pursued and obtained the maximum funding that was authorized in their annual budgets.

5. Quality performance - A commitment to high standards insures that the dynamic institution will continue to attract quality students, will be sought after for research contracts by private sector clients and will be assured of continued government funding. These favorable and positive stimuli from the environment will continue to reinforce the quality performance. This beneficent cycle in turn contributes to overall sustainability.

6. "Demand-driven" awareness - The more services the dynamic institution offers as well as the more contracts it receives through external linkages, the more it will adapt to and respond to beneficial market forces. This in turn influences the orientation of the curriculum to be more attuned to preparing students for the work of work. Naturally, this awareness and response must be balanced with a commitment to academic standards, scholarship and the integration of theory with practice.

UNIVERSITY PROJECTS IN THE SELECTED ANE COUNTRIESData Source: Congressional
Presentations and DIU Abstracts

<u>Country</u>	<u>Project Title</u>	<u>HC Institution</u>	<u>U.S. University</u>	<u>LOP Cost</u> (\$/Mitts.)	<u>Years</u>
INDIA	Indian Inst. of Technology Kanpar	IIT/K	U.S. Engineering Consortium of 9 Univs. (Cal. Inst. of Tech, Carnegie, Case-Western, EDC, MIT, Ohio State, Princeton, Purdue, UC Berkley, Michigan	14	1959-72
	National Inst. of Education	NIE	TCCU	1.8	1960-67
	Medical Education Training	Osmania Trivandum Medical Colleges		1.9	1958-66
INDONESIA	Development of Agricultural Colleges	IPB (Boga)	Kentucky	5	1956-65
	Development of Science and Engineering Colleges	GMU ITB	UCLA Kentucky	8.6	1956-65
	Development of Medical Colleges	Airlanzga	UC Berkeley	4.1	1959-66
	Higher Agricultural Education	GMU IPB	MUCIA	7.1	1969-75
	Agriculture Education for Development	GMU IPB	Wisconsin	1.5	1976-78
	Graduate Agricul- tural School	IPB	Wisconsin	7.5	1979-86
	Eastern Islands Ag.	(6)	Wash. State		1980-85
	Western Univs. Ag.	(11)	Kentucky		1980-90
	Faculties of Public Health	U. of Indonesia & 4 others	U.S. MD's		1985-92

<u>Country</u>	<u>Project Title</u>	<u>HC Institution</u>	<u>U.S. University</u>	<u>LOP Cost</u> (\$/MITTs.)	<u>Years</u>
THAILAND	Kasetsart University	Kasetsart University	Oregon State		1954-60
			Hawaii		1962-65
	Khen Kaen Univ. Research Development				1983-88
TUNISIA	Mgt. Education and Executive Development U. of Tunis	L'Institut Superieur de Gestion	University of Illinois	1.7	1966-81
			Minnesota	2.1	1960-68
JORDAN	Fac. of Ag.	Jordan University			
PAKISTAN	Postgraduate Med.			2.1	1955-65
	Teacher Training Institutes	Lahore Dacca	Indiana Colorado State	4.5	1959-68
	West Pakistan Ag. University (Inter College Exchange, 1955)		Wash. State	3.7	1961-69
	East Pakistan Universities (Inter College Exchange, 1955)	EP Ag. U. EP Eng. & Tech. U.	Texas A&M Texas Tech.	5	1961-69
	Assistance to Peshawar U.		Colorado St.	2.2	1954-67
	Institutional Grants	Peshawar U. Inst. of Ed. Research, Lahore	Colorado St. Indiana		1967-70
NEPAL	Higher Education		E. Advisor	1.3	1954-66
	Inst. of Ag. & & Science (IAAS)		Ohio State Illinois		1977-84

<u>Country</u>	<u>Project Title</u>	<u>HC Institution</u>	<u>U.S. University</u>	<u>LOP Cost</u> <u>(\$/Mills.)</u>	<u>Years</u>
YEMEN	Ag. Dev. Support				1978-86
	IBB/Ag. Trg. Center (ATC)		New Mexico State		
	IBB/Secondary Ag. Institute (ISAS)		New Mexico State		
	Horticulture Improvement Training (HIT)		Cal Poly		

A.I.D. IMPACT EVALUATIONS

<u>Country</u>	<u>Project Title</u>	<u>HC Institution</u>	<u>U.S. University(Fac.)</u>	<u>LOP Cost</u> <u>(\$/Mills.)</u>	<u>Years</u>
INDIA	Ag. Universities Development	State Ag. Univs. (8)	U.S. Land-Grant (337) Univs. (6)	31 11 in U.S.- owned rupees	1952-1972
		Madhga Pradesh Uttar Pradesh Orissa Mysore Andra Pradesh Rajasthan Punjab Maharasthra	Illinois Missouri Tennessee Kansar Ohio Pennsylvania		
MOROCCO	Higher Ag. Ed. in Morocco; Agronomic Institute	IAV	Minnesota (15)	1.6 3.3 28.5	1969-77 1977-79 1980-90
DOMINICAN REPUBLIC	Funding came from portions of 6 grants/ loans;	ISA		3.4	1962-80
	Rural Development Admin. Center			2.4	1981-87
THAILAND	Kasitsart U.		Oregon State Hawaii		1954-60 1962-65
NIGERIA	Faculties of Ag. & Vet. Medicine Ahmada Bello University		Kansas State (75)	12	1962-78
	Faculties of Ag. & Science University of Ife		Wisconsin (37)	5.5	1962-75
	U. of Nigeria (Nsukka)		Michigan State (79)	9.9	1960-67
MALAWI	Bunda College of Ag.		Massachusetts (11)	6.8	1963-82

IV. SECOND GENERATION LINKAGES

A. Institutional Stagnation

The problems of establishing an institution differ from those of maintaining it. Since the successful institution building efforts of the 50's and the 60's, major universities in the ANE region - the Indian SAUs for example - have stagnated. Organizationally, many of the universities are isolated from one another and from the international scholarly world, while their leadership has passed from a dynamic generation educated overseas to a less worldly one, mostly educated in-country. Hence teaching, research and outreach activities have declined in performance and in output, while faculty members face heavy teaching loads, constraints to do research, and overall, feel a sense isolation and frustration. In a less than stimulating environment, many Ph.D's in scientific fields become disappointed at their level of scholarly productivity and seek employment elsewhere. This malaise contributes to the obsolescence of scientific curricula, ill-equipped facilities, laboratories, and classrooms, and inadequate library and information resources.

Through its participant training program, AID has educated thousands in S&T fields at the graduate level and has trained thousands more through short term coursework and work-study programs. Many of these currently occupy key administrative, teaching and research positions though they confront the above problems. One proposed strategy is to revitalize this cadre of American educated faculty through a second generation of training. Such a revitalization, it is argued, would inject new life at vital points in the stagnant institutions by renewing or strengthening contacts, experiences and confidence through the exchange of scholarly information, research and ideas. This exchange would serve as a mechanism for ANE university personnel to articulate their needs and problems with American faculty and administrators and to generate new approaches to teaching, research and extension.

B. Returned Participants

It might not be an exaggeration to say that returned participants are a "captive audience" for a second generation program. Conventional wisdom that their training in the US left them with a favorable attitude towards the US is documented through studies in international education (Morris 1960; Klineberg and Hall 1979). In addition this positive attitude persists and blends with sentiments of fondness and nostalgia, particularly as frustration with their environment mounts (Goodwin and Nacht 1984). Perhaps most important, an extended training period in the US, especially at the graduate level, tempers this positive

disposition towards the United States with one of worldliness and acceptance of its shortcomings along with its strengths. "The sojourn and educational experience tends to engender a more sophisticated, differentiated, personalized and concretized knowledge and perception of the host country (America), its achievements and problems, its peoples and policies, and its 'ways of life' as compared to 'knowledge' and images held before. The result is a soberer appraisal of some of its features, values and practices and of their relevance to one's own role, one's field of activity and one's own country (Flack 1976:11)."

If not captive, then returned participants most likely are predisposed to pursue actively renewed training and could spearhead a movement to revitalize teaching, research and outreach in their respective institutions. Having been trained in the US, many of whom probably maintained their overseas contacts, they would grasp quickly new ideas, techniques and approaches in their respective fields. Some no doubt have research ideas or projects which they have harbored in hopes of developing someday, and they could do so through a second generation program. In addition, these participants occupy key and visible positions and so their advanced training would validate a mandate to lead colleagues and students in different or innovative teaching approaches or research programs. Upon return they could accelerate further faculty and student exchange, information flows with the outside scholarly world, and the development of research projects in science and technology. As leaders and outstanding scholars, they would function as reference points with different networks in the national and international scientific community.

C. Proposals

The Directorate of Human Resources in the S&T Bureau had considered the George C. Marshall Research Fellowship Program to address the above concern. The purpose was to develop LDC scientific leadership for undertaking research in priority development areas. It was to achieve this by providing research fellowships to outstanding former Ph.D. participants in the natural and social sciences who had already demonstrated their potential as productive scholars and who showed promise of further success in their home institutions. Each award would extend for a six-year period with expenditures for books, materials, subscriptions, research project activities, and travel and maintenance. The host country employing institutions would continue to pay the Fellows' salary during the award period. A total of 675 former AID Ph.D. participants would receive Fellowships over a 16 year period at a total cost of \$36 million through central funding.

The overall objective was to have a broad impact on institutions rather than to single out a small handful of talented former participants for research assistance. Hence, several Fellows would be selected from each participating institution. With a world wide pool of almost 5000 AID participants who have received Ph.D's since 1970 or who are currently in training, the Program could afford to be selective. Probably 50% of the Fellows would come from the ANE region. It was hoped the nucleus of Fellows in each institution would provide leadership for improving research and teaching. It was also hoped the Program would re-establish or maintain the Fellows' contacts with scientists in other parts of the world with additional funding to strengthen these contacts through travel, conferences and projects. In this way scientific networks would emanate from the host country institution to other institutions in the scientific community.

A related proposal, also from the S&T Bureau, encourages missions who have project contracts with Title XII institutions to maintain a separate contract once their project contract terminates. Since there is normally a large reservoir of personal and institutional relationships and mutual trust between the US institution, the host country and the mission as a result of the project, the idea is to capitalize on this for continued technical assistance and participant training. The separate contract would provide for travel, subsistence, fees, shipping, materials, supplies, publications, communications and other agreed-upon items among the three parties. The proposal offers no central funding and urges missions (unfortunately from their view) to fund this continued effort from 3-5 years after termination of the main project with annual funding up to \$50,000 for a university contract, and up to \$100,000 for a multi-university contract. Renewed contracts would provide for a cost-sharing formula in hopes that the linkage would be self-sustaining by the end of its second term.

Clearly, both proposals as types of follow-up to participant training are worthwhile. Until they become realities, however, the ANE Bureau will have to seek alternatives. It could develop related types of activities through the missions at relatively low cost. The Office of International Training maintains records of former participants, and the Training Officers at missions are experienced and often know the whereabouts of returned participants. Once missions identify returned participants who are active (or potentially so) in S&T development, they could provide seminars and conferences or individualized training programs for them in country or in Third countries. If additional funding were available, follow up training could take the form of return visits to the US or even additional study at a post Masters or Doctorate level.

V. DEVELOPING LINKAGES

This section examines in more detail linkages and their likely impact in current ANE projects. Both internal and external linkages are examined. Before examining linkages, however, two caveats will be discussed as possible constraints to the development of external linkages. These have to do with a university culture and with the "fit" of linkages with ADC and LDC countries.

A. Caveats

To expect that ANE universities will take on external linkages assumes that they have an outward orientation and a capacity to interact with development institutions in their environment. As was seen in Section III, the lessons learned regarding African universities, suggest that this may not be a correct assumption.

The "developmental" university adds a third function of service to the age-old ones of teaching and research. This distinguishes it from the traditional university which emphasizes, perhaps exclusively, the teaching and research functions. Service, in the developmental university, refers to participation in policy formulation, national and regional planning, contract research and evaluation, outreach in agricultural, health and educational services, and the diffusion of knowledge through the mass media (Coleman 1986). Clearly, the developmental university is more disposed to engage in external linkages than the traditional one.

The service function, however, is a recent phenomenon in most Asian and Middle Eastern universities unless of course they were chartered with this mandate at their inception. The SAUs in India are an example of this where they were founded according to the American Land Grant institutional model. The older universities which pre-dated or were founded in the Colonial era tend to be European in orientation. As a result they tend to be inward-looking, elitist, self-contained and isolated from society in an "ivory tower" pursuit of scholarship through teaching and research.

This elitist and isolationist outlook, one could argue, is a reflection of a national university culture shared more or less by major Asian and Middle Eastern universities. This culture resembles their former Colonial authority, even though aspects of this culture may have changed in contemporary European universities. As a vestige of Colonialism, it not only persists, but may serve as a constraint, however subtly expressed, for a university to become developmental and to take on external linkages (Illich in Stifel et al. 1982).

Table 1 profiles, somewhat arbitrarily, the national university cultures of Southeast Asian universities, and compares them with former Colonial powers along 11 characteristics:

Table 1

National University Cultures Compared with Former Colonial Powers

<i>Characteristic</i>	<i>Britain/Malaysia, Singapore, Aspects of Thailand</i>	<i>Holland Indonesia</i>	<i>France Aspects of Thailand</i>	<i>United States/ Philippines</i>
Emphasis on post-B.A education (or its equivalent)	low	medium	ambivalent	high
Tolerance toward private sector in higher education	low	low	low	high
Degree of elitism in university admission	high	high	ambivalent	low
Degree to which university teaching and research are mixed (vis-à-vis research confined to nonteaching research institutions)	medium	low	low	high
Requirement of full-time residence for advanced work	high	medium	high	low
Responsiveness to "consumer demand" (whether of students or employers)	low	low	ambivalent	high
Degree of closeness to the responsible government ministry	high	high	high	low
Autonomy of faculty governance (e.g., selection of deans)	high	high	ambivalent	low
Number of professors in faculties	low	low	low	high
Faculty control over examination process	low	low	low	high
Extent of "fit"	high	high	medium	high

The following observations can be made:

- o At risk of oversimplification, the characteristics of this national university culture can be compared among the five Southeast Asian nations and with their former metropolitan powers;
- o The Asian universities' characteristics are remarkably close to those prevailing in these nations' former Colonial associations;
- o With the exception of the Philippines, the clustering of the characteristics is inward looking, elitist, and isolated from the world of work. The Philippine universities, on the other hand, are the opposite, reflecting very much the cultural orientation of their American heritage;
- o External linkages are more likely to take hold in Philippine universities than in those of the other countries represented here.

The point here, is not to compare universities and their respective heritage, but to suggest that their European-based, national culture may inhibit the growth of external linkages. In addition to the overwhelming problems **within** Asian and Middle Eastern universities of maintaining instructional standards, current curricula, and innovative research, this tradition may constrain the best of intentions of promoting **outside** the university external linkages for development research and service.

A further caveat is the need to consider the type of linkage with the needs and objectives of the university itself. These needs and objectives should define the nature of the linkages in terms of complexity, duration, costs and anticipated benefits. Holding aside for a moment the posited inhibiting factor of a university culture, external linkages are probably more appropriate for universities in ADCs while internal linkages are more appropriate for those in LDCs.

Given the level of institutional sophistication in ADCs, there are probably more opportunities for American universities to collaborate with faculties in the creation of external linkages with private sector agencies for project development. ADCs would have more opportunities for public and private sector institutions to request contract research from the universities. Hence US universities would first establish internal linkages with ADC university faculties and then collaborate as appropriate to build external linkages with businesses, institutes or government agencies.

For LDCs the institutional needs are probably more basic, numerous and pressing. A US institution's contribution would best be served with faculty upgrading, curriculum development or joint research than external linkages say in biotechnical research with a private firm. It has only been recently that Yemen and Nepal, for example, have come to grips with educating a university population, and their needs are more internal and academic in nature. Thus, using the selected countries discussed in Section III as examples, linkages would most likely correspond to their development level as follows:

ADCs -----	----- LDCs
India, Thailand, Tunisia.....	Pakistan.....Nepal, Yemen
External linkages	Internal linkages

B. Internal Linkages

Much of this paper has addressed directly or indirectly the objectives, types and components of internal linkages, and so discussion here will be more general. After reviewing briefly the components of internal linkages, they will be discussed in the differing contexts of ADCs and LDCs.

Just as differing needs of universities suggest alternative use of external or internal linkages respectively, so may they suggest different emphases in the use of internal linkages. For some universities, most likely in ADCs, linkages might be considered more in the context of cooperation, exchange or mutual understanding as noted in the initial discussion of linkages (Section II). Emphasis here would be very much on the two-way exchange for satisfaction of mutual needs. For less sophisticated universities, most likely in LDCs, linkages might be considered more in the context of academic development with the resource flow being greater from US to host country universities. Emphasis is upon improvement of teaching, research, outreach and administration yet still within the spirit of parity and collaboration. However, some ADC universities may also seek linkages for improvement, as for the example, the illustrations given below.

1. Components - The following is a list of commonly referred to components of internal linkages.

Faculty exchange - US university faculty are assigned to the host country institution for teaching or research purposes anywhere from a few weeks to a few years; and counterpart faculty from the partner institution are

assigned to the US institution for similar functions during that period.

Training - Senior, mid level or junior faculty from the host country pursue post doctorate, doctorate or graduate level training at a US university. A similar arrangement by US faculty is used particularly for post doctorate or doctorate research. Graduate and undergraduate students from host country institutions pursue appropriate study in the US. Unfortunately, the present construction of the Foreign Assistance Act does not allow AID to sponsor US students to train in developing countries.

Curriculum development - As part of faculty exchange, US faculty strengthen disciplines in host country universities. Objectives, approaches, instruction, fieldwork and evaluation would be addressed with particular attention to interdisciplinary approaches, integration of theory with practice, and combination of classroom and field work. Where appropriate, host country faculty would do the same in US universities, particularly when the former demonstrate a comparative advantage, say in tropical science.

Collaborative research - The US is a formidable source of scientific knowledge and technological know-how; it is also a significant importer of technology in some cases. Collaborative research is an effective way for the US and the developing world to gain access to improved technology. It can be mutually productive as for example in the following areas:

- genetic improvement, including traditional plant breeding and biotechnology;
- low-resource farming in which LDCs have much experience;
- malaria vaccine and drug detoxification;
- denge fever (Thailand) and contraceptive immunology (India).

Research networks, particularly those already established with Title XII institutions, are mechanisms to sponsor the planning, execution and review of research.

Outreach and extension - As part of teaching and research, or as separate activities, US and host country university personnel collaborate in outreach activities. This is particularly important for integrating theory with practice and may be done efficiently through a project focus.

Library and information resources - This involves not only the transfer of appropriate materials, books references, journals, etc. but the capacity to produce, manage and to gain access to information. US universities could make available the latest systems in library sciences, management and computerized cataloguing and access.

Administration - Often overlooked in linkages is the exchange of university deans, administrators, and even administrative staff. ADC/LDC universities especially need to manage better admission, registration, academic programs, budgets, accounting, scheduling, enrollment, personnel, records, physical plant and student services. These functions are vital to efficient operation. Linkage activities would allow ADC/LDC administrators to learn modern techniques in an American university environment, while American counterparts could provide technical assistance to their universities.

Selected commodities - All types of commodities are likely to be requested (and needed) as part of linkages, but perhaps the three most needed areas are educational equipment (video production, projectors, easels, etc.), scientific equipment (electronic microscopes, spectrometers, refrigeration, etc.), and computers and reproduction equipment. One condition for provision of commodities, however, is that they be integrated with the purpose and activity of the linkage of the above components and not merely be a "drop."

2. Cooperation

Perhaps the best known linkage which has cooperation and mutual understanding as its objectives is the USIA University Affiliations Program. Each year up to 30 grants are available on a competitive basis for linkages between US universities and those of industrial and developing nations. Priorities in geographical and discipline areas may change from year to year. Total funding for each grant may not exceed \$60,000 with USIA funding **only** travel costs and modest supplements for maintenance expenses. Institutional overhead is not allowable. Participating institutions should be prepared to assign faculty or staff to the partner institution for teaching, lecturing or research assignments of one month or longer, maintain the faculty on full salary or benefits, and receive visiting faculty or staff from the partner institution for one month or longer for the same complimentary activities. Grants may be requested for a minimum of two years and a maximum of three years.

Another well known linkage program which is mainly cooperative in nature is that established by Partners of the

Americans in Brazil. Although in another region, the concept is quite transferable to ADCs in Asia and the Near East. As of 1986 cooperative agreements exist between twenty-nine US universities and twenty-eight Brazilian institutions (Harrison 1986). Much of the work involved in the teaching, research and service part of the exchanges is voluntary with participants receiving no compensation and only travel and maintenance. In addition, Partners encourages participants to perform service activities in the community outside the institution which they are visiting and to report their experiences to audiences in their home country upon return.

3. Academic Improvement

Usually these types of linkage have multiple components which attempt to upgrade a department, faculty, or even an institution through different approaches. The following are examples of how various components are packaged in a linkage to improve academic resources.

The Tunisian Agriculture Technology Transfer project, described below as an external linkage because of its outreach, also makes an attractive use of an internal linkage. In a personalized approach Tunisian agricultural institutions maintain contact with US sister institutions as returned Tunisian participants continue their relationship with their former US advisor through joint research activities. The US and Tunisian institutions build upon these initial relationships through increased exchanges of faculty on sabbatical or of interdisciplinary teams.

The University of the Philippines at Los Banos (UPLB) had a successful linkage program with Cornell University during the 50s and 60s. Currently UPLB would like to improve and expand its programs in basic sciences, agriculture and rural development, and it would like to renew its linkage with Cornell or another US university. UPLB has proposed a multifaceted linkage to upgrade academic and administrative personnel. Academic upgrading will take place through doctoral and post doctoral training at the American university while dissertation research will take place at UPLB. Faculty and staff exchange, collaborative research, and joint extension projects are also included as part of personnel upgrading. UPLB would also like the linkage to provide for some replacement and maintenance of equipment, as well as an overhaul of its library with new materials and the installation of a computerized cataloging system.

On an even larger scale the State University Agricultural Universities (SAUs) of India, based upon the recommendations from AID's impact evaluation (Section III), are considering the re-establishment of their relationships with US Land

Grant Universities. Areas of collaboration being considered are: research and teaching, post-doctorate exchanges, faculty visits, student exchanges, assistance with Indian initiatives to upgrade weaker SAUs (similar to the Indonesian "Pembina" concept), and the general need to share experiences. The Indians state emphatically that they do not want a repeat of the 60's modality of technical assistance, but want "...a relationship which treats Indian SAUs as collaborative peers (USAID India May 26, 1988)."

4. Administration

The Indian request for renewed linkages brings up the question of administering linkages, particularly when they are large, as proposed between the SAUs and the Land Grant universities. Following the Kanpur example (Section III), the proposed SAU renewed linkage suggests that Indian and US universities not be linked on a one-to-one basis, but rather through a joint committee comprised of Indian Vice Chancellors and US Deans of Agricultural Schools. The joint committee would have wide discretion in selecting the activities it would support, based upon guidance from USAID which would play only a broad monitoring role (IBID.).

As for the administration and management of other linkages, particularly those involving groups of institutions or consortia, the ANE Bureau might want to consider the Consortia for International Cooperation in Higher Education (CICHE). CICHE was founded in 1979 to serve as a contact point between foreign and US universities, to broker relationships between them, and to administer linkages once they were established. Currently CICHE functions as a clearinghouse, broker and coordinator between US and foreign universities, and assists in the identification, selection and alignment of US higher education resources to match specific needs in developing countries. "Of special concern to CICHE in the proposals and efforts to establish inter-university linkages is the overriding focus on the scientific and technical assistance areas (IBID:16)." CICHE or a similar brokering agency could assist the Bureau significantly in the development and administration of linkages, particularly if AID intends to deal with linkages only indirectly.

C. External Linkages

Five projects and their external linkages will be examined. The purpose is to bring out a distinctive proposition of this linkage which might be of use in the design of future linkages. It would be convenient to call these propositions "lessons learned", but the projects are still ongoing.

In actuality the external linkages include an internal linkage. That is, there is a capacity-building effort through the US and host country university linkage, and then this effort is directed through applied research or outreach to solve a development problem. In effect, there is an integration of internal and external linkages, but again for convenience, this will be considered as an external linkage.

1. Linkages do not just happen; USAIDs must make them work - Egypt University Linkages project

This is an attempt to harness the research potential from Egypt's 11 universities, 12,000 Ph.D's, 15,000 research assistants and 50,000 graduate research students to address through applied research priority development problems. American universities collaborate with Egyptian universities through minilinkages -- specific, focussed, research activities, and through maxilinkages -- larger, interdisciplinary, more broadly developmental research efforts. Linkages also assist in capacity building for individual universities through faculty exchange, joint seminars, US graduate study for Egyptian faculty and students, and US consultantships. In effect, the project calls for external and internal linkages.

Major achievements to date have included applied research through external linkages. Recent examples are: development of a wind-solar power generation system for rural areas; improving government milk and meat production; and developing science education in primary schools. In addition suppliers and users of applied research have a greater appreciation of its value and utility for development. Second, the ULP has instituted a structure and procedures for surveying research needs, soliciting proposals, reviewing and funding them, and for strengthening university capacity to do research.

There have also been problems. Linkages with US universities have taken longer than expected to develop. There have been delays in the review and selection of proposals from universities for grants, and personal relationships and favoritism have biased the standardized process of review. More important, AID was optimistic about what could be accomplished in given time frames and overlooked the need to build personal relationships in a long term collaborative process. AID also did not define the contractor's role clearly, and confusion among the participating parties arose as to whether the contractor would be facilitator or mentor to the Egyptians. Finally, many of the US university personnel found that the Egyptians preferred them to be consultants rather than collaborators in the linkages.

The lessons learned are that -- as expected -- the institutionalization of linkages is a long term process without quick returns for much effort. In addition, AID should take on a more concentrated role to interpret regulations and procedures to US and Egyptian university personnel and not expect the contractor to do this.

2. Linkage institutionalization must include research management and marketing - Egypt Development Planning Studies Project

This project attempts to strengthen the development planning and implementation process in Egypt. It creates the Development Research and Technology Planning Center (DRTPC) to promote external linkages between the suppliers of the technology -- the Egyptian academic community; and the end-users -- the GOE ministries who use it for the design, analysis and implementation of technical programs. The DRTPC was created as an autonomous research unit within Cairo University to administer, manage and market research resources and needs; and to link effectively the universities with the GOE ministries and private sector companies. MIT is the collaborating university for technical matters of the project.

DRTPC has promoted successfully external linkages, and MIT has made important technical contributions. University research has identified and explored a number of policy issues and suggested cost-saving innovations. Applied research was undertaken and used in the problem areas of water resource management, transportation planning, plastics production, and energy conservation. Secondly, DRTPC has had impact upon both suppliers and users of research: DRTPC has involved graduate students in applied research projects, introduced new coursework at Cairo University, and has provided post doctoral training for faculty. It has also sensitized and improved the understanding of Ministry personnel regarding such matters as Nile river erosion and overloads on electric power generation.

A major problem remains. There is still confusion among project participants -- GOE planning, university and Ministry personnel -- about the project purpose and the role of DRTPC. During the course of institutionalizing research management, the result has been more to strengthen the role of DRTPC as a research agency than as a manager of research. Rather than initiating and conducting research itself, DRTPC should have been strengthening external linkages between the various university faculties and departments in Government ministries. It would do this by matching user needs through surveys with resources through marketing. The lesson learned is that institutionalizing linkages demands attention to strengthening research administration,

management and marketing as much as it does the strengthening the technical capacities to conduct research.

3. Simplicity makes for efficiency - Tunisia Agriculture Technology Transfer.

This project illustrates how linkages can be used in multiple ways for institutional strengthening and exchange. The Mid-America International Consortium (MIAC), made up of five US universities, has a \$5 million host country contract with the Tunisian Ministry of Agriculture under the project. Through the Department of Teaching, Research and Extension of the MOA, MIAC links Tunisian agricultural institutions with US universities in three ways:

- (1) cooperative research agreements;
- (2) sister-to-sister school agreements; and
- (3) sabbatical leave exchanges.

A resident MIAC manager plans, programs and monitors each of these activities in collaboration with Tunisian University and MOA personnel and the US universities.

The cooperative research agreement is a personalized relationship between a returning Tunisian Ph.D or M.S. participant and his US faculty advisor. The purpose is to enable the student-advisor relationship to continue through joint research so that the participant becomes a productive researcher and scholar. Each agreement is small in scope and limited to \$15,000 allowing for travel and equipment. The expected results are mutual research opportunities and publications.

The sister-to-sister school agreements build upon these research agreements whereby interdisciplinary teams from US universities work with counterpart teams in Tunisian universities. They take an interdisciplinary approach to such problem areas as integrated pest management, farming systems, range management, soil and water conservation and biotechnology. These agreements elevate the personal relationships to institutionalized commitments, and each team has a budget and flexibility in the planning and use of funds.

Through these team approaches external linkages have developed between the universities and experimental stations. They have provided solutions to problems in soil and fertilizer testing, and in cereal and legume production. They convert these solutions into technical packages which can then be used by extension workers with farmers. The

testing and development of these packages are done in the field at experimental stations.

The sabbatical leave exchanges allow senior teachers and researchers to study at the counterpart institutions which have established sister-to-sister agreements - or at other institutions that come under the project. Tunisian faculty are encouraged to take sabbatical leave and receive 45% total compensation of the base salary with the project funding the balance to live adequately in the US. A similar arrangement operates for the American faculty.

Perhaps fortuitously, the linkages in the Tunisian ATT project seemed to have responded to the Lessons Learned noted above in Section III. The project began in 1978 and the mission intended to maintain MIAC as the US university contractor until the completion of the project in 1990. Interpersonal relations between MIAC's and Tunisian faculty have been "exceptionally" strong, while MIAC organizational arrangements have been flexible. For example, tailored coursework for Tunisians was provided at universities outside the consortium, while management of the project in country appears to follow the loose but efficient arrangement used in the Indonesian Graduate Agriculture School project (Section III) to accommodate an extended series of short term consultants. In addition, the Ministry of Agriculture has taken strong leadership and support for the project while encouraging returned participants and faculty trained in the US to undertake applied research.

4. Subprojects are effective mechanisms to organize and focus linkages - Pakistan Institutional Excellence project

The Pakistan Institutional Excellence project (IEL - pending authorization) uses external linkages to improve the quality of education and research in higher education and to strengthen higher education's role in economic growth. US universities will be invited to assist selected Science and Technology faculties or Centers for advanced research in Pakistan. The project is very large with a \$60 million AID contribution for seven years. The project, strictly speaking, uses linkages for institutional strengthening. Hence the flow of resources and services is predominantly one way: from US universities and AID to the Pakistan universities and research centers. Nevertheless, the project is a unique effort in trying to upgrade universities internally as well as to strengthen their impact externally upon end-users of applied research.

The linkages with US universities will improve efficiencies in teaching, curriculum, faculty incentives and finances. These include measures to:

- o integrate research with instruction;
- o focus research on national and provincial development needs;
- o provide financial and institutional incentives for graduate students to teach introductory courses and for senior faculty to devote more time on development-oriented research;
- o and charge higher tuition, expand contract research and use classroom facilities more efficiently.

Linkage activities will consist of short term teaching and consultancies by US faculty and administrative/financial specialists in Pakistan, and through short and long term training of Pakistani faculty and students in partner US universities. Faculty exchanges may be in conjunction with research projects, or as separate but related activities such as curriculum development. The project will fund long and short term faculty exchanges, though it is not expected that full salaries or institutional overhead costs will be covered in such exchanges.

Joint research will focus on problems of national or provincial importance with funding for personnel, field support, data gathering, processing and dissemination of results. Whenever possible, US universities will develop "channel" programs such as those used in Egypt whereby US faculty provide instruction in the host country while dissertation research is undertaken at the US university. The degree is awarded by the Pakistani institution. Similar to the Indonesian Communications project in Section III, provision of training by US professors in the host country also enables the professor to conduct technical assistance.

External linkages will be implemented through subproject grants. These grants will combine university and research center faculty, US university specialists, and professionals from end-user organizations. The objectives of external linkages are (1) to enable faculty and end-user personnel to work efficiently with one another; (2) to make research projects demand-driven; and (3) to focus research projects on real, practical and important development problems -- be they private or public sector based -- by funding only projects which demonstrate clear capacity to do so. A policy-making unit comprised of personnel from Pakistan and US universities, relevant ministries and end-user organizations will formulate subproject criteria, select subprojects for implementation, and monitor their progress. End-user organizations will contract appropriate faculties or centers to conduct applied research or provide services. By concentrating on approved research products or services, university efforts will be more development oriented, will

address institutional needs beyond the university, and will increase its revenues.

The following are examples of how linkages would work in subproject research grants:

- o In a production oriented subproject, an Earth Sciences faculty from a US university collaborates with a geology research center in Pakistan to conduct research and training in geology with application to mineral and oil resources exploration. Research concentrates on tectonic and geologic evolution, diagenesis on reservoir studies of basinal areas, and evaluation of metallic and mineralization zones. Research products for Pakistani petroleum companies include geological atlases of various basinal areas, computerized data bases of the same, and feasibility reports or exploration strategies.
- o In a research oriented subproject a biological institute collaborates with a US biology faculty for specialized training to work on genetic engineering techniques to address specific problems in agriculture, health and industry.
- o In a service oriented project a community health division at a Pakistani university collaborates with researchers from a US public health department or institute to develop prototype primary health care units that would be appropriate to different population groups in Pakistan. Critical factors in defining these units are group settlement patterns, food production cycles and family structures.

5. Complex linkage problems should be approached from the basics - Thailand Science and Technology for Development project

This is a complex project whose purpose is to restructure and strengthen science and technology activities in the public and private sectors for development. It draws from Korean and Egyptian experience in science and technology and builds on these principles:

- o build strong linkages between government, universities and the private sector through the restructuring of incentives, delivery of needed information and services, and the provision of funds so that S&T research becomes both demand-driven and development oriented;
- o select and concentrate on key development problems for sustained research efforts;

- o create policy directives and management procedures that sustain the flow of S&T research between universities and government and the private sector;

- o include medium and small scale farms and firms in S&T policies and programs as beneficiaries.

Essentially, the project attempts to strengthen linkages between the end-users of technology in industry and the suppliers of technology in Thai universities, engineering institutes and public sector research institutions. The brokering or implementing agency between users and suppliers of S&T is the Science and Technology Development Board (STDB). Through external linkages between universities and industry, the STDB intends to shift research and service activities toward market and development needs. Where possible, US universities will assist Thai universities and institutes through internal linkages, though this does not appear to be a major element in the project.

Thai universities suffer to some extent from isolation and have not always been open, motivated nor disposed to conduct applied research for development. (Admittedly, progress has been made in this regard as noted in Section III regarding the research achievements of Kasetsart university.) Through the readjustment of economic incentives, public sector efficiency and fiscal and monetary policies, STDP is trying to tighten the linkages between technology producers in the universities and the end-users in industry and agriculture.

STDP is charged with setting research priorities, surveying research needs in the private sector, funding development oriented research that addresses these needs, and marketing the results of successful contract research. The areas of bioscience and biotechnology, material technology and applied electronic technology are priority areas for research activities. The project is further complicated in that private companies may be both suppliers of technologies as well as users. In addition, some research problems and companies are designated for STDP attention by Thai government policy, while others must compete for it on a market basis.

VI. CONCLUSION AND NEXT STEPS

A. Conclusion

While it was not the intention to prove with documented evidence the two hypotheses stated in the beginning of this paper, there has been sufficient evidence to argue plausibly that the hypotheses are valid. That is, internal linkages can contribute to improved quality of teaching, research and outreach in host country and US universities; and external linkages, under certain conditions, can contribute to economic growth. The impact evaluations offer the most persuasive evidence that the first hypothesis makes good development sense and should be used as a guide for both university development and for furthering broader political, economic and commercial objectives. They also offer evidence to argue that the second hypothesis makes good development sense; perhaps more importantly, they help define the conditions under which external linkages can contribute to growth outside the university.

On the basis of the evidence, illustrations and arguments presented in this paper, it is further argued that the Asia and Near East Bureau should consider proceeding with developing university linkages in science and technology activities. As a review, exploration and analysis of S&T linkages in higher education for the ANE Bureau, this paper has tried to generate greater interest and support for developing linkages. It is hoped that ANE/TR/EHR will raise further the level of awareness and generate action regarding the linkages. It is also hoped that this paper provides the catalyst and analytical underpinnings that in turn will be picked up by US and ANE universities with close support from the respective USAIDs.

B. Next Steps

1. Internal Review - TR/EHR could take the lead to distribute this paper to the technical, project, planning and regional offices within the ANE Bureau. It could then solicit comments and reactions, and if appropriate conduct a meeting to review these comments, to decide whether there is consensus to continue with developing linkages, and to identify priority actions. TR/EHR should then draft a document summarizing this review, consensus, and actions to be taken.

2. Mission Reaction - TR/EHR at the same time could send the paper to ANE missions to elicit their reactions and comments. It would try to ascertain whether missions would be interested in principle in generating directly or indirectly university linkages in science and technology.

It would also try to get them to identify problem areas which the missions feel linkages could address. The objective would be to obtain positive and specific responses from the missions as to whether they want to develop linkages or even to develop a linkage project.

These could be conveyed by cable or letter to the Chief of TR/EHR. On the basis of the internal review and mission responses, TR/EHR could then decide whether there is sufficient consensus to continue with the linkage effort.

3. Field Visits - Assuming there is some positive response from missions, TR/EHR could put together a team to pursue mission interests. The purposes of these visits would be:

- o to further raise the level of consciousness about the problems which linkages could address;

- o to visit with local university personnel to identify problem areas as well as possible responses through linkages;

- o to work with mission personnel to design in preliminary form linkage activities, exchanges or even a project idea if the interest is there.

4. Parallel Discussions - TR/EHR could also communicate and exchange information about developments with other ANE Offices that might impinge upon the linkage effort. It should keep abreast of activities in the Agriculture, Science and Technology and Health Divisions in TR which pertain to the review and formulation of sector strategies. Linkage activities could well fit in with aspects of these strategies.

In addition TH/EHR should communicate with the World Bank and the Regional Banks as well as agencies or foundations such as the Institute for International Education or the Rockefeller Foundation. As mentioned in the Introduction, the donor community is interested in reviewing higher education initiatives, particularly how linkage activities might be used for assistance. It may be convenient at some point for AID to collaborate with these agencies in the formulation of a statement, strategy or even a project regarding university linkages. Early communication between AID and these agencies would lay the bedrock for possible collaboration later on.

5. Exploratory Activities - TR/EHR could then encourage the initiation of simple, modest, but visible exchanges or related linkage activities. On the basis of the information

and possible commitments obtained in the field visits and parallel discussions, TR/EHR could then solicit interest about linkages from American universities.

As a start, informal visits to a sample of universities and colleges might be appropriate. With no commitments, discussions with Faculty heads and Deans of Colleges and International Studies and would be useful. This could be followed up through an announcement in the IEE newsletter or perhaps even an article in the Chronicle of Higher Education about the Bureau's interests and intentions. It could be done more formally through a request for expression of interest.

If a funding source were available, AID could then share the costs of start-up or exploratory activities with interested universities. Their willingness to share the costs would demonstrate their commitment to undertake linkage activities. If launched, TR/EHR would coordinate their execution with the ANE universities and their respective USAID missions. AID funding for initial activities could be around \$100,000.

6. Larger Activities or Project Development - Based on a review of the exploratory activities ANE might want to launch more substantial activities. These could include:

- o establishment of joint committees on a country or possibly a regional basis, whereby representatives from US and ANE universities work out objectives, target areas, procedures, guidelines, and funding levels, including cost-sharing arrangements to assist program implementation of university linkages;

- o support to CICHE or to a related coordinating agency to widen the ANE universities' access to American universities;

- o support and assistance to missions to develop bilateral linkage projects;

- o development of a regional project on the order of a general participant training project to allow for exchanges, training, conferences, technical assistance and under certain conditions, commodity transfer -- all under linkage arrangements. The project should be flexible to allow for the multifaceted development of linkage activities.

7. Expected Results - Just as the institution building efforts of the past took a long time to bear fruition, so will the linkage activities of the present. However,

simple, modest and short term efforts are perhaps the best way to begin in hopes that more substantial efforts will follow. It would be best to assign one person on a full time basis to be responsible for this development over a period of time in the ANE Bureau. The effort should bear results in the form of small activities and later in the form of bilateral and possibly regional projects.

BIBLIOGRAPHY

1. AID Bureau Documents

Asia and Near East Bureau. Office of Technical Resources. Division of Science and Technology. **Inventory** Wash, DC. 1988.

Asia and Near East Bureau. Office of Program Development. **New Relationships: Models for MIC's** Wash, DC. 1987.

Asia and Near East Bureau. Office of Technical Resources. Division of Education and Human Resources. **AID's Experience in Education, and Possible Areas for Investment in ANE.** Wash, DC. 1988.

Bureau of Policy and Program Coordination. Office of Policy Development and Program Review. **Advanced Developing Country Concept Paper.** Wash, DC. 1988

Bureau of Science and Technology. Office of Food and Agriculture. **Draft Nucleus of the Strategy for Modernization.** Wash, DC. 1987

2. AID Evaluations

AID Evaluation Special Study No. 24. **Management Education in Modern Tunisia: L'Institut Supérieur De Gestion.** Wash, DC. 1985.

AID Project Impact Evaluation Report No. 64. **Malawi: Bunda Agricultural College** Wash, DC. 1987.

AID Project Impact Evaluation Report No. 65. **The Hassan II Institute of Agriculture and Veterinary Medicine in Morocco.** Wash, DC. 1987.

AID Project Impact Evaluation Report No. 66. **Three Nigerian Universities and Their Role in Agricultural Development.** Wash, DC. 1988.

AID Project Impact Evaluation Report No. 67. **Dominican Republic: The Superior Institute of Agriculture.** Wash, DC. 1988.

AID Project Impact Evaluation (Draft). **Universities for Development: Report of the Joint Indo-US Impact Evaluation of the Indian Agricultural Universities - A Synthesis of the Team Reports.** Wash, DC. 1988.

AID Project Impact Evaluation (Draft). **Kasetsart University in Thailand.** Wash, DC 1988.

Development Information Unit. **Selected Project Evaluations: Abstracts and Reports.** Office of Policy and Program Coordination, Center for Development Information and Evaluation. Wash, DC. 1988.

USAID/Cairo. **Mid-Term Evaluation of the University Linkages Project (263-0118).** Wash, DC. 1983.

USAID/Cairo. **Project Evaluation, Phase III: Mid-Term Evaluation, Development Planning Studies Project (263-0061)** Wash, DC 1987.

3. AID Project Papers and Cables

USAID/Cairo. **University Linkages Project (263-0118).** 1980.

USAID/Islamabad. **Institutional Excellence Project.** (Draft). 1988.

USAID/Bangkok. **Science and Technology for Development (493-0340).** 1985.

USAID/Tunis. **Tunisian Agriculture Technology Transfer (664-0304).** Amendment #4. 1985.

Bureau of Science and Technology. Office of Human Resources. **The George C. Marshall Fellowship Program.** Wash, DC. 1985. (Draft).

USAID/New Delhi (13443). **Study of Agricultural Higher Education.** May 26, 1988.

S&T/RUR (118900). **Continuing Linkages Between US and Developing Country Institutions** Wash, DC. April 25, 1988.

4. Articles and Papers

Coleman, J.S. "The Idea of the Developmental University." **Minerva** (476-494) 1986.

Development Associates, Inc. **India Human Resource Development Strategy Report** Wash, DC. 1987.

Education Development Center. **Kanpur Indo-American Program: Final Report.** Newton, Mass. 1972.

Federal Register. **Bureau of Educational and Cultural Affairs, University Affiliations Program.** Vol. 52, No. 200, 38561-38563. 1987.

Flack, M.J. "Results and Effects of Study Abroad." **Annals of American Academy of Political Science.** Vol 424. (107-117).

Gallegos, A.M. "The Growing Education Crisis in Developing Countries: Improving Education - The University Connection." **Educational Technology** Vol. 22, No. 3. (13-19). 1982.

Harrington, F. "International Linkages in Higher Education: A Feasibility Study." **American Council on Education et al.** Wash, DC. 1978.

Harrison, C. "US-Brazil: Partners in Education". **Change.** Vol 18, No.4. (54-55). July, 1986.

Institute for International Education. **The Role of Education and Training in Development in the 1990s: Policy Report and Conclusions.** New York, 1988.

Lyman, P. **Beyond AID: Alternative Modes of Cooperation.** Paper prepared for Symposium III Cooperation for International Development: US Policies and Programs for the 1990s. American Embassy, Lagos, Nigeria. 1988.

McDowell, G. and D.C. Wilcock. **Lessons From Institution Building Efforts in Africa: US University Experiences Building College of Agriculture.** Amherst, Mass. 1984.

Starr, P.D. "Institutional Barriers to the Transfer of Agricultural Technology: A View from the Land Grant Universities of the US". **International Review of Education.** Vol 28, No. 4. 485-488. 1982.

University of the Philippines, Los Banos. **Proposal for Renewing University Linkages.** Los Banos, Philippines. 1987.

5. Books

Behrman, J. **Industry Ties with Science and Technology Policies in Developing Countries.** Cambridge, Mass. 1980.

Blume, S. et al. **Industry and University: New Forms of Cooperation.** Paris, OECD. 1984.

Goodwin, C. and W. Nacht. **Fondness and Frustration.**
Institute for International Education, New York. 1979.

Jones, G. **The Role of Science and Technology in
Developing Countries.** London, 1971.

Klineberg, O. and F. Hull. **At a Foreign University.**
New York, 1979.

Morgan, R.P. et al. **Science and Technology for
Development: The Role of US Universities.** New York.
1979.

Morris, R.T. **The Two Way Mirror: National Status in
Foreign Students' Adjustment.** Minneapolis, 1960.

Segal, A. ed. **Learning by Doing** Boulder, Colo. 1987.

Stifel, L., Davidson, R. and J.S. Coleman. **Social
Sciences and Public Policy in the Developing World.**
Lexington, Mass. 1982.